

**FACTORS INFLUENCING MAIZE PRODUCTION AMONG SMALL SCALE
FARMERS IN KENYA, A CASE OF BUNGOMA CENTRAL SUB COUNTY**

SILVANUS WANJALA SIMIYU

**A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE AWARD OF DEGREE OF MASTERS OF ARTS IN
PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF
NAIROBI**

2014

DECLARATION

This research project is my original work and has not been presented for award of degree in this or any other university.

SignatureDate.....
SILVANUS WANJALA SIMIYU
L50/61869/2013

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

SignatureDate.....
MRS. JULIANA MUNIALO
Lecturer Department of Distance Studies
University of Nairobi

DEDICATION

This research project is dedicated to my wife Christine, my parents Mr. Emmanuel Simiyu and Mrs. Elizabeth Simiyu for their constant encouragement and unceasing support.

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to my supervisors Mrs. Juliana Munialo and Mr. Marani for tirelessly guiding me in the development of this research project.

I also acknowledge administrative assistants Mr. Issa and Mr. Marcus for effective coordination of operations in Bungoma Extra Mural Sub centre.

Much appreciation goes to my parents Mr. Emmanuel and Mrs. Elizabeth Simiyu, my wife Christine, my brothers; Calvin, Bramuel , sisters; Bedina, Caroline, Florence, Janerose, Jentrix, Ebby and my sister in law Wilkister for their moral, financial and social support.

Above all, I would like to thank the Almighty God for giving strength to do all this work without which I would not have managed.

TABLE OF CONTENTS

DECLARATION	ii
DEDICATION.....	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS.....	v
ABBREVIATIONS AND ACRONYMS.....	xiii
ABSTRACT	xiv
CHAPTER ONE:INTRODUCTION.....	1
1.1 Background of the study.....	1
1.2. Statement of the Problem.....	2
1.3. Purpose of the study.....	3
1.4. The Objectives of the Study	3
1.5. Research questions.....	4
1.6. Significance of the Study.....	4
1.7. Delimitations of the Study	5
1.8. Limitation of the Study.....	5
1.9. Assumptions underlying the Study.....	5
1.10. Definition of Operational Terms.....	5
1.11. Organization of the Study.....	6
CHAPTER TWO:LITERATURE REVIEW	7
2.1. Introduction.....	7
2.2. Costs of production and maize production	7
2.3. Agricultural extension services and maize production.....	10

2.4. Demographic characteristics of small scale farmers and maize production.....	12
2.5. Credit availability to small scale farmers and maize production.....	15
2.6. Theoretical Framework.....	18
2.7 Conceptual Framework.....	19
2.7.1 Discussion of Conceptual Framework.....	21
2.8 Research gap.....	21
2.9. Summary of Literature Review	22
CHAPTER THREE:RESEARCH METHODOLOGY	24
3.1 Introduction.....	24
3.2. Research design	24
3.3. Target Population	24
3.4. Sample Size and Sampling Procedure	25
3.4.1 Sample Size Determination	25
3.4.2. Sampling Procedure.....	25
3.5 Data Collection Instruments	26
3.5.1 Pilot Study	26
3.5.2 Validity of the Instruments	27
3.5.3 Reliability of the Instruments	27
3.6. Data Collection Procedure	28
3.7. Data Analysis Techniques	28
3.8. Ethical Considerations	28
3.9. Operational definitions of variables.....	29

CHAPTER FOUR: DATA ANALYSIS, PRESENTATIONS, INTERPRETATIONS

AND DISCUSSIONS	30
4.1 Introduction.....	30
4.2 Questionnaire Return Rate.....	30
4.3 Demographic Characteristics of Respondents	30
4.3.1 Respondents by gender	30
4.3.2 Age of Respondent and Maize Production	31
4.3.3 Respondents by education level.....	32
4.3.4 Respondents by ward level.....	32
4.4 Costs of production and maize production	33
4.4.1 Sources of power	33
4.4.2 Modern methods	34
4.4.3 Costs of maize production.	36
4.4.4 The most costly input.....	38
4.5 Demographic characteristics and maize production.....	39
4.5.1 Age and new technology	39
4.5.2 Education and new technology.....	40
4.5.3 Gender and farm size	41
4.6 Agricultural extension services and maize production.....	42
4.6.1 Attendance of field days.....	42
4.6.2 The last field day attended.....	43
4.6.3 Extension visits and soil testing.....	44
4.6.4 Importance of extension services.....	45

4.6.5 Improved agricultural practices.....	46
4.6.6 Availability of arable land.....	46
4.6.7 Agricultural extension officers.....	47
4.7 Credit accessibility and maize production.....	49
4.7.1 Credit accessibility.....	49
4.7.2 Last credit obtained.....	49
4.7.3 Membership.....	51
4.7.4 National and county governments.....	51
4.7.5 Access to credit and the decision to use inorganic fertilizer.....	52
4.7.6 Barter arrangements.....	53
4.7.7 Farmers groups.....	54
4.7.8 Saving surplus cash.....	55
4.7.9 Maize shortage.....	55
CHAPTER FIVE:SUMMARY OF FINDINGS, CONCLUSIONS AND	
RECOMMENDATIONS.....	57
5.1. Introduction.....	57
5.2 Summary of the Findings.....	57
5.3 Conclusions.....	60
5.4 Recommendations.....	62
5.5 Suggestions for further research.....	64
REFERENCES.....	65
APPENDICES.....	74
APPENDIX1: LETTER OF TRANSMITTAL.....	74

Appendix 2: Farmers Questionnaire..... 75

LIST OF TABLES

Table 3.1: Sample Size Distribution Table.....	26
Table 3.2: Operational Definition of Variables	29
Table 4.1: Gender Distribution of the Respondents.....	30
Table 4.2: Age distribution of the respondents.....	31
Table 4.3: Education Level.....	32
Table 4.4: Farmers' Ward.....	33
Table 4.5: Sources of power	33
Table 4.6: Modern methods of farming.....	35
Table 4.7: Minimum tillage in maize production.....	36
Table 4.8: Fertilizer	37
Table 4.9: Herbicides.....	37
Table 4.10: The most costly farm input	38
Table 4.11: Age and new technology.....	39
Table 4.12: Education level and new technology.....	40
Table 4.13: Male headed households and fertilizer application.....	41
Table 4.14: Farm size and fertilizer application	42
Table 4.15: Attendance of field days.....	43
Table 4.16: The last field day attended.....	43
Table 4.17: Extension visits and soil testing.....	44
Table 4.18: Importance of extension services.....	45
Table 4.19: Improved agricultural practices.....	46
Table 4.20: Availability of arable land	47
Table 4.21: Agricultural Extension officers	48
Table 4.22: Those who have ever received credit	49
Table 4.23: Last credit obtained.....	50
Table 4.24: Membership.....	51
Table 4.25: National and county governments.....	52
Table 4.26: Access to credit and decision to use inorganic fertilizer.....	52

Table 4.27: Barter arrangements	53
Table 4.28: Farmer groups	54
Table 4.29: Saving surplus cash	55
Table 4.30: Maize shortage	56

LIST OF FIGURES

Figure 2.1: Conceptual Framework Showing the relationship between the independent and dependent variables	20
---	----

ABBREVIATIONS AND ACRONYMS

- ADB** – Agriculture Development Bank of Pakistan.
- AEOs** – Agricultural Extension Officers.
- CAN** – Calcium Ammonium Nitrate fertilizer.
- CBS** – Central bureau of statistics
- CDF** – Chipata District Farmers Association.
- CIMMYT** – International Maize and Wheat Improvement Centre.
- CSPR** – Civil Society for Poverty Reduction.
- DAP** – Di-ammonium Phosphate fertilizer.
- FAO** – Food and Agriculture Organization.
- FSP** – Fertilizer Support Programme.
- GDP** – Gross Domestic Product.
- GoK** – Government of Kenya.
- GRZ** – Government of the Republic of Zambia.
- MDGs** – Millennium Development Goals
- MoA** – Ministry of Agriculture.
- MT** – Metric tonnes.
- NCPB** – National Cereals and Produce Board.
- NPK** – Ratio of Nitrogen to Phosphorus to Potassium.
- NACOSTI** – National Council of Science and Technology and Innovation.
- PRSP** – Poverty Reduction Strategy Paper.

ABSTRACT

The purpose for this study was to investigate factors influencing maize production among small scale farmers of Bungoma Central Sub County, Kenya. The study was guided by the following objectives: to investigate how costs of production influence maize production of small scale farmers, to establish how demographic characteristics influence maize production of small scale farmers, to determine how extension services influence maize production of small scale farmers and to examine how accessibility to credit influence maize production of small scale farmers of Bungoma Central Sub County. The study adopted descriptive survey design which was used to obtain information to describe the existing phenomena. The target population was 18,580 both male and female consisting of small scale farmers. The estimated sample size was 202 from the target population using Cochran 1963 formula at 7% level significance. The study employed stratified random sampling in order to include all the wards; proportionate allocation was used to determine the number of farmers from each ward that would be the respondents in the study. Systemic random sampling was used to select the actual respondents from the wards. Content validity was used where the researcher shared the research instrument with his supervisors to assess its appropriateness in content. Split half method was employed to test the reliability of the instrument. A questionnaire with closed ended questions was prepared and distributed to the respondents in all the wards. The questionnaires were then collected after one week. All the questionnaires were filled and were used for analysis. Data was analyzed using descriptive method. Frequency tables and percentages were used for data presentation after analysis. The findings revealed that fertilizer remains the most costly input in maize production, followed by land preparation. Also most farmers do not attend field days and only a negligible percentage have access to credit. The national and county governments should avail subsidized fertilizer in good time and make it easily accessible. Proper sensitization should be done by agricultural extension officers to all farmers about the available extension services and county government should provide sufficient facilitation to agricultural extension officers to promote extension services. Farmers should be encouraged to form groups in order to access credit services, market their produce and acquire farm inputs collectively. Both national, county governments and financial institutions should make credit easily accessible and affordable to small scale farmers. The researcher recommends further research on causes of low attendance of field days and low level of accessing extension services in general to ascertain the underlying causes of low dissemination of extension information.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Maize is one of the most important cereal crops in the world, in agricultural economy both as food for human beings, feed for animals and other industrial raw materials. It is one of the world's leading crops cultivated over an area of about 142 million hectares with a production of 637 million tons of grain. In Nepal, the current area planted under maize was 849,892 ha with an average yield of 2.02 t ha (CBS, 2006). It is estimated that for the next two decades the overall demand of maize will be increased by 4% ~8% per annum resulting from the increased demand for food. Such increase in demand must be met by increasing the productivity of maize per unit of land (Paudyal *et al.*, 2001; Pingali, 2001). However, over the decades, the agricultural production including maize has either remained stagnant or increased at a very slow rate (Kaini, 2004).

Maize is the staple food in Zambia and most small-scale farming households are engaged in maize production. Fertilizer is used predominantly on maize and agricultural marketing is dominated by maize sales among smallholders (Govereh *et al.*, 2003). Improving maize productivity has been a major goal of the Zambian government. Over 80% of smallholder farmers nationwide own less than 5 hectares of land. Zambian government agricultural policy has for the past several decades focused on fertilizer subsidies and targeted credit programs to stimulate small farmers' agricultural productivity, enhance food security and ultimately reduce poverty.

Agriculture in Nigeria as in most other developing countries is dominated by small scale farm producers (Oladeebo, 2004). Education of farmers, farm size, extension agent contact, farm income, ability to predict rainfall, modern communication facilities, output of maize and mixed cropping combination with maize have positive influence on maize production. Mpuga (2004) conducted a research study in Uganda to investigate the factors which affect demand for agricultural credit. The findings of the study reveal that the demand for agricultural credit is strongly and significantly affected by the age, location, education

level, value of the assets held by the household, occupation, and other dwelling characteristics. On the other hand, the availability of the sources of credit has limited effect on the demand for credit.

Olwande *et al.*, (2009) in Kenya also confirm that age, education, credit, presence of a cash crop, distance to fertilizer market and agro ecological potential significantly influenced maize production by smallholder farmers. Wanyama *et al.*, (2009) in Kenya showed that change agent (extension) visit to farmers, proportion of land under maize production, sex of household head, and agricultural training significantly affected likelihood of farmers adopting new technologies in maize production. Maize is the main staple in the diet of over 85 per cent of the population in Kenya. The per capita consumption ranges between 98 to 100 kilograms which translates to at least 2700 thousand metric tonnes, per year (Nyoro *et al.*, 2004). Small scale production accounts for about 70 per cent of the overall production. The remaining 30 per cent of the output is from large scale commercial producers (Export Processing Zone Authority, 2005). Small scale producers mainly grow the crop for subsistence, retaining up to about 58 per cent of their total output for household consumption (Mbithi, 2000). Poor weather is blamed for the low output of maize in some years. However, yields have also remained at an average of 2 tonnes per hectare below the possible 6 tonnes per hectare a situation attributed to inadequate absorption of modern production technologies such as high yielding maize varieties and fertilizers because of high input costs, lack of access to credit and inadequate extension services to small scale producers (Kang'ethe, 2004).

1.2. Statement of the Problem

Maize is the staple food for most Kenyan households and grown in all the farming communities. Due to diminishing farm sizes in Bungoma Central Sub County, crop productivity and the efficiency of farming systems are of great concern. Many researchers and policymakers have focused on the impact of adoption of new technologies in increasing farm productivity and income (Hayami and Ruttan, 1985). Increasing per capita food production, productivity and raising rural incomes are key challenges facing small-scale farmers in Bungoma Central Sub County. Here, over fifty percent of the population lives

below the poverty line and are food insecure (CBS, 2001, World Bank, 2000). According to the World Bank, (2000) definition, spending less than one USA dollar per person per day is considered to be below poverty line. Recent studies show that soil nutrient mining is widespread in western Kenya, resulting into land degradation and low crop productivity. This situation undermines the ability of many agrarian households to produce enough food for household subsistence (FAO, 2004, Smaling *et al.*, 1993, Tiftonell *et al.*, 2005). To attain this objective, provision of soil-related information services to the farmers such as application of inorganic fertilizers, organic manure, soil and water management and the use of improved commercial seeds, with the overall aim of addressing the rampant problems of soil and land degradation is imperative.

Agricultural productivity in Bungoma Central Sub County has continued to decline over the last two decades and poverty levels have increased (Ministry of Agriculture Bungoma Central Sub County 2014). On average maize yield is 8 bags per acre in Bungoma Central Sub County compared to the average yields of 18 bags per acre in Kimilili, 15 bags in Webuye, 12 bags in Bungoma South, 20 bags of Mt Elgon sub counties, (annual report 2013, ministry of agriculture Bungoma County). The problem of declining maize yields is magnified by the fact that population continues to increase annually at a rate of about 4.3% leading to decreasing per capita consumption with a population density of 570 people per km². Therefore increasing maize productivity in Bungoma Central Sub County is of urgent necessity and one of the fundamental ways of improving food security.

1.3. Purpose of the study

The purpose of this study was to investigate factors influencing maize production among small scale farmers of Bungoma Central Sub County.

1.4. The Objectives of the Study

The study was guided by the following objectives:

- 1) To investigate how costs of production influence maize production of small scale farmers of Bungoma Central Sub County.
- 2) To establish how demographic characteristics of small scale farmers influence maize production in Bungoma Central Sub County.

- 3) To determine how agricultural extension services influence maize production of small scale farmers of Bungoma Central Sub County.
- 4) To examine how accessibility to credit influence maize production among small scale farmers of Bungoma Central Sub County.

1.5. Research questions

- 1) To what extent did costs of production influence maize production of small scale farmers of Bungoma Central Sub County?
- 2) How did demographic factors influence maize production of small scale farmers of Bungoma Central Sub County?
- 3) To what extent did extension services influence maize production of small scale farmers of Bungoma Central Sub County?
- 4) To what extent did accessibility to credit influence maize production of small scale farmers of Bungoma Central Sub County?

1.6. Significance of the Study

The study findings and recommendations were hoped to help both the national and county governments to implement policies that can revitalize maize production and encourage other stakeholder participation on food security initiatives.

