SELECTED FACTORS INFLUENCING COTTON PRODUCTION AMONG SMALLHOLDER FARMERS IN BURA IRRIGATION AND SETTLEMENT SCHEME, KENYA

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DECLARATION AND RECOMENDATION

Declaration

I certify that this is my original work and has not been presented elsewhere for an award of a degree, diploma or certificate in this or any other University/Institution.

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Recommendation

This research thesis has been submitted for examination with our approval as university supervisors

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DEDICATION

To my beloved wife Emilly Atieno Odull and Children Travis Romin, Tanicia Dorice and Taleen Margy for their patience when I was undertaking this study.

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ABSTRACT

Kenyan smallholder cotton production has remained low despite the spirited effort by the government and the private sector to revive the sector. Several factors combined seem to be responsible for this perpetual low production. Among the factors are constraints ranging from, inadequate extension services, limited access to information on production and poor marketing systems. The purpose of this study was to investigate how these selected factors (cluster group extension approach, information sources and seed cotton marketing) influence cotton production among smallholder farmers in Bura Irrigation and Settlement Scheme. The study utilized descriptive survey research design to collect primary data from farm households on the influence of selected factors on cotton production, while secondary data was collected from Cotton Development Authority and National Irrigation Board offices in Bura Irrigation and Settlement Scheme. The study population was all smallholder cotton farmers in Bura Irrigation Scheme. Proportionate simple random sampling method was used to select 120 farmers from 1022 cotton farmers in 11 villages within the scheme, who were included in the study. A validated questionnaire was used to collect data. The questionnaire attained reliability Coefficient of $\alpha = 0.80$ at confidence level of 0.05 after it was pilot tested among 30 farmers in Galole Sub County. Descriptive and inferential statistics were used to analyze the data to determine association and relationships using Statistical Package for Social Science (SPSS) version 20.0. The findings showed that most of the households are headed by women (54%), majority are of middle age (36-55) and a significant 27.5% lacking basic education. Most farmers (55.8% of the respondents) preferred cluster group extension approach while 71.7% obtain production information from other farmers within the Scheme. On marketing of seed cotton 60.8% of the respondents recommended the establishment of a ginnery within the Scheme as the selling price of seed cotton showed a direct relationship with the production levels. The study recommended that efforts should be made to establish the reasons behind the unacceptable low levels of education among farmers within the scheme and brokers should be regulated to avoid malpractices associated with their activities in the Scheme.

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ABBREVIATIONS AND ACRONYMS

AGOA	African Growth Opportunity Act
ARC	Agriculture Research Council
ASAL	Arid and Semi-Arid Land
CODA	Cotton Development Authority
GoK	Government of Kenya
ICAC	International Cotton Advisory Committee
ICM	Integrated Crop Management
KARI	Kenya Agricultural Research Institute
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KMT	Kenya Markets Trust
NESC	National Economic and Social Council
NIB	National Irrigation Board
SSA	Sub-Saharan Africa
TCB	Tanzania Cotton Board
NASEP	National Agricultural Sector Extension Policy.
CIAT	International Centre for Tropical Agriculture

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Cotton is the largest revenue earning of the non-food crops produced in the world. Its production and processing provide some or all of the cash income of over 250 million people worldwide, including almost 7 percent of the available labor force in developing countries (International Cotton Advisory Committee [ICAC], 2013). These activities are becoming highly concentrated over time; today, 77 percent of global cotton output and 73 percent of the cotton hectares are accounted for by China, the United States, India, Pakistan, and the Central Asian Republics. India accounts for approximately 21 percent of the world cotton area but the average productivity of cotton is markedly low, at about 115 kilograms of lint cotton per acre compared to 240 kg per acre of world average per year (Sen, 2012).

According to ICAC (2011), cotton production faces crucial challenges such as: escalating costs of production, low cotton lint prices, inefficient pest management, stickiness, yield variability within the same location, late cotton picking, subsidies in the developed countries, diminishing production capital and competition from other crops. These obstacles diminish the benefits from continuing cotton cultivation (International Cotton Advisory Committee [ICAC], 2014). Even though the challenges are numerous, all the parties involved in cotton production are optimistic that Kenyan cotton will regain and even surpass its former position through the enhancement and implementation of site-specific and low-input technologies (Alex and Rivera, 2010). Significant improvements in institutional, policy and financial aspects must also be made in order to achieve competitiveness in the global economy (Bedi 2012). These challenges have to be taken up by the whole spectrum involved in the cotton sector, that is, researchers, extension workers, production agronomists, economists and policy makers (Kenya Institute for Public Policy Research Analysis [KIPRA], 2014).

According to ICAC (2012), poor yields from smallholder cotton in Africa have been a long standing problem that has not been greatly altered by release of new varieties or by other recommendations made on the basis of research findings and consequently there seems to be a number of problems in translating the outputs from research into the farmers' fields; farmers are consistently not taking up the recommendations. In response to African Growth and Opportunity Act (AGOA) and the expectation of declining cotton subsidies in developed countries, a number of Sub-Sahara African countries are embarking on programmes to stimulate cotton production

(Larsen, 2011). The focus is mainly on the provision of subsidized seed, fertilizer and insecticide but missing factors are both the development of sustainable integrated crop management practices and similarly sustainable mechanisms for the delivery of technical support services to the producers (ICAC, 2010). In South Africa, relatively low prices, high input costs, exchange rates, cheap import of cotton fibre and international subsidies are all factors affecting cotton production negatively (Cotton, 2013).

The Kenya's cotton sector performance declined substantially in the 1990's at the height of trade liberalization; both cotton production and the textiles garments industry suffered due to continued synthetic fibre competition, diminishing world prices, introduction of cheap imports of second hand clothes and diminished cotton profitability aggravated by inefficiencies in the production system and supply side constraints (Bedi, 2012). The decline in cotton production in the last two decades has also coincided with increase in poverty levels in areas designated as major cotton belts (Lisa and Minot, 2011). The gradual cotton decline has also affected other parts of the value chain including ginners, textile mills and manufacturers (Institute of Economic Affairs [IEA], 2013).

Cotton in Kenya is mainly grown by small-scale farmers in marginal and arid areas, on small land holdings. It is estimated that Kenya currently has 90,000 small-scale cotton farmers compared with over 200,000 farmers in the mid-1980s when the industry was at its peak (Cotton Development Authority [CODA], 2012). The Cotton Board of Kenya estimates that countrywide, 1,000,000 acres is suitable for rain-fed cotton production with the potential to produce about 260,000 bales of lint annually, and 100,000 acres for irrigated cotton with the potential to produce 108,000 bales of lint annually (Cotton Lint and Seed Board [CL&SB], 1992). However, only about 75,000 acres is currently under the crop, and the total annual lint production stands at only about 20,000 bales (CODA, 2013).

Despite these efforts, issues affecting cotton production have not been adequately addressed as most of the cotton production regions are yet to embark on its production despite the local markets available for the same (Alex and Rivera, 2010). Given that the average yield is only 500 kg/acre profitability would be greatly improved even with production at 50% of the yield potential of the commercial varieties (Wakhungu & Wafula, 2013).

Kenyan cotton is produced under both irrigated and rainfed conditions. In Bura Irrigation and Settlement Scheme where the study was conducted, cotton is the major crop which is grown in

rotation with maize (National Irrigation Board [NIB], 2016). According to Cotton Lint and Seed Board [CL&SB] (1992), by 1985, Bura Irrigation Scheme was responsible for 45% of the total country's seed cotton production where on farm average production stood at 3,600 kg/acre of seed cotton and thus, the Scheme was recognized as the pillar of cotton sector in Kenya. The current average seed cotton production under irrigation stands at 1,000 kg/acre against the potentials of 4,000 kg/acre under research of the HART 89M variety (Waturu, 2014). The scheme has a total of 16,000 acres of land which has been opened up for production by National Irrigation Board and is under irrigation (NIB, 2016).

One strategy for lowering the cost of cotton production would be to increase yields, which currently stands at about 21% of the potential for the varieties grown in Kenya (Kenya Agricultural Research Institute [KARI], 2010). However, according to Cotton Development Authority [CODA] (2013), cotton production in Kenya is currently faced by constraints ranging from erratic weather patterns, weak cooperative movement, high cost of inputs, lack of rural credit, poor seed quality, inadequate extension services and inappropriate extension approaches and poor marketing systems. CODA (2013) further indicated that efforts to release a new variety of genetically modified cotton seeds to farmers has been halted by the government's ban on genetically modified organisms, consequently farmers have to wait a little longer to benefit from the recent break through. This study was restricted to three factors, namely cluster group extension method used to reach out to farmers, source of information about cotton farming to farmers and cotton marketing mechanisms in the Scheme.

1.2 Statement of the Problem

In spite of the potentials of cotton crop as means to eradicate poverty in arid and semi-arid areas, and promotion by the government of Kenya and other stakeholders in the industry, cotton production in the study area has remained lower than what is recommended by research. Several factors appear to influence cotton production at household level. In particular, the influence of some of these factors – cluster group supported extension method, sources of information for cotton farming, cotton marketing, might not be appreciated by the stakeholders in the cotton industry. The extent to which cluster group supported extension approach; sources of information for cotton farming and cotton marketing, influence cotton production in the study area have not been clarified. This study therefore sought to investigate and document the extent to which these factors influence cotton production in Bura Irrigation and Settlement Scheme.

1.3 The Purpose of the Study

The purpose of the study was to investigate how selected factors (cluster group supported extension method, sources of information for cotton farming and cotton marketing) influence cotton production amongst smallholder farmers in Bura Irrigation and Settlement Scheme, Kenya.

1.4 Objectives of the Study

The study was guided by the following objectives:

i. To establish the status of cotton production in terms of yields and area by smallholder farmers in Bura Irrigation Scheme of Kenya
ii. To investigate the influence of cluster group supported extension method on cotton production among smallholder farmers in Bura Irrigation Scheme
iii. To investigate the influence of sources of farming information on cotton production among smallholder farmers in Bura Irrigation Scheme.
iv. To investigate the influence of cotton marketing on cotton production among smallholder farmers in Bura Irrigation Scheme.

1.5 Research Questions

i. What is the state of cotton production by smallholder farmers in Bura Irrigation Scheme?
ii. In what ways has cluster group supported extension method influenced cotton production by smallholder farmers in Bura Irrigation Scheme?
iii. What extent has sources of information on farming influenced cotton production by smallholder farmers in Bura Irrigation Scheme?
iv. What extent has seed cotton marketing influenced cotton production by smallholder farmers in Bura Irrigation Scheme?

1.6 Significance of the Study

The study findings provide basis for the policy makers to come up with the most relevant extension policies that could enhance cotton production in Kenya. It is also useful to policy makers in creating an enabling environment for cotton farmers to maximize on their potentials. The study provides information that could lead to successful revival of the textile industries since the major challenge currently is low cotton production**.** The findings of the study provide relevant information for designing and using appropriate extension methods to improve on extension service provision not only to cotton farmers but to all smallholder farmers in the country.

1.7 Scope of the Study

The study was designed to investigate the influence of cluster group supported extension method, sources of information for cotton farming and cotton marketing on cotton production among smallholder farmers in Bura Irrigation Scheme, Kenya. Secondary data on cotton production was taken for 2009 to 2013.

1.8 Assumptions of the Study

i. The cotton variety used by farmers was the best and the most appropriate for the smallholder farmers in Bura Irrigation and Settlement Scheme.
ii. Erratic weather pattern would not come into play since production is under irrigation and water for irrigation is available throughout the production season.
iii. The respondents would be willing and honest enough to give correct information meaningful for analysis

1.9 Limitations

The generalization of this study will be limited to areas of similar characteristics with those of the study area. There was also the challenge of insecurity in the area due to the frequent attacks by terror groups, thus farmers could have been hesitant to freely interact with the enumerators who were not familiar to them. This challenge was managed by the use of the local village administrator who accompanied the researcher during the data collection period.

1.10 Definitions of Terms

Cluster Group Extension Method – Oxford English Dictionary defines cluster as a group of similar things or people positioned or occurring closely together. Cluster Group Extension Method is where extension services are offered to farmers in convenient groups say from a common locality. In the study, the cluster group in this case will mean cotton farmers in one village.

Cotton Marketing – American Marketing Society (2004), defines marketing as an organizational function and set of processes for creating, communicating and delivering value to customers and for managing relationships in a way that benefits both of the stakeholders. For this study the definition will be limited to pricing, potential buyers and stakeholder relations.

Cotton production – Production is the quantity of goods that is produced (Oxford English Dictionary). In this study it will be defined as the yield of seed cotton obtained per unit area and changes in area (acreage) under cotton crop.

Cotton Seed - International Cotton Advisory Committee (ICAC, 2011), defines Cotton seed as the planting material. The definition will be maintained in the study.

Extension teaching methods – These are the various channels used by extension agents to reach out to farmers (Anderson, 2012). For this study, the definition will be limited to cluster group extension approach.

Seed Cotton – International Cotton Advisory Committee (ICAC, 2011), defines Seed Cotton as what is harvested from the field and is yet to be ginned. This definition is going to be maintained for the study.

Smallholder – World Bank (2012) defines smallholders as farmers owning between 0.2 – 12 hectares of farm land. This definition shall be maintained in the study.

Sources of information – This is how farmers acquire new knowledge for production of crops (Anderson, 2007). In this study the sources include government agencies and private entities.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter reviews the economic importance of cotton crop, challenges and opportunities in cotton sector. The chapter also reviews the global and African situation on cotton production and the influence of selected factors. Theoretical framework and a conceptual framework have been used to provide a contextual setting of the independent variables and the dependent variable for the study.

