



The role of agricultural extension services in maize (*Zea mays*) production in Chuka division, Tharaka-Nithi District, Kenya

Elias Nabea Muriithi

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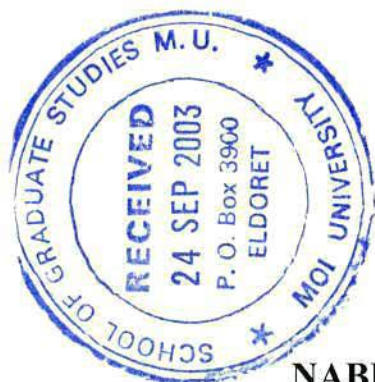
THE ROLE OF AGRICULTURAL EXTENSION SERVICES
IN MAIZE (*Zea mays*) PRODUCTION IN CHUKA
DIVISION, THARAKA - NITHI DISTRICT, KENYA

BY

ELIAS NABEA MURIITHI

2003

**THE ROLE OF AGRICULTURAL EXTENSION SERVICES IN
MAIZE (*Zea mays*) PRODUCTION IN CHUKA DIVISION,
THARAKA-NITHI DISTRICT, KENYA**



BY

NABEA ELIAS MURIITHI

**B.ED (ARTS), HONOURS
(MOI UNIVERSITY)**

**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE
STUDIES, MOI UNIVERSITY IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF
MASTER OF PHILOSOPHY (M.PHIL.) IN GEOGRAPHY**

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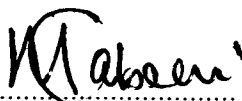
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DECLARATION

DECLARATION BY THE CANDIDATE

This thesis is my original work and has not been presented for a degree in any other university.

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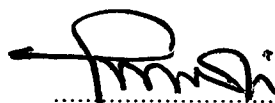
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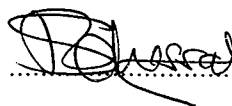
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ABSTRACT

Food insecurity is a very serious problem in Tharaka-Nithi District. The extension services are inadequate, not timely and does not translate to higher maize productivity. This study investigated the role of agricultural extension services in maize production in Chuka Division, Tharaka-Nithi District, Kenya, with a view to making recommendations for effective delivery and adoption of agricultural extension services. The specific objectives of this study were: to evaluate the influence of spatial location of the farmers in provision of extension services and on farming activities; to establish the timeliness of agricultural extension services; to evaluate the status of farmer training and farming demonstration; to identify the main methods of information dissemination and constraints to effective delivery and adoption of extension services; and to make recommendations for effective delivery and adoption of extension services in the study area.

Both primary and secondary qualitative and quantitative data were collected. Primary data was collected through the use of questionnaire from a sample of 130 respondents comprising of 120 farmers and 10 extension officers. Observation method was also used to complement the primary data. Secondary data was collected from relevant published and unpublished materials, such as textbooks, journals, reports and newspapers. The conceptual framework, which guided the study is derived from agricultural knowledge system model, diffusion and participatory methodological approaches. The data collected was analyzed using the computer spreadsheet package, statistical package for social sciences (SPSS).

The salient findings of this study are: farmers located close to Chuka Town (the district headquarters) at a range of 0-10 Kilometers received the extension services more regularly as opposed to farmers beyond 11 Kilometers. Extension services in the study area were not timely. All the farmers (100%) were aware of the existence of extension services in the study area, but only 31.66% (38) of them received timely extension services. The status of farmer training in the study area was low, while farming demonstration was moderate. The main method of information dissemination adopted by the extension officers was group method while individual visits was least utilized. The major constraints to delivery and adoption of research and extension services were lack of means of transport and fear of low yields respectively.

On the basis of these findings, it is recommended that: The extension officers should be provided with means of transport (mobility) for wide area coverage. The extension officers should ensure that the farmers are visited on a regular basis. Farmer training should be upheld, and the farmers should be motivated to adopt what they learn during training. This study also recommends that an agricultural show ground should be developed in the district for annual agricultural exhibitions. Attempts should be made by the extension machinery to step up individual visits to the farmers. More extension officers should be recruited and trained. Further research should focus on: training needs assessment for the extension officers; effective channels of information dissemination; and gender relations in agricultural extension especially on the impact of gender discrimination in adoption of extension recommendations.

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ABBREVIATIONS

AEO	Agricultural Extension Officer.
AEZs	Agro-ecological zones.
AI	Artificial Insemination.
AIC	Agricultural Information Centre.
ARCA	Advisory Research Committee on Agriculture.
ASALs	Arid and Semi-Arid Lands.
CBOs	Community Based Organizations
CBS	Central Bureau of Statistics.
DAC	District Agricultural Committee.
DC	District Commissioner.
DDC	District Development Committee.
DDO	District Development Officer.
DEC	Divisional Extension Co-ordinator.
DFRD	District Focus for Rural Development.
EIA	Environmental Impact Assessment.
ES	Extension Services.
FAEP	Focal Area Extension Planning.
FEW	Frontline Extension Worker.
FPR	Farmer Participatory Research.
FSRE	Farming Systems Research and Extension.
FTC	Farmers Training Center.
GDP	Gross Domestic Products.
GoK	Government of Kenya.
GP	Government Printer.
HPAs	High Potential Areas.
IMF	International Monetary Fund.
IPAR	Institute of Policy Analysis and Research.
KADoC	Kenya Agricultural Documentation Centre.
KARI	Kenya Agricultural Research Institute.

K.I.E	Kenya Institute of Education.
LEISA	Low External Input Sustainable Agriculture.
MoARD	Ministry of Agriculture and Rural Development.
MPZs	Medium Potential Zones.
NAEP	National Agriculture Extension Policy.
NALEP	National Agriculture and Livestock Extension Programme.
NGOs	Non-Governmental Organizations.
NSWCP	National Soil and Water Conservation Programme.
PAR	Participatory Action Research.
PRA	Participatory Rural Appraisal.
PTD	Participatory Technology Development.
RAAKS	Rapid Appraisal of Agricultural Knowledge.
RDF	Rural Development Fund.
SIDA	Swedish International Development Agency.
SMS	Subject Matter Specialist.
T&V	Training and Visit.
USA	United States of America.
WB	World Bank.