The study was endeavored to provide information to agricultural extension personnel to identify the strengths and weaknesses of the farmers in maize production and come up with appropriate capacity building programmes. Also for agricultural extension officers to examine their own weaknesses and strengths as change agents and come up with appropriate corrective measures to improve maize yields among small scale farmers.

The findings were hoped to provide information to small scale maize farmers to efficiently produce high maize yields with minimal inputs thereby maximizing profit.

The research study is also hoped to provide a base for further research on maize production issues especially among small scale farmers.

The research is also hoped to be a reference material in the University of Nairobi's Library. This will consequently hasten the realization of the MDGs and also vision 2030 in the Sub County and the whole nation at large.

1.7. Delimitations of the Study

Delimitation is the process of reducing the study population and area to a manageable size. This research was delimited in terms of the scope that it covered. It only targeted small scale maize farmers in Bungoma Central Sub County.

1.8. Limitation of the Study

According to Best and Khan (2008), limitations are conditions beyond the control of the researcher that may place limitations on the conclusion of the study and their application to other situations. Some respondents were affected by factors such as suspicion; however the researcher assured them of the confidentiality of the study. Some respondents wanted to give pleasing responses to avoid offending the researcher, however this was resolved by enlightening them that the research was purely objective and not subjective.

1.9. Assumptions underlying the Study

The researcher made the following assumptions in the process of carrying out the study: answers given by respondents reflected the factors influencing maize production among small scale farmers of Bungoma Central Sub County, the sample size selected was a representative of the target population and that the respondents were able to fill all the questionnaires without interacting with one another.

1.10. Definition of Operational Terms

Production:	Maize yield per acre of land measured in number of 90kg bags.
Costs of production:	These are inputs involved in maize production.
Small scale farmers:	Farmers having less than five acres of land for farming.

- Level of education:** The highest level of education attained by a farmer.
- Extension service:** The act of disseminating agricultural information.
- Demographic characteristics:** Demographic characteristics looked into in this study were gender, age, education qualification, sex of household head, farm size of the small scale farmers.
- Accessibility to credit:** The ease to obtain off farm financial assistance for farming activities.

1.11. Organization of the Study

The study has five chapters. Chapter one focuses on introduction, background to the study, problem statement, purpose and objectives of the study, research questions, significance, limitations, delimitations, and assumptions of the study and definition of terms. Chapter two is the literature review. Chapter two has been organized according to the objectives of the study. A theoretical framework, conceptual framework, research gap and summary of literature review at the end. Chapter three presents; research design, target population, sampling procedure and sample size, research instruments, data collection procedure and analysis and operationalization of study variables. Chapter four presents the data analysis, interpretation, presentation and discussions of the findings. Chapter five presents the summary, conclusions, recommendations and suggestions for further research in the area of study.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This section consists of review of related literature. The section contains: introduction, influence of the costs of production and maize production, the influence of extension services and maize production, the influence of education level and maize production and finally the influence of credit accessibility and maize production among small scale farmers of Bungoma Central Sub County. It also covers theoretical framework, conceptual framework, research gap and summary of literature review.

2.2. Costs of production and maize production

According to Nyoro J.K (2000) Machinery costs includes costs of ploughing, harrowing, chiseling, planting, spraying, harvesting, shelling and transport to stores. Machinery costs are generally high particularly in maize. Farmers have also complained that the ownership of farm machinery has reduced in the last 10 years due to lack of financing mechanism for procurements of farm machinery. High costs of farm machinery thus have affected the quality and timeliness of farm operations such as the land preparation in the key maize production zones. The high costs of farm operation have forced farmers to reduce the quality of seedbed preparation. Whereas in 1994, most maize producers for example did two ploughs and two harrows to create a fine seedbed suitable for planting maize and wheat, in 1999 and 2000 seasons, most farmers had reduced the number of times they ploughed and harrowed thereby reducing the quality of the seed bed. Thorough land preparation normally involves deep ploughing and thorough incorporation of weeds and crop residues, row planting, correct placement of fertilizers through use of machinery; superior and thorough crop protection against weeds, and better harvesting operations due to use of machinery. Reduction in the quality of land preparation thus could have adversely affected maize yields and hence cause an increase in production costs per unit production. Maize yields in the country during the favorable weather conditions vary from 10 to 27 bags per acre (2.0 and 5.4 tons per hectare). Production levels and structure of production costs differ between the

large and small production systems. Large-scale production systems have higher yields than the small-scale systems because of various reasons. In Trans-Nzoia for example, large-scale maize production systems use about 39 percent more intermediate inputs- fertilizers and agrochemical-than the small-scale systems. Similarly, the large-scale systems have higher mechanization costs than the small-scale systems. The small-scale systems on the other hand depend on manual labor for some operations hence incurring higher labor costs. Although the yields for the large-scale systems in Trans-Nzoia are about 47 percent higher than that in the small-scale systems, the costs of production are about the same at Ksh 780 per bag because the large-scale systems incur on average a higher cost per acre. Due to slightly lower yields, Uasin Gishu has a higher cost of production than Trans Nzoia.

Farm characteristics that make a significant impact on uptake of the improved maize varieties include hiring of labor and off-farm income. Hiring labor might not directly influence adoption of improved varieties, but it is a proxy for available cash to invest in agricultural production, E. Wekesa *et al.*, (2003). From the time of planting until about a third of its life, maize is very susceptible to weed competition. Failure to weed during this critical period may reduce the yield by 20% (Bangun 1985). The recommended practice is to weed twice or more depending on the extent of weed infestation. Most farmers who grow high-yielding varieties weed twice, while those with local varieties usually weed only once. Requirements for labour vary according to variety, type of land, previous crop in sequence, cropping method, moisture availability and the source of labour. It appears that both male and female labourers work interchangeably for most of the various cropping operations, except for: Soil preparation, where male labour is used in combination with draft cattle and spraying, where male labour is used exclusively. Limited evidence from previous research suggests that too much farm family labour encourages the adoption of labour-intensive technology, while the lack of it discourages both the adoption and efficient use of the technology (Schutjer and Van der Veen 1976). In the absence of labour-saving technology, therefore, limited family labour may hamper the adoption of hybrid varieties. Availability of family labour is positively related to the frequency of adoption in hybrid maize variety, the relationship being stronger in cases of mono cropping than of intercropping. Limited family

labour therefore appears to constrain the adoption of more labour-intensive technology such as the hybrids. Aman D. *et al.*, (2004).

Fertilizer prices can influence negatively or positively maize yields; if the price decreases farmers purchase more meaning they will apply more leading to higher yields and if it increases farmers purchase less, therefore apply less and therefore get less yields. (Wanyama *et al.*, 2010). Many farmers in Sub-Saharan Africa (Hassan, 1998) countries face declining crop yields, which has constrained economic growth. The underlying constraints are low and unreliable rainfall, pests and diseases, and inherently infertile soils. The soil infertility is related mainly to the low nutrient status of the soils while the qualities of some soils have declined as a result of continuous cultivation without returning enough of them to the soil. Maize is the most important staple food crops in Kenya. It is estimated to contribute more than 25% of agricultural employment and 20% of total agricultural production (Government of Kenya, 2001). Despite the key role maize plays in food security and income generation in Trans Nzoia district and the whole country at large, its productivity has not been adequate especially in the past four decades during which stagnation/decline in maize yield led to frequent food security problems. Ariga *et al.*, 2006) have attributed maize yield decline to two main reasons: (i) declining soil fertility and (ii) increase in world fertilizer prices (Omamo 2003; Xu, *et al.*, 2006). The situation has been exacerbated by maize price fluctuation and occasional importation of cheap maize grains. The problem of declining maize yields is magnified by the fact that population continues to increase annually at a rate of about 2.9% leading to decreasing per capita consumption. The combined effect of increasing human population and poor maize yields on the country's capacity to feed the population is then accelerated annually (Government of Kenya, 2001; and 2004). The major contributory factors are soil degradation and low use of fertilizers. It has been proposed that soil nutrient mining is an important issue contributing to poor maize production in Kenya (De Jaeger *et al.*, 1998). Enhanced soil management has been recognized as crucial to soil fertility replenishment and enhanced agricultural productivity Though important in soil fertility improvement it has be reported that, farmers typically apply inorganic fertilizers at rates well below recommended levels, or not at all (Ariga *et al.*, 2006). In a move to bolster production after a disputed presidential election that led to disruption of farm activities,

NCPB imported fertilizer in 2008 but delivered it late which contributed to a poor crop. This in turn created pressure from some farmer lobby groups and activists for increased subsidization of inputs (fertilizer and seed) to raise productivity of maize to counter an expected increase in hunger in 2009. In 2009 the GoK imported substantial amounts of fertilizer through NCPB to be distributed through its branches and select private retailers at subsidized prices. Given the prominence of maize in Kenyan agriculture (Pearson *et al.*, 1995), returns to maize production as reflected in maize prices likely are an important influence on households' willingness to apply fertilizer. Indeed, Mose, Nyangito, and Mugunieri (1997) identified the maize: fertilizer price ratio as a significant determinant of fertilizer use on small farms in Kenya: the higher the ratio, the higher were fertilizer application rates among sampled farmers. The positive and significant relationship between maize prices and revenues from fertilizer sales confirms the dominant perception in Kenya of a positive correlation between the demand for fertilizer and returns to maize production.

Agricultural technology for the small scale farmer must help minimize the drudgery or irksomeness of farm chores. It should be labor-saving, labor-enhancing and labor-enlarging. The farmer needs information on production technology that involves cultivating, fertilizing, pest control, weeding and harvesting. V. N. Ozowa, (1995). Herbicides lower production costs by saving labor and enhancing productivity. The Cost of production is lower per bag and gross margin per hectare is greater when herbicides are used, FSRP/ACF and MACO, (2 February, 2011).

2.3. Agricultural extension services and maize production

The economy of Ghana is basically agrarian. This is against the backdrop that agriculture contributes about 35 percent to the Gross Domestic Product (GDP) of the country (ISSER, 2010). Besides, agricultural activities constitute the main use to which Ghana's land resources are put. The agricultural sector is the major source of occupation for about 47 percent of the economically active age group of Ghanaians (Wayo, 2002). Despite the fact that the country covers an area of approximately 239 thousand square kilometers of which agricultural land forms about 57 percent of the total land area, only about 20 percent of this agricultural land across the different agro-ecological zones is under cultivation. This

means that Ghana is yet, to fully utilize its natural resource base, particularly land for agricultural production.

The country's ability to fully utilize its agricultural production potential depends on the innovativeness of actors in the agricultural sector, particularly farmers. The capacity of farmers and actors along the agricultural value chain to innovate in their production activities is contingent on the availability of technology. The Green Revolution in Asia as demonstrated in the empirical literature (Moser and Barrett, 2003; Minten and Barrett, 2008; among others) is an indication that improved technology adoption for agricultural transformation and poverty reduction is critical in modern day agriculture. Technical change in the form of adoption of improved agricultural production technologies have been reported to have positive impacts on agricultural productivity growth in the developing world (Nin *et al.*, 2003). Promotion of technical change through the generation of agricultural technologies by research and their dissemination to end users plays a critical role in boosting agricultural productivity in developing countries (Mapila, 2011). The availability of modern agricultural production technologies to end users, and the capacities of end users to adopt and utilize these technologies are also critical. Unfortunately, the Ghanaian agricultural sector is characterized by low level of technology adoption and this according to Ghana's Ministry of Food and Agriculture (2010), contributes to the low agricultural productivity in the country. This is worrisome given that numerous interventions by successive governments have been implemented to promote technology adoption among farmers. Unraveling the reasons for low technology adoption among farmers requires that the factors that influence their decisions to adopt or not to adopt modern agricultural production technologies be identified.

Access to extension services is critical in promoting adoption of modern agricultural production technologies because it can counter balance the negative effect of lack of years of formal education in the overall decision to adopt some technologies (Yaron *et al.*, 1992). Access to extensions services therefore creates the platform for acquisition of the relevant information that promotes technology adoption. Access to information through extension services reduces the uncertainty about a technology's performance hence may change individual's assessment from purely subjective to objective over time thereby facilitating adoption. Related to this is access to extension services which was also found to be

positively related to the adoption of modern agricultural production technologies and was found to be significant at 10 percent level.

This means that farm households are more likely to adopt modern agricultural production technologies if they have access to extension services. Extension services are one of the prime movers of the agricultural sector and have been considered as a major means of technology dissemination. Visits by extension agents to farmers and participation of the latter in field days, tours, agricultural shows or seminars are cost effective ways of reaching out with new maize technology. Regarding the visits, which were paid by extension agents, 41% of households in western Kenya declared receiving at least one visit by extension agents; about 78% were adopters and only about 27% were non adopters illustrating the low output of extension services which most probably impacted negatively on adoption decision. (Adoption of a New Maize and Production Efficiency in Western Kenya, Mignouna *et al.*, (2010).

According to FAO (1999), extension workers could provide assistance to individual farmers and groups in establishing links with formal and semi-formal financial institutions and by providing a list of input suppliers in the area who operate credit schemes, out grower schemes, or barter arrangements. It is not sufficient just to improve small farmers' access to finance; they need to be able to manage their money efficiently. This is all-too-often overlooked. In the same way that extension workers can do much to assist farmers market their maize, there is considerable scope for them to help farmers to obtain necessary inputs. These activities include helping farmers to: calculate their input needs; identify where to buy their inputs; organize group transport; obtain credit and saving the surplus cash at harvest time to purchase inputs for the following season.

2.4. Demographic characteristics of small scale farmers and maize production

Socio-economic conditions of farmers are the most cited factors influencing technology adoption. The variables most commonly included in this category are age, education, household size, landholding size, livestock ownership and other factors that indicate the wealth status of farmers. Farmers with bigger land holding size are assumed to have the ability to purchase improved technologies and the capacity to bear risk if the technology fails (Feder *et al.*, 1985). This was confirmed in the case of fertilizer by Nkonya

et al., (1997) Studies undertaken have shown that access to resources and services (information, credit) vary by gender of household head who makes key decisions. It was hypothesized that the variable could positively or negatively influence the adoption of fertilizer and soil erosion information technologies in Tanzania, Hassan *et al.*, (1998a) in Kenya and Yohannes *et al.*, (1990) in Ethiopia whereas; farm size did not matter in Nepal Shakaya and Flinn, 1985).

The role of education in technology adoption has been extensively discussed in the literature. Education enhances the allocative ability of decision makers by enabling them to think critically and use information sources efficiently. Producers with more education should be aware of more sources of information, and more efficient in evaluating and interpreting information about innovations than those with less education (Wozniak 1984). Education was found to positively affect adoption of improved maize varieties in West shoa, Ethiopia (Alene *et al.*, 2000), Tanzania (Nkonya *et al.*, 1997) and Nepal (Shakaya and Flinn, 1985). (Agrekon, Vol 45, No 1 (March 2006) Fufa & Hassan.

For widespread adoption of improved varieties and chemical fertilizer by farmers, extension educators need to understand the factors affecting technology adoption (Abebaw & Belay, 2001). Adoption of technology is influenced by physical, socio-economic, and mental factors including agro-ecological conditions, age of farmer, family size, education of farmer, how-to-knowledge, source of information, and farmer's attitudes towards the technology (Feder *et al.*, 1985; Byerlee & Polanco, 1986; Neupane *et al.*, 2002; Rogers, 2003). Young farmers are more likely to adopt a new technology because they have had more schooling and are more open to attitude change than older farmers (International Maize and Wheat Improvement Center [CIMMYT], 1993; Visser & Krosnick, 1998). Education is expected to enhance decision making and the adoption of agricultural technologies. Knowledge influences adoption. Farmers who have adequate knowledge of technology use are more likely to adopt it (Abebaw & Belay, 2001; Rogers, 2003).

On the other hand, farm size, level of formal education of the head of the farm family, number of instructional contacts the farmer had with extension agents, ratio of credit to total cost of production, degree of farm enterprise commercialization, membership of farmers' associations, knowledge of fertilizer use and application as well as ratio of non-

farm to total annual income of farmers had positive signs, implying direct effect on the probability of adoption and intensity of use of fertilizer by the farmers. Specifically, these imply that a unit increase in the farm size, level of formal education of the head of the farm family, number of instructional contacts the farmer had with extension agents, ratio of credit to total cost of production, degree of farm enterprise commercialization and ratio of non-farm to total annual income of farmers would bring about increased adoption and intensity of use of fertilizer among the farmers.