2.2 Challenges and Opportunities in Cotton Production

According to Oswald and Sauerboth (2009), cotton is one of the most important and widely produced agricultural and industrial crops in the world. It is estimated that cotton is planted on about 2.5 per cent of the world's arable land, making it one of the most significant crops in terms of land use after food grains and soybeans (Giovannucci, 2013). Cotton is one of the most important textile fibres, accounting for more than half of all fibres used in clothing and household furnishing, and about 38 percent of world fibre market (Bedi, 2012). More than 100 million family units are engaged directly in cotton production, when family labour, hired farm labour and workers in ancillary services such as transportation, ginning, baling and storage are considered, the total involvement in cotton sector reaches one billion people (ICAC, 2010). It also provides millions of employments in allied industries such as agricultural inputs, machinery and equipment, cotton seed crushing and textile manufacturing, the above reasons explain why the social impacts of globalization in the cotton/textile supply chain had a profile over the last five years in political debates across a wide range of countries (Boughton, Minde and Tschirley, 2011).

Southern countries (China, India, Pakistan, Uzbekistan and Bangladesh) produce 77 percent of the world's cotton, and constitute 58 percent of world cotton exports (Marquardt, 2011). Cotton textiles constitute approximately half the total textile fiber and arguably the largest industry in the world and it has been the leading industrial sector in many southern economies (Bedi, 2012). Cotton trade in the 1990s averages about 6 million tonnes annually, representing one third of the crop output, the remaining two-thirds either consumed domestically or exported in processed form. Similarly, the percentage of cotton traded internationally has fallen from 38 percent to 27 percent (ICAC, 2014). The low productivity of cotton in India is caused by some serious constraints. Lack of irrigation, limited supplies of quality seeds, poor management practices,

high costs of cultivation (particularly of plant protection measures) and serious pest outbreaks have been the major limiting factors in the past (Sen, 2012).

Textile production has traditionally been the first industrial sector of many developing countries, and has paved the way for broad scale industrialization and economic expansion (ICAC, 2014). In most cotton producing countries, the government provides some form of assistance to cotton growers. Research and technical assistance are perhaps the most common form of assistance provided by governments (Farrington and Hussein, 2011). Other forms of assistance are discounted prices of inputs, credit at lower interest rates, and promotional activities. All of these forms of assistance are indirect and, unlike direct subsidies to production and trade, are virtually impossible to document worldwide (Oxfarm, 2013). Over the last 15 years, international negotiations, in particular those that led to the creation of the World Trade Organization resulted in the gradual decline of direct subsidies. Nonetheless, direct production and trade subsidies persist in several countries (Gereffi, 2010).

The cotton-led growth of many African countries has been negatively affected by the growing volatility of world prices, competing synthetic fibers, and cotton subsidies in the United States, Europe and China (Garibay and Katke, 2013). According to ICAC (2012), there are substantial growth opportunities for African cotton, although some challenges need to be addressed: improving value addition (and quality), closing the productivity gap between Africa and other world producers through farm-level productivity and ginning efficiency; and supporting capacities and institutions through the capacity-building of stakeholders, and strengthening of governance structures. In the short-term, the main threats to the sustainability of the African cotton sector include: the US dollar to Euro exchange rate, subsidies, inadequate access to finance and extension services, weak cooperatives/marketing systems and a lack of adapted risk management tools (European Union, 2011). All of these issues have to be addressed to enhance the prospects for the competitiveness of Africa's cotton sector (European Union, 2011).

Poor yields from smallholder cotton in Africa have been a long-standing problem that has not been greatly altered by release of new varieties or by other recommendations made on the basis of research findings (ICAC, 2012). According to Larsen (2011), there appear to be a number of problems in translating the outputs from research into the farmers' fields; farmers are consistently not taking up the recommendations. Reasons for this situation includes; research institutions that do not have an adequate system to ensure that recommendations are followed, some recommendations are based on high input systems and are not presented as baskets of

options from which farmers can select based on their individual resources and knowledge. Although on-farm demonstrations have now been recognized as one of the best ways to build the capacity of farmers in best practice crop management, their numbers are usually too few to have a large impact and poor coordination among the players in the sector (Pretorius, 2010).

There is a widespread belief that the Kenyan cotton sector lags behind its full potential. This sentiment is expressed in numerous reports. CODA (2012) noted that the sector has the potential to dramatically increase its contribution to the economy through value addition and creation of employment. CODA (2013) further concluded that Kenya can produce 140,000 bales against the current 22,000 bales. The dismal performance is attributed to constraints ranging from, high cost of inputs, inadequate marketing structures, poor seed quality, erratic weather patterns, inadequate extension services, weak cooperative movement, lack of rural credit, competition from imported second hand clothes, low and declining producer prices.

2.3 Factors Influencing Cotton Production

Several factors interplay to influence cotton production; an understanding of these factors would be helpful to all the stakeholders in cotton industry to come up with better strategies to improve production. A study by Rudat, Burgen & Frey (2013) identifies such factors as the farmers' characteristics, attributes of the innovation, institutional factors, socio-economic and cultural factors, macro and microclimate and if one of the variables is unfavourable to the receiving client, then the rate and level of adoption will certainly not be satisfactory. Adoption studies by Rudat et al. (2013), done in the subsistence agriculture regions of Eastern Zambia to identify the factors influencing farmers' decision to adopt the technology of improved fallow for improved soil fertility. The study findings indicated that farmers' decision to adopt a new technology is not dependent on a single factor, but depends on a matrix of factors including household characteristics, community level factors, socio-economic constraints and incentives that farmers face, access to information, local institutional management, and macro policies in agriculture. According to Chaudhary, Fang & Mohanty (2007), the main three factors determining the yield of cotton are genetic make-up and optimization of gene technology, agronomic practices and agricultural technologies and biotic and a biotic stress-related factors. This study investigated the cluster group extension approach used, information sources and marketing of seed cotton as factors influencing cotton production in Bura Irrigation and Settlement Scheme in Kenya.

2.4 The Cluster Group Extension Approach

2.4.1 Status of Extension Services

In most countries research-extension linkages are problematic due to (in part) the collapse or the poor state of agricultural extension. This has helped to fuel the search for other approaches, including increased provision of extension services by non-governmental organizations, civil society organizations, and the private sector (Alex & Rivera, 2012). A number of options have been tested but no apparently promising alternative has yet emerged (Gemo, Eicher, & Teclemariam, 2010). Up-scaling the limited success stories tend to be difficult and often prohibitively expensive. Unfortunately, there is little systematic rigorous research and analysis on the performance, cost effectiveness, and sustainability of the alternative extension models (FAO, 2014).

A study by International Centre for Tropical Agriculture (CIAT) on technology generation and dissemination included enhancing farmers understanding about the problem and tapping their knowledge. It illustrated an adaptive approach to Integrated Pest Management development and dissemination with smallholder farmers in Lushoto, Northern Tanzania. Farmers preferred the following pathways; On farm demonstration of IPM technology, demonstration in schools, training through community learning activities, distribution of extension information leaflets and posters among others about the problem and its management; and awareness creating seminars and field tours (Centre for Tropical Agriculture [CIAT], 2010).

The performance of the public agricultural extension service in Kenya has been a very controversial subject (Anderson and Feder 2012). The system has been perceived as top-down, uniform and inflexible and considered a major contributor of the poor performing agricultural sector (Republic of Kenya 2005a). Thus, there has been a desire to reform extension into a system that is cost effective, responsive to farmers' needs, broad-based in service delivery, participatory, accountable and sustainable. Smallholder farmers not only require advice to increase farm productivity, but also advice on a diverse range of rural development options including markets, value addition, and diversified income opportunities. An extension system that does not significantly contribute to improving the lives of its clientele is inappropriate.

As a result of ineptness in the public extension system, a third type of extension service private agricultural extension system has emerged comprising of private companies, nongovernmental (NGOs), community-based (CBOs), and faith-based organisations (Nambiro, Omiti and Mugunieri 2013). Privatisation is used in the broadest sense - of increasing private sector

participation, which does not imply a transfer of state-owned assets to the private sector. According to Nambiro et.al (2013) the entry of private actors in the agricultural extension provision has raised questions about their strengths and weaknesses: how different are they from the public extension system? Under what circumstances does agricultural extension cease to be a public good - can it be performed more efficiently by private agencies? Is it prudent to operate parallel extension systems (public and private)? What is the new role of the government under these circumstances? To respond to these concerns, the government has embarked on a decisive move to revise the national extension policy by preparing the National Agricultural Sector Extension Policy (NASEP) and the NASEP Implementation Framework (Republic of Kenya 2005b).

2.4.2 Role of Extension Services

According to Anderson and Feder (2012), extension should be viewed as a very specific input. Extension approach and its timing should be tailored to the socio-economic and the physical characteristics of the farm and farmer. Young, more educated and less experienced farmers are likely to have a different farm structure than older, less educated and more traditional farmers. As such the extension needs of the two groups are different and thus the likely benefits are also dissimilar. However, in designing extension services, one should keep in mind not only the relative efficiency gains from each type of extension, but also the constraints that each type faces (FAO, 2014).

In performance evaluation, it was realized that all farms in an area have access to the same production technology but some are more successful than others in using it efficiently. Despite farm-specific characteristics that may account for such differences, some of the inputs used in the production process may also be responsible. This may occur when either farmer's have acquired more information, knowledge, and experience with respect to one input productivity than another, or some inputs affect the productivity of other inputs indirectly. The latter seems more likely in advanced agricultural systems. In either case, extension may be a potential input that fulfills both of these requirements. In that respect, the number of extension visits to advice on different methods of input application may result in different levels of output, causing diversity in the efficient use of inputs and thus, differences in productivity (Battese & Broca, 2010).

Those farmers who have above average resources for production preferred hands-on group learning, while poorer farmers preferred activities which took less of their time such as field

days, on-farm demonstration, audio programs and role plays. This adaptive approach to technology development and dissemination enhances farmers' capacity to analyse their production problems and to identify appropriate solutions (Ramesh & Singh, 2013).

Australian cotton growers continually seek new ideas and solutions to production challenges. Grower "suck" is an important component of extension: growers are proactive in seeking advice and on suggesting new ideas and approaches to research and extension. Research and extension is a continuum in Australian cotton, with research scientists being actively involved in extension, while regional extension staffs are also active in local research issues. This overlap assists with research extension coordination. Through time State extension staff in each region have become specialized as cotton Industry Development Officers (IDO), with coordinated extension activities and extension focus (Constable, 2012).

It is now generally accepted that extension strategies designed to increase farm income and rural livelihoods will depend, in part, on the socio-economic characteristics of different farm households, as well as the potential enterprises and market opportunities that may be available within specific locations. For example, the socio-economic characteristics of most farm families depend in large part on the number people within a household, including their age and gender; their access to water and other production resources; technical and management skills of the men and women within these farm households, as well as their engagement with other farm households within their community in organizing different types of socio-economic groups, such as micro-credit, producer and other self-help groups (World Bank, 2013).

Participatory approach extension method is responsive to intended beneficiaries' agricultural development problems and information needs because its extension objectives, strategies, methods, messages, and multimedia materials are specifically developed based on survey results of their knowledge, attitude and practice vis-a-vis the recommended agricultural technologies. Such a participatory approach in planning agricultural extension activities increases the degree of relevance, and thus acceptability, of extension messages or recommendations among intended beneficiaries who are consulted during the planning process regarding their priority concerns and needs. It does not assume the target beneficiaries to be ignorant or requiring all the information there is to know. Rather, it tries to understand and assess farmers' local indigenous knowledge, values and belief systems on farming practices which may be good, need to be improved, or perhaps need to be discouraged. In short, it follows the well-known principles of

rural reconstruction: "start with what people already know" and "build on what they already have (Adhikarya, 2011).

2.4.3 Group Extension Approaches

The use of farmer groups in extension has been popular due to its less consumption of time and other resources, it is important to realize that adoption is at individual level and not group level. A study by Amudavi (2005), in Kenya on linking institutional partnership, community groups and rural livelihood improvement, found out that not all groups equally have successful economic outcomes, especially where some economic resources are required up front. Local groups generate mainly social benefits.

Based on an impact evaluation of 25 different case studies, United Nations Conference on Trade and Development [UNCTAD] concluded that Farmer Field Schools (FFS) had a significant impact on reducing the use of pesticides and increasing yields. Perhaps more importantly, however, this approach stimulated continued learning and strengthened the social and political skills of farmers. In some countries, these developments triggered a range of local development activities, relationships, and policies. As the FFS model has been implemented in Sub-Saharan Africa, this non-formal education approach has been expanded to cover an increasing range of production practices, most with an individual crop production focus (UNCTAD, 2012). Public research and extension services increasingly focus on poverty alleviation through enhancing income generation. They adopt a wider livelihood perspective and integrate market-oriented thinking into their approach. They therefore need to provide information ranging from improved production technologies to enhanced opportunities for market access (Heemskerk and Wennink, 2013).

2.4.4 Challenges in Extension Systems

According to Onyango (1987), it is not possible to have an efficient extension system unless several factors operate correctly. Such factors include the situation of the public service which controls the development strategy for both extension workers, and clients of extension and finally the whole philosophy of extension and how it is expected to contribute to the national development effort. World Bank (2012), indicated that the effectiveness of an extension depends on; the legal nature of the instrument, the type of teaching objectives of the transfer, and terms and conditions under which transfer of technology takes place.

In sub-Saharan Africa extension tends to lose its sense of mission. As one of the few government institutions with the broad coverage of the rural areas, extension agents are liable to be engaged in performing any task which fulfils ministerial policy at village level, be it supplying inputs and credit, transferring technology, feeding back information to research workers, mobilizing local communities for group action to solve community-wide problems, or dealing with specific farmer problems and referring them to specialists. Because policy objectives tend to outstrip the resources available to achieve them, this leads to overload on the agents (World Bank, 2011). Moreover, it also leads to them trying to do jobs for which they have neither the training nor the experience. The resultant pressure of being expected to do more than they are able both quantitatively and qualitatively demoralizes the extension staff (Ameur, 2012). According to Global Forum for Rural Services [GFRAS] 2013, rural extension clienteles will always seek advisory services from the nearest available source without paying attention to the validity of the information obtained.