OPERATIONAL DEFINITION OF TERMS

It is not the purpose of this section to write a treatise on semantics. However, in view of the variant usage of words related to the research problem under investigation and the various meanings accorded to words by different authors, it is important to clarify the position of this study.

Extension Services: Agricultural extension service is a two-way communication/training process involving researchers, extension officers and farmers whose aim is to improve knowledge, change attitude/behaviour, lead to adoption of new technologies and improve skills for both farmers and extension workers, with a view of increasing and improving farmers incomes and productivity on a sustained basis.

Innovation: An idea, method or object which is regarded as new by an individual but which is not always the result of recent research.

Extension Methods: A "method" is a systematic way of transferring knowledge or information for instance from the researchers and the extension officers. Extension methods include for instance demonstrations, field days, agricultural shows, mass media individual visits, on farm trials, discussions, excursions etc.

Extension worker/client/officer: Extension worker, client or officer refers to anybody within the extension machinery who delivers extension information or messages to the farmers.

Famine: A widespread, prolonged and persistent, extraordinary and insufferable hunger lasting for several months and affecting the majority of the rural population over more or less extensive area, resulting in socio- economic disorganization and starvation.

Food Security: Food security is the relative certainty of availability of the right quality of food at the right place and time. It also encompasses the ability to grow and to purchase needed food. Conversely food insecurity would be the condition whereby food consumption fails to meet a minimum level of certainty for every individual to achieve adequate nutrition.

Household: A person or group of persons living together under one roof, or several roofs within the same compound or homestead areas, sharing a community life by their dependence on a common holding as a source of income and food, which normally but not necessarily involves them eating from a "common pot."

Subsistence farming: This is a type of farming whose objective is to provide enough products for basic family requirements. There is little surplus after the family's food requirements are met. When there is surplus it is sold locally to provide money for other basic necessities.

Small-scale farming: This is a type of farming practiced on a limited amount of land. It involves a farmer who owns and uses less than 20 hectares of land. It is characterized by mixed farming and mixed cropping to take care of risks and uncertainties.

DEDICATION

**To the people
them that the next meal is a nightmare.**

**In memory of the late
Ibiuku, Kabari and Godfrey Njeru.**

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I alone remain responsible for this thesis.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Agricultural extension in rural Kenya has been a major concern of the Kenya government since independence. Historically, the major player in the provision of extension services has been the government of Kenya through the Ministry of Agriculture and Rural Development (MoARD). At least for the period between 1950s and 1980s, these services were very effective in assisting the majority of small-scale farmers to improve their agricultural production (GoK 2001a).

However, especially in the last one decade, these services have deteriorated to a point where they seem to have been withdrawn. The purpose of this study was to evaluate the role of agricultural extension services in maize production in Tharaka-Nithi District, with the view of making recommendations for effective delivery of extension services and adoption of these services by the farmers for sustainable maize production.

The task of the extension staff is to transfer research and extension knowledge to the farmers in a two-way communication/training process. Together with the researchers and the farmers, the extension officers are supposed to provide feedback from the farmers to the researchers, for instance on the problems encountered by the farmers in the process of adopting new technologies. Agricultural extension involves learning techniques whose aim is to improve knowledge, change attitude/behaviour, lead to

adoption of new technologies and improve skills for both farmers and extension workers, with the goal of increasing and improving farmers incomes and productivity on a sustainable basis (GoK 2001a). Scholars such as Kareri (1985), Mutoro (1997), and Chessa (1992) recognize the role of extension staff as linking the sources of agricultural information and innovations with the farmers.

The importance of agricultural extension services in achieving food security and improvement in living standards, especially for the rural small-scale farmers is further echoed by Kinara (1981) and Della (1991) who have argued that to these farmers farming is but a way of life. Information dissemination should not be viewed as an end in itself but a means to an end. The overall and ultimate purpose of farming systems research and extension (FSRE) is to improve the agricultural production on the farms and hence provide food for the nation as a whole. The centrality of the agricultural sector in Kenya cannot be over-emphasized. Kenya has virtually no mineral wealth or oil deposits. Kenya's economy depends to a large extent on the agricultural sector, which contributes about 25 per cent of the gross domestic product (GDP), and is important in the provision of industrial raw materials.

In addition, the agricultural sector meets most of the domestic demand for food, is the chief source of income for the rural populations, and over 80 per cent of Kenya's population depends directly or indirectly on the agricultural sector, which employs over 70 per cent of Kenya's population (IPAR 2000). The sector provides the country with substantial and reasonably stable export earnings and is basis for industrial and commercial growth, (Mutoro, 1997). Food crops such as maize, millet and beans; cash crops such as coffee, tea and pyrethrum and horticultural products such as fruits

and vegetables are grown for local, as well as overseas markets. Over 60 per cent of the total value of Kenya's export is derived from agriculture (K.I.E 1985, Ominde 1988, Kinara 1981, IPAR 2000). On the overall, maize is the most important food crop for the majority of Kenyans. It is the staple food and when there is a shortage of maize in the country, this is taken to signal an impending famine.

Despite the above contributions of agriculture to Kenya's economy the growth in this sector has slowed down considerably over the last decades. Since independence (1963), the sector fluctuated and tended towards a downward trend, manifested in declining food production and its contribution to GDP. During the period 1964-1974, the agricultural sector contributed 36.6 per cent of GDP. In the period 1974-1979 the sector contributed 33.2 per cent, 1980-1989 it contributed 29.8 per cent and during the period 1990-1995, the agricultural sector contributed 26.2 per cent of the GDP (GoK, 1997b). The poor performance in the agricultural sector has been attributed to an interplay of various socio-economic, environmental, technological and institutional constraints.