Also, membership of farmers association brings about increased awareness on the part of the farmers regarding existing and new farming technologies. With increased awareness of the availability of improved farm inputs coupled with information on their applicability, the level of adoption and intensity of use of fertilizer would increase. These views have also been expressed by Chukwuji and Ogisi (2006).

Cultivation of large farm sizes makes it more economical for farmers to apply fertilizers. Also, the larger the size of farm cultivated and therefore output produced, the more commercialized the farm would be. Increased level of education of farmers and contacts with extension agents lead to increased knowledge of input uses and their application because ignorant of the uses and abuses of inputs in crop production could discourage farmers from using them. These findings are in line with the reports of Daramola and Aturamu (2000) who noted that contacts with extension agents as well as acquisition of formal education exposes the farmers to the availability and technical-know-how of innovations and increases their desirability for acquiring them. The high and positive effect of off farm incomes on the adoption indices of the farmers is an indication that they need improved financial bases in order to adopt better farming technologies. Also gender issues in agricultural production and technology adoption have been investigated for a long time. Most of such studies show mixed evidence regarding the different roles men and women play in technology adoption. Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana, and Overfield and Fleming (2001) studying coffee production in Papua New Guinea show insignificant effects of gender on adoption.

2.5. Credit accessibility to small scale farmers and maize production

A productive resource such as agricultural credit is very vital for efficient and sustainable production activities especially in developing countries (Nweke, 2001). Farm credit is among the essential factors needed for agricultural production, and with it, farmers can secure farm inputs such as; farm equipments and hired labour (Odoh, *et al.*, 2009). Farm credit is widely recognized as one of the intermediating factors between adoptions of farm technologies and increased farm income among rural farmers in Nigeria (Omonona *et al.*, 2008, Akpan *et al.*, 2013). It is one of the fundamental ingredients of sustainable agricultural production; as such its accessibility and demand is among the prerequisites for attaining the national goal of reducing rural poverty and ensuring self sufficiency in food production in the country (Nwaru *et al.*, 2011 and Akpan *et al.*, 2013). Consequently, a general awareness on the significance of credit as a tool for agricultural development has been increasing (Omonona *et al.*, 2008). Agricultural credit is seen as an undertaking by individual farmers or farm operators to borrow capital from intermediaries for farm operations (Odoh, *et al.*, 2009). According to Olayemi (1998), credit involves all advances released for farmers' use, to satisfy farm needs at the appropriate time with a view to refunding it later. Thus, credit can be in the form of cash or kind, obtained either from formal, semi-formal or informal sources.

Access to agricultural credit has been positively linked to agricultural productivity in several studies in Nigeria (Rahaman and Marcus, 2004, Abu, *et al.*, 2011, Ugbajah, 2011). Despite this positive correlation, some empirical studies have revealed cases of credit insufficiency among rural farmers in Nigeria (Deaton 1997; Udry 1990; Zeller 1994; Idachaba 2006; Adebayo and Adeola, 2008 and Ololade and Olagunju, 2013). In the similar way, several studies have identified reasons for poor credit access among rural farmers in Nigeria. Among others, Ololade and Olagunju, (2013) discovered a significant relationship between farmer's sex, marital status, lack of guarantor, high interest rate and access to credit in Oyo State, Nigeria. A study by Ajagbe (2012) showed that farmer's age, membership to social group, value of asset, education and the nature of the credit market are the major determinants of access to credit and demand among rural farmers in Nigeria. In addition, Akpan *et al.*,(2013) reported that farmers' age, gender, farm size, membership of social

organization, extension agent visits, distance from the borrower's (farmer) residence to lending source, years of formal education and household size are important determinants of access to credit among poultry farmers in Southern Nigeria. Contribution by Lawal *et al.*, (2009) showed that, a direct relationship exists between social capital, contribution in the associations' by the farming households and access to credit.

History of modern agriculture has witnessed huge expansion in production. The development of agriculture is mainly due to the extensive use of credit. Agricultural credit is considered as an important factor in the course of modernization of agriculture. It creates and maintains adequate flow of inputs, and thus increases efficiency in farm production. It makes farmers able to use modern technologies and advanced practices. Credit facilities are vital for progress of the rural and agricultural development. In short, agricultural credit plays integral role in boosting up the speed of agricultural modernization and economic development, but only if it is easily and widely available and utilized effectively.

Various researchers have worked in different regions of the world on access to agriculture credit, obstacles faced by farmers in accessing agriculture credit and the impact of their socio-economic characteristics on access to agriculture credit for example: Diagne and Zeller (2001) differentiated between participated in credit market and access to credit. They concluded that farm households have access to credit but do not choose to take part in credit market due to risk and expected rate of return on loan. The authors studied the formal and informal loans in agriculture. They found that formal lenders like to provide a greater percentage of loans to farmers than informal lenders. Khandker and Faruqee (2003) studied the availability of sufficient formal and informal agricultural credit in Pakistan. They concluded that the major share of formal credit is provided by agriculture development bank of Pakistan (ADBP). But these loans are not cost effective due to covariate risk. They identified that the causes of covariate risk is due to the fact that large holders get huge amount of finances in comparison to the small holders. They recommended that if ADBP contribute to small holders than for large holders, it will reduce its loan default cost.

Khalid (2003) studied the factors which affect farmers' access to credit using data collected from 300 farmers selected randomly from few villages of Tanzania, including the villages of Unguja and Pemba. Results indicate that gender, age, level of income, education

level, and level awareness regarding credit availability are the key factors which significantly affect the access to credit by small-scale farmers. FAO (2004) reported that in Indonesia commercial banks are issuing agricultural credit but due to their difficult procedure of access to credit and rigid requirements; their credit policy is not working well. The author suggested that government must setup sustainable micro finance institutions, launch land certificate program, and introduce modified conventional banking system for small credit holders.

According to Awoyinka and Adeagbo (2006) annual income from cassava production, farm size cultivated, cost of fund from formal sources, cost of fund from informal sources membership of the state cassava production program, and possession of collateral are the main vital factors that influence farmers demand for credit. Wittlinger and Tuesta (2006) found that small scale single crops farmers are facing many obstacles in securing credit. These types of farmers require definite conditions, strategic alliances with members, low prices and conditional climate; because only in these conditions these farmers can have access to credit. Most of the farmers only obtained loan from informal sources such as suppliers, traders, processors etc.

Fletschner (2009) explained that those household which are more educated, wealthier and have more family labor; can easily approach and access financial institutions. The farmers who have lack of land face many obstacles in accessing credit. According to Satish and Nirupam (2009) security against loan is the main source to access credit and lenders utilize collateral to secure the loan. For the large households the land is used as collateral in the agrarian economy. For the small holders land is not used as collateral. Therefore, they have to provide assets other than farm land as collateral such as crops, gold, commitment of future labor and 3rd party as a guarantor. When the smallholders fail to provide the collateral then they cannot access formal credit. Availability of off-farm incomes is an indication of farmer's involvement in nonfarm economic activities, with complementing income effects on farming activities. The incomes generated serve to ferry the farmers over the periods waiting for their crops to mature. The incomes also help the farmers to acquire the necessary farm inputs. Daramola and Aturamu (2000) however, reported opposite effects and pointed out that high proportion of off-farm relative to farm income suggests that

incomes from farm investments are not enough to encourage farmers to take on some risks and adopt. It is obvious therefore that making the rewards from farm investments attractive through appropriate policies would discourage farmers from going into off-farm economic activities so as to increase the efficiency of farming activities. The financial bases of the farmers can also be increased through policies aimed at making them have easier access to production credit at affordable prices so as to increase their ability to purchase and use fertilizers. Credit availability to farmers is a measure of his financial worth and that most of them can not adopt any innovations when their purchasing power is ineffective.

According to FAO (1999) barter arrangements with input suppliers can help farmers exchange their maize (or other acceptable crops) for required inputs. No cash changes hands but generally the exchange of produce must take place prior to the release of inputs. In Zambia one of the main fertilizer companies has established depots at district level in the provinces where it operates, in order to improve access for small-scale farmers. Furthermore agricultural traders and agribusinesses in addition to operating out grower schemes, agricultural traders can provide credit directly to small-scale producers. Also farmer associations can assist in the supply of inputs and credit to individual association members, and market produce through a collective marketing mechanism;

2.6. Theoretical Framework

The theoretical framework consists of theories, principles, generalizations and research findings which are closely related to the present study. The researchers knowledge of the problem and his understanding of the theoretical and research issues related to the research question will be demonstrated. This section looked into the underlying theories supporting maize production. In this study the theory of Allocative efficiency was used. Allocative efficiency is a measure of how an enterprise uses production inputs optimally in the right combination to maximize profits (Inoni, 2007). Thus, the allocatively efficient level of production is where the farm operates at the least-cost combination of inputs. Most studies have been using gains obtained by varying the input ratios based on assumptions about the future price structure of products say maize output and factor markets. This study follows Chukwuji, *et al.*, (2006) reviewed assumptions used by farmers to allocate resources

for profit maximization. Such assumptions included, farmers choose the best combination (low costs) of inputs to produce profit maximizing output level; there is perfect competition in input and output markets; producers are price takers and assumed to have perfect market information; all inputs are of the same quality from all producers in the market.

Allocative efficiency can also be defined as the ratio between total costs of producing a unit of output using actual factor proportions in a technically efficient manner, and total costs of producing a unit of output using optimal factor proportions in a technically efficient manner. (Inoni, 2007). Thus for the farm to maximize profit, under perfectly competitive markets, which requires that the extra revenue (Marginal Value Product) generated from the employment of an extra unit of a resource must be equal to its unit cost (Marginal Cost = unit price of input) (Chukwuji, *et al.*, 2006). In summary if the farm is to allocate resources efficiently and maximize its profits, the condition of $MVP = MC$ should be achieved.

2.7 Conceptual Framework

Conceptual framework is a diagrammatic representation of variables in a study, their operational definition and how they interact in the study. It shows how the independent variables influence the dependent variable of the study. The framework below is an illustration of possible underlying factors influencing maize production among small scale farmers. The independent variables are grouped together on the left side but not in any order of importance. The dependent variable is placed on the right hand connected with an arrow as a sign of direct relationship.

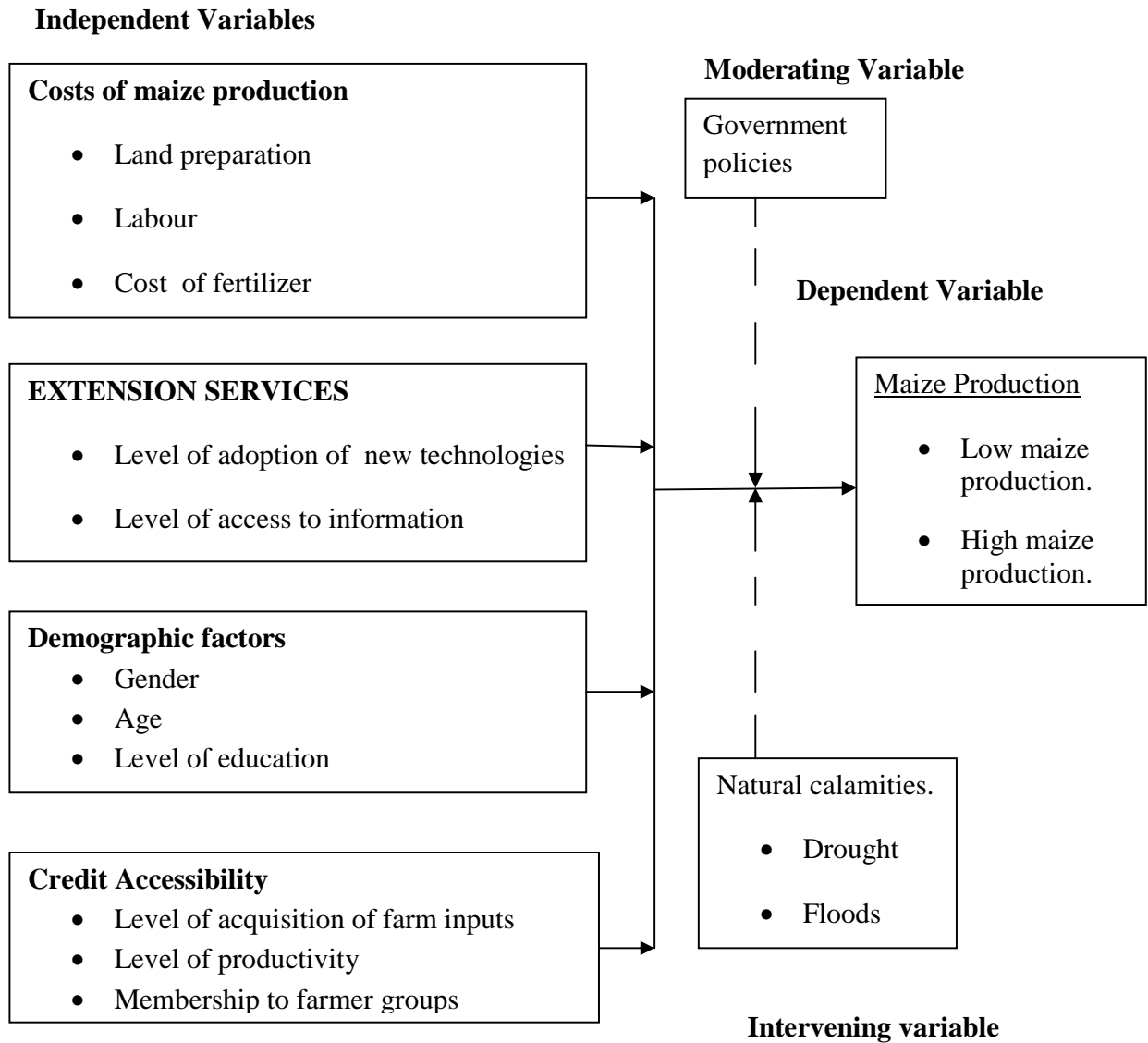


Figure 2.1: Conceptual Framework showing the relationship between the independent and dependent variables

Source: Researcher (2014)

2.7.1 Discussion of Conceptual Framework

The cost of inputs like fertilizer, labour and land preparation, have a correlation to maize production.

Maize production depends also on demographic characteristics of the community of concern. The farm size of the farmer, gender roles, age and education level of the farmer involved.

Extension services and credit accessibility also had an influence on maize production which in this study was the dependent variable especially on adoption of new technology and acquisition of farm inputs.

Other factors, even if not directly related to the study, for example government policies, community altitude and weather conditions will also influence the study's dependent variable.

2.8 Research gap

The knowledge gap that was addressed in this study is that despite the government's efforts to improve maize production through fertilizer subsidies and provision of agricultural extension services, maize production remains low in Bungoma Central Sub County for the last two decades. On average maize yield is 8 bags per acre in Bungoma Central Sub County compared to the average yields of 18 bags per acre in Kimilili, 15 bags in Webuye, 12 bags in Bungoma South, 20 bags of Mt Elgon sub counties, (annual report 2013, ministry of agriculture Bungoma County). This prompted the researcher to investigate factors influencing maize production among small scale farmers of Bungoma Central Sub County. The problem of declining maize yields is magnified by the fact that population continues to increase annually at a rate of about 4.3% leading to decreasing per capita consumption with a population density of 570 people per km². The combined effect of increasing human population and poor maize yields in the sub county weakens its capacity to feed the population. (Government of Kenya, 2001; and 2004). With global technology advancements in agriculture and given that maize is the main staple food in the county, small scale farmers can produce adequate maize for food, if they apply the technologies and sell the surplus.

2.9. Summary of Literature Review

The main purpose of reviewing related literature is among other concerns to examine how other factors with possible influence on maize production are interrelated.

The literature reviewed is intended to help the researcher identify gaps in knowledge in order to create a framework and a direction for other new research studies. In the literature reviewed, costs of production, demographic factors, extension services and credit accessibility and their influence on maize production have been investigated.