2.5 Sources of Information

Many would argue that the 'bottom line' of extension is the quality of its message. Yet sufficiently relevant or new technology necessary to improve productivity is one of the most common constraints in extension, and a major constraint in rainfed, resource-poor environments (Crowder, Quamar & Rivera, 2011). The World Bank (2012), ex-post evaluation of extension projects found that inadequate research extension links too adversely affect a large proportion of the projects reviewed, and insufficient available technology to be an even more common problem. The inherent problem is that extension disseminates information and advice generated by a knowledge-generating system which is generally not under extension management. This leads to a crucial dependence, which itself is not necessarily a problem. However, research and extension often tend to compete for power and resources, and fail to see themselves as part of a broader agricultural technology system. There is also a tendency for both extension and research to look for solutions within national borders, whereas relevant information and technology might be readily available across such artificial boundaries (World Bank. 2011).

The absence of adequate information in the income of the farmers does not stop agricultural policy from implementation; rather it means that decision makers have an imperfect picture against which it operates hence the traditional view of technology transfer is a one-way process (Hill, 1989). According to this view, research produces innovations which are passed on to extension and finally to farmers. In such kind of arrangements, feedback takes place informally

and research has no direct contact with the farmer (Mettrick, 2010). Therefore, services design to make information more readily accessible, relevant and appropriate to particular needs are becoming increasingly important throughout the society (Swanson, 1984).

As the agricultural sector moves toward the goal of increasing diversification and intensification of farming systems, especially those involving small-scale and women farmers, all farmers will need access to relevant and current technical and market information that reflects these emerging domestic and international market opportunities for the different agro-ecological areas within each sub-district, district, and province within the country (World Bank 2012).

According to World Bank (2011), it should be noted that small-scale and women farmers, most of whom are illiterate or poorly educated, are heavily dependent on extension workers, input supply firms, and other intermediaries to supply them with relevant technical skills and knowledge, as well as up-to-date market information. Certain social and cultural customs allow men to seek education whereas women are deprived. Generally, educational facilities for general public, particularly for rural areas, are not sufficient. Therefore, inadequate access to education results in an illiteracy rate in rural Egypt of 36.6% (El-Din, 2014). Additionally, high illiteracy rate and poor skill levels are observed, particularly in rural women. Rural dwellers do not have enough awareness of concepts and principles of sustainable agriculture. They lack knowledge on exportable markets. Due to the shrinking job opportunities in the rural areas and farming sector, farmers not only experience difficulties finding qualified and skilled agricultural laborers but they also have to pay them more. Institute of Economic Affairs (2013), have noted that, to successfully help poor farmers over the long term, a "cognitive approach to learning" will be required to increase the capabilities of small-scale farmers and their producer groups to find or create replicable solutions to their problems.

2.6 Seed Cotton Marketing

According to Kibua and Nzioki (2013), seed cotton prices have been in relative decline in recent years, although recent price spikes have seen lint prices rise for only the second time since the American civil war. One reason for the rise was that farmers have switched to other crops added to the fall-out from the global financial crisis and bad weather that had affected harvest in Pakistan and China. The average price for cotton was the highest since 1994/1995 but growing production in the coming year would bring averages down again (Kibua and Nzioki, 2013). Besides low productivity, the production of cotton has been increasingly constrained by competition from other crops in addition to low cotton prices on the world markets.

While some of the overall long-term decline in prices of seed cotton can be explained by reductions in production costs as a result of technological advances, slow demand growth, and strong competition from synthetic fibres, the recent volatility and depressed cotton prices are more of a direct consequence of the subsidies granted by rich cotton producing countries notably, the United States, China and the European Union (Gillson, Poulton, Bulcombe & Page, 2011). Looking at the global balance of cotton, China and the United States as the two largest cotton producers, each account for approximately 20 percent of world output, followed by India by 12 percent, and Pakistan by 8 percent. Other significant cotton producers are the countries of Francophone Africa, Turkey, Brazil, Australia, and Greece, which account for a combined 18 percent of global output (Baffes, 2009).

One of the major factors influencing the fluctuation of commodity prices is cyclical income fluctuations in the consuming countries. Consequently, the ups and downs in industrial country production have serious consequences for commodity exporters. Prices fall when restrictive policies are imposed to reduce inflationary pressures in the importing countries. The consequent slowing down of economic growth leads to sharp decline in the demand for raw materials. Commodity prices also fluctuate in response to good or poor harvests caused by variations in weather conditions (Kilima, 2013). Volatile commodity markets lead to disruptions in investment planning and contribute to the misallocation of resources. Unstable markets cannot reliably indicate the relative profitability of alternative lines of investment. Consequently, risk-averse investors become hesitant to invest in sectors that are subject to high volatility. High price instability of a country's commodity exports impact on the rate of domestic savings and also tend to favour investments for short gain, whereas low price instability would tend to favour long-term investment in productive assets. In other words, private investment may be channeled into domestic projects with short-term profits rather than into riskier ventures, even though the latter may reflect the country's comparative advantage (Maizels, 2009). The instability of commodity prices also constrains economic development through the resulting variability in imports of capital and intermediate products (Kilima, 2013).

Smallholder farmers in West and Central Africa are, however, flexible, opportunistic and responsive where they have the capacity and incentives to change the mix of agricultural products they produce. Recent trends indicate that cotton farmers are indeed switching to food grains given dramatic price rises for grains in the last 2 years. Final seed cotton production estimates across the region indicate 2009/10 was the worst year for production since 1994-5.

This shows the remarkable capacity of West and Central African smallholder farmers to adapt strategies to respond to market demand and, where conditions allow, take up new productive activities in the face of price volatility (Goodwin & Piggott, 2013). This shift in production patterns is already happening at the level of smallholder farms. For example, in Mali and Burkina Faso, areas planted to cotton decreased by 30% in 2010, representing shifts to cereals to take advantage food price increases and needs of local/ regional markets (Hazell & Williamson, 2012).

It was observed that there are numerous constraints to the stability of commodity markets in Africa. Such constraints include low production and productivity, poor performance of state and public institutions as well as infrastructure; low value addition and other constraints to diversification. Although African countries are exposed to the various approaches to stabilization such as supply management, diversification and market-based risk management instrument, not much have been done in utilising the latter two approaches. However, there is a general consensus that these two approaches hold the key to the transformation of African economies if properly harnessed and utilised. Without doubt, there are challenges which need to be adequately taken care of. Efforts should therefore be made to employ innovative financing methods much more widely. Diversification of production would also need to be vigorously pursued through the introduction and sustenance of reform programmes. Such initiatives would usher in grater private sector participation, increased efficiency in production and greater competitiveness (UNCTAD, 2012).

2.7 Theoretical Framework

Two theories will form the basis of this study, these are; Fishbein & Ajzen (1975), Theory of Reasoned Action (TRA) and Baggozi, Davis & Warshow (1989) Technology Acceptance Theory (TAM). TAM has been acknowledged as one of the most relevant and most cited model in studying user acceptance and use of technology (Lee, Chao, Gay, Davidson & Ingraffea, 2010). This is because it specifies the casual relationships between system design features, perceived usefulness, and perceived ease of use attitude towards using and actual usage behavior. Overall the TAM provides and informative representation of the mechanisms by which design choices influence user acceptance of a technology.

TAM was constructed for purpose of elucidating computer adoption and use (Lierbermann, 2006). In addition, the main goal of TAM was to provide an explanation of the determinants of technology acceptance that was general, capable of explaining user behavior across a broad range of end user computing technologies and user populations while at same time remain both

parsimonious and theoretically justified Baggozi et al. (1989). Moreover, Baggozi et al. (1989) and Liebermann, (2006), both in their studies demonstrated the ease of use and usefulness, as perceived by the potential adopter, were important variables in predicting the adoption rate.

Although TAM is useful in determining factors affecting technology acceptance and use through perceived ease of use and usefulness, it does not consider social influence which determines whether an individual will engage or not engage in a particular behavior this fact necessitates the use of second theory, TRA which is a referent of TAM. It includes social influence via a construct called subjective norm which has received little attention in the context of TAM research. The TRA posits that individual behavior is driven by behavioral intention where behavioral intentions are a function of an individual's attitude toward the behavior and perception of what other people think about the performance of the behavior.

In studying the extent to which the selected factors influence cotton production maybe defined as the cotton farmers' positive or negative feelings about using a particular technology. It is determined through one's belief regarding the consequences arising from this behavior and an evaluation of desirability of these consequences. Formally overall attitude can be assessed as the sum of the individual consequences and desirability assessments for all expected consequences of the behavior. Anderson (2011) concluded that TRA and TAM both of which have strong behavioral elements, assume that when someone forms an intention to act they will act without limitation.

2.8 Conceptual Framework

The conceptual framework provides a contextual setting under which several factors influencing cotton production among smallholder farmers. In this study, the independent variables were Cluster group extension method, Sources of information for cotton farming and cotton marketing.

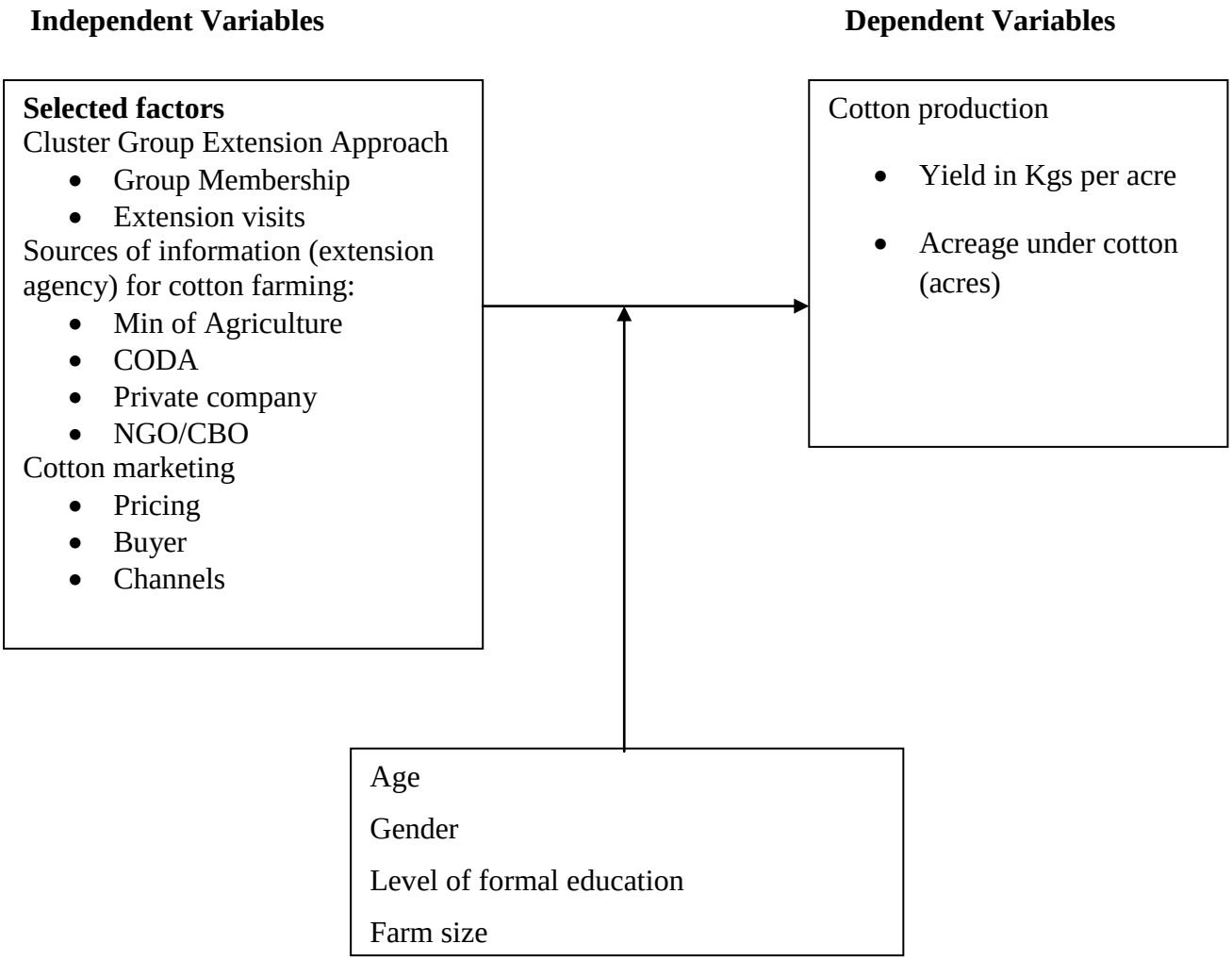

Figure 1: Factors Influencing Seed Cotton Production

The dependent variable was cotton production and was measured through yield in kilograms per acre and acreage under cotton crop. The intervening variables were smallholder cotton farmers; age, gender, level of education and farm sizes. These variables influenced smallholder cotton production and therefore had a contingent effect on the relationship between independent variables and dependent variable. The moderator variables were studied and their effect determined.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research method that was used to carry out the study.

The chapter covers various sections of research method. It discusses the research design, the location of the study, the target population, the sampling procedure sample size. It also covers instrumentation, the data collection techniques with regard to their suitability of the study and data analysis.

3.2 Research Design.

Descriptive survey research design was used for the study. Descriptive survey research design was appropriate for this study because it allows one to obtain information concerning the current status of the phenomena to describe 'what exists' with respect to variables or conditions (Kathuri & Pals, 1993). Descriptive survey research design was therefore most suitable for this study as the study sought to find out what existed at the time of conducting the research. Mugenda and Mugenda (2003), describe this method as one that determines and reports the way things are. The design involves collection of information from a sample that has been drawn from a predetermined population at one point in time (Kathuri & Pals, 1993).

3.3 Study Location

The study was carried out in Bura Irrigation and Settlement Scheme of Tana River County, Kenya. Bura Irrigation Scheme is located in Tana River County, about 120 Kilometers South of Garissa town and it's 50km North of Hola Town and about 400 kilometers North of Mombasa town. The scheme is situated on the right bank of River Tana within the lower Tana River basin. At its inception in 1977, the scheme had targeted to settle approximately 5150 families to utilize 75,000 acres of irrigation land. However, irrigation infrastructure covering only 2500 acres was developed due to the constraints during the initial implementation (NIB, 2014).