Against this background, a national food policy was formulated in 1981, whose top priority was that Kenya should produce enough food to feed its rapidly growing population. The food policy sets out clearly and concisely the goals of the agricultural sector and the ways by which food production can be increased in order to meet the growing demand of the population (GoK 1981, Kareithi 2000). Kinara (1981) postulates that Kenya's main hope of improving food output lies in applying new technology in agriculture. This knowledge is either developed locally in research stations located in all major farming areas of the country or is imported from other

countries. Through technological advancement, hybrid seeds of cereals such as maize have been bred over the years producing crops that are high yielding and disease resistant in their local environments.

Better propagation and cultivation methods have also been developed. However this knowledge needs to be transferred to the farmers for increased food production. To achieve the goals of the national food policy sustainably, agricultural information has to be transferred from those who are well acquainted with it to those who need to use it. This in essence involves researchers, government extension officers, non-governmental organizations (NGOs) and the farmers themselves.

The Kenyan government deems rural agricultural extension both individually and collectively as potentially providing effective mechanisms for re-activating and promoting rural development. It has been observed that the flow of information between the researchers and the farmers has been inadequate (Kinara 1981, GoK 1984, Chessa 1992). Chessa further argues that the government's agricultural policy, as documented in its plans and official extension programs concentrate on large farms and on the more "progressive" elements among the medium and small-scale farmers thereby creating a conflicting scenario.

Burrows (1975) in regard to information dissemination and technological innovations for the agricultural sector notes that there is sufficient amount of research information available to permit agricultural development programs to go ahead. However, this information has not been effectively transmitted to the farmers and consequently, agricultural extension in Kenya has not successfully transformed the rural agricultural

enterprise and the present extension research linkage is proving to be wholly inadequate.

At a Nairobi conference in 1972 which addressed the problem of research information dissemination to the farmers, and attended by stakeholders in information dissemination who included senior government officials, leading adult educators, teachers, mass communicators (journalists, radio and television producers), librarians, extension workers and researchers the Council of Science and Technology was established by an act of parliament in 1977. The major objective of the council was to ensure the application of the results of scientific activities to the development of agriculture, industry and social welfare in Kenya (Kinara, 1981).

The Advisory Research Committee on Agriculture (ARCA) is part of the council of science and technology. As one of its major tasks is to advise on the publishing of the results of research in relation to the problems of Kenya and the popularizing of such results where their general recognition is considered to be of national importance. The various participants of the 1972 conference suggested many generalized solutions on information transfer from the researchers to via the extension officers the farmers who are the end users.

So far the most common policy followed and implemented by the Kenya Government and the MoARD in particular has been the establishment of more agricultural colleges and schools (to train teachers and extension workers), as well as the setting-up of a large number of Farmers Training Centers (FTCs) to provide short and long duration courses to farmers throughout the country. These are considered as "information

support" centers to provide extension staff, teachers in schools and FTCs, with relevant information from the research stations.

Although the Kenya Government has been engaged in extension training, MoARD fund allocations towards extension services have not however increased proportionally to the growing number of staff involved in extension services. This study then, holds the thesis that the extension machinery has not been able to provide timely extension services to the farmers on a regular basis due to such constraints as lack of efficient means of transport for wide area coverage and a high number of farmers implying that the extension officers are overwhelmed in their attempts to disseminate information to the farmers.

This study investigated the nature and effectiveness of extension services whose failure can be held as a partial explanation for the declining contribution of the agricultural sector to GDP, and to the unstable food security in the country. The link between research and farming is however more complicated than the provision of extension staff and educators alone. This view is held by Kareri (1985) who notes that the services are more important than the number of the extension staff since an extension agent can provide different kinds of services to a relatively large number of farmers so long as information is available and he is empowered for instance with means of transport.

There is an urgent need to revitalize the extension machinery to ensure that extension information is availed to the farmers and that the information that flows is in line with the current agricultural needs, and is sufficient in order to boost small-scale

agricultural production. It is important to understand the various constraints that hamper the delivery and adoption of extension services in order to ensure that extension officers play a more dynamic role in reversing the poor performance in the agricultural sector. The extension staff has a role to work towards mitigating against the various constraints to agricultural development especially from the perspective of information dissemination through training, farming demonstrations, on-farm experimentation, organizing field days, developing and testing new technologies, and linking researchers with the farmers.

1.2 Statement of the Problem

Recognition of the role played by the agricultural sector in the economic development and generally to the welfare of the Kenyans in terms of employment, provision of income and food has grown considerably over the last decade. The prospects of achieving increased and sustained maize production thus ensuring relative food security and poverty alleviation especially for the rural populations lies in improving the productivity of the land resource sustainably.

Low and declining maize production is a serious problem particularly in Chuka Division and in Tharaka-Nithi District in general. Although the district has a high potential for increased maize production, maize yields have been declining over the years to a point where the district is under chronic food shortages. The missing link between the researchers and the farmers in a bid to increase maize production has been identified as a major constraint towards achieving this goal. This is especially in relation to information dissemination through farmers' training, farming

demonstrations, developing technological innovations, field days, research and conducting on-farm experiments and trials.

The flow of appropriate and timely information from the researchers to the farmers in the study area is ineffective. This problem is further compounded by the fact that there is inadequate feedback from the farmers to the researchers on which the researchers can base further research work on. This implies that the much required extension services are not available to the majority of the farmers. Extension services are vital in an attempt to increase the productivity of the land resource, thereby attaining food security and economic development.

1.3 Objectives of the Study

The general objective of this study was to investigate into the role of agricultural extension services in maize production in Chuka Division, Tharaka-Nithi District, Kenya, with a view to making recommendations for effective delivery and adoption of agricultural extension services.

The specific objectives of this study were:

- (1) To evaluate the influence of spatial location of the farmers in provision of extension services and on farming activities.
- (2) To establish the timeliness of agricultural extension services.
- (3) To evaluate the status of farmer training and farming demonstration.

- (4) To identify the main methods of information dissemination and constraints to effective delivery and adoption of extension services.
- (5) To make recommendations for effective delivery and adoption of extension services.