Most of the studies reviewed have discovered the importance of giving out fertilizer subsidies to farmers to improve the amounts applied in order to improve maize yield, since it is the main staple food for Sub Sahara Africa, Kenya and Bungoma Central Sub County is no exception. The same studies have discovered that despite the subsidies the percentage of improved yield is still low. The researcher would therefore wish to uncover other possible gap problems on why farmers are still applying low rates of fertilizer. The source of power on the farm is another area highlighted contributing to low maize production, however not many solutions have been forwarded to solve the problem.

Given that the economy of most developing nations is mainly agrarian, the country can only revitalize agricultural production through innovativeness of actors in the agricultural sector, particularly small scale farmers. The capacity of farmers and actors along the agricultural value chain to innovate in their production activities is contingent on the availability of technology. Unraveling the reasons for low technology adoption among farmers requires that the factors that influence their decisions to adopt or not to adopt modern agricultural production technologies be identified. Access to extensions services therefore creates the platform for acquisition of the relevant information that promotes technology adoption. Access to information through extension services reduces the uncertainty about a technology's performance hence may change individual's assessment from purely subjective to objective over time thereby facilitating adoption. Also farm credit is widely recognized as one of the intermediating factors between adoptions of farm technologies and increased farm income among rural farmers. In short agricultural credit plays integral role in boosting up the speed of agricultural modernization and economic development, but only if it is easily and widely available and utilized effectively. The

researcher wishes to find ways of enabling farmers' access extension services and credit easily and affordably.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter gives a brief overview of various steps and methods that the research employed in the study. It gives a description of the research design used, target population, sample and sampling procedure, instruments for data collection, validity and reliability of the research instruments, data collection procedures and data analysis.

3.2. Research design

According to Kothari (2004), states that research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. Descriptive research studies are those studies which are concerned with describing the characteristics of a particular individual, or of a group. Descriptive survey design was used in this study. This is because as Kothari (2004) says, the descriptive design assists the researcher in collecting data from a relatively larger number of cases at a particular time. The descriptive survey design helps answer the questions like who, what, where and how on describing the phenomenon on study. This design was appropriate for the study because it enabled data collection from the sample on the factors influencing maize production among small scale farmers.

3.3. Target Population

Target population is that population that the researcher wants to generalize the results of the study. Mugenda and Mugenda (2003) define target population as the entire group a researcher is interested in or the group about which the researcher wishes to draw conclusion.

According to the records from the Ministry of Agriculture Bungoma Central Sub County, it has four Wards. The Sub County has a population of 18,580 small scale farmers by the year 2014 (Ministry of Agriculture Bungoma Central Sub County Office, 2014). The target population for this study was 18,580 small scale maize farmers.

3.4. Sample Size and Sampling Procedure

This section presents the method used to determine the study sample size from which data was collected. It also describes the sampling techniques used in selecting elements to be included as the subjects of the study sample. A sample size is a sub-set of the total population that is used to give the general views of the target population (Kothari 2004). The sample size must be a representative of the population on which the researcher would wish to generalize the research findings.

3.4.1 Sample Size Determination

The researcher used a formula adopted by Cochran 1963 to determine the sample size as 202 at 7% level of significance

$$n = N / [1 + N (e)^2]$$

Where; n – sample size

N – Population size

e – Level of significance

$$n = 18,580 / 1 + 18,580(0.07)^2 = 202$$

3.4.2. Sampling Procedure.

This is the act of selecting a suitable sample or a representative part of a population for the purpose of determining characteristic of the whole population (Frankel & Wallen, 2008).

The sample size was selected using Cochran 1963 formula in determining the sample size. Therefore the sample size for the study was 202. Proportional allocation was used to determine the sample size from the wards. To select individuals from the wards to participate in the study, systematic random sampling was used, whereby using farmers' lists, the names of the respondents were chosen at an interval.

Table 3.1: Sample Size Distribution Table

Ward	N	n
Bwake / Luhya	4500	$4500/18580 \times 202 = 49$
Nalondo	4500	$4500/18580 \times 202 = 49$
Mukuyuni	4380	$4380/18580 \times 202 = 47$
Chwele	5200	$5200/18580 \times 202 = 57$

3.5 Data Collection Instruments

Creswell (2003) indicates that research instruments are the tools used in the collection of data on the phenomenon of the study. A questionnaire according to Mugenda and Mugenda (2003) is a list of standard questions prepared to fit a certain inquiry. For this study the researcher used questionnaires. In order to collect data for the study, the researcher used questionnaires to get information the selected farmers in Bungoma Central Sub County. The questionnaire had closed ended questions.

3.5.1 Pilot Study

The research instruments were piloted in order to standardize them before the actual study. The pilot study was done using Kiboochi Youth Group of Luhya location in Bwake Luhya ward using simple random sampling. This helped in identifying problems that respondents might encounter and determined if the items in the research instrument will yield the required data for the study. Using simple random sampling, the researcher selected a sample of 22 subjects' equivalent to 10% of the study sample size of 202 subjects. According to Mugenda and Mugenda (2003), a sample equivalent to 10% of the study sample is enough for piloting the study Instruments. After responding to the instruments, the subjects were encouraged to make necessary corrections and adjustments of the instruments to increase their reliability.

3.5.2 Validity of the Instruments

Validity is defined as the appropriateness, correctness, and meaningfulness of the specific inferences which are selected on research results (Frankel & Wallen, 2008). It is the degree to which results obtained from the data analysis actually represent the phenomenon under study. This research study concerned itself with content validity. Content validity according to Kothari (2004) is the extent to which a measuring instrument provides adequate coverage of the topic under study.

Content validity ensures that the instruments will cover the subject matter of the study as intended by the researcher. Therefore, content validity of the instrument was determined by colleagues and experts in research who looked at the measuring technique and coverage of specific areas (objectives) covered by the study. The experts then advised the researcher on the items to be corrected. The corrections on the identified questions were incorporated in the instrument hence fine tuning the items to increase its validity. Validity was ascertained by checking whether the questions were measuring what they are supposed to measure such as the: clarity of wording and whether the respondents were interpreting all questions in the similar ways. Validity was established by the researcher through revealing areas causing confusion and ambiguity and this will lead to reshaping of the questions to be more understandable by the respondents and to gather uniform responses across various respondents

3.5.3 Reliability of the Instruments

Mugenda and Mugenda 2003, research instruments are expected to yield the same results with repeated trials under similar conditions. For them, the instrument returns the same measurements when it is used at different times. Therefore in order to determine the consistency of the measuring instrument to return the same measurement when used at different times, the researcher used the split half method to determine reliability of the instrument. This happened during the pilot study, before the actual research was done. The questionnaire items responded by the respondents of the pilot testing group were assigned arbitrary scores. The scores obtained were used in Spearman rank correlation coefficient, of which a correlation coefficient of 0.912 was obtained. According to Mbwesa (2006), if the correlation

coefficient of the instruments falls above +0.6, the instrument is taken reliable and therefore suitable for data collection.

3.6. Data Collection Procedure

The researcher obtained an introductory letter from the University of Nairobi which was used to apply a research permit from the National Council of Science and Technology and Innovation (NACOSTI), and then proceeded to the study area for appointments with farmers and AEOs for data collection. A covering letter was attached to the questionnaire to request the respondents to participate in the study. The AEOs were informed beforehand about the purpose of the study. A total of 202 small scale maize farmers participated in the study and were given questionnaires. The farmers filled the questionnaires and the researcher collected the filled ones one week after distribution.

3.7. Data Analysis Techniques

The study employed descriptive statistical methods in order to analyze the data collected. There was cross checking of the questionnaires to ensure that the questions are answered properly. The data was first divided into themes and sub themes before being analyzed. Frequency and percentages were used in the analysis and presented in a tabular form to enhance interpretation of data. The frequencies and percentages were used to determine the factors influencing maize production by small scale farmers.

3.8. Ethical Considerations

The researcher assured the respondents of the confidentiality of the information provided, including their own personal information. The respondents were informed of the purpose of the study, that is, for academic purposes only. This was to enable them to provide the information without any suspicions.

3.9. Operational definitions of variables

This section shows the objectives of the study, dependent variable and indicators and the indicators of the independent variables and how they can be measured.

Table 3.2: Operational Definition of Variables

Objectives	Variables	Indicators	Measurement scale
To investigate how costs of maize production influence maize production of small scale farmers of Bungoma Central Sub County.	Independent variable Costs of production	Land preparation Labour	Nominal
	Dependent variable Maize production	Price of fertilizer	Ordinal Interval
To establish how demographic factors of small scale farmers influence maize production in Bungoma Central Sub County.	Independent variable Demographic factors	Gender	Nominal
	Dependent variable Maize production	Age	Interval
		Level of education	Ordinal
To determine how extension services influence use of fertilizer intensity in maize production of small scale farmers in Bungoma central Sub County.	Independent variable Extension services	Level of access to information.	Nominal
	Dependent variable Maize production	Level of technology adoption	Ordinal
To examine how accessibility to credit influences use of fertilizer intensity in maize production of small scale farmers in Bungoma Central Sub County.	Independent variable Accessibility to credit	Level of acquisition of farm inputs.	Nominal
	Dependent variable Maize production	Level of productivity.	Ordinal
		Level of Adoption of new technologies.	Interval

CHAPTER FOUR

DATA ANALYSIS, PRESENTATIONS, INTERPRETATIONS AND DISCUSSIONS

4.1 Introduction

This chapter provides an analysis, presentation, interpretation and discussion of the results for the study on factors influencing maize production of small scale farmers of Bungoma Central Sub County. The main sub headings are; costs of maize production, demographic characteristics and maize production, extension services and maize production and credit accessibility and maize production.

4.2 Questionnaire Return Rate

The study sample was 202 subjects, all of which were small scale maize farmers. The response rate was 100 %, this was possible since I worked closely with agricultural extension officers who also helped in collection of the questionnaires. According to Frankel and Wallen (2004), a response rate of above 95% of the respondent can adequately represent the study sample and offer adequate information for the study analysis and thus conclusion and recommendations.

4.3 Demographic Characteristics of Respondents

This section looked at the gender, age and education level of the respondents.

4.3.1 Respondents by gender

Respondents were asked to indicate their gender and. The results were presented in Table 4.1.

Table 4.1: Gender Distribution of the Respondents

Gender	Frequency	Percentage
Male	104	51.50
Female	98	48.50
Total	202	100

Table 4.1 showed that 104 (51.5%) of the 202 respondents were men while 98 (48.5%) were women. Part of the reason for male dominance in the study is their higher time availability

to participate in the study. Additionally, most females shied off from the interviews referring the researcher to the males who are regarded as the household head and the ‘owners’ of the farms. The study finding also confirms observation made by the World Bank (2006) which stated that, in Kenya men were the key decision makers in farming, yet women provide the greatest labour.

4.3.2 Age of Respondents

The study sought to estimate the range of age of the small scale farmers involved in maize production. The results are shown in Table 4.2.

Table 4.2: Age distribution of the respondents

Age bracket	Frequency	Percentage
18 – 20	5	2.48
20 – 30	29	14.36
30 – 40	58	28.70
40 – 50	53	26.24
50 – 60	34	16.83
60 – 70	20	9.9
Above 70	3	1.49
Total	202	100

It was found that 2.48% were between 18 – 20 years old, 14.36% were between 20 – 30 years old, 28.70% were between 30 – 40 years old, 26.24% were between 40 – 50 years old, 16.83% were between 50 – 60 years old, 9.9% were between 60 – 70 years old and 1.49% were above 70 years old. The majority of the farmers were between 30 and 60 years. These findings showed that young people are better placed in adoption of new technologies than old people. These findings concur with (International Maize and Wheat Improvement Center [CIMMYT], 1993; Visser & Krosnick, 1998) that said young farmers are more likely to adopt a new technology because they have had more schooling and are more open to

attitude change than older farmers. However these findings do not agree with (Harper *et al.*, 1990), Hybrid Cocoa in Ghana (Boahene *et al.*, 1999) that says age may not be significant or may be negatively related to adoption.

4.3.3 Respondents by education level

The respondents were asked to indicate their level of education they had attained.

The findings are shown in Table 4.3.

Table 4.3: Education Level of the respondents

Educational level	Frequency	Percentage
Primary	46	22.77
Secondary	76	37.62
College	53	26.24
University	19	9.41
Post graduate	8	3.96
Total	202	100

The Table shows that 22.77% of the farmers had attained primary school education, 37.62% of the farmers had attained secondary school education, 26.24% of the farmers had attained college level education, of the farmers had attained university level education 9.41% of the farmers had attained post graduate level education and 3.96% . The study revealed that majority of the farmers had attained basic up to college level education. These results agree with Abebaw & Belay, 2001; Rogers, (2003) that says education is expected to enhance decision making and the adoption of agricultural technologies. Knowledge level influences adoption.

4.3.4 Respondents by Ward Level

Respondents were asked to indicate the wards they come from. The results are shown in Table 4.4.

Table 4.4: Farmers' Ward

Ward	Frequency	Percentage
Luuya / Bwake	49	24.26
Mukuyuni	47	23.27
Nalondo	49	24.26
Chwele	57	28.21
Total	202	100

The Table shows that 24.26% of the farmers carried out maize farming in Luuya/Bwake, 23.27% in Mukuyuni, 23.27% in Nalondo and 28.22% in Chwele. The distribution by wards was fair with slight difference with Chwele that is towards Mt. Elgon. This was due to the fact other wards allocate part of their land to sugarcane farming unlike Chwele Ward.

4.4 Costs of production and maize production

This section attempts to look at the extent to which cost of inputs influences maize production among small scale farmers and presents the responses to various items, their frequency and percentages.

4.4.1 Sources of power

The respondents were asked to indicate sources of power on their farms. Table 4.5 shows various sources of power that farmers use on their farms.

Table 4.5: Sources of power

Type of labour	Frequency	Percentage
Unpaid family labour	81	40.10
Hired manual labour	25	12.38
Animal draught power	76	37.62
Mechanical power	20	9.90
Total	202	100

From the Table 4.5, the study revealed that 40.10% of the respondents used unpaid family labour; followed by 37.62% that used animal draught power 12.38% used hired

manual labour and only 9.90% used mechanical power in maize production. These findings showed that most farmers used unpaid family labour and animal draught power. This showed that farmers had not yet embraced new technologies that are labour saving that agrees with V. N. Ozowa, (1995) that says agricultural technology for the small scale farmer must help minimize the drudgery or irksomeness of farm chores. It should be labor-saving, labor-enhancing and labor-enlarging. Also according to Nyoro J.K (2000) high costs of farm machinery have affected the quality and timeliness of farm operations such as the land preparation in the key maize production zones. The high costs of farm operation have forced farmers to reduce the quality of seedbed preparation. As a result, most farmers had reduced the number of times they ploughed and harrowed thereby reducing the quality of the seed bed. Thorough land preparation normally involves deep ploughing and thorough incorporation of weeds and crop residues, row planting, correct placement of fertilizers through use of machinery; superior and thorough crop protection against weeds, and better harvesting operations due to use of machinery. Reduction in the quality of land preparation thus could have adversely affected maize yields and hence cause an increase in production costs per unit production. Again this is in line with E. Wekesa *et al.*, (2003) who said that hiring labor might not directly influence adoption of improved varieties, but it is a proxy for available cash to invest in agricultural production. This also agreed with (Bangun 1985) that said from the time of planting until about a third of its life, maize is very susceptible to weed competition. Failure to weed during this critical period may reduce the yield by 20%.

4.4.2 Modern methods of farming

The respondents were asked to indicate if they used or had heard of irrigation, minimum tillage, dry planting, use of herbicides and use government subsidized fertilizer. The findings are shown in Table 4.6.