The main aim of setting up the scheme was to settle the landless, unemployed or the under-employed; increase food and cash crop production to ensure food sufficiency and save foreign exchange; open up arid and semi-arid regions by providing water; and improve and rehabilitate the environment by planting trees to provide wood fuel and building materials for the scheme's populace and its environs. From inception the scheme has been known for cotton production as the main cash crop, while maize, groundnuts, vegetables and legumes as food crops. This has since changed a bit to include seed maize as a cash crop. The Scheme is organized such that it

has 24 villages but only 11 villages have been opened up for agricultural production with a total of 6,500 acres of land. Each village has designated settlement areas adjacent to the farms for easy access (NIB, 2014).

3.4 Population of Study

A population is the total collection of elements from which we wish to make some inference (Kothari, 1990). The population for this research was all cotton producing households in Bura Irrigation and Settlement Scheme. A detailed summary of the population distribution across the villages is shown in Table 1.

Table 1: Summary of the population in the study area (N = 1022).

Village	Number of Cotton farmers
Village 1	102
Village 2	155
Village 3	88
Village 4	93
Village 5	82
Village 6	161
Village 7	50
Village 8	90
Village 9	102
Village 10	78
Village 11	21
Total	1022

Source: Compiled from CODA (2013)

3.5 Sampling Procedure and Sample Size

The targeted population was 1022 farmers. A sample of 120 farmers shall be sampled for the study. A sample size of 120 respondents was considered appropriate for the study as it way above the minimum recommended sample size of 100 in consideration of the level of accuracy required and the accessible population (Kathuri & Pals, 1993). The extra number of 20 households was to cater for dropouts and non-respondents during the study. Proportionate simple random sampling was used to select the farmers to be studied from each of the Villages. A list of all cotton farmers in the entire villages of the scheme was obtained from CODA Zonal Office at Bura. The list constituted the sampling frame. With the aid of table of random numbers, participating farmers were identified (the sample). The sampling unit was the head of the household. This allowed every farmer to have an equal independent chance of being

included in the sample. Table 2 gives the Villages in the study area and the corresponding number of respondents that were selected.

Table 2: Summary of the sample selection per village (n = 120).

Village	Number of farmers	Proportion of the population	Number selected (sample)
Village 1	102	9.98%	12
Village 2	155	15.17%	18
Village 3	88	8.61%	10
Village 4	93	9.10%	11
Village 5	82	8.02%	10
Village 6	161	15.75%	19
Village 7	50	4.89%	6
Village 8	90	8.81%	11
Village 9	102	9.98%	12
Village 10	78	7.63%	9
Village 11	21	2.05%	2
Total	1022	100%	120

3.6 Instrumentation

A questionnaire was developed to collect data from farmers (research participants). The questionnaire was developed along the objectives of the study. Secondary data was collected from National Irrigation Board and Directorate of Fibre Crops offices at Bura Irrigation and Settlement Scheme.

3.6.1 Validity

The validity of the instruments was ascertained by colleagues (both workmates and classmates) and the supervisors in the Agricultural Education and Extension Department of Egerton University. They were asked to check for its content and item construction to ensure that the items adequately address the objectives of the study.

3.6.2 Reliability

The instrument was pilot tested for its reliability in Galole Sub-County (Tana Irrigation Scheme) on a sample of 30 respondents. Galole Sub-County was chosen for pilot study because it has similar characteristics as Bura Irrigation Scheme. Cronbanch's alpha coefficient was calculated to establish the reliability of the instruments. Reliability of the instrument was carried out to

measure the consistency of the results from the instrument (Mutai, 2000). The reliability of the instrument was accepted at alpha coefficient of 0.70 and above.

3.7 Data Collection

The researcher sought a research permit from the National Commission for Science, Technology and Innovation through the Graduate School, Egerton University. Upon acquisition of the research permit, a schedule for the visits to meet the respondents was prepared. The assistance of local village elders and extension staff was sought to enable the researcher locate respondents. Appointments for visits was made with the respondents in advance but if found absent on two visits, that particular respondent was skipped and replaced with another. The purpose of the study was clearly explained to remove doubts, which could interfere with the study during the interview visits to the households. Data was collected by the researcher himself.

3.8 Data Analysis

Data from questionnaires was organized, collated and coded for possible errors according to study objectives and variables. Summarized data was keyed into the computer for analysis using Statistical Packages for the Social Sciences (SPSS) version 20.0. Descriptive and inferential statistics was used to analyze the data. For objective one, descriptive statistics was used to summarize the data to determine the state of cotton production in Bura Irrigation and Settlement Scheme. Objectives two and three, multiple regression analysis model was used to determine the extent of the influences of the various independent variables on cotton production among smallholder farmers. Descriptive statistics were used for objective four to determine whether seed cotton marketing has any influence on cotton production.

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1 Introduction

The chapter presents the results and discussions based on the objectives of the study. The discussion is organized based on the objectives of the study. The chapter, thus comprises of five main sections namely the profile of respondents, level of cotton production, influence of cluster group supported extension approach on cotton production, influence of sources of information on cotton production and influence of cotton marketing on cotton production in Bura Irrigation and Settlement Scheme, Kenya.

4.2 Profile of the Respondents

The profile of the respondents that were assessed by the study include gender of the household head, ages of the household heads, farm sizes and formal educational levels attained by the household heads in Bura Irrigation and Settlement Scheme.

4.2.1 Gender of Household Head

An assessment of gender of the respondents revealed that majority of the households within Bura Irrigation and Settlement Scheme are headed by females who during the time of this study ranked 54% while male scored 46% (Table 3).

Table 3: Gender of the Household Heads by villages (cluster groups)

Gender of Household Heads	Percentage
Male	46
Female	54
Total	**100**

In light of the above observation Change Agent particularly those engaged in cotton production and socio-economic dynamics of the scheme ought to take into account the gender distribution in Bura. Farming technologies that have cultural limitations must be packaged in line with this gender distribution.

4.2.2 Age of household heads

The results of this study indicate that most of the farmers (35.8%) were aged between 46 and 55 years old with an average of 48.55 years and a standard deviation of 10.2 years. The modal distribution points to 51 years as the highly repeated score for age ranking. However, age

distribution in the Scheme is slightly skewed to the left (Figure 2) with a skewness of -0.244 recorded and variation of 2.45 between the mean (48.55) and the median (51)

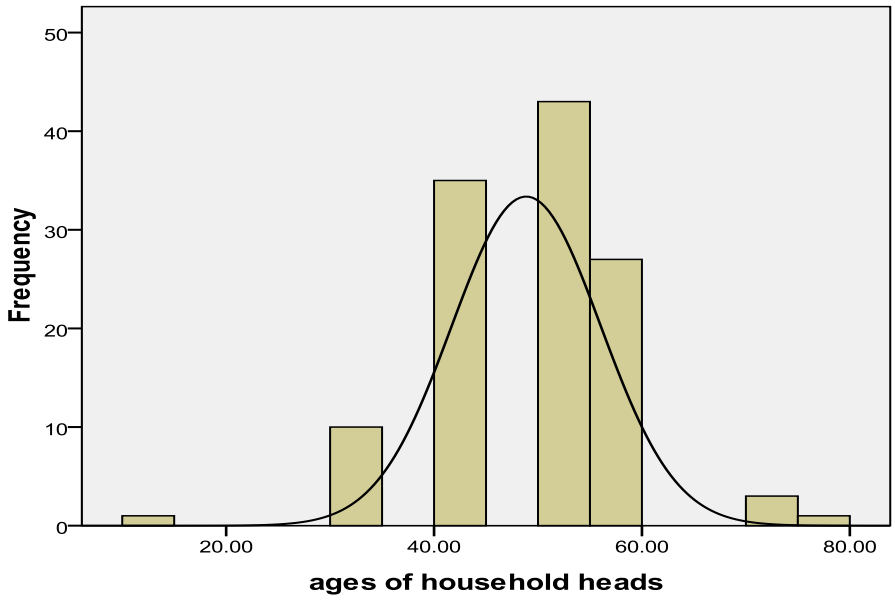

Figure 2: An illustration of distribution of the ages of the respondents in Bura Scheme

Only 1% of the respondents were less than 25 years, while only 4% were over 65 years. On the other hand, 28% were between 36 and 45years old, 36% were between 46 and 55 years old, while 23% were between 56-65 years (Table 4). Based on this, it can be concluded that demographically, cotton farmers in Bura Irrigation and Settlement Scheme are of middle age.

Table 4: Age distribution of household heads

Ages of Household heads	**Frequency**	**Percentage**
Less than 25	1	1
26 – 35	10	8
36 – 45	34	28
46 – 55	43	36
56 – 65	27	23
Over 65	5	4
Total	**120**	**100**

Further analysis of the results reveals that the cotton farming community of Bura Irrigation and Settlement Scheme majorly consists of a middle aged category that is between 36 and 55 years

(Table 4); approximately, 64% of the respondents confirmed that they belong to this category. Indeed, the average age of the respondents was 48 years. The importance of this is that majority of the farmers in this area are still in their prime age for making rational farming decisions and implement them. This is therefore an opportunity that can be exploited by service providers in the cotton production sector

4.2.3 Farm Size

The respondents were requested to indicate the sizes of land they have for agricultural production and analysis of the results indicate that 5% of all the respondents have between 1 and 2 acres, 27% have between 2-3 acres, 35% have between 3-4 acres, while 38% have over 4 acres (Table 5).

Table 5: Size of the farm in acres

Farm Size	**Percentages**
1 – 2	5
2 – 3	23
3 – 4	35
Over 4	38
Total	**100**

The size of farm is an important factor in capital allocation as it determines the extent to which appropriate mechanization can be implemented. Also important to note is that the larger the parcel of land the more the farmer reaps from economies of scale as the costs of fixed assets are spread to more production units.

4.2.4 Education Level

The results of this study shows that most of the respondents have only attained primary school education, with those who have never attended any formal school scoring 27.5% compared to those who acquired tertiary education who scored 1.7%. (Figure 3)

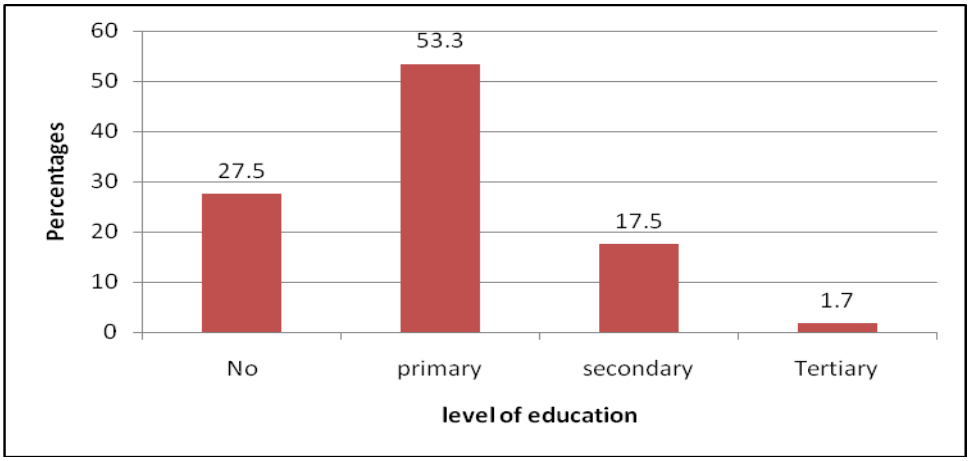

Figure 3: Proportions on response to question on the level of education

This low level of education may impact negatively on the rate of adoption and subsequent adaption of farming technology, hence, a need to rethink on the best approach to use when disseminating agricultural innovations for cotton production farmers. According to Anderson and Feder (2008), extension approach and its timing should be tailored to the socio-economic and the physical characteristics of the farm and farmer. As mentioned elsewhere in this document, young, more educated and less experienced farmers are likely to have a different farm structure than older, less educated and more traditional farmers. As such, the extension needs of the two groups are different and thus the likely benefits are also dissimilar.

4.3 Objective one: Status of cotton production

Objective one sought to establish the level of cotton production in terms of yields and area by smallholder farmers in Bura Irrigation Scheme. The study assessed the area under cotton production and the average yield of cotton produced.

4.3.1 Acreage under Cotton Production

The study sought to establish the average acreage under cotton production from 2011 to 2015. The results of the study are presented in Figure 4. The results were obtained through analysis of secondary data about cotton production trends in the study area. The results indicate a sharp increase in the acreage from the years 2011 to 2015 and thereafter a decline.

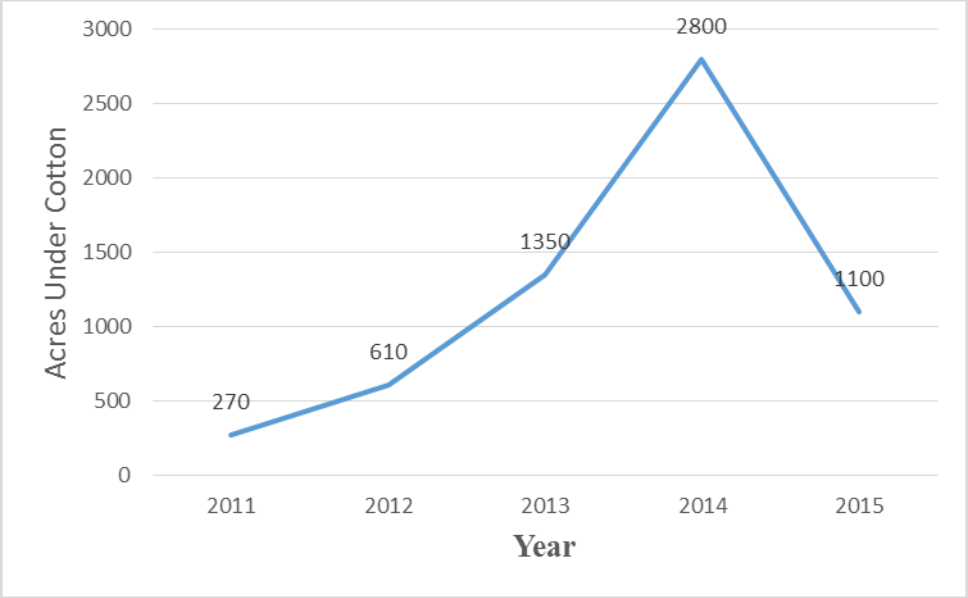

Figure 4: Average Acreage under cotton from 2011 to 2015

This increase and decline in area under cotton production could be attributed to marginal increase and decrease in the price of seed cotton over the same period of time (Figure 14). CODA (2016), further concluded that, the dismal performance in Kenya is attributed to constraints ranging from, high cost of inputs, inadequate marketing structures, poor seed quality, erratic weather patterns, inadequate extension services, weak cooperative movement and, low and declining producer prices.