1.4 Assumptions of the Study

The following assumptions were made in this study:

- (1) Farmers close to Chuka Town where the district and divisional agricultural offices are located received extension services more frequently than farmers located far away from the district headquarters at a distance of 11 kilometres and beyond.
- (2) Provision of agricultural extension services in the study area was frequent and timely.
- (3) Farmers usually underwent training in farming.
- (4) The extension officers carried out farming demonstrations in relation to maize production in the study area.
- (5) The farmers in Chuka Division attended field days and agricultural shows.

1.5 Hypotheses of the Study

The study proposed four hypotheses.

- (1) The spatial location of farmers does not significantly influence the provision of extension services.

- (2) The frequency and timeliness of the extension services have no impact on the overall adoption of the recommendations made and also on the yields obtained.
- (3) Farmers training and farming systems demonstration do not significantly influence maize production in.
- (4) Field day attendance by the farmer does not significantly influence maize production.

1.6 Justification of the Study

This study is justified on six pertinent points, which shed some light on its utility in arresting the problem of declining maize production in the study area as manifested in a rising state of food insecurity.

Firstly, this study aimed at filling the existing gap in knowledge on the role of agricultural extension services in maize production in the study area. The study aimed at providing information on agricultural extension in maize production in the study area, which form the basis of recommendations made for effective delivery of extension services by the extension officers and adoption of recommendations by the farmers. The recommendations include those for general planning purposes and for academic purposes.

Secondly, this study is justified on the grounds that maize is the staple food for Kenyans. KARI (1997) notes that for nearly a century, maize has been the staple food for Kenyans and that for the majority of Kenyans, "a day without maize is a day without eating." A shortfall in maize production is literally taken as an early warning

of an impending famine. KARI further argues that when there is a shortage of maize, there is famine in the country. Maize in Kenya is grown by more than 90 per cent of the 2.8 million smallholder farm families, contributing more than 20 per cent of the total agricultural production. Considering the dire consequences of famine, which include malnutrition, impoverishment and at worst death, there is need for studies such as the current one, which could have a bearing on agricultural policy formulation.

Thirdly, there is an urgent need for effective agricultural extension policies. Problem-oriented policies can only be formulated from reliable and up-to-date data. Information provided by this study can serve as a basis in policy formulation, implementation and evaluation. The reliability and validity of this study is based on research-supported data from which recommendations have been drawn.

Fourthly, this study bears heavily on economic growth, and poverty alleviation. Food security is a prerequisite for the attainment of economic growth and poverty alleviation. On the other hand economic growth is a function of such factors as savings, investments, re-investment, capital accumulation and support services such as banking (Todaro 1989). With high maize produce, farmers can sell the surpluses and thus earn an income, which can be invested in other income generating projects. Moreover the agricultural sector provides a big market for industrial products such as fertilizers, and crop chemicals, and at the same time serves as a source of raw materials for agro-based industries. And as agriculture relates to the economic growth, it is plausible to argue that the battle for Kenyan's sustainable economic growth will either be won or lost in the agricultural sector.

Fifthly, this study adds to knowledge and socio-economic researches conducted in various parts of the country. Findings of researches on different development problems are vital for integrated sectoral planning for sustainable development in Kenya. This is in line with the contention that expanding and improving research knowledge is vital for agricultural productivity.

Lastly, this study is important in that, in Kenya's agricultural sector, small-scale farmers play a very important role and hence the need to give special attention to this group. The small-scale farmers comprise majority of the rural population (over 80 per cent). Considering the role the agricultural sector plays in the country's economy, it warrants attention into the production dynamics of the small-scale farmers. Summarily, agriculture will remain essential for Kenya's development for the following reasons:

- (1) The creation in Kenya of productive employment every year for almost 200,000 new entrants to the labour market can only be sustained by a rapid growth in the agricultural sector.
- (2) Agriculture is supposed to feed the ever-increasing population.
- (3) Revenue from agriculture is central to national efforts to find funds for servicing and repaying the national debt.
- (4) The prosperity of industry, commerce and other sectors of the economy are largely dependent on the prosperity of the agricultural sector, which has great potential for inter-sectoral economic linkages.

1.7 Agricultural Extension in Kenya

In Kenya, the Ministry of Agriculture and rural development through the Extension and Agricultural Services Division and the Ministry of Livestock Development through the Departments of livestock production and Veterinary Services largely control agricultural extension. Agricultural extension in Kenya dates back to the colonial period. The colonial government for the first time addressed the question of agricultural extension through the Swynnerton plan of 1953 which was in response to the 1952 state of emergency declared by the colonial government (Leys 1975, Chessa 1992).

The Swynnerton plan addressed various issues related to rural development including land consolidation, adjudication and registration, land tenure, agricultural credit and marketing, agricultural extension and farmers' training. It was to act as an impetus for cash crop growing and animal husbandry for the Africans. To this end, the colonial government provided funds to stimulate development of African agriculture with the hope that every African family would provide for its own subsistence and be in a position to earn income from the sale of crops.

The plan set a fund for training African farmers, conducting agricultural demonstrations, field days for agricultural information dissemination and acquisition of inputs such as seeds. This fund was to produce farm demonstrators and information dissemination agents. Despite all these changes, however, productivity in the African farms remained low. Most resources were directed towards the development of the white highlands owned by the settlers.

Kenya adopted the training and visit system of agricultural extension (T&V) in the early 1980s, which was a system of disseminating agricultural knowledge to farmers. The T&V system was first developed in the late 1960s in the USA and introduced by individual governments in a number of countries including India, Pakistan, Sri-Lanka, Bangladesh, Indonesia, Thailand and Kenya (Chessa, 1992). The primary goal of T&V in Kenya was to improve agricultural production on smallholder farms by utilization of low-level technology (Kareri, 1995). Extension programs were planned in accordance with the activities of the farmers in the respective agricultural zones (Della, 1991).