Table 4.6: Modern methods of farming

	Frequency		Percentage	
	Yes	No	Yes	No
I carry out irrigation at times	74	128	36.63	63.37
I practice minimum tillage	71	129	27.72	63.86
You have heard of dry planting	146	56	72.28	27.72
I practice dry planting	52	150	25.70	74.30
I have heard of herbicides	180	22	89.11	10.89
I use government subsidized fertilizer	96	106	47.52	52.48

From the Table 4.6, only 36.63% of the farmers used irrigation on their farms at times while 63.37% did not, only 27.72% used minimum tillage while 63.86% did not, 72.28% had heard of dry planting while 27.72 did not, only 25.70% practiced dry planting while 74.30% did not, 89.11% had heard of herbicides while 10.89% had never heard of herbicides and 47.52% used government subsidized fertilizer and 52.48% did not use it. These findings showed that a good number of farmers did not use government subsidized fertilizer, did not practice dry planting, did not practice minimum tillage neither did they irrigate their crops. This showed that most farmers do not use modern technologies in crop production. The study findings were also found to concur with the conclusion made by V. N. Ozowa, (1995), that says agricultural technology for the small scale farmer must help minimize the drudgery or irksomeness of farm chores. It should be labor-saving, labor-enhancing and labor-enlarging. The farmer needs information on production technology that involves cultivating, fertilizing, pest control, weeding and harvesting. Most farmers were not practicing minimum tillage neither were they using herbicides, which save labour and cost of production. Also given that most farmers did not use government subsidized fertilizer, it means they apply inadequate fertilizer since it is the most costly input as results showed in table 4.10, this is in agreement with (Heisey *et al.*, 1997; Ariga *et al.*, 2006), who said that though important in soil fertility improvement it has be reported that, farmers typically apply

inorganic fertilizers at rates well below recommended levels, or not at all. This is because fertilizer prices can influence negatively or positively maize yields; if the price decreases farmers purchase more meaning they will apply more leading to higher yields and if it increases farmers purchase less, therefore apply less and therefore get less yields, (Wanyama, *et al.*, 2010).

4.4.3 Costs of maize production.

The respondents were asked to indicate if they had knowledge on minimum tillage and fertilizer use in maize production and use of herbicides in lowering cost of producing maize. The findings are shown in Table 4.7.

Table 4.7: Minimum tillage

Likert scale	Frequency	Percentage
Strongly agree	154	76.24
Agree	38	18.81
Uncertain	4	1.98
Disagree	4	1.98
Strongly disagree	2	0.99
Total	202	100

From Table 4.7, 76.24% and 18.81% of the farmers strongly agreed and agreed respectively that minimum tillage lowers the cost of maize production. This showed that farmers are knowledgeable about minimum tillage as a modern technique in farming that saves costs in land preparation and weeding. These findings are in line with FSRP/ACF and MACO, (2February, 2011) that says minimum tillage lowers the cost of production, as is labor saving and enhances productivity.

The respondents were asked to indicate if they had knowledge on fertilizer use in maize production. The findings are shown in Table 4.8

Table 4.8: Fertilizer

Likert scale	Frequency	Percentage
Strongly agree	159	78.71
Agree	38	18.81
Uncertain	3	1.49
Disagree	0	0
Strongly disagree	2	0.99
Total	202	100

From Table 4.8, 78.71% of the farmers strongly agreed that fertilizer use increase returns from maize production. These findings showed that farmers were aware of the importance of using fertilizer in maize production and that when adequate amounts are applied, yields are increased. This is in line with (De Jaeger *et al.*, 1998) who says that soil nutrient mining is an important issue contributing to poor maize production in Kenya. Enhanced soil management has been recognized as crucial to soil fertility replenishment and enhanced agricultural productivity.

The respondents were asked to indicate if they had knowledge on use of herbicides in the lowering cost of producing maize. The findings are shown in Table 4.9.

Table 4.9: Herbicides

Likert scale	Frequency	Percentage
Strongly agree	155	76.73
Agree	37	18.32
Uncertain	5	2.48
Disagree	2	0.99
Strongly disagree	3	1.48
Total	202	100

From table 4.9, 76.73% of the farmers strongly agreed that use of herbicides lower the cost of maize production. These findings showed that farmers were knowledgeable on the importance of using herbicides as an alternative and a cheaper way of ploughing a farm or weeding maize. This is line with FSRP/ACF and MACO, (2 February, 2011) that says minimum tillage lowers the cost of production, as is labor saving and enhances productivity.

4.4.4 The most costly input

Respondents were asked to indicate the most costly input in maize production. The findings are shown in Table 4.10.

Table 4.10: The most costly input

Input	Frequency	Percentage
Land preparation	28	13.86
Planting	1	0.49
Fertilizer acquisition	164	81.19
Seed acquisition	7	3.47
Weeding	2	0.99
Total	202	100

From Table 4.10, 81.19% of the farmers indicated that fertilizer acquisition is the most costly input in maize production followed by 13.86% of the farmers that cited land preparation. This showed that most farmers still cannot afford fertilizer due to high prices despite government subsidized fertilizer being available. Also this might mean that that access to the subsidized fertilizer is low. These results concur with Ariga *et al.*, (2006) who have attributed maize yield decline to two main reasons: (i) declining soil fertility and (ii) increase in world fertilizer prices. These findings also agree with Wanyama, *et al.*, (2010), who said that fertilizer prices can influence negatively or positively maize yields; if the price decreases farmers purchase more meaning they will apply more leading to higher yields and if it increases farmers purchase less, therefore apply less and therefore get less yields.

4.5 Demographic characteristics and maize production.

This section shows which age, level of education that can easily adopt new technology in maize production and how the sex of the household and farm size influence fertilizer use on the farm.

4.5.1 Age and new technology

Respondents were asked to indicate the age bracket that easily adopts new technology. The findings are shown in Table 4.11.

Table 4.11: Age and new technology

Age Bracket	Frequency	Percentage
20 – 30 years	154	76.24
30 – 40 years	44	21.78
40 – 50 years	3	1.49
50 – 60 years	1	0.49
Total	202	100

From Table 4.11, 76.24% of the farmers indicated that the age bracket of 20 – 30 easily adopts new technology followed by 21.78% of age between 30 and 40, 1.49% suggest 40 – 50, 0.49% say 50 – 60 and none suggests above 60 years. These findings showed that young people are better placed in adoption of new technologies than old people. These findings concur with (International Maize and Wheat Improvement Center [CIMMYT], 1993; Visser & Krosnick, 1998) that said young farmers are more likely to adopt a new technology because they have had more schooling and are more open to attitude change than older farmers. However these findings do not agree with (Harper *et al.*, 1990), Hybrid Cocoa in Ghana (Boahene *et al.*, 1999) that says age may not be significant or may be negatively related to adoption.

4.5.2 Education level and new technology

Respondents were asked to indicate the education level that easily adopts new technology.

The findings are shown in Table 4.12.

Table 4.12: Education level and new technology

Education level	Frequency	Percentage
Primary	2	0.99
Secondary	7	3.47
College	11	5.44
University	27	13.37
Post graduate	155	76.73
Total	202	100

From Table 4.12, it shows that 76.73% of the respondents said that farmers with post graduate level of education can easily adopt new technology, followed by 13.37% that said farmers with university level of education can easily adopt new technology. The results showed that farmers with either university or post graduate level of education easily adopt new technology unlike the ones with less education levels. These results agree with Abebaw & Belay, 2001; Rogers, (2003) that says education is expected to enhance decision making and the adoption of agricultural technologies. Knowledge influences adoption. Farmers who have adequate knowledge of technology use are more likely to adopt it. Also these findings are in line with (Wozniak 1984), that says producers with more education should be aware of more sources of information and more efficient in evaluating and interpreting information about innovations than those with less education. Also (Alene *et al.*, 2000), says that education was found to positively affect adoption of improved maize varieties in West Shoa, Ethiopia, Tanzania (Nkonya *et al.*, 1997) and Nepal (Shakaya and Flinn, 1985).

4.5.3 Gender and farm size

In this section respondents were asked to indicate if male headed households and larger farm sizes apply more fertilizer.

Respondents were asked to indicate if male headed household apply more fertilizer than their female counterparts. The findings are shown in Table 4.13.

Table 4.13: Male headed households and fertilizer application

Likert scale	Frequency	Percentage
Strongly agree	57	28.22
Agree	72	35.64
Uncertain	40	19.80
Disagree	15	7.43
Strongly disagree	18	8.91
Total	202	100

From Table 4.13, it showed that more than half of the respondents agreed that male headed households apply more fertilizer than their female counterparts and 19.80% were uncertain. These results showed that male headed households apply more fertilizer than their female counterparts. This could be due to the fact that men are more mobile and seek information more than women on agricultural issues. These findings are in line with Nkonya, *et al.*, 1997; that says access to resources and services (information, credit) vary by gender of household head who makes key decisions. It was hypothesized that this could positively or negatively influence the adoption of fertilizer. However Doss and Morris (2001) in their study on factors influencing improved maize technology adoption in Ghana, and Overfield and Fleming (2001) studying coffee production in Papua New Guinea show insignificant effects of gender on adoption.

Respondents were asked to indicate if farmers with larger farm sizes apply more fertilizer than their female counterparts. The findings are shown in Table 4.14.

Tables 4.14: Farm size and fertilizer application

Likert scale	Frequency	Percentage
Strongly agree	97	48.02
Agree	71	35.15
Uncertain	22	10.89
Disagree	2	0.99
Strongly disagree	10	4.95
Total	202	100

From Table 4.14, 35.15% and 48.02% agreed and strongly agreed respectively that farmers with larger farm sizes apply more fertilizer than those with small farms accounting for 83.17% of the respondents. These findings showed that farmers with larger farm sizes apply more fertilizer than those with small farm sizes. Cultivation of large farm sizes makes it more economical for farmers to apply fertilizers. Also, the larger the size of farm cultivated and therefore output produced, the more commercialized the farm would be. This is line with Feder *et al.*, 1985 that says farmers with bigger land holding size are assumed to have the ability to purchase improved technologies and the capacity to bear risk if the technology fails. These views have also been expressed by Chukwuji and Ogisi (2006) who said that cultivation of large farm sizes makes it more economical for farmers to apply fertilizers. Also, the larger the size of farm cultivated and therefore output produced, the more commercialized the farm would be.

4.6 Agricultural extension services and maize production

This section shows the responses of respondents regarding access to extension services, belonging to farmer groups and soil testing.

4.6.1 Attendance of field days

Respondents were asked to indicate if they attend field days. The findings are shown in Table 4.15.

Table 4.15: Attendance of field days

	Frequency	Percentage
Yes	64	31.68
No	138	68.32
Total	202	100

From Table 4.15, 68.32% do not attend field days while 31.68% do attend. This showed that most farmers do not attend field days. This is similar to Mignouna, D.B.; *et al.*, 2010 that says extension services are one of the prime movers of the agricultural sector and have been considered as a major means of technology dissemination. Visits by extension agents to farmers and participation of the latter in field days, tours, agricultural shows or seminars are cost effective ways of reaching out with new maize technology. This explained why there were low adoption rates of new methods of farming in the Sub County. This agreed with Mapila, (2011) who said that promotion of technical change through the generation of agricultural technologies by research and their dissemination to end users plays a critical role in boosting agricultural productivity in developing countries.

4.6.2 The last field day attended

Respondents were asked to indicate if the last field day they had attended. The findings are shown in Table 4.16.

Table 4.16 : The last field day attended

	Frequency	Percentage
Within the last half year	42	20.79
Within the last one year	15	7.42
Within the last two years	7	3.47
Total	64	31.68

From Table 4.16, of those that admitted attending a field day, 20.79% had attended within the last half year, 7.42% within the last one year and 3.47% within the last two years. This showed that the number of farmers attending field days is increasing over the last two

years but at a very slow pace. This was in line with Mignouna, *et al.*, 2010, that says extension services are one of the prime movers of the agricultural sector and have been considered as a major means of technology dissemination. Visits by extension agents to farmers and participation of the latter in field days, tours, agricultural shows or seminars are cost effective ways of reaching out with new maize technology. This explained why there were low adoption rates of new methods of farming in the Sub County. This also agreed with Mapila, (2011), who said that promotion of technical change through the generation of agricultural technologies by research and their dissemination to end users plays a critical role in boosting agricultural productivity in developing countries. Unraveling the reasons for low technology adoption among farmers requires that the factors that influence their decisions to adopt or not to adopt modern agricultural production technologies be identified.

4.6.3 Extension visits and soil testing

Respondents were asked to indicate if they had been visited by extension officers on their farms or as a farmer group and if they had ever heard of soil testing or had tested their soils. The findings are shown in Table 4.17.

Table 4.17: Extension visits and soil testing

	Frequency		Percentage	
	Yes	No	Yes	No
Your farm or farmer group has been visited by an extension officer.	92	110	45.54	54.46
You have ever heard of soil testing or tested your soil.	77	125	38.12	61.88
Total	202		100	

From Table 4.17, 54.46% of the respondents had never been visited by extension officer on their farms or in a farmer group while 45.54 had been visited. The results showed that most farmers had never been visited by agricultural extension officers. These findings concur with Mignouna, D.B.; *et al.*, 2010, that says regarding the visits, which were paid by extension agents, 41% of households in Western Kenya declared receiving at least one visit by extension agents. From this table the results showed visits both on the farm and in farmer

groups. In farmer groups more farmers are always reached than individual visits. 61.88% of the respondents had never heard or tested their soils while 38.12% have had heard or tested their soils. The results indicated that most of the farmers had never heard nor tested their soils. This limited maize production, as most soils in Kenya have become acidic due to continuous use of acidifying fertilizers like D.A.P and Urea. Therefore farmers that test their soils are in a better position to increase maize production on their farms.

4.6.4 Importance of extension services

Respondents were asked to indicate if extension services play a significant role in influencing the use of fertilizer. The findings are shown in Table 4.18.

Table 4.18: Importance of extension services

	Frequency	Percentage
Strongly agree	158	78.21
Agree	36	17.82
Uncertain	5	2.48
Disagree	2	0.99
Strongly disagree	1	0.5
Total	202	100

From Table 4.18, 78.22% strongly agreed and 17.82% agreed that extension visits play a significant role in influencing the use of fertilizer. The results indicated that most farmers are aware of the importance of agricultural extension visits to their farms. These findings are in line with Yaron *et al.*, 1992, that says access to extension services is critical in promoting adoption of modern agricultural production technologies because it can counter balance the negative effect of lack of years of formal education in the overall decision to adopt some technologies. Also this is line with Nin *et al.*, (2003), who said that technical change in the form of adoption of improved agricultural production technologies have been reported to have positive impacts on agricultural productivity growth in the developing world.

4.6.5 Improved agricultural practices

Respondents were asked to indicate if farmers who adopt improved agricultural services realize higher yields. The findings are shown in Table 4.19.

Table 4.19: Improved agricultural practices

	Frequency	Percentage
Strongly agree	169	83.66
Agree	30	14.85
Uncertain	2	0.99
Disagree	0	0
Strongly disagree	1	0.5
Total	202	100

From Table 4.19, almost all farmers 98.51% agreed that farmers who adopt improved agricultural practices realize higher yields. The findings showed that almost all farmers agree to the fact that farmers who adopt improved agricultural practices realize higher yields. These findings are in line with Yaron *et al.*, 1992 that says access to extension services is critical in promoting adoption of modern agricultural production technologies because it can counter balance the negative effect of lack of years of formal education in the overall decision to adopt some technologies.

4.6.6 Availability of arable land

Respondents were asked to indicate if with limited availability of arable land, increase in maize yields can only be achieved using modern technologies. The findings are shown in Table 4.20.

Table 4.20: Availability of arable land

Likert scale	Frequency	Percentage
Strongly agree	169	83.66
Agree	30	14.85
Uncertain	5	2.48
Disagree	0	0
Strongly disagree	0	0
Total	202	100

From Table 4.20, 98.51% agreed that given limited availability of arable land, increase in maize yields can only be achieved using modern technologies. These findings showed that farmers are aware of the need for modern farming methods in order to improve their maize yields, given the small farm sizes they have. These findings are in line with Yaron *et al.*, (1992) that says access to extension services is critical in promoting adoption of modern agricultural production technologies because it can counter balance the negative effect of lack of years of formal education in the overall decision to adopt some technologies.

4.6.7 Agricultural Extension Officers

Respondents were asked to indicate if extension workers can help farmers calculate their farm inputs, identify where to buy inputs, organize group transport of their produce, to obtain credit and to save money to buy farm inputs for following season. The findings are shown in Table 4.21.