4.3.2 Average yield harvested in Kilograms per Acre

The study sought to establish the average yield per acre under cotton production from 2011 to 2015. The results of the study are presented in Figure 5.

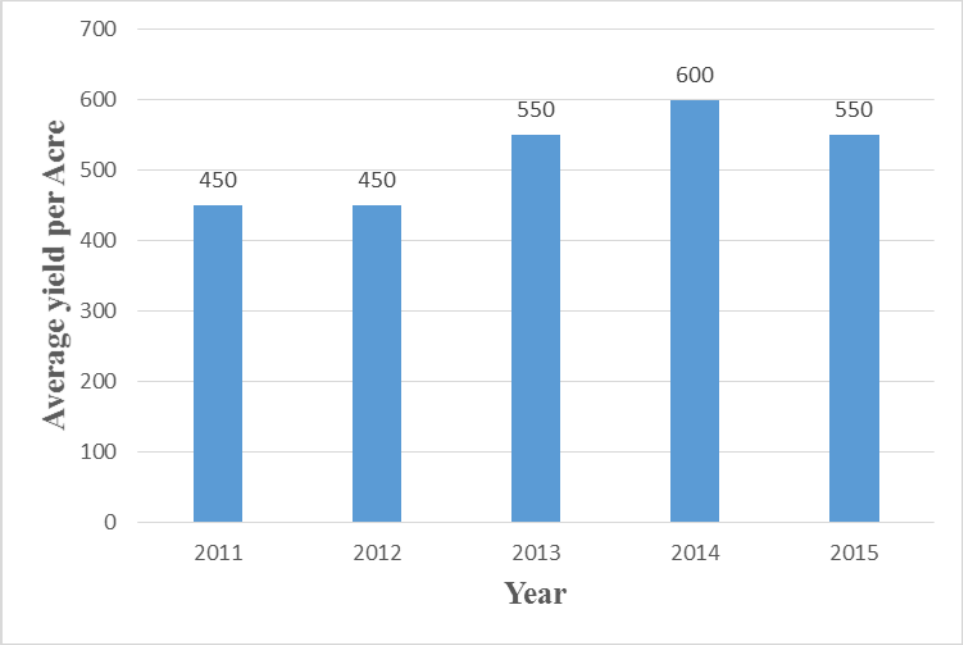

Figure 5: Average seed cotton yield from 2011 to 2015

The results were obtained through analysis of secondary data about cotton production trends in the study area. The results indicate an increase in the acreage from the years 2011 to 2014 and thereafter a decline. the increase in the acreage of cotton from 2011 translated in the increase in cotton production up to 2014 which was followed by a slight decrease towards 2015 (Figure 4). Although the National Irrigation Board (2016) has reported that the current area under cotton production stands at 1,100 acres, this is still way below the potential of 16,000 ha of land that can be achieved. Likewise, the pattern of cotton production in terms of yields takes the same trend (Figure 5) where production increases from 2011 to 2014 and then declines in 2015 where only 500kgs/acre were achieved. This is way below what has been reported by Waturu (2014) where the current average seed cotton production under irrigation stands at 1,000 kg/acre of HART 89M variety grown. Indeed, Wakhungu & Wafula, (2013) reported that profitability would be greatly improved even with production at 50% of the yield potential of the commercial varieties. The analysis confirms ICAC (2011) assertion that poor yields from smallholder cotton in Africa have been a long standing problem that has not been greatly altered by release of new varieties or by other recommendations made on the basis of research findings. It may be safe to attribute this sudden decline in acreage under cotton production to a similar trend observed in the selling price of cotton.

4.4 Objective two: Influence of Cluster Groups Extension Method on Cotton Production

Objective two sought to determine the influence of cluster group's extension method on Cotton production in Bura Irrigation Scheme. The study investigated membership of the farmer in a cotton farmer group, who is turned to for advice whenever faced with a problem on the farm, frequency of visits to the farm by Extension Officers, availability of extension workers when needed, training received on cotton production in the recent past and their influence on cotton production.

4.4.1 Group Membership

The respondents were asked whether they were members of any cotton farmers' group and the reasons for or against belonging to a group. The results of the investigation are presented in Table 6 and 7

Table 6: Group Membership

Group Membership	
Membership	**Percentage**
Yes	71
No	29
Total	**100**

Analysis of results in Table 6 indicate that 71% of the respondents belonged to cotton production groups, and 29% of the cotton farmers did not belong to any one cotton group.

Table 7: Reasons for group Membership

Reason	**Percentage**
To access credits from AFC	71
Does not like groups	0.8
No specific reason	2.5
Not interested	21.6
Denied Membership	3.3
Ejected from a group	0.8
Total	**100**

The respondents were further requested to give reason for either being or not being in cotton group, where 71% indicated that the main reason is to access credits from AFC, while 22% indicated that they were not interested in joining any group as 7% cited other varied reasons (Table 7).

All those belonging to groups (100%) cited access to credit from AFC as the major motivating factor.

4.4.2 Sources of Farm Advice Services

The respondents were requested to indicate the various sources they sought assistance on cotton production whenever they are faced with problems. The results of the investigations are presented in Table 8

Table 8: Sources of Farm Advice

Source	**Percentage**
GoK Extension Officers	2.5%
Other farmers	77.5
Private Officers	18.3
Others (CBOs)	1.7
Total	**100**

All the respondents indicated that they seek for advice whenever they are faced with challenges during cotton production from various providers. Most of the respondents, 77.5% indicated that they seek assistance from other farmers while 18.3% obtain services from private service providers and only 2% who seek assistance from Government Extension Officers (Table 8). Since majority of the respondents indicated that they obtain farm advice from fellow farmers, the findings are in agreement with what was reported by GFRAS (2013) where it was indicated that extension clienteles will always seek services from the next available source within their reach regardless of the credibility of the information obtained. Nambiro et.al (2013) also questioned the entry of private actors in the agricultural extension provision, particularly about their strengths, weaknesses, and how different are they from the public extension system.

4.4.3 Frequency of Visits by Extension Officers

Asked about the extension officer's visit to their farms, 90.8% of the respondents indicated that they have never been visited by these officers, 3.3% had at least a visit in a month and 5.8% were visited once in a year (Figure 6).

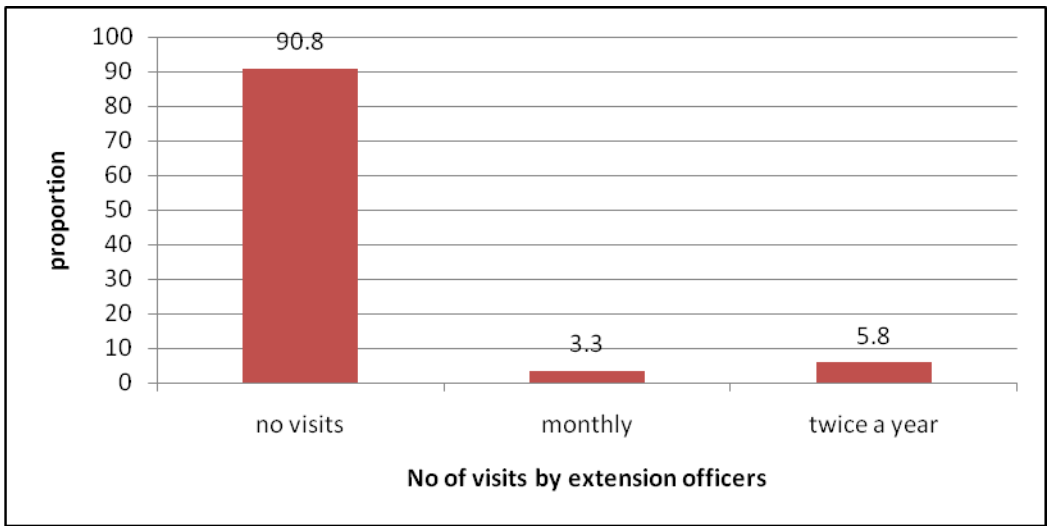

Figure 6: Frequency of visits to cotton farmers by extension officers

Probably, this could be an explanation as to why majority of the respondents indicated that they seek assistance from fellow farmers whenever confronted with cotton production challenges. Onyango (1987), indicated that it is not possible to have an efficient extension system unless several factors operate correctly. Such factors include the situation of the public service which controls the development strategy for both extension workers, and clients of extension and finally the whole philosophy of extension and how it is expected to contribute to the national development effort.

4.4.4 Availability of Extension Officers

To establish whether extension officers were available when demanded, 29% of the respondents indicated that the officers were not available on demand, 58% indicated that the Officers were sometimes available as only 13% indicated that the officers were always available when demanded. (Figure 7)

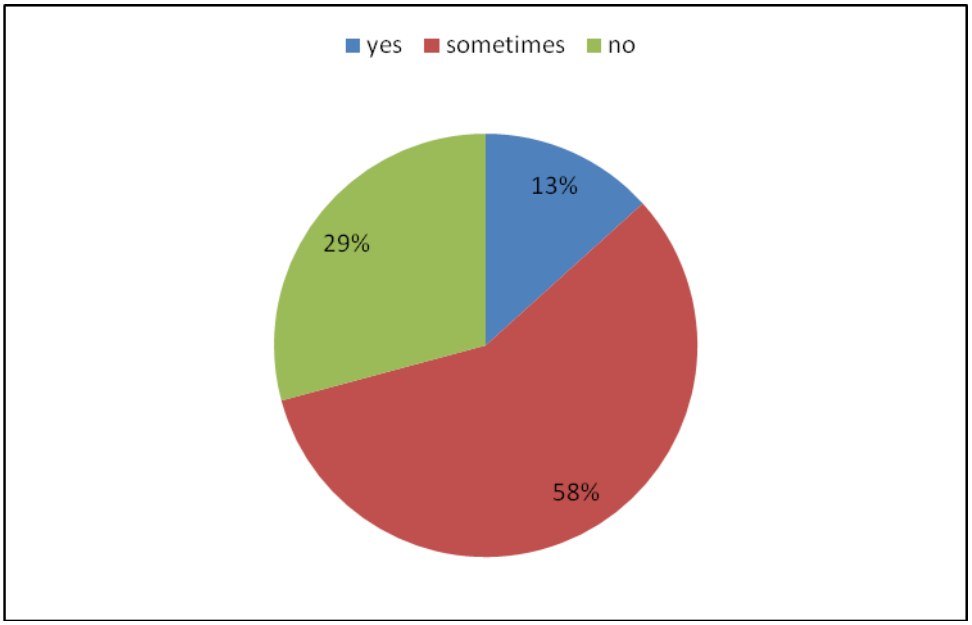

Figure 7: Proportions of respondents on the quetions of availability of officers on demand

Majority of the respondents (87 percent) indicated that the Extension Officers were not always available when needed. This scenario presents a weak linkage in the entire extension and research system. This supports Alex and Rivera (2010), position that in most countries research-extension linkages are problematic due to (in part) the collapse or the poor state of agricultural extension, thus this has helped to fuel the search for other approaches, including increased provision of extension services by non-governmental organizations, civil society organizations, and the private sector.

4.4.5 Appropriateness of Cluster Extension Methodology

With the use of a likert scale, the respondents were required to state whether cluster group method is the most ideal for reaching out to cotton farmers. The proportion of those who strongly disagreed was 14.2% as opposed to 20% of those who strongly agreed. (Figure 8)

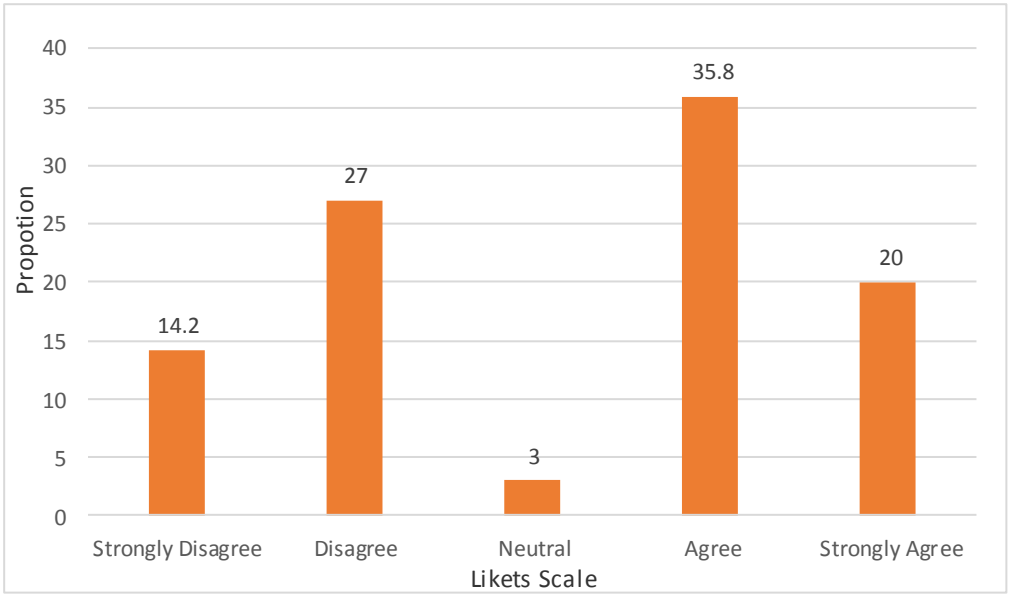

Figure 8: Proportions of Cluster group approach to extension services

Further analysis reveals that majority of the respondents (56%) were in agreement that Cluster group approach to extension services is the most ideal for reaching out to farmers within the scheme. According to the analysis of the data, most of the farmers prefer this method where a cumulative 56% of the respondents confirmed that it was the ideal approach as opposed to 44% % of those who disagreed. It is important to note here that the proportion of those who disagreed, although comparatively low is significantly high to warrant attention. For this reason, a hybrid of different extension approaches may be more appropriate in Bura irrigation scheme as opposed to cluster group extension method alone. However, according to FAO, 2014, when designing extension services, one should keep in mind not only the relative efficiency gains from each type of extension, but also the constraints that each type faces.