The T&V approach focused on the transfer of knowledge and farming skills through close contact with the farmers on the basis of a regular visiting cycle. Chessa (1992) observes that the essence of this approach was a tightly structured work program for the extension agents based on a strict schedule of regular visits. It had training and updating sessions for the agents at regular intervals. Moreover the T&V was hierarchically organized with subject specialists for quality and efficient extension. The subject matter specialists had a role to support the extension staff. Research recommendations and technological innovations were selected and disseminated to the selected farmers with the hope that they would diffuse to the rest of the farmers.

The T&V was organized in such a way that it was carried out fortnightly by the agent frontline extension worker (FEW), to each selected farmer in his or her domain. Supervision was close and exercised through a management structure with a single line of responsibility. This single direct line of technical support and administrative

control aimed at assigning specific extension duties to agricultural agents so that they may not be held responsible for all aspects of rural development.

The specialization aspect of the extension agents was essentially meant to increase their efficiency in discharging extension services to the farmers. Failure by the T&V system to produce the desired results of invigorating and rejuvenating the agricultural sector and thus attainment of food security in the country led MoARD developing a model for the National Agricultural and Livestock Extension Programme (NALEP) in the late nineties.

1.7.1 National Agricultural Extension Policy (NAEP)

National agricultural extension policy has a very important role to play in the growth of the agricultural sector and therefore has a strong bearing on the growth of Kenya's economy. NAEP has been prepared to guide and harmonize management and delivery of extension service in the country. This is in order to transform and modernize agricultural production from subsistence smallholder farming to commercial profit-oriented undertakings (GoK 2001a). The policy is in response to the reforms and policy changes such as liberalization and public sector staff retrenchment. Further new methods of service delivery have necessitated changes in the policy and hence the need to incorporate these changes and improve delivery systems.

The policy is to give direction to all players in extension direction on how to strengthen coordination, collaboration and partnerships. All MoARD staff, private sector extension providers, NGOs, CBOs, and development partners supporting

agricultural extension will use it. Until December 2001, Kenya did not have an extension policy because the government had monopoly in the provision of extension services. Due to the ongoing socio-economic changes and agricultural sector reforms taking place, the need to have a policy became a pressing urgency in order to provide guidance and conducive environment to other service providers. The need for NAEP has arisen from the following factors:

- (i) The poor performance of agricultural sector over the last decade.
- (ii) The implementation of economic reforms over the same period.
- (iii) The below par performance of the public sector extension services.
- (iv) Due to the diversified mix of players in the agricultural sector and accumulated sufficient human resource to provide alternative delivery systems for extension services.
- (v) Financial constraints have made the GoK to focus on long-term sustainability of the extension services.

NAEP perceives the role of agricultural extension service as being to provide information to extension clients. This is in order for them to make better use of available resources by increasing options and their organizational skills so that they may take greater advantage of production and market opportunities.

The objectives of the extension policy are to:

- (i) Facilitate the development of pluralism in service delivery;

- (ii) Improve the efficiency and effectiveness of extension service provision by the public and private sectors.
- (iii) Put in place a regulatory system to guide service providers and modalities of setting of operational standards, quality and norms.

In the past, the various extension service providers have used different extension approaches with varying levels of success. The approaches have included progressive or model farmer approach, integrated agricultural rural development approach, farm management, T & V, attachment of officers to organization, farming systems approaches, farmer field days and FTCs. A major weakness in all these approaches is that they have not been participatory enough, and NAEP thus emphasizes farmer participation in extension.

National agricultural extension policy (NAEP), is therefore to provide an improved environment in which the farmer will have more choices of technologies and extension service providers. No single extension approach can be considered appropriate to address the needs of all agro-ecological zones. Approaches to be adopted will depend on, among other factors agro-ecological zones, farmer literacy level, land tenure system, farmer's resources, socio-cultural factors and farmer's needs.

NAEP emphasizes the use of group approach rather than individual farmers because of their relatively low cost. This is a move towards participatory, demand-driven extension service. Currently the extension delivery methods in use by both the public and private sector extension providers include face-to-face extension on a one-to-one

basis, on-farm demonstration, shows, field days, film shows, mobile training units, adaptive on-farm trials and mass media. For greater outreach, NAEP recommends increased use of group approach, mass media, field days and demonstrations in technology dissemination in the high and medium potential areas while in the arid and semi- arid areas (ASALs), group, demonstrations, film shows, joint discussions and targeted radio programmes should be tried.

The policy envisages a real danger in research–extension linkages with privatization of extension service that these linkages will weaken. This is because of the separation of institutions responsible for research and extension. According to NAEP, the farmer must be part of the linkages so that it is “farmer–research–extension” linkages that are strengthened and not research-extension links per se. Further, extension service providers will need to provide evidence that they are sufficiently linked to research. The private sector will be required to provide feedback to the public sector research for further research priorities.

Unlike in the past where the strategy has been to equip farmers with knowledge, skills and information, the policy will promote a holistic approach where additionally, parallel development of other services required by farmers is promoted. These services include among others, rural access roads, wholesale markets, livestock auction yards, micro-credit and finance, water harvesting technologies, micro-irrigation schemes, rural agro-industries, machinery services and support institutions such as regulatory bodies.

The policy considers the principle of commercialization and privatization of extension services necessary. This is in order to enhance the ownership and sustainability of the service. This has been necessitated by the declining government funding towards extension services and the need for the extension providers to be accountable to the farmers. The farmers must therefore make monetary or other contributions towards the cost of the services. Commercialization of extension services may lead to biased service towards those able to pay rather than those who need the service. There is the likelihood of little exchange of information between the private research and public extension. Further, as farmers are required to pay for information, they are likely to become reluctant to share it with the other farmers freely as in the past.

The policy proposes that information should be provided free by the public sector as far as possible but only the delivery should be charged for. MoARD should also have prescribed rates to be charged for one-to-one service, which should be comparable with those charged by private sector providers. Levels of contributions considered are to include partial cost recovery (cost sharing), full cost recovery and privatization. The farmers' proportion of partial cost recovery will increase gradually to reach full cost recovery for all private goods or services throughout the country by the year 2020.