Table 4.21: Agricultural Extension Officers

	Frequency		Percentage	
	Yes	No	Yes	No
Calculate their farm input needs	194	8	96.04	3.96
Identify where to buy their inputs	190	12	94.06	5.94
Organize group transport	189	13	93.56	6.44
Obtain credit	184	18	91.09	8.91
Save	192	10	95.05	4.95
Total	202		100	

From Table 4.21, 96.04% of the farmers agreed that agricultural extension officers can help farmers calculate their farm inputs, 94.06% agreed that agricultural extension officers can help farmers identify where to buy inputs, 93.06% agreed that agricultural extension officers can help farmers organize group transport of their produce, 91.09% agreed that agricultural extension officers can assist farmers to obtain credit and lastly 95.05% agreed that agricultural extension officers can assist farmers to save money to buy farm inputs for following season or expand their enterprises. This showed that farmers understand the importance of agricultural extension services not only in maize but crop production in general. These findings are in line with FAO (1999) that says agricultural extension workers could provide assistance to individual farmers and groups in establishing links with formal and semi-formal financial institutions and by providing a list of input suppliers in the area who operate credit schemes, out grower schemes, or barter arrangements. It is not sufficient just to improve small farmers' access to finance; they need to be able to manage their money efficiently. This is all-too-often overlooked. In the same way that extension workers can do much to assist farmers market their maize, there is considerable scope for them to help farmers to obtain necessary inputs. These activities include helping farmers to: calculate their input needs; identify where to buy their inputs;

organize group transport; obtain credit and save money to buy inputs for the following season or expand their enterprises.

4.7 Credit accessibility and maize production

4.7.1: Credit accessibility

Respondents were asked to indicate whether they had once received credit from a financial institution or not. The findings are shown in Table 4.22.

Table 4.22: Those who had ever received credit

	Frequency	Percentage
Yes	23	11.39
No	179	88.61
Total	202	100

From Table 4.22, 88.61% respondents had never received credit from a financial institution while only 11.39% had ever received credit. The responses showed that generally farmers do not access credit services for their farms. This could be lack of information, fear of defaulting to repay the loan or lack of collateral. These findings are in line with Wittlinger and Tuesta (2006) who found out that small scale farmers are facing many obstacles in securing credit. These types of farmers require definite conditions, strategic alliances with members, low prices and conditional climate; because only in these conditions these farmers can have access to credit. Most of the farmers only obtained loan from informal sources such as suppliers, traders, processors etc.

4.7.2 Last credit obtained

Respondents were asked to indicate if they had once received credit from a financial institution or not. The findings are shown in Table 4.23.

Table 4.23: Last credit obtained

	Frequency	Percentage
Within the last one year	16	7.92
Within the last two years	5	2.48
Within the last three years	1	0.5
Four years and above	1	0.5
Total	23	11.4

From Table 4.23, out of 11.40% of the farmers that had ever received credit, only 7.92% had obtained within the last one year. These findings showed that the percentage of farmers receiving credit is negligible. These findings explained why most farmers in the Sub County do not adopt modern technologies and why they do not commercialize their agricultural enterprises. These findings are in line with (Nweke, 2001), who said that a productive resource such as agricultural credit is very vital for efficient and sustainable production activities especially in developing countries. Also Odoh, *et al.*, 2009, says that farm credit is among the essential factors needed for agricultural production, and with it, farmers can secure farm inputs such as; farm equipments and hired labour. These findings also agree with Omonona *et al.*, (2008) Akpan *et al.*, (2013) who say that farm credit is widely recognized as one of the intermediating factors between adoptions of farm technologies and increased farm income among rural farmers in Nigeria. It is one of the fundamental ingredients of sustainable agricultural production; as such its accessibility and demand is among the prerequisites for attaining the national goal of reducing rural poverty and ensuring self sufficiency in food production in the country. Consequently, a general awareness on the significance of credit as a tool for agricultural development has been increasing. These findings are also in line with Wittlinger and Tuesta (2006) who found that small scale single crops farmers are facing many obstacles in securing credit. These types of farmers require definite conditions, strategic alliances with members, low prices and conditional climate; because only in these conditions these farmers can have access to credit. Most of the farmers only obtained loan from informal sources such as suppliers, traders, processors etc.

4.7.3: Membership

Respondents were asked to indicate if they belonged to an active farmer group. The findings are shown in Table 4.24.

Table 4.24: Membership

	Frequency	Percentage
Yes	64	31.68
No	138	68.32
Total	202	100

From the Table 4.24, 68.32% of the farmers did not belong to an active farmer group or cooperative while 31.68% did. These findings showed that most farmers do not have or belong to active farmer groups. These findings explained why most farmers find it hard to access credit. The findings are in line with Wittlinger and Tuesta (2006) who found that small scale single crops farmers are facing many obstacles in securing credit. These types of farmers require definite conditions, strategic alliances with members, low prices and conditional climate; because only in these conditions these farmers can have access to credit. Most of the farmers only obtained loan from informal sources such as suppliers, traders, processors etc. Also the results agree with Akpan *et al.*, (2013) reported that farmers' membership of social organization and extension agent visits, are important determinants of access to credit.

4.7.4 National and county governments

Respondents were asked to indicate if the National and County governments can help farmers easily access affordable credit. The findings are shown in Table 4.25.

Table 4.25: National and county governments

	Frequency	Percentage
Yes	182	90.10
No	20	9.90
Total	202	100

From Table 4.25, 90.1% of farmers believed that the county and national governments could assist them to easily access affordable credit while only 9.9% did not think so. These findings showed that both the National and County governments have a vital role to play in assisting small scale farmers to easily access affordable credit. These findings are in line with FAO (2004) who reported that in Indonesia commercial banks are issuing agricultural credit but due to their difficult procedure of access to credit and rigid requirements; their credit policy is not working well. The author suggested that government must setup sustainable micro finance institutions, launch land certificate program, and introduce modified conventional banking system for small credit holders.

4.7.5: Access to credit and the decision to use inorganic fertilizer

Respondents were asked to indicate if access to credit influences the decision to use inorganic fertilizer. The findings are shown in Table 4.26.

Table 4.26: Access to credit and the decision to use inorganic fertilizer

	Frequency	Percentage
Strongly agree	96	47.52
Agree	68	33.66
Uncertain	33	16.34
Disagree	4	1.98
Strongly disagree	1	0.50
Total	202	100

From Table 4.26, 47.52% of the farmers strongly agreed that access to credit influences the decision to use inorganic fertilizer, 33.66% agreed, 16.34% were uncertain, 1.98% disagreed, while 0.50% strongly disagreed. The results showed that access to credit influences the decision to use inorganic fertilizer. These findings are in line with Odoh, *et al.*, (2009) that says farm credit is among the essential factors needed for agricultural production, and with it, farmers can secure farm inputs such as; farm equipments, fertilizer and hired labour.

4.7.6 Barter arrangements

Respondents were asked to indicate if barter arrangements with input suppliers can help farmers exchange their maize or other crops for required inputs. The findings are shown in Table 4.27.

Table 4.27: Barter arrangements

	Frequency	Percentage
Strongly agree	92	45.54
Agree	87	43.07
Uncertain	21	10.40
Disagree	2	0.99
Strongly disagree	0	0
Total	202	100

From Table 4.27, 45.54% and 43.07% strongly agreed and agreed respectively that farmers could have barter arrangements for their produce in exchange for inputs from suppliers. These findings showed that barter arrangements can assist farmers obtain inputs in time and lead to early planting of maize. This agrees with Olayemi (1998), who said that credit involves all advances released for farmers' use, to satisfy farm needs at the appropriate time with a view to refunding it later. Thus, credit can be in the form of cash or kind, obtained either from formal, semi-formal or informal sources.

4.7.7: Farmer groups

Respondents were asked to indicate if farmer associations can assist in the supply of inputs and credit to individual association members, market their produce through a collective marketing mechanism. The findings are shown in Table 4.28.

Table 4.28: Farmer groups

	Frequency	Percentage
Strongly agree	110	54.46
Agree	84	41.58
Uncertain	8	3.96
Disagree	0	0
Strongly disagree	0	0
Total	202	100

From Table 4.28, 54.46% strongly agreed, 41.58% agreed that farmer associations can assist in the supply of inputs and credit to individual association members, market their produce through a collective marketing mechanism, while 3.96% were uncertain. These findings showed that farmer associations can assist in the supply of inputs and credit to individual association members, market their produce through a collective marketing mechanism. This is in line with Olayemi (1998), who says credit involves all advances released for farmers' use, to satisfy farm needs at the appropriate time with a view to refunding it later. Thus, credit can be in the form of cash or kind, obtained either from formal, semi-formal or informal sources. Also the results agree with Akpan *et al.*, (2013) reported that farmers' membership of social organization and extension agent visits, are important determinants of access to credit.

4.7.8: Saving surplus cash

Respondents were asked to indicate if saving surplus cash at harvest time can be used to purchase inputs for the following season. The findings are shown in Table 4.29.

Table 4.29: Saving surplus cash

	Frequency	Percentage
Strongly agree	104	51.48
Agree	80	39.60
Uncertain	16	7.92
Disagree	1	0.5
Strongly Disagree	1	0.5
Total	202	100

From Table 4.29, 51.48% and 39.60% of the respondents strongly agreed and agreed respectively that saving surplus cash at harvest time can be used to purchase inputs for the following season. 7.92% were uncertain and 0.5% for both strongly disagreed and disagreed. These results showed that farmers agree to the fact that saving cash at harvest time can be used to purchase inputs for the following season. This showed that agricultural extension agents play an important role in attaining food security. These findings are in line with FAO (1999) that says extension workers can do much to assist farmers market their maize, there is considerable scope for them to help farmers to obtain necessary inputs and saving the surplus cash at harvest time to purchase inputs for the following season.

4.7.9: Maize shortage

The respondents were asked to indicate if perennial maize shortage in the Sub County would be a thing of the past if small scale farmers are given incentives to increase production. The findings are shown in Table 4.30.

Table 4.30: Maize shortage

	Frequency	Percentage
Strongly agree	116	57.12
Agree	67	33.17
Uncertain	17	8.41
Disagree	1	0.5
Strongly disagree	1	0.5
Total	202	100

From Table 4.30, 57.42% and 33.17% of the respondents strongly agreed and agreed respectively that perennial maize shortage in the Sub County would be a thing of the past if small scale farmers were given incentives to increase production, while 8.41% were uncertain. From this table most small scale farmers still require incentives to attain food security in the Sub County. This is in line with Daramola and Aturamu (2000) who pointed out that high proportion of off-farm relative to farm income suggests that incomes from farm investments are not enough to encourage farmers to take on some risks and adopt. It is obvious therefore that making the rewards from farm investments attractive through appropriate policies would discourage farmers from going into off-farm economic activities so as to increase the efficiency of farming activities. The financial bases of the farmers can also be increased through policies aimed at making them have easier access to production credit at affordable prices so as to increase their ability to purchase and use modern technologies.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter is organized into the following subheadings: summary of the study, conclusions of the study, recommendations of the study and suggestions for further studies in line with the research questions.

5.2 Summary of the Findings

The study sought to investigate factors influencing maize production among small scale farmers of Bungoma Central Sub County with an aim of suggesting correcting measures so as to improve maize yield to attain food security and improve income levels among households. In this sub section the researcher outlines summary of findings based on objectives of the study.

The researcher sought to investigate the extent to which cost of inputs influences maize production among small scale farmers. As pertains sources of power on their farms, 40.10% of the respondents used unpaid family labour; followed by 37.62% used animal draught power, 12.38% used hired manual labour and only 9.90% used mechanical power in maize production. The study showed that most farmers used unpaid family labour and animal draught power. Only 36.63% of the farmers used irrigation on their farms at times while 63.37% did not, only 27.72% used minimum tillage while 63.86% did not, 72.28% had heard of dry planting while 27.72 did not, only 25.70% practiced dry planting while 74.30% did not, 89.11% had heard of herbicides while 10.89% had never heard of herbicides and 47.52% used government subsidized fertilizer and 52.48% did not use it. These findings showed that a good number of farmers did not use government subsidized fertilizer, did not practice dry planting, did not practice minimum tillage neither did they irrigate their crops. This showed that most farmers do not use modern technologies in crop production. On modern technologies; over 95% of the farmers agreed that minimum tillage lowers the cost of maize production. This showed that farmers are knowledgeable about minimum tillage as a modern technique in farming that saves costs in land preparation and

weeding. 78.71% of the farmers strongly agreed that fertilizer use increase returns from maize production. This showed that farmers were aware of the importance of using fertilizer in maize production and that when adequate amounts are applied, yields are increased. 76.73% of the farmers strongly agreed that use of herbicides lower the cost of maize production. This indicated that farmers were knowledgeable on the importance of using herbicides as an alternative and a cheaper way of ploughing a farm or weeding maize. Over 80% of the farmers indicated that fertilizer acquisition is the most costly input in maize production followed by 13.86% of the farmers that cited land preparation. This showed that most farmers still cannot afford fertilizer due to high prices despite government subsidized fertilizer being available.

Concerning the age bracket that easily adopts new technology, 76.24% of the farmers indicated that the age bracket of 20 – 30 easily adopts new technology followed by 21.78% of age between 30 and 40, 1.49% suggest 40 – 50, 0.49% say 50 – 60 and none suggests above 60 years. These findings showed that young people are better placed in adoption of new technologies than old people. On the education level that easily adopts new technology, 76.73% of the respondents said that farmers with post graduate level of education can easily adopt new technology, followed by 13.37% that said farmers with university level of education can easily adopt new technology. The results showed that farmers with either university or post graduate level of education easily adopt new technology unlike the ones with less education levels. To the respondents, male headed household apply more fertilizer than their female counterparts. More than half of the respondents agreed that male headed households apply more fertilizer than their female counterparts. These results showed that male headed households apply more fertilizer than their female counterparts. This could be due to the fact that men are more mobile and seek information more than women on agricultural issues. On farm size, over 80% agreed that farmers with larger farm sizes apply more fertilizer than their female counterparts. These findings showed that farmers with larger farm sizes apply more fertilizer than those with small farm sizes. Cultivation of large farm sizes makes it more economical for farmers to apply fertilizers. Also, the larger the size of farm cultivated and therefore output produced, the more commercialized the farm would be.

On attendance of field days, 68.32% did not attend field days. This showed that most farmers do not attend field days. On when the last field day they had attended, 20.79% had attended within the last half year, 7.42% within the last one year and 3.47% within the last two years. This showed that the number of farmers attending field days is increasing over the last two years but at a very slow pace. On extension visits, 54.46% of the respondents had never been visited by extension officer on their farms or in a farmer group. The results showed that most farmers had never been visited by agricultural extension officers. On the role of extension services, over 90% agreed that extension visits play a significant role in influencing the use of fertilizer. The results indicated that most farmers are aware of the importance of agricultural extension visits to their farms. On farmers adoption of improved agricultural services, almost all farmers; 98.51% agreed that farmers who adopt improved agricultural practices realize higher yields. The findings showed that almost all farmers agree to the fact that farmers who adopt improved agricultural practices realize higher yields. Also over 90% of the respondents agreed that extension workers can help farmers calculate their farm inputs, identify where to buy inputs, organize group transport of their produce, to obtain credit and lastly to save money to buy farm inputs for following season or expand their enterprises. This showed that farmers understand the importance of agricultural extension services not only in maize but crop production in general.

The study also established that, 88.61% respondents had never received credit from a financial institution. The responses showed that generally farmers do not access credit services for their farms. Also on membership to farmer groups, 68.32% of the farmers did not belong to an active farmer groups or cooperatives. This could be lack of information, fear of defaulting to repay the loan or lack of collateral. These findings showed that the percentage of farmers receiving credit is negligible. These findings explained why most farmers in the Sub County do not adopt modern technologies and why they do not commercialize their agricultural enterprises. Over 90% of farmers believed that the county and national governments could assist them to easily access affordable credit and over 80% agreed that access to credit influences the decision to use inorganic fertilizer. On barter arrangements, over 78% agreed that barter arrangements with suppliers can help them get

inputs from suppliers. These findings showed that barter arrangements can assist farmers obtain inputs in time and lead to early planting of maize. Concerning farmer associations over 90% agreed that farmer associations can assist in the supply of inputs and credit to individual association members, market their produce through a collective marketing mechanism, while 3.96% were uncertain. These findings showed that farmer associations can assist in the supply of inputs and credit to individual association members, market their produce through a collective marketing mechanism. On saving surplus cash at harvest time over 90% respondents agreed that saving surplus cash at harvest time can be used to purchase inputs for the following season. Over 80% of the respondents agreed that perennial maize shortage in the Sub County would be a thing of the past if small scale farmers were given incentives to increase production. These findings showed that most small scale farmers still require incentives to attain food security in the Sub County.