4.4.6 Training on Cotton Production

Respondents were requested to indicate whether they have had any training in the resent past and to specify the kind of training if any. Analysis reviled that, 39% of the respondents indicated that they had been trained on cotton production as opposed to 61% who said they had not been trained on cotton production in the recent past (Table 9). All those who admitted to have been trained had received one training on pest management.

Table 9: Training on cotton production

Training on Cotton Production	Percentage
Yes	39
No	61
Total	**100**

Even though majority of the farmers have not benefited from training on cotton production in the recent past, this has not stopped them from engaging in cotton production. This is an indication that there exist a strong will within the respondents to engage in cotton production.

4.4.7 Influence of Cluster Group Supported Extension Method on Cotton Production.

Regression analysis was used for the analysis. The area under cotton during last season (Y) =Constant b_0 + training on cotton production ($X_{1)}$+, person sought for in case of problems ($X_{2)}$+ availability of extension workers ($X_{3)}$+ frequency of visit (X_4). ($Y=b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_4$). The R reflects a weak prediction of the dependent variable (Area under cotton during last season) with a score of 0.223 and R^2 of 0.05 (Table 10). Subsequently, only 5% of variability in the dependent variable can be attributed to the independent variables (training on cotton production, person consulted in case of problems, availability of extension workers and frequency of visit).

Table 10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.223[a]	.050	.017	.5169

a. Constant: training on cotton production, sources of farm advice in case of problems, availability of extension workers, frequency of visit.

The model equation for this analysis has been derived from table 11; $Y=1.132+0.092X_1+0.128X_2+0.032X_3+0.093X_4$,

Table 11: Coefficient of independent variables used to determine area under cotton

Model	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
	B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound
1 Constant	1.132	.366		3.094	.002	.407	1.856
Frequency of visit	.092	.117	.087	.791	.430	-.139	.323
Source of farm advice	.128	.073	.191	1.760	.081	-.016	.272
Avail. Of ext. workers	.032	.088	.039	.367	.714	-.141	.206
Training on cotton	.093	.120	.088	.775	.440	-.145	.332

a. Dependent Variable: area under cotton during last season

From the results obtained no individual independent variable cannot significantly influence the dependent variable which is in this case is the area under cotton production.

4.5 Objective 3: Influence of Source of Information on Cotton Production

Objective three sought to determine the Influence of sources of information on Cotton production in Bura Irrigation Scheme. The study investigated the sources of information, the preferred sources of information, frequency of obtaining information and sources of specific information on cotton production in the recent past and their influence on cotton production.

4.5.1 Source of Information for Cotton Production.

A majority of the respondents (71.7%) said that the source of information for cotton production practices and marketing was largely from other farmers while 21.7% get their information from private company as 5.8% obtained information from CODA officers, yet these are the people mandated by the government with the responsibility of providing extension services to farmers and only 0.8% of the respondents indicated that they never get information on cotton production (Figure 9).

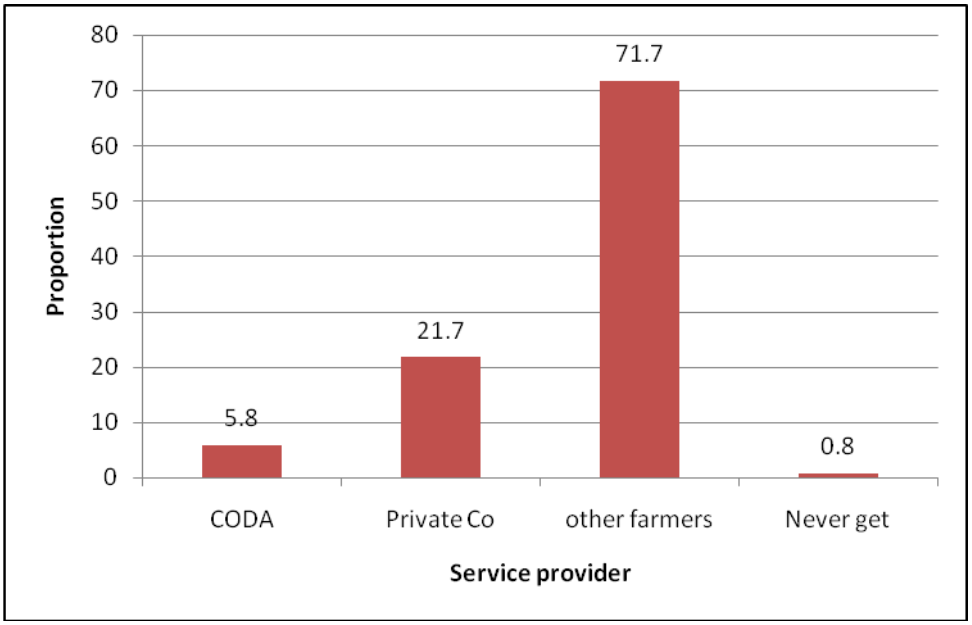

Figure 9: Response on the sources of Information for production and marketing by the respondents

Further analysis established that all the respondents who indicated that they never get information on cotton production did not belong to any group.

4.5.2 Preferred Source of Information

The respondents were required to indicate whether they obtain information from preferred source and to provide a reason to that effect. Analysis revealed 83% of the respondents were not getting information from preferred source as 17% of the respondents indicated that they were getting information on cotton production from the preferred source (Table 12).

Table 12: Preferred Source of information

Preferred Source	Percentage
Yes	17
No	83
Total	**100**

Although majority of the respondents get information on cotton production practices, the study revealed that they do not always get information from the preferred source.

A significant proportion of 71 percent said they fail to get information from the preferred source because the said sources of information are far away from the villages. Others (19%) said the government officers who they prefer are inaccessible due to the distance of their location (Figure 10). This only reaffirms what Cotton Development Authority stated in 2012 that cotton

production in Kenya is currently faced by constraints which include inadequate extension services and inappropriate extension services.

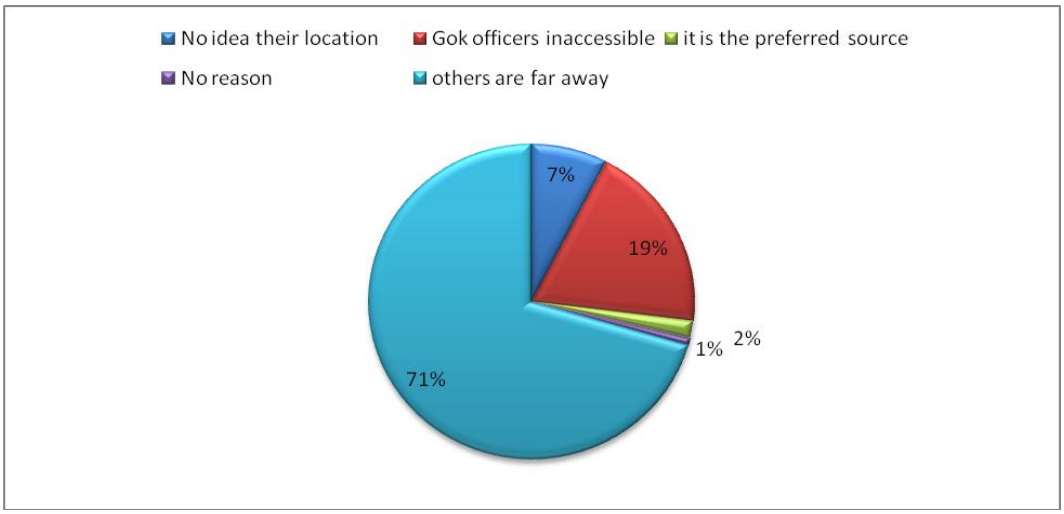

Figure 10: Proportions of the preference to sources cotton production and marketing information

This was also captured in World Bank (2011) where it was noted that, as the agricultural sector moves toward the goal of increasing diversification and intensification of farming systems, especially those involving small-scale and women farmers, all farmers will need access to relevant and current technical and market information that reflects these emerging domestic and international market opportunities for the different agro-ecological areas within each sub-district, district, and province within the country (World Bank 2011).

4.5.3 Frequency of cotton production information

The respondents were required to provide information on the frequency of obtaining cotton production information, upon which 70% said they rarely get this information as 25% indicated that at least they get some information yearly (Figure 11).

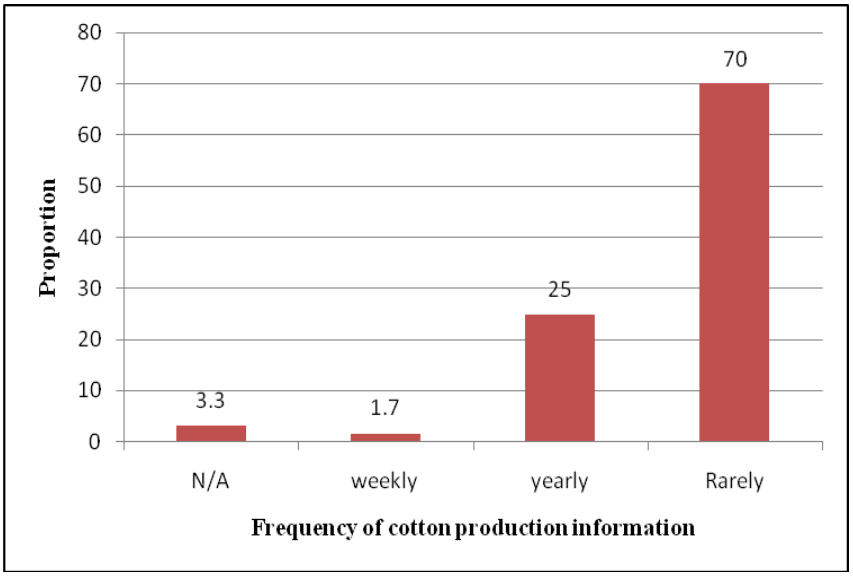

Figure 11: Proportions of the respondents frequencies to receiving informatio

Accessibility of extension packages to cotton farmers is crucial, particularly if productivity is to be increased. toward the goal of increasing diversification and intensification of farming systems, especially those involving small-scale and women farmers, all farmers will need access to relevant and current technical and market information that reflects these emerging domestic and international market opportunities for the different agro-ecological areas within each Ward, Sub-County and County within the country.

4.5.4 Source of specific information on cotton production

The respondents were requested to indicate where they obtain specific information on cotton production. Analysis of the responses established that Cotton Development Authority is the major source of information for planting material for cotton; this was according to 84% of the respondents (Table 13).

Table 13: Proportions of sources of specific information on cotton production

Service provider	Planting material	Time of planting	Pest Mngt	Harvesting	Post Harvest	Marketing Channels
MoA	13.3	26.7	0.0	2.5	0.8	3.3
CODA	84.2	17.5	0.0	10.0	9.2	56.7
P/Company	0.8	15.0	95.8	25.0	28.3	38.3
NGO/CBO	0.0	2.5	0.0	1.7	0.0	0.0
Never get	1.7	38.3	4.2	60.8	61.7	2.0
Total	**100**	**100**	**100**	**100**	**100**	**100**

On the other hand, information about the time of planting is mainly obtained from the Ministry of Agriculture, this was according to 26.7% of the respondents. However, a significant proportion (95.8%) said they get information about pest identification and management from Private Company probably due to the fact that crop protection services are business oriented. Likewise, majority of the respondents (25% & 28.3%) obtain harvesting of cotton seed and post harvesting handling information from Private Company. Cotton Development Authority is a major source of information on marketing channels; this was according to 56.7% of the respondents

4.5.5 Influence of different sources of information on cotton production

Different Sources of information (MOA, CODA, Private Company, CBOs and Never get) were analyzed to determine how well they contribute to the variability of area under cotton. The R score was 0.305 and the contribution to variability was determined to be 9.4% (R^2-0.093). (Table 14)

Table 14: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.305	.093	.035	.5120

a. Constant: Sources of information (MOA, CODA, Private Company, CBOs and Never get)

Individually, no independent variables can satisfactorily influence the variability of the dependent variable in this case. This is captured by the beta analysis of individual independent variables in the table 15.

Table 15: Coefficients of independent variables for prediction of the dependent variables

Model	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error			
MOA Source	.027	.028	2	.977	.380
Private Company	.343	.051	2	45.599	.000
CODA	-.029	.081	1	.128	.721
CBOs[a]	.	.	.	.	.
Never Get	-.027	.092	2	.089	.915

Dependent Variable: area under cotton during last season

a. The selected or specified sign pattern results in quantifications that are all zero for this variable

From the results obtained no individual independent variable cannot significantly influence the dependent variable which is in this case is the area under cotton production.

4.5.6 Effectiveness of cotton production of information

The respondents were required to agree or disagree with the statement that cotton production information is readily available; cumulatively, 63.3.3% disagreed while 36.7% agreed with this statement (Table 16). Similarly, 78.4% disagreed with the statement that information on cotton production is accurate and relevant, however, 21.6% agreed with the statement. It is important to note that all the respondents disagreed with the statement that they have access to web based information (Table 16).

Table 16: Proportions of respondents on response about Effectiveness of information on cotton production.

Variable	SD	D	N	A	SA	Total
Information readily available	5.0	58.3	0.3	36.4	0.0	**100**
Information accurate & relevant	24.1	51.2	3.1	20.8	0.8	**100**
All knowledge & skills provided	24.2	55.0	4.2	20.0	0.6	**100**
Access to web based information	99.2	0.8	0.0	0.0	0.0	**100**

Even though the respondents indicated that they receive information from different sources, the effectiveness of the received information is not known, thus there is need to regulate the sector. This supported by Republic of Kenya (2005a), that despite positive aspects in pluralistic extension system, it has its own challenges that include the need for a regulatory system to coordinate the players. Coordination and regulation are required to promote professionalism and reduce unnecessary competition, dissemination of conflicting extension messages to clients, duplication of effort and wastage of resources.