With the privatization of the extension services, there is danger that farmers are bound to become overwhelmed in terms of their ability to make the right choice of service provider and the verification of the value of the information. In the absence of quality controls, service providers may inundate farmers with loads of doubtful value information. NAEP argues for vetting service providers to ensure that they have the

capacity to offer sustainable and quality services. Further privatization of funding could lead to loss of control of extension by the public sector—since it is difficult to identify the extension activities that are public and those that are of private good in extension service delivery, as far as possible, both sectors should be involved in providing activities of both public and private good.

NAEP on gender equity and mobilization in extension indicates that the majority of small-scale farmers in the country are women and they provide for well over 80% of domestic food requirement in the rural areas. Further, women contribute over 80% of the agricultural labour force. Women therefore deserve recognition in all extension programmes and projects, private and public.

In the past, male extension workers tended to target male farmers for their extension messages, training and even in allocation of farm inputs. The messages were not prepared taking into account the gender of the target audience and were presumed to be gender-neutral, which in reality is not the case. Projects were planned without proper gender analysis and did not take into account the special needs of women. To correct the gender bias, all extension providers will be encouraged to conduct socio-economic, gender analysis and socio-cultural studies, which will be in-built in extension projects and programmes.

For sustainable development to be achieved, the policy advocates for sound environmental protection and preservation. The policy notes that environmental concern will remain a key consideration in the country in order to conserve the existing resource potential for the future generations. To this end all new agricultural

programmes and projects will be subjected to environmental impact assessment (EIA), and will need to satisfy the environmental law with regard to EAI before final acceptance, and all extension workers will be expected to be familiar with the major aspects of the Environmental management and coordination act, 1999, as it relates to agriculture.

1.7.2 National Agricultural and Livestock Extension Programme (NALEP)

Globally, agriculture and livestock extension is in transition. The international monetary fund (IMF), the World Bank (WB) and other international agents are advancing financial, structural and managerial strategies, all aimed at improving extension. This is with the aim of raising the income levels of the farmers, poverty reduction and ensuring food security. In this transition, key elements are for instance: decentralization, cost sharing and participation of stakeholders. Most of the features of NALEP have been borrowed from the experiences of the National Soil and Water Conservation Programme (NSWCP), which came to an end in June 2000 after being in operation for 26 years since 1974, and thereby paving way for NALEP which has the following features:

1. Concentration of effort in a given area over a specified period.
2. Stakeholder participation in decision-making, planning, monitoring and evaluation.
3. Bottom-up planning.
4. Activity driven budgeting /fund allocation.
5. Strict resource control and audits.

6. Structured supervision, reporting, monitoring and evaluation.

The NALEP approach aims at organizing farmers in common user groups to access a wide range of services. It also brings stakeholders closer to each other enabling delivery of manpower and other resources. NALEP project uses the shifting focal Area Extension Approach, derived from the catchment approach, which was developed in the NSWCP.

The outputs expected from the programme include:

1. Institutionalization and strengthening of participatory approaches in extension services.
2. Empowerment of farmers, pastoralists, fishermen and other stakeholders.
3. Improvement in the organization and management of both public and private extension.
4. Availability and access of new technologies for farmers, pastoralists and fishermen is improved.
5. Improved availability and management of extension resources.
6. Improved motivation for extension personnel.
7. Creation of an enabling environment for private sector entry into extension service provision.

1.7.3 Focal Area Extension Strategy

The focal area extension strategy employs a participatory approach. As Baiya (2001) puts it, effectiveness of extension services to farmers and agro-pastoralists is not achieved by merely visiting and telling them what to do. There is need for extension agents to create a forum where the farmers are playing a leading role in identifying their production problems, and opportunities for improvements and hence the focal Area Extension Strategy.

Participatory extension involves participation of extensionists, farmers, local leaders, inputs suppliers, farm produce traders and processors. The approach involves concentration of effort and resources in a few geographical areas, on a specific number of farmers over a particular period of time. The farmers take a leading role while the functions and roles of the extension agents are changed from those of an instructor to a facilitator.

Focal area approach has several advantages, which include:

1. Improves on staff supervision and follow-up.
2. Utilize the available resources more effectively for improved achievements.
3. Attracts the support and collaboration from other departments and agencies, organizations and private practitioners in addressing agricultural development for rural communities.
4. Empowers individuals / community to spearhead development in their areas.

The Focal Area Extension Planning (FAEP) is employed to achieve the above advantages. FAEP has two main operational phases namely the community mobilization phase and the individual farm-planning phase. Community mobilization phase includes:

1. Constituting the collaboration forum.
2. The participatory rural appraisal activity,
3. The promotion of opportunities.
4. Drawing of the community action plan.
5. Formation of the community interests groups.
6. Election and the training of the focal area developments committee and development of the focal area map. Demonstrations and field days may be included in this phase.

The second phase, which is the development of individual farm extension packages, involves the development of the preliminary farm specific action plans by the FEW. This is followed by the specialist intervention by the divisional subject matter specialists as per farmer demands and the implementation by farmers and promotion of new opportunities takes place continuously (Baiya 2001).

The identification of the focal area is done eight months before actual implementation starts so that the formulated budget can fit into the GoK's financial calendar. Farmers should take lead because they know their farming problems, social interactions, cohesiveness and their aspirations. However, extension staff plays a major role in guiding and advising on the focal area selection. According to Baiya (2001), in the

process of selecting the focal area, the following factors should be put into consideration:

1. The general level of agriculture development in relation to the rest of the division.
2. Distribution of previous catchment areas under NSWCP.
3. Accessibility of the focal area.
4. The frontline extension worker must be a resident of the selected area.
5. Farmers enthusiasm.
6. The size of the focal area should usually be 300-400 farms.

1.8 Scope of the Study

The general focus of this study is on agricultural development and hence food security in Tharaka-Nithi District, Kenya. Specifically, the topic is centered on the role of agricultural extension services in maize production in Chuka Division. Tharaka-Nithi is one of the twelve districts in Eastern Province. The district has eight divisions. This study was based in Chuka Division, and mainly focused on small-scale maize production in the division.