5.3 Conclusions

The researcher sought to investigate the extent to which cost of inputs influence maize production among small scale farmers. The study showed that most farmers used unpaid family labour and animal draught power, a good number of farmers did not use government subsidized fertilizer, did not practice dry planting, did not practice minimum tillage neither did they irrigate their crops. Although most farmers are aware of the importance of minimum tillage which lowers the cost of maize production, they did not practice it on their farms. Therefore it was concluded that adoption of modern farming methods is still very low in the Sub County, leading to low maize yields. Most farmers agreed that fertilizer use increase returns from maize production. This showed that farmers were aware of the importance of using fertilizer in maize production and that when adequate amounts are applied, yields are increased. Fertilizer acquisition remains the most costly input in maize production followed by land preparation. This showed that most farmers still cannot afford fertilizer due to high prices despite government subsidized fertilizer being available leading to low maize yields.

Concerning the age bracket that easily adopts new technology, most farmers indicated that the age bracket of 20 – 30 easily adopts new technology followed by the age

between 30 and 40 and none suggested above 60 years. These findings showed that young people are better placed in adoption of new technologies than old people. On the education level that easily adopts new technology; most respondents said that farmers with post graduate level of education can easily adopt new technology, followed by those with university level of education. The results showed that farmers with either university or post graduate level of education easily adopt new technology unlike the ones with less education levels. More than half of the respondents agreed that male headed households apply more fertilizer than their female counterparts. Therefore it was concluded that male headed households apply more fertilizer than their female counterparts. This could be due to the fact that men are more mobile and seek information more than women on agricultural issues. On farm size, most respondents agreed that farmers with larger farm sizes apply more fertilizer than their female counterparts. These findings showed that farmers with larger farm sizes apply more fertilizer than those with small farm sizes. Cultivation of large farm sizes makes it more economical for farmers to apply fertilizers. Also, the larger the size of farm cultivated and therefore output produced, the more commercialized the farm would be. Therefore it was concluded that small farm sizes limit commercialization of maize production in the Sub County.

On attendance of field days, the findings showed that most farmers do not attend field days. It was concluded that either field days are not held regularly or they are never properly publicized or the ones held were not relevant to the farmers needs. On extension visits, most of the respondents had never been visited by an extension officer on their farms or in a farmer group. This could be due to few agricultural extension officers, or less facilitation or incompetence on the part of the officers. Also farmers may not be seeking the services of the extension officers. On the role of extension services, almost all respondents agreed that extension visits play a significant role in influencing the use of fertilizer. The results indicated that most farmers are aware of the importance of agricultural extension visits to their farms. The findings also showed that almost all farmers agree to the fact that farmers who adopt improved agricultural practices realize higher yields. Also most respondents agreed that extension workers can help farmers calculate their farm inputs, identify where to buy inputs, organize group transport of their produce, to obtain credit and

lastly to save money to buy farm inputs for following season or expand their enterprises. Given that access to agricultural extension services is low, this has limited adoption of new farming methods and consequently contributed to low maize production.

The study also established that, most respondents had never received credit from a financial institution. The responses showed that generally farmers do not access credit services for their farms. This could be due to lack of information, fear of defaulting to repay the loan or lack of collateral. Also on membership to farmer groups, most farmers did not belong to an active farmer group or cooperative. These findings explained why the percentage of farmers receiving credit is negligible. These findings explained why most farmers in the Sub County do not adopt modern technologies and why they do not commercialize their agricultural enterprises. It also became clear that farmers believe that the county and national governments could assist them to easily access affordable credit and that access to credit influences the decision to use inorganic fertilizer. Most respondents agreed that barter arrangements with suppliers can help them get inputs from suppliers. These can assist farmers obtain inputs in time and lead to early planting of maize. Most respondents agreed that farmer associations can assist in the supply of inputs and credit to individual association members, market their produce through a collective marketing mechanism. These findings showed that farmer associations can assist in the supply of inputs and credit to individual association members, market their produce through a collective marketing mechanism. On saving surplus cash at harvest time most respondents agreed that saving surplus cash at harvest time can be used to purchase inputs for the following season. Most of the respondents agreed that perennial maize shortage in the Sub County would be a thing of the past if small scale farmers were given incentives to increase production. These findings showed that most small scale farmers do not access credit, therefore limiting the use of inorganic fertilizer, adoption of modern farming methods and commercialization of agricultural enterprises.

5.4 Recommendations

Farmers should use mechanical power that is faster and more efficient than unpaid family labour and animal draught power. Farmers should use government subsidized

fertilizer that is cheaper than buying from commercial shops, this will enable them to apply adequate amounts of fertilizer that will lead to increase in maize yields. Also farmers should practice dry planting and practice minimum tillage, this will increase maize yield and lower the cost of producing maize.

Young people should be encouraged to fully embrace maize farming given that they are better placed in adoption of new technologies than old people. Also deliberate efforts have to be made by both county and national governments to lure people with university education and post graduate levels into maize farming given that farmers with either university or post graduate level of education easily adopt new technologies unlike the ones with lesser education levels. Female headed households should be encouraged to seek more information fertilizer application rates given that male headed households apply more fertilizer than their female counterparts.

National and county governments should come up with the minimum land size that should be sub divided in order to have larger farm sizes because the findings showed that farmers with larger farm sizes apply more fertilizer than those with small farm sizes. Also, the larger the size of farm cultivated the more output is produced, the more commercialized the farm would be, leading to increased maize yields.

Agricultural extension officers should hold field days regularly, properly publicize them and they should be relevant to the farmers' needs especially on modern farming methods to enhance their adoption. County governments should employ adequate agricultural extension officers and facilitate them adequately for them to disseminate agricultural information properly to most farmers through extension visits. Also incompetent agricultural officers should be replaced. Also farmers should be encouraged to seek the services of the extension officers. This will promote adoption of improved agricultural practices and farmers will realize higher maize yields. Also agricultural extension officers should help farmers calculate their farm inputs, identify where to buy inputs, organize group transport of their produce, obtain credit and lastly to save money to buy farm inputs for following season or expand their enterprises. This will lead to commercialization of maize production.

Farmers should form associations to enable them market their produce collectively and help them obtain credit. County and national governments should assist farmers to easily access affordable credit. This will assist farmers to commercialize their agricultural enterprises. Farmers should be encouraged to come up with barter arrangements with suppliers to help them get inputs from them. These can assist farmers obtain inputs in time and lead to early planting of maize. Farmers should be encouraged on saving surplus cash at harvest time to purchase inputs for the following season. County and national governments should give incentives to small scale farmers in order to improve maize production.

5.5 Suggestions for further research

The following areas are recommended for further research;

Since the study was limited to one Sub County, there is need for a replication of this study in other sub counties that might have different situations that can elicit different responses.

Further research on low attendance of field days and extension services in general need to be undertaken to ascertain the underlying causes of low dissemination of information.

REFERENCES

- Abebaw, D., & Belay, K. (2001). Factors influencing adoption of high yielding maize varieties in Southwestern Ethiopia: An application of logit. *Quarterly Journal of International Agriculture*, 401, 49-167.
- Abu, G. A, I. U. Odoemenem and A. Ocholi. (2011). *Determining optimum farm credit* .
- Adebayo O. O, Adeola R.G., (2008). *Sources and uses of agricultural credit by small scale farmers*.
- Adepetu, J. A. (1997). *Soil and Nigeria food security*. Inaugural Lecture Series 119, Obafemi Adoption: The Case of SRI in Madagascar. *Agricultural Economics* 35.3: 373-88.
- Agrekon in Sub-Saharan Africa. *Food Policy (special issue)* 28.4. in Surulere Local Government Area of Oyo State. *Anthropologist*, 10(4): 313-314. International Dev. Paper US.
- Agricultural Consultative Forum. 2009. *Study Team - Policy Advisory Note Proposed Reforms*.
- Ajagbe F. A., (2012). *Analysis of Access to and Demand for Credit by Small Scale Entrepreneurs*.
- Alene AD, Poonyth D & Hassan RM (2000). *Determinants of the adoption and intensity of use of fertilizer*.
- Aman D, Adimesra D, Irlan S. (2004) Maize production in Java Nepal, prospects for farm level technology.
- Ariga, J. M., Jayne, T. S., and Nyoro, J. K. 2006. *Factors driving the growth in fertilizer application*.
- Awoyinka, Y.A., and Adeagbo, S.O. 2006. *Analysis of demand for informal and formal credit*.
- Azagaku, E. D. and H. Anzaku (2002). *Effect of NPK Fertilizer Levels on the Growth . broader replicability in Sub-Saharan Africa. Working Paper 24. Tegemeo Institute*.
- Bangun, Pirman. 1985. Pengendalian gulma pada tanaman jagung. *in* Risalah rapat teknis hasil penelitian jagung, sorgum dan terigu 1980-1984. Pusat Penelitian dan Pengembangan Tanaman Pangan.
- Boahene, K., Snijders, T.A.B. & Folmer, H. (1999). An integrated socio-economic analysis

- of innovation adoption: The case of Hybrid Cocoa in Ghana. *Journal of Policy Modeling*, 21(2), 167-184.
- Byerlee, D., & de Polanco, H. E. (1986). *Farmers' stepwise adoption of technological packages*:
- CBS (2001) Poverty reduction strategy paper, 2001-2004. IN PLANNING AND NATIONAL DEVELOPMENT (Ed.) Nairobi, Kenya, Government printers.
- Central Bureau of Statistics (CBS), 'Statistical Pocket Book, Nepal', Central Bureau of Statistics, Government of Nepal, National Planning Commission Secretariat, Nepal (2006) pp. 46-114.
- CDFA. 2008. *Chipata District Farmers Report on the Findings of the 2007/08 Fertilizer Support Programme*. Chipata, Zambia: Chipata District Farmers Association (CDFA).
- Central Bank of Nigeria (CBN) *Statistical Bulletin 2003, 2010 and 2011*.
- Chinu J. N. and H. Tsujii (2004). *Determinant of farmer's decision to adopt or not to adopt inorganic fertilizer in savanna of northern Nigeria*. *Nutr. Cyc. Agroecosyst.*, 70: 293-301
- Completion Report*. Report No. 24444-ZA. Washington, D.C.: World Bank.
consumption in Kenya, 1990-2005: Sustaining the momentum in Kenya.
- Chukwuji Christopher O., Odjuvwuederhie E. Inoni, O'raye D. Ogisi, William J. Oyaide (2006): "A Quantitative Determination of Allocative Efficiency in Broiler Production in Delta State, Nigeria": Department of Agricultural Economics and Extension, Delta State University, Asaba Campus, Asaba. Delta State, Nigeria: *Agriculturae Conspectus Scientificus*, Vol. 71 (2006) No. 1 (21-26)
- Cochran W.G (1963). *Sampling Techniques*. John Willey and sons Inc., New York
- Crawford, E. and V. Kelly. 2002. *Evaluating Measures to Improve Agricultural Input Use*.
- Creswel, J.W. (2003). *Research design: qualitative, quantitative and mixed methods approach*: (2nd edition). Sage publications, Thousand Oaks, California.
- CSPR. 2005. *Targeting Small Farmers in the Implementation of Zambia's Poverty Reduction*.
- Daramola, A.G and Aturamu, O. A (2000): "Agro forestry Policy Options for Nigeria: A Simulation Study". *J. Food Agric. Environment*. 3: 120-124.

- De Jager, A., Kariuki, I.W., Matiri, F.M., Odendo, M., Wanyama, J. M., (1998).
"Monitoring nutrient flows and performance in african farming systems
(NUTMON). Linking nutrient balance and economic performance in 3 districts in
Kenya." *Agriculture Ecosystems and Environmental Journal* 71(1998): 81-92.
- Deaton 1997 *The Analysis of Household Surveys: A Micro – econometric Approach to
Determinants of Credit Access and Demand among Poultry Farmers in Akwa Ibom
State, Development Policy*. Baltimore: John Hopkins University Press. P. 85.
development. *Ife Journal of Agriculture*, 8: 111 – 118. Draft.Agricultural
Management, Marketing and Finance Service (AGSF), Agricultural
Economic Review 51(4), 566-593.
- Doss, C. R & Morris, M. L. (2001). How does gender affect the adoption of agricultural
innovation? The case of improved maize technologies in Ghana. *Journal of
Agricultural Economics*, 25, 27-39.
- Endogenous sampling analysis of the extent and intensity of adoption. Agrekon, vol. 45 no.1
Evidence from Oyo State, Nigeria. *Journal of Emerging Trends in Economics and
Export Processing Zone Authority* (2005), *Grain production in Kenya*, Export
Processing Zone Authority, Nairobi.
- E. Wekesa, W. Mwangi, H. Verkuijl, K. Danda, H. De Groote (2003), Adoption of Maize
Production, Technologies in the Coastal Lowlands of Kenya.
- FAO (1999) Marketing and Rural Finance Service Agricultural Support Systems Division
Food and Agriculture Organization of the United Nations Viale delle Terme di
Caracalla 00100 Rome, Italy
- FAO 2004. Access to farm credit by small-scale farmers. A country report of Indonesia .
Economic Survey of Pakistan, 2005-06. Economic Affairs Division, Islamabad.
- FAO, 2004. *Increasing fertilizer use and farmer access in sub-Saharan Africa*. A literature
review. *farmers in Zambia: what can fertilizer consumption alone do or not do?*
Working paper.
- FAO (2004) Scaling Soil Nutrient Balances: Enabling Meso-level Applications for African
Realities. Rome, Italy, FAO.
- Feder G, Just RE & Zilberman D (1985). Adoption of agricultural innovations in developing
countries: A survey. *Economic Development and Cultural Change* 33(2):255-
298.fertilizer among rural dwellers in Afijio Local Government of Oyo State.
Unpublished B.Sc. Project in the Department of Agric.
Extension and Rural Development, University of Ilorin.fertilizer use in Benin and
Malawi. International Food Policy Research Institutes US.