4.6 Objective 4: Influence of Seed Cotton Marketing on Cotton Production

Objective four sought to investigate the Influence of seed cotton marketing on Cotton production in Bura Irrigation Scheme. The study investigated seed cotton marketing channels, farmers' engagements with brokers, seed cotton marketing challenges and potential remedies, and the effects of seed cotton price in the recent past and their influence on cotton production.

4.6.1 Marketing channels on Cotton production

The respondents were required to indicate whether they sell their seed cotton individually or collectively and to whom they sell to. All the respondents indicated that they sell their seed cotton individually (Table 17).

Table 17: How Seed Cotton is sold

How Seed Cotton is sold	Percentage
Individually	100
Collectively	0
Total	**100**

All the respondents indicated that seed cotton brokers exit in their area. According to the results, (Table 18) the major buyer of seed cotton in Bura is actually the broker going by 67% of the respondents who positively admitted to selling their seed cotton to brokers. Conversely, only 33% sell their seed cotton to ginnery.

Table 18: Buyers of Seed Cotton

Buyer	Percentage
Ginnery	32.5
Brokers	67.5
Total	**100**

4.6.2 Engagements with seed cotton brokers

As a follow up of whether the respondents sell their seed cotton to brokers, a large proportion (40.8 percent) admitted that they do this most of the times while 27.5 percent of the respondents said they never sell their seed cotton to brokers (Figure 12).

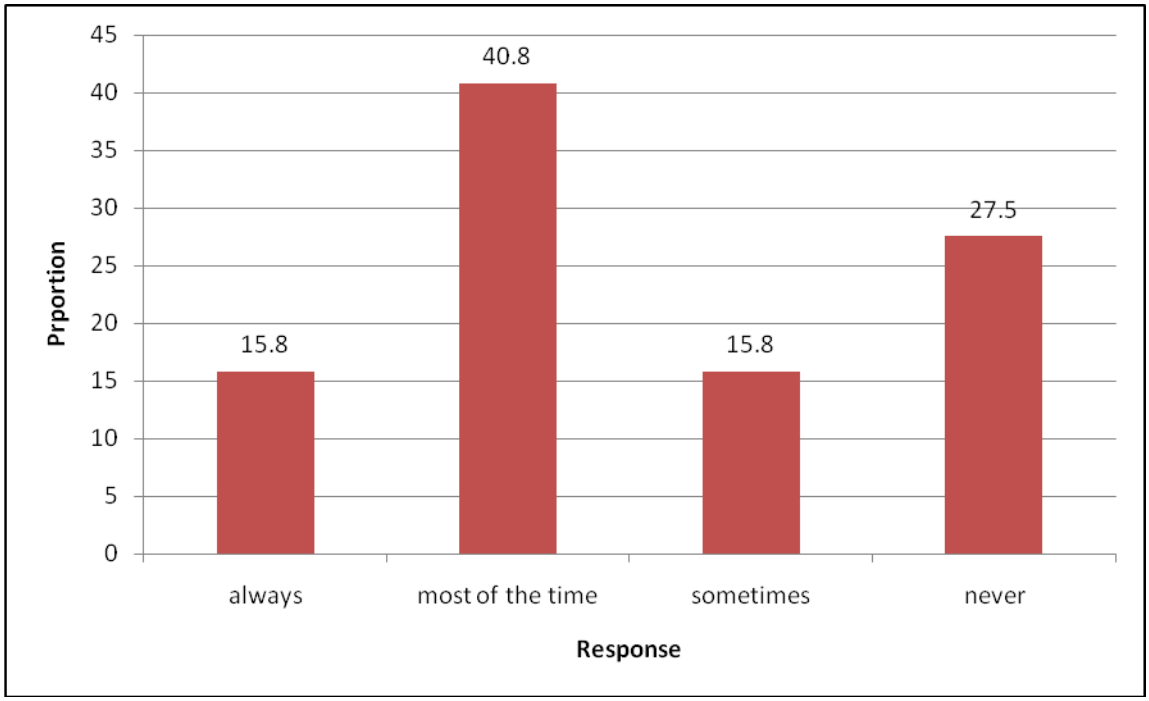

Figure 12: Proportions showing frequencies of selling seed cotton to brokers

This study also set to find out the reasons for either selling seed cotton to the brokers or not selling to them. Majority of the respondents (62.5 percent) said they sell their seed cotton to brokers because these are the people who are available at the time of harvesting. On the other hand, 0.8 percent said they need quick money to settle their needs such as payment for labour and since the brokers are available to offer this service they sell the seed cotton to them. On the other side of the divide we have those who do not sell their cotton seed to brokers, 30 percent of these respondents cited the meager price offered by the brokers (Figure 13)

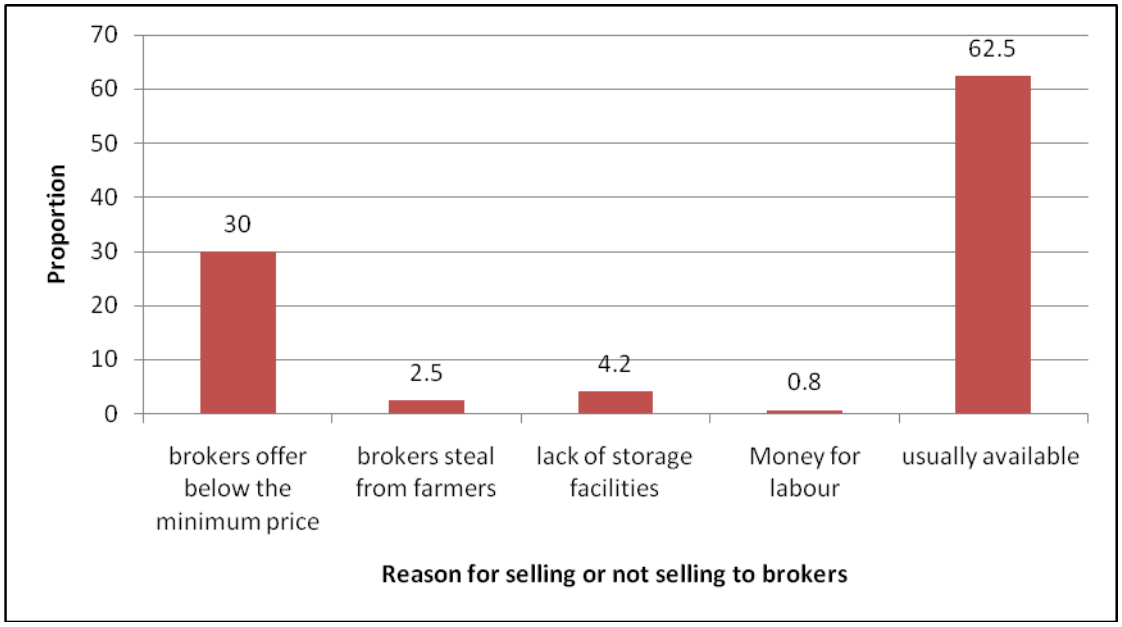

Figure 13: Proportions of respondents identifying reasons for selling to brokers

4.6.3 Seed Cotton marketing challenges

The respondents were asked to indicate whether they experience challenges during marketing of their seed cotton and to cite the challenges experienced. Analysis established that 80% admitted that they did experience challenges as 20% said they did not experience any challenge in marketing of seed cotton (Table 19).

Table 19: Existence of Seed Cotton Marketing Challenges

Marketing Challenges	Percentage
Yes	80
No	20
Total	**100**

The challenges cited ranged from inadequate of storage facilities (33 percent), delay by ginners to come and buy (32 percent), poor grading systems by brokers 13 percent, poor prices offered by brokers 17 percent and 5 percent indicated that brokers using uninspected or faulty weighing machines (Table 20)

Table 20: Challenges experienced by cotton farmers

Challenge	Percentage
Inadequate storage facilities	33
Poor grading system by brokers	13
Delay by ginners to come and buy	32
Use of uninspected weighing scales by brokers	5
Poor prices offered by brokers	17
Total	**100**

The respondents indicated inadequate storage facilities and delay by ginners to come and buy seed cotton as the main challenges experienced. This is further supported by Gereffi (2010), where it was indicated that storage is an important function in marketing and should be organized well in advance before production begins, failure to which, serious loses will be realised.

4.6.4 Recommendation from respondents

The respondents were asked to give their recommendations on how to improve the seed cotton value chain (Table 21).

Table 21: Recommendations cited by respondents for seed cotton value chain improvement

Recommendations	Proportion (%)
Brokers should be eliminated out of the sector	16.7
Brokers should offer recommended prices for seed cotton	10.1
Brokers weighing machines should be inspected	1.7
Ginnery to be established in Bura Irrigation Scheme	60.8
Government to buy seed cotton from farmers	0.8
No idea	1.6
Storage facilities should be set up for farmers within Bura Scheme	8.3
Total	**100.0**

Going by what the respondents recommended, most of them (60 percent) would like to see ginnery being established in Bura Scheme, the average distance from Bura Scheme to the nearest Ginnery was recorded to be 350 kilometers away. Others recommended brokers to be eliminated from the seed cotton value chain (16.7 percent), still others suggested that brokers should offer recommended price for seed cotton (10 percent)

4.6.5 Effects of seed cotton price on cotton production

The respondents were requested to state how the price of seed cotton has affected cotton production in their farms and also give their opinion on what should be done to improve cotton production in their farms. Analysis revealed that poor prices seems to be an impediment to seed cotton production, for instance 97.5 percent of the respondents said that the area under production in their farm has significantly declined due to poor prices while a significantly low proportion of 2.5 percent said that prices have no effect in cotton production of their farm (Table 22).

Table 22: Effects of price on cotton Production

Effect	**Percentage**
Decline in area under production	97.5
No effect	2.5
Total	**100**

On the opinion of farmers on what should be done to remedy the situation, 29.2 percent of the respondents wished that the cost of production should be brought down through government subsidies and introduction of *bt* cotton, while 70.8 percent wished that better prices for seed cotton should be offered to farmers (Table 23).

Table 23: Opinion on Seed Cotton price

Opinion on price	**Percentage**
Lower the cost of production	29.2
Improve on seed cotton price	70.8
Total	**100**

Analysis of secondary data also revealed that the selling prices of cotton steadily increased from 2011 to 2012 and then experienced a sharp increase from 2012 to 2013. However, from 2013 there was a negative trend as the price decreased sharply up to 2014 and then a steady increase towards 2015. (Figure 14)

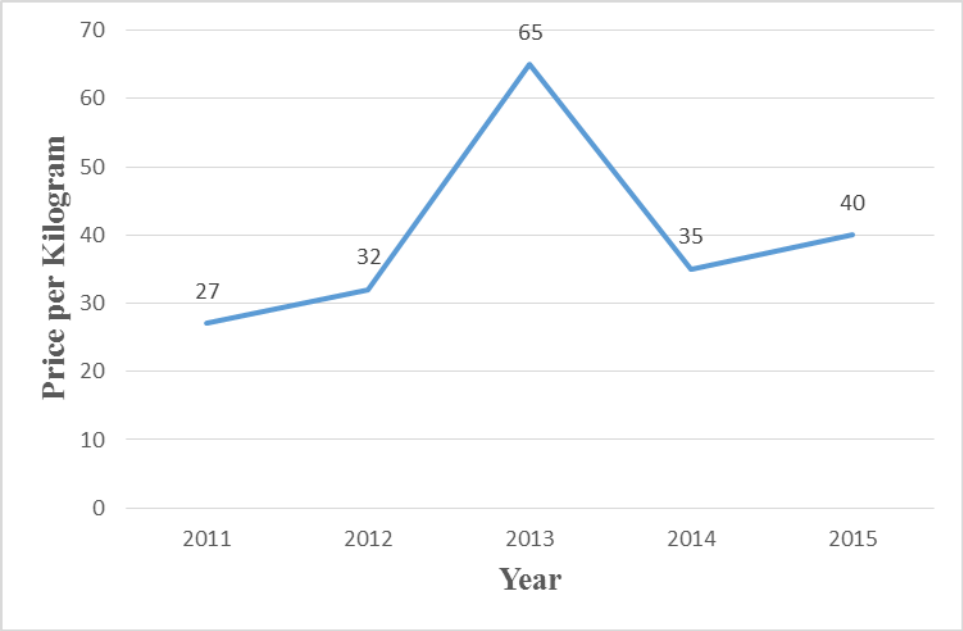

Figure 14: Average cotton prices from 2011 to 2015

This results concurred with Kilima (2013), where he observed that one of the major factors influencing the fluctuation of commodity prices is cyclical income fluctuations in the consuming countries. Consequently, the ups and downs in industrial country production have serious consequences for commodity exporters. Prices fall when restrictive policies are imposed to reduce inflationary pressures in the importing countries. The consequent slowing down of economic growth leads to sharp decline in the demand for raw materials. Commodity prices also fluctuate in response to good or poor harvests caused by variations in weather conditions.

4.6.6 Influence of Seed Cotton marketing factors on cotton production

The respondents were requested to state how cotton market factors influence cotton production. The response was based on a likert scale ranging from strongly disagree to strongly agree (Table 24). On the basis of this scale, 100% cumulatively agreed that price incentives play part in cotton production. Likewise, 100% of the respondents strongly agreed that adequate storage facilities influence cotton production. However, prompt payment of produce after production is

also a factor that influences cotton production, 98% of the respondents agreed to this statement. Similarly, 62% of the respondents agreed that access to required packaging influences cotton production. On the other hand, cumulatively 98% of the respondents did agree that existing marketing channels influence cotton production negatively.

Table 24: Influence of cotton marketing on cotton production in Bura Scheme.