1.9 Location of the Study Area

This study was based in Chuka Division, Tharaka-Nithi District, Eastern Province, Kenya. Tharaka-Nithi District is one of the twelve districts, which comprise Eastern Province. The district borders Meru Central District to the North, Embu and Mbeere Districts to the South, Mwingi District to the South-East, Meru-North District to the

North East, Kirinyaga and Nyeri Districts to the West at the peak of Mt. Kenya (Fig.1.1).

Tharaka-Nithi lies between latitudes 00° 03' 47" North and 00° 27' 28" South, and between longitudes 37° 18' 24" East and 28° 19' 12" East, and has a total area of 1092.9 square kilometres. According to the 1999 population census, the district had a population of 265,451 persons and a population density of 118 persons/km² (Table 1.1). Chuka Division had the largest number of locations (six) while Muthambi and Igambang'ombe Divisions had the least (three each). Mwimbi and Magumoni Division had five locations each. Mwimbi Division had the highest population (64,380), while Igambang'ombe Division had the least (23,300). Magumoni division had the highest population density of (510 persons /KM²), while Igambang'ombe Division had the least, (110 persons per square kilometre).

Table 1.1: District Population Distribution by Household, Area and Density

Division	Locations	Households	Area (Km²)	Population	Population Density
Magumoni	5	7,433	64.2	2,715	510
Igambang'ombe	3	5,088	210.9	23,300	110
Mwimbi	5	14,673	203.4	64,380	317
Chuka	6	12,596	169.6	53,517	316
Muthambi	3	7,194	84.4	31,539	372
Total	22	46,984	1092.9	265,451	118

Source: District statistics office, Chuka, 2002.

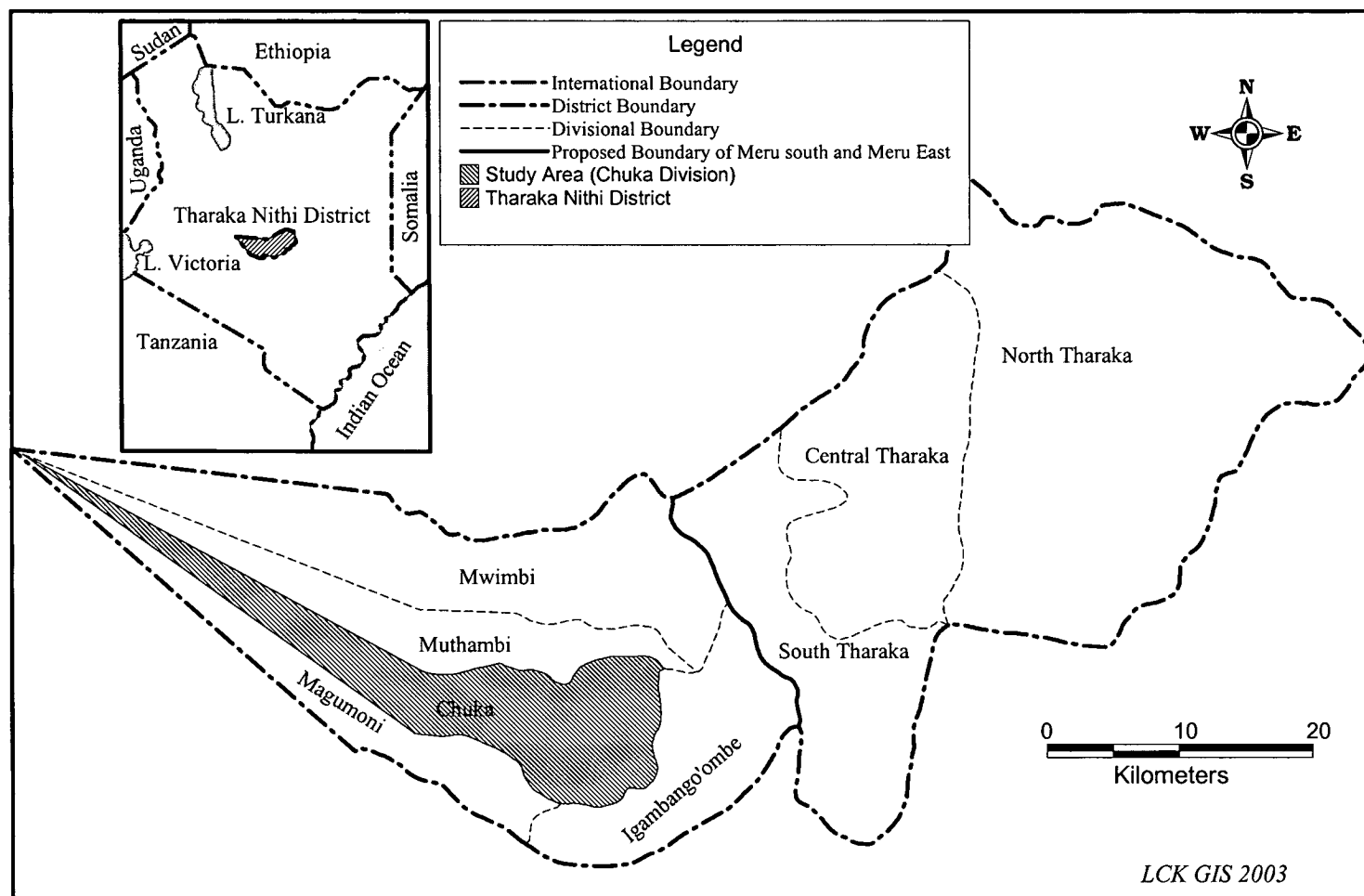


FIG. 1.1: THE STUDY AREA.

Source: Tharaka - Nithi District Development Plan 1997 - 2001.