- Fletschner, D. 2009. Rural women access to credit: market imperfections and intra household dynamics. *W Dev-Elsevier*. 37 (3):618. *Food Security Research Project, Lusaka, Zambia*.
- Frankel, J. R., and Wallen, E. (2004). *How to Design and Evaluate Research in Education*. 7th ed Mc Graw-Hill International Edition
- Fufu, B. and R. M. (2006). *Determinants of Fertilizer use in maize in eastern Ethiopia*.
- FSRP/ACF and MACO/Policy and Planning Dept. Presentation at Belvedere Lodge, Lusaka 2 February, 2011 Cost of Producing Maize for Smallholders in Rural Zambia.
- Govere, J., Jayne, T.S., Sokotela, S. Lungu, O.I., 2003. *Raising maize productivity of smallholder farmers*.
- Harper, J. K., Rister, M. E., Mjelde, J. W., Drees, B. M. & Way, M. O. (1990). Factors influencing the adoption of insect management technology. *American Journal of Agricultural Economics*, 72(4), 997-1005
- Hassan RM, Onyango R & Rutto JK (1998a). *Determinants of fertilizer use and the gap between farmers' maize yield and potential yields in Kenya*. In: Hassan RM (ed), *Maize technology development and transfer: A GIS approach to research planning in Kenya*. CAB International, London.
- HAYAMI, Y. & RUTTAN, V. W. (1985) *Agricultural development: An international perspective*, Baltimore, USA, Johns Hopkins University Press.
- Idachaba F S 2006. Rural development in Nigeria: Foundations of sustainable economic improved maize varieties in the central highlands of Ethiopia: A Tobit analysis.
- Inoni O.E. (2007): Allocative Efficiency in Pond Fish Production in Delta State, Nigeria: A Production Function Approach *Agricultura Tropica Et Subtropica* vol. 40 (4) 2007
- International Maize and Wheat Improvement Center (CIMMYT). (1993). *The adoption of agricultural technology. A guide for survey design*. Mexico, D. F.: CIMMYT: Author. Johnston, B.F., Mellor, J., 1961. *The Role of Agriculture in Economic Development*.
- Kaini, B.R., 'Increasing Crop Production in Nepal', Proceeding of the 24th National Summer Crops Research Workshop on Maize Research and Production in Nepal, held in June 28-30 (2004) at Nepal Agricultural Research Institute, NARC, Khumaltar, Lalitpur, Nepal (2004) pp.15-19.
- Kang'ethe, W.G. (2004), *Agricultural development and food security in Kenya*:

- A case for more support. A paper prepared for agriculture and food organization (September).
- Kelly, V. A. (2006). *Factors affecting demand for fertilizer in sub Saharan Africa*. A report submitted to World Bank.
- Kenya Government of Kenya (2004). *Strategy for revitalizing agriculture 2004-20014*. Nairobi, Kenya. Ministries of Agriculture, Livestock and Fisheries Development, and Cooperative Development and Marketing.
- Khandker, S. and Faruquee, R.R. 2003. *The impact of farm credit in Pakistan*. J. Agric. Econ. 28(3):197-213.
- Kothari, C.R. (2004). *Research Methodology, Methods and Techniques*. 2 rd edition. New Age International, New Delhi.
- Lawal J . O, Omonona B. T, Ajani O. I, Oni A. O., (2009). *Effects of Social Capital on credit Access among Cocoa Farming Households in Osun State, Nigeria*. *Agric. Journal*; 4:184–191. Lusaka, Zambia: Food Security Research Project Development of early Maturing Maize Cultivar (TZESR –W). In M. Iloeje, G.. Osuji, Udoh H. and G Asumugha (eds). Lusaka, Zambia: FSP. *Management Sciences. Volume 3(3):180-183*.
- Mapila, M. A. T. J. (2011). Rural livelihoods and agricultural policy changes in Malawi. *Agricultural Innovations for Sustainable Development*. In: Manners, G. and Sweetmore, A., (Editors). Accra-Ghana, CTA and FARA, 3, 190-195. *Marketing Behavior in Zambia: Implications for Policy*. FSRP Working Paper No. 20.
- Mbithi, L.M. (2000), *Agricultural policy and maize production in Kenya*: Universiteit Gent, Unpublished Ph.D Thesis.
- Mbwesa J. (2006). *Introduction to Management Research: Methods and Techniques* (2 rd Edition): New Delhi, Gupta K.K
- Minten, B., & Barrett, C. B. (2008). Agricultural technology, productivity, and poverty in Madagascar. *World Development*, 36(5), 797–822.
- Mose, L., H. Nyangito, and L. Mugunieri. 1997. *An Economic Analysis of the Determinants of Fertilizer Use Among Smallholder Maize Producers in Western Kenya*. Nairobi: Kenya Agricultural Research Institute. Unpublished manuscript.
- Moser, C., & Barrett, C. B. (2003). "The disappointing adoption dynamics of a yield increasing, low external input technology: The case of SRI in Madagascar. *Agricultural Systems*, 76(3), 1085-1100. MSU Staff Paper 01-55. East Lansing:

Michigan State University.Nairobi Kenya: Egerton University.

- Mpuga, P. 2004, March. *Demand for credit in Rural Uganda: who cares for the peasants?* Presented at the conference on Growth, Poverty Reduction and Human Development, Africa Center for the study of African Economics. The Centre for the Study of African Economies and the Global Poverty Research Group, University of Oxford, St Catherine's College, Oxford.
- Mugenda, O.M and Mugenda, A.G. (2003). *Qualitative and Quantitative approaches. Research Methods Africa Center for Technology Studies* (Acts) Press. Nairobi Kenya.
- Neupane, R. P., Sharma, K. R., & Thapa, G. B. (2002). Adoption of agroforestry in the hills of Nepal: a logistic regression analysis. *Journal of Agricultural Systems* ,72, 177-196. Nigeria. *American Journal of Experimental Agriculture*, 3(2): 293-307.
- Nin, A., Arndt, C., &Precktel, P. (2003). Is agricultural productivity in developing countries really shrinking? New evidence using a modified nonparametric approach. *Journal of Development Economics*, 71, 395-415.
- Nkonya E, Schroeder T & Norman D (1997). Factors affecting adoption of improved maize seed and fertilizer in Northern Tanzania. *Journal of Agricultural Economics* 48(1):1-12.
- Nwaru J. C, Essien U. A, Onuoha R.E., (2011). Determinants of Informal Credit Demand and Supply among Food Crop Farmers in Akwa Ibom State. *Nigeria Journal of Rural and Community Development*, 6, 1;129–139.
- Nweke, N. O. (2001). *Farming in Rural Areas. Satellite Newspapers. Office of Human Resources and Development. Pp. 25-31.*
- Nyoro J. K (2000) Kenya's Competitiveness In Domestic Maize Production: *Implications For Food Security*. Tegemeo Institute, Egerton University, Kenya.
- Nyoro, J., Kirimi, L. and Jayne, T.S. (2004), "Competitiveness of Kenyan and Ugandan maize production: *Challenges for the future*", *Working Paper 10, Egerton University, Tegemeo Institute, Nairobi.*
- Odoh, N. E., Nwibo, S. U and Odom, C. N. (2009) Analysis Of Gender Accessibility Of Credit By Smallholder Cassava Farmers .
- Ogula, P. (1998). *A handbook on Education Research* : Nairobi. New Kemit Publishers
- Ogunmola, R. O. (2007). *Perception of farmers toward the use of agro-chemical and organ mineral.*
- Oladeebo, J. O. (2004). Resource-Use Efficiency of Small and Large Scale Farmer in South

- Western Nigeria: Implication for Food Security". *International Journal of Food and Agricultural Research*. 2004; Vol. 1, No. 12, Pp 227-235.
- Olayemi (1998) in Dayo Phillip, Ephraim Nkonya, John Pender, and Omobowale Ayoola Oni –Constraints of Increasing agricultural Productivity In Nigeria” (2008). *International Food Policy Institute (IFPRI) Nigerian Strategy Support Programm. Brief NO. 4.*
- Omamo, S. W. (2003). "Fertilizer Trade And Pricing In Uganda." *Agrekon*, Vol 42, No 4 (December 2003) Vol 42(No 4 (December 2003)): 310-324.
- Omonona B. T, Akinterinwa A. T, Awoyinka Y. A., (2008). Credit Constraint and Output Supply of Cowan Farmers in Oyo state Nigeria. *European Journal of Social Sciences*, 6(3):382-390.
- Orodho, A. J., (2005). *Essentials of educational and social sciences research method*. Nairobi: Masola Publishers
- Overfield, D. & Fleming E. (2001). A note on the influence of gender relations on the technical efficiency of smallholder coffee production in Papua New Guinea. *Journal of Agricultural Economics*, 153-156.
- Paudyal, K.R, Ransom, J.K., Rajbhandari, N.P ., Adhikari, K., Gerpacio, R.V. and Pingali, P.L., ‘Maize in Nepal: Production systems, constraints and priorities for research’ NARC and CIMMYT, Kathmandu, Nepal (2001) pp. 1-48.
- Pearson, S. R, E. Monke, G. Argwings-Kodhek, A. Winter-Nelson, S. Pagiola, and F. Avillez. 1995. *Agricultural Policy in Kenya: Applications of the Policy Analysis Matrix*. Ithaca: Cornell University Press. Planning, Department of Planning and Economic Management. Lusaka: Government of Zambia.
- Pingali, P. L. (ed.), ‘CIMMYT 1999-2000 World Maize Facts and Trends’ Meeting World Maize Needs: Technological Opportunities for the public Sector , Mexico, D. F., CIMMYT (2001).
- Rahaman, J and Marcus, N. D., (2004). Gender Differentials in Labour Contribution and Productivity in Farms.
- Republic of Kenya (2004), *Strategy for revitalizing agriculture*, Government Printer, Nairobi.
- Rogers, E. M. (2003). *Diffusion of Innovations* (Fourth Edition), New York: Free Press.

- Satish, P., and Nirupam M. 2009. Credit markets for small farms: role for institutional Innovations; *European Association of Agricultural Economists 111th Seminar, June 26-27, 2009, Canterbury, UK.*
- Schutjer, Wayne A. and Marlin G. Van Oer Veen. 1976. *Economic constraints on agricultural technology adoption in developing nations.* USAID-AE and RS. August Publication No. 124.
- Shakya PB & Flinn JC (1985). Adoption of modern varieties and fertilizer use on rice in the Eastern Tarai of Nepal. *Journal of Agricultural Economics* 36:409-419. *Agrekon, Vol 45, No 1 (March 2006) Fufa & Hassan* small scale farmers in Benue State. *Journal of Economics and International Finance Vol. 3.*
- SMALING, E. M. A., STOORVOGEL, J. J. & WINDMEIJER, P. N. (1993) Calculating soil nutrient balances in Africa at different scales. II : District scale. *Fertilizer Research*,35 237-250
- Tiffen, M., 2003. *Transition in Sub-Saharan Africa: Agriculture, Urbanization and Income Growth.* World Development 31(8), 1343-1366.toward introduced soil-fertility enhancing technologies in Western Africa. *Nutrient Cycling in Agroecosystems*, 53, 177-187.
- TITTONELL, P., VANLAUWE, B., LEFFELAAR, P. A., SHEPHERD, K. E. & GILLER, K. E. (2005) Exploring diversity in soil fertility management of smallholder farms in western Kenya II. Within-farm variability in resource allocation, nutrient flows and soil fertility status. *Agriculture Ecosystems and Environment*, 110,166-184.
- Udry C 1990. Credit markets in Nigeria: Credit as insurance in a rural economy. *World Bank Economic Review*, 4(3): 21.
- Ugbajah, M. O., (2011) *Gender Analysis of the Structure and Effects of Access to Financial Services among Rural Farmers in Anambra State, Nigeria.* *J Agri Sci*, 2(2): 107-111.
- Visser, S. P., & Krosnick, J. A. (1998). Development strength over the life cycle: surge and decline. *Journal of personality and social psychology*, 75, 1389-1410. Washington, D.C.: World Bank.
- V. N. Ozowa, (1995) *Quarterly Bulletin of the International Association of Agricultural Information Specialists, IAALD/CABI (v. 40, no. 1, 1995)*
- Wayo, A. S. (2002). Agricultural growth and competitiveness under policy reforms in Ghana. *ISSER Technical publication*, 61. Wetland Region of Cross River State. *Global Journal of Agricultural Sciences vol.8 NO. 2 Pp 195-201.*

Wittlinger, B. and Tuesta, T. M. 2006. *Providing cost-effective credit to small-scale single-crop farmers: The case of Financiera El Comercio*. Accion InSight. 19.

World Bank, (2006). *Poverty and hunger issues and opinions for food security in developing countries*. Washington D.C .The international bank for reconstruction and development: The World Bank.

Yaron, D., Dinar A., & Voet H. (1992). *Innovations on family farms: The Nazareth Region in Israel*.

Yohannes K, Gunjal K & Garth C (1990). Adoption of new technologies in Ethiopian agriculture: The case of Tegulet-Bulga district, Shoa province. *Agricultural Economics*

Zeller M 1994 .Determinants of credit rationing: A study of informal lenders and formal credit groups in Madagascar. *World Development*, 22(12): 19.

APPENDICES

APPENDIX1: LETTER OF TRANSMITTAL

SILVANUS S. WANJALA
P.O. BOX 95,
ELDORET.
Date.....

Dear respondent,

RE: FILLING OF THE QUESTIONNAIRE.

I am a student at the University of Nairobi undertaking a Master of Arts degree in Project planning and management. I have identified you as a respondent to a questionnaire to gather information on the factors influencing maize production among small scale farmers of Bungoma Central Sub County. Kindly I request you to fill in the questionnaire as honestly as possible. All your responses will be handled with confidentiality and will only be used for academic purposes. Thank you for your cooperation.

Yours faithfully,

Silvanus Wanjala

Appendix 2: Farmers Questionnaire

The purpose of this questionnaire is to gather information about factors influencing maize production among small scale farmers in Bungoma Central Sub County.

Please answer the questions freely. The information you provide will be treated with utmost Confidentiality and will only be used for academic research purposes by the researcher himself.

PART A: PERSONAL DETAILS.

Put a tick [√] or fill with appropriate response(s)

1. What is your gender? Male Female

2. Age.

18-20 []

20-30 []

30-40 []

40-50 []

50-60 []

60-70 []

Above 70 []

3. What is your highest level of Education?

Primary []

Secondary []

College []

University []

Post graduate []

Part B: Costs of production and maize production.

1. The source of power on my farm during land preparation is;

Source	Tick (✓) appropriately
Unpaid family labour	
Hired manual labour	
Animal draught power	
Mechanical power	

2. If you agree with the following activities, tick [Yes] or [No] ;

Activity	Yes	No
I carry out irrigation on my farm at times		
I practice minimum tillage		
You have heard of dry planting		
I practice dry planting		
I have heard of herbicides		
I use government subsidized fertilizer		

3. Tick (✓) to indicate the level you agree with the following statements.

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Minimum tillage reduces the cost of land preparation					
Fertilizer use increases returns from maize production					
Herbicides lower costs of maize production					

Below are some of the main costs involved in maize production. Tick the most costly.

- Land preparation []
- Planting []
- Fertilizer acquisition []
- Seed acquisition []
- Weeding []

PART. C : Demographic characteristics and maize production.

1. Basing on age, tick (✓) the age bracket that easily adopts new technology.

- 20 – 30 []
- 30 – 40 []
- 40 – 50 []
- 50 – 60 []
- Above 60 []

2. Basing on level of education, tick (✓) the level that easily adopts new farming techniques.

- Primary []
- Secondary []
- College []
- University []
- Post graduate []

3. Tick (✓) to indicate the level you agree with the following statements.

	Strongly agree	agree	Uncertain	disagree	Strongly disagree
Male headed households apply more fertilizer than female counterparts.					
Farmers with larger farm sizes apply more fertilizer than those with smaller farms.					

PART D: Agricultural extension services and maize production

1. I have attended agricultural field days in my area; Yes [] No []

2. If yes in one above, when was the last field day that you attended?

- Within the last half year []
- Within the last one year []
- Within the last two years []

3. Do you agree with the following statements; tick (✓) appropriately.

	Yes	No
Your farm or farmer group has been visited by an agricultural extension officer.		
You have ever heard of soil testing or tested your soil.		

4. Tick (✓) to indicate the level you agree with the following statements.

	Strongly agree	agree	Uncertain	disagree	Strongly disagree
Extension visits play a significant role in influencing the use of fertilizer.					
Farmers who adopt the improved agricultural practices realize higher yields.					
Given the limited availability of arable land, increase in maize yields can only be achieved by the use of modern technologies among the rural poor.					

5. Extension workers can help farmers do the following; tick (✓) appropriately.

ITEM	YES	NO
Calculate their farm input needs		
Identify where to buy their inputs		
Organize group transport		
Obtain credit		
Save		

Part E; Credit accessibility and maize production

1. I have once received credit from a financial institution; Yes [] No []

2. If yes to Q1 above, indicate when you took the last credit?

Within the last one year []

Within the last two years []

Within the last three years []

Four years and above []

3. I belong to an active farmer group or cooperative; Yes [] No []
4. As pertains credit, do you think the both the national and county governments can assist farmers with affordable and easily accessible credit? Yes [] No []
5. Tick (√) to indicate the level you agree with the following statements.

	Strongly agree	agree	Uncertain	disagree	Strongly disagree
Access to credit influences the decision to use inorganic fertilizer,					
Barter arrangements with input suppliers can help farmers can exchange their maize (or other acceptable crops) for required inputs.					
Farmer associations can assist in the supply of inputs and credit to individual association members, and market produce through a collective marketing mechanism;					
Saving the surplus cash at harvest time can be used to purchase inputs for the following season.					
The perennial maize shortage in the sub county would be a thing of the past if small-scale farmers are given incentives to increase production.					

Thanks for your cooperation!