Variable	SD	D	A	SA	Total
Price incentive	0.0	0.0	37.0	63.0	100
Adequate storage facilities	0.0	0.0	49.4	50.6	100
Prompt payment of produce	0.0	7.3	37.1	56.6	100
Access to required packaging materials	26.1	33.7	38.1	12.1	100
Existing marketing channels	0.0	2.0	62.0	36.0	100

Seed cotton marketing functions were found to have an effect on cotton production as majority of the respondents indicated in table 24. Thus any stakeholder interested in enhancing cotton production within the Scheme should ensure that post-harvest handling infrastructure are in place to support as lack of these facilities render farmers vulnerable to uncontrolled brokers.

CHAPTER FIVE
SUMMARY, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

The purpose of the study was to assess the influence of selected factors influencing cotton production in Bura Irrigation and Settlement Scheme. The chapter presents summary of the findings of the study, conclusions and recommendations based on the objectives of the study.

5.2 Summary of the Findings

The study engaged 120 cotton farm household heads out of whom 54% were female while 46% were male. The study revealed that majority of the respondents (64%) were aged between 36-54 years old with only 4% being over 65 years old, meaning the farming community in the Scheme are of middle age bracket. Majority of the respondents (73%) also indicated that they have over three acres of land for agricultural production which can be interpreted to mean that land is not a limiting factor among the farmers in the Scheme. On the level of formal education of the respondents, only 1.7% had attained tertiary education and 53.3% had only primary level education. But of significance is the proportion of those respondents who did not have any formal education, that is, 27.5% of the respondents lacks any basic education.

Objective one sought to determine the level of cotton production in terms of area and yield per year. According to the results, the current acreage stand at an average of 1,100 acres against the potential of 16,000 acres of land available for agricultural production. The acreage under cotton production and the yields of cotton per acre increased and decreased with subsequent increase and decrease in the selling price of seed cotton. Thus the seed cotton selling price has a significant effect on the level of cotton production within the scheme.

Objective two sought to determine the influence of cluster group extension approach on cotton production within Bura Irrigation and Settlement Scheme. According to the results, 71% of the respondents indicated that they belonged to a cluster group of which all of them indicated that the main reason is to access production credits from AFC. Of the 29% who did not belong to any group, majority of them pointed at lack of interest as the main hindrance in joining any of the groups. Majority respondents, 77.5% indicated that they seek for farm production advice from other farmers whenever a challenge arises in the farm, followed by 18% who seek the same service from private officers. On farm visits by extension officers, 91% of the respondents indicated that they were never visited by the extension officers during the last production year. On the other hand only 13% of the respondents indicated that the extension officers are always

available when needed. On cotton production trainings, only 39% indicated that they had attended one training on pest management in the recent past. Further analysis reveals that majority of the respondents (56%) were in agreement that Cluster group approach to extension services is the most ideal for reaching out to farmers within the scheme.

Objective three sought to determine the influence of the sources of information on cotton production within Bura Irrigation and Settlement Scheme. On sources of information, the analysis reveals that 71.7% of the respondents receive their extension information from other farmers while 21.7% of the respondents get their information from private companies, and only 5.8% of the respondents receive their information from CODA. Although majority of the respondents get information on cotton production practices, the study revealed that they do not always get information from the preferred source since 83% of the respondents indicated that they don't get information from preferred sources. This is either because the service providers are far away from the villages or the respondent are not aware of where to find them. The respondents further indicated that they rarely receive cotton production information packages (70%) as only 25% get the information annually. It was also established that the respondents would desire to obtain specific information from different sources, critical is pest management practices which is predominantly obtained from private companies probably because crop protection is business oriented. Further analysis revealed that 63% of the respondents indicated that cotton production information in not readily available, 78% disagree with the statement that information provided on cotton production is accurate and relevant, as all the respondents indicated that they do not have access to web based information.

Objective four sought to determine the influence of the seed cotton marketing on cotton production within Bura Irrigation and Settlement Scheme. On channels of marketing, all the respondents indicated that they sell their seed cotton individually even though majority of them belonged to cotton production groups. All of the respondents admitted that seed cotton brokers exist within the scheme and 67% indicated that they have sold seed cotton to brokers while 33% usually sell their seed cotton to ginners. Of the respondents who usually sell their seed cotton to brokers, 63% indicated that they do so since brokers are usually available to buy as they harvest, on the other hand, majority of those who never sell to brokers (30%) indicated that brokers do offer very low prices to farmers. While 80% of the respondents indicated that they do encounter several challenges during marketing of seed cotton within the Scheme. The challenges identified included inadequate storage facilities, delay by ginners to come and buy, poor prices offered by

brokers, poor grading systems by brokers and brokers' use of uninspected weighing scales when buying seed cotton. Majority of the respondents further recommended that a ginnery should be established within the Scheme (61%) while 17% recommended that brokers should be eliminated out of the cotton value chain. While 98% of the respondents stated that the current price of seed cotton offered in the market has led to the decline in area under cotton production. To remedy the situation, 29% of the respondents suggested that the cost of production should be brought down through the use of government subsidies and introduction of *bt* cotton, while 71% suggested that the price of seed cotton should be improved to increase the profit margin of farmers. Analysis of secondary data revealed that an increase in the price of seed cotton would result into an increase in cotton production and any decline in seed cotton price would results in a subsequent decline in cotton production. When opinion of the respondents on the effects of some of the marketing functions on cotton production, all the respondents agreed that price of seed cotton and adequate storage facilities have direct effect on cotton production, 98% indicated that prompt payment for seed cotton delivered will improve cotton production, as 98% of the respondents indicated that the current marketing channels does not favour cotton production, while 62% of the respondents indicated that lack of the ideal packaging materials wouldn't affect cotton production.

5. 3 Conclusions

i. Cotton production in Bura Irrigation Scheme is mainly handled by the middle age category (36-55 years) and most of whom are women. The importance of this is that majority of the farmers in this area are still in their prime age for making rational farming decisions and implement them. This is therefore an opportunity that can be exploited by service providers in the cotton production sector. However of concern is the proportion of those respondents who did not have any formal education, disturbingly, 27.5% of the respondents lacks any basic education. Consequently, this may impact negatively on the rate of adoption and subsequent adaption of farming technology, hence, a need to rethink on the best approach to use when disseminating agricultural innovations for cotton production farmers.

ii. Most of the farmers support cluster group extension approach as the ideal approach in reaching out to cotton farmers in Bura Irrigation Scheme. However, it is important to note that the proportion of those who disagreed, although comparatively low is significantly high to warrant attention. For this reason, a hybrid of different extension approaches may be more appropriate in Bura irrigation scheme as opposed to cluster group extension method

alone. However, according to FAO, 2014, when designing extension services, one should keep in mind not only the relative efficiency gains from each type of extension, but also the constraints that each type faces.

iii. Cotton farmers in Bura Irrigation Scheme have very limited sources of cotton production information and majority of them rely on other farmers. The government agencies providing extension service in the scheme are either not available on demand or are not within the reach of most of the farmers in most cases because of the distance involved. The frequency of the visit by extension officers to the farms is also very low hence farmers are most likely to lose out on getting timely interventions Private extension providers though present in the area, they only provide specific information on pest management and the credibility of the information provided is not known.

iv. The study revealed that the selling price of seed cotton had an influence on cotton production within Bura Irrigation and Settlement Scheme. The absence of storage and ginning facilities within the Irrigation scheme makes cotton farmers to be vulnerable hence selling their produce to brokers at below the market price. All the participants agree that brokers do exist within the scheme, and their presence and activities indicate that they have a significant role in the value chain, though they are seen to impact negatively on cotton production within the scheme.

5. 4 Recommendations

i. The study revealed somewhat unacceptable low levels of education for smallholder farmers in Bura Irrigation Scheme. The low level of education subsequently affected farmers' adoption of technologies, technologies that would enhance cotton production. Deliberate efforts should be put in place by stakeholders to address literacy levels of smallholder farmers in Bura Irrigation Scheme. Exploring possibilities of combining extension programmes for enhancement of cotton production and literacy classes is strongly recommended. This approach of providing adult literacy alongside agricultural extension education could provide mutual benefit to the farmers, the adult literacy and extension providers in the scheme.

ii. Cluster group extension approach scored high in terms of effectiveness in delivery of extension services. Therefore, it could be appropriate to organize and strengthen farmers' groups with a view of using such groups as platforms for extension provision for the small holder farmers in the scheme.

iii. There was evidence for unavailability of the extension officers at times when needed by farmers. The unavailability of extension officers has to be addressed accordingly. There ought to be an increase in the frequency of visits by extension officers to cotton production sites to provide technical support promptly when sought by the farmers in the irrigation scheme. Farmers appeared to be in need of technical and market information for the emerging domestic and international opportunities for cotton production.

iv. The study found out, selling prices has a significant impact on cotton production. Therefore, appropriate stakeholders in the cotton industry should on regular basis come together and work on strategies to address and improve the marketing issues associated with cotton. Cotton in the scheme is purchased from the farmers by brokers. Brokers quite often manipulate the weighing scales they use, offer lower prices, below the recommended prices of cotton lint to farmers, and many other malpractices should be checked.

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APPENDIX A

QUESTIONNAIRE FOR FARMERS

The information provided is strictly confidential and will only be used for the purpose of this study. Please answer the questions as accurately as you can remember by filling in the gaps or ticking where appropriate.

Questionnaire Number: _____ Date of Interview: _____ Village_____

A. Profile of the Respondents

1. Gender of the household head/decision maker; 1. Male [ ] 2. Female [ ]

2. Age of the Household head

Less than 25 [ ]; 25-35 [ ]; 36-45 [ ]; 46-55 [ ]; 56-65 [ ]; Over 65 yrs [ ]

3. What is the size of your own farm?

Less than 1 acre [ ]; 1-2 acres [ ]; 2-3 acres [ ]; 3-4 acres [ ]; Over 4 acres [ ]

4. What was the area under cotton during the last crop season?

5. What is the highest level of formal education attained?

a) No [ ], b) Primary [ ], c) Secondary [ ], d) Tertiary [ ]

6. What type of labour do you have on the farm?

Family [ ], Hired [ ], Both [ ]

7. Besides cotton, what other enterprise do you engage on?

8. Comment on the following activities

i. How many times did you weed your cotton crop last season? ……..

ii. How many times did you spray your cotton crop last season? ……..

B. Cluster Group Extension Approach

9. Are you a member of any cotton farmer group? Yes [ ] No [ ]

10. Give reason for your answer above,

…… ……..

11. Who do you consult for advice whenever you have a problem on the farm?

a) GoK Officer [ ] b) Other farmers [ ] c) Private Officers [ ] d) Other (specify)

12. Frequency of visits to your farm by Extension Officers

a) No visits [ ] b) Weekly [ ] c) Monthly [ ] d) Twice a year [ ]

13. Are extension workers always available on demand?

a) Yes [ ] b) Some-times [ ] c) No [ ]

14. Have you been trained on cotton production in the recent past?

a) Yes [ ] b) No [ ]

(i) If yes above, indicate the number f trainings

(ii) Type of training?

15. Rate the extent to which you agree with the following statement regarding the influence of cluster group extension methods used on cotton production by ticking as appropriate.

KEY: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Statement	**SD**	**D**	**N**	**A**	**SA**
Cluster Group method is the most Ideal for reaching out to cotton farmers					

C. Source of information?

16. Where do you get information on cotton production practices? [1. MoA Officers, 2.CODA Officers, 3.Private Company, 4.NGOs/CBOs, 5.Local Leaders 6.Other farmers 7. Never get].

17. Give reason for not getting information from the preferred source; ……

…….

18. How often do you get information on cotton production?

N/A [ ], Weekly [ ], Monthly [ ], Yearly [ ] Rarely [ ]

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

Type of information	**Source of information**				
	MoA	**CODA**	**Private Co.**	**NGO/CBO**	**NEVER GET**
Source of good planting materials					
Time of planting and how to plant cotton seeds					
Pest identification and pest management					
Harvesting of seed cotton					
Post-harvest handling					

Marketing channels and prices of seed cotton					

20. On a scale of 1 to 4 where SD= Strongly Disagree, D=Disagree, A=Agree, SA= Strongly Agree, kindly rate the extent to which you agree with the following statements on sources of information regarding cotton production

Statement	**SD**	**D**	**N**	**A**	**SA**
The information on cotton production is readily available to farmers					
All the extension functionaries working in the area provide accurate and relevant information needed for cotton production					
Farmers in Bura Irrigation have been provided with all the knowledge and skills required for cotton production.					
Farmers have access to web based information					

D. Cotton Marketing

21. How do you sell seed cotton

a) Individually b) Collectively

22. Who buys' seed cotton from your farm

a) Ginnery b) Brokers

23. Do seed cotton brokers exist in your area?

a) Yes b) No

24. Have you ever sold seed cotton to brokers?

a) Always b) Most of the time c) Sometimes d) Never

25. Give reason for your answer above…….....

…….....

26. What would you wish to be done differently? .....

…….....

27. Did you experience any problem with marketing?

Yes [ ] No [ ]

If yes then specify …….....**.....**

28. How has the price of seed cotton affected cotton production in your farm?

…….....

29. What would you wish to be done differently?

…….....

30. Rate the extent to which you agree with the following statements regarding the influence of seed cotton marketing on cotton production by ticking as appropriate.

KEY: SD = Strongly Disagree, D = Disagree, A = Agree, SA = Strongly Agree

Statement	**SD**	**D**	**A**	**SA**
The current price provides an incentive for cotton production				
The existing marketing channels favour cotton production				
Farmers have access to the required packaging materials				
Farmers are promptly paid for their produce after collection.				
Adequate storage facilities are available for farmers				

Thank you!

APPENDIX B

SECONDARY DATA FROM NIB/CODA

1. Cotton production trends

Cotton production status	**2011**	**2012**	**2013**	**2014**	**2015**
Average acres under cotton production in acres					
Average yield harvested in Kgs/Acre					

2. What was the selling price of seed cotton in the last five years?

	Year	**Price (Ksh/Kg)**
1.	2011	
2.	2012	
3.	2013	
4.	2014	
5.	2015	

3. What is the average distance between Bura Irrigation Scheme and the nearest Ginnery? ……

4. What is the recommender number of sprays on cotton crop per season within the Bura Irrigation Scheme?

Thank you