1.9.1 Topography and Climate of the Study Area

The topography of the district is greatly influenced by the volcanic activity of Mt.Kenya. The district has numerous rivers, which originate from Mt.Kenya forest. They flow eastward as tributaries of Tana River, which discharges its load in the Indian Ocean. The rivers which traverse the district include Kathita, Thingithu, Kithino, Mutonga, Mara, Nithi, Naka, Ruguti and Thuci. They have deep “V” shaped valley in their youth stages, but the depth decreases towards the east (old stage) as they flow away from their source. The altitude of the district ranges from 5,200m at the peak of Mt.Kenya to about 300m in the dry lowlands of Igambang'ombe Division.

A bi-modal rainfall pattern is prevalent in the district. Rain falls in the months of March to May (long rains) and October to December (short rains). The highest precipitation is received from October to December. The annual rainfall ranges from 2,000mm in the chogoria forest to below 700mm in the lower areas (Table 1.2). Thus the district receives enough rainfall for increased agricultural activity.

Temperatures are cool in the highland areas and range between 14 °c - 17 °c. They are moderate in the middle areas and hot in the lowland areas. Temperatures in this latter zone range from 21° c - 27°c, but may at times rise to as high as 37°c in areas lying below 600m above sea level.

1.9.2 Land and Soils

Tharaka-Nithi soils are characterized by deep red loam soils in the highland divisions of Mwimbi, Muthambi, Chuka and Magumoni. These soils are well drained and fairly fertile. They thus require fertilizers to improve their fertility, which has been lowered as a result of continuous cultivation. These soils are extremely deep and have friable clay with acid humic topsoil. In the upper divisions, the soils are well drained and of moderate fertility.

In Igambang'ombe Division, soils range from moderately deep to very deep, dark reddish brown to dark yellowish brown. They range from sandy clay to clay, from excessively drained to well drained. They have rocks, boulders and are mostly stony and have acidic humic top soil and are generally of low fertility. The land use in the district is categorized according to the eight Agro-Ecological Zones (AEZs) as outlined in Table 1.3. and as shown in figure 1.2.

Table 1.2: Tharaka-Nithi Annual Rainfall 1982-2001 (mm.)

MONTHS	JAN	FEB	MAR	APR	MAY	JUN.	JUL.	AUG	SEP	OCT	NOV	DEC	TOTAL
YEAR													
1982	-	-	90.1	228.2	70.4	9.9	9.5	-	43.2	86.8	-	7.0.	545.1
1983*													
1984	-	-	8.4	121.2	-	-	6.4	-	-	118.9	115.9	56.5	427.3
1985	6.2	10.5	211.7	286.5	101	-	7.7	-	-	72.6	187.7	61.5	945.4
1986*													
1987	27.2	-	4.4	144.3	54.5	39.7	1.4	22.4	2.4	11.2	321.1	11.25	639.85
1988	40.15	11.6	84.6	570.9	42.5	12.68	5.6	12.5	9.5	214.9	245.2	320.8	1570.93
1989	88.2	51.8	77.8	-	97.6	2.7	2.2	9.6	19.8	509.4	620.8	93.1	1573
1990	69.9	49.2	245.1	370.1	59.4	2.5	6.2	1.9	7.0	265.0	321.5	227.3	1625.1
1991	51.8	-	67.9	136.0	148.6	1.6	1.7	12.2	-	176.9	343.3	193	1133
1992	47.6	-	-	279.9	103.5	2.3	8.4	5.8	6.2	109.9	315.6	238.6	1117.8
1993	260.7	162.0	21.1	239.0	160.3	5.0	14.9	-	-	121.6	280.6	64.4	1329.6
1994	-	53	123.3	353.0	52.1	3.7	9.1	14.7	3.0	291.4	465.2	-	1368.5
1995	13.5	27.0	158.1	410.4	111.2	17.0	6.0	11.5	16	349	227.4	185.3	1532.4
1996	49.0	13.5	247.8	75.3	27.9	5.0	13.9	1.2	-	68.0	182	-	683.6
1997	1.3	-	71.8	571.5	33.6	-	-	-	-	279.5	818.3	334.5	2110.5
1998	579	145	252.3	293.2	111.1	108	-	-	-	77	296.7	-	1862.3
1999	9.3	9.5	238.8	130.1	85	-	-	-	-	4.0	403.4	-	880.1
2000	6.0	-	-	73.2	-	-	31.0	0.5	9.5	12.2	399.1	-	531.5
2001	140.3	83.4	352.7	14.0	9.3	*	*	*	*	*	*	*	599.7

Source: Weru Dispensary, Chuka, 2002.

- Records not available.

Table 1.3: Tharaka-Nithi Agro-Ecological Zones and Agricultural Activities

ZONE	SPATIAL COVERAGE	AGRICULTURAL ACTIVITIES
UH₀, LH₀: Tropical alpine	Mt. Kenya forest	
	Chuka, Magumoni, Mwimbi,	
LH₁: Tea-Dairy zone	Muthambi	Tea growing, dairy farming
		Tea growing, coffee, macadamia, maize,
UM₁: Cotton-Tea zone	Chuka, Magumoni, Mwimbi,	beans, yams, bananas sunflower and
	Muthambi	dairy farming
		Tea growing, coffee, maize, beans,
UM₂: Maize-coffee zone	All divisions	yams, bananas, macadamia, sunflower
		and dairy farming are practiced
UM₃: Marginal-coffee zone	All divisions	Mainly coffee and maize
	Lower Chuka, Magumoni,	Mainly maize, beans, tobacco, cotton,
LM₃: Cotton zone	Mwimbi, Muthambi and most of	pigeon peas sorghum and millet are
	Igambang'ombe	grown
	Lower Chuka, Magumoni,	Mostly cotton, cowpeas, green grams,
LM₄: Marginal-cotton zone	Mwimbi, Muthambi and most of	pigeon peas, sorghum and millet are
	Igambang'ombe	grown
LM₅: Millet zone	Mostly Igambang'ombe Division	Mainly millet growing and livestock
		keeping
LM₆: Ranching zone	Southern part of Igambang'ombe Division	Cattle ranching

Source: Tharaka-Nithi District development plan, 1997-2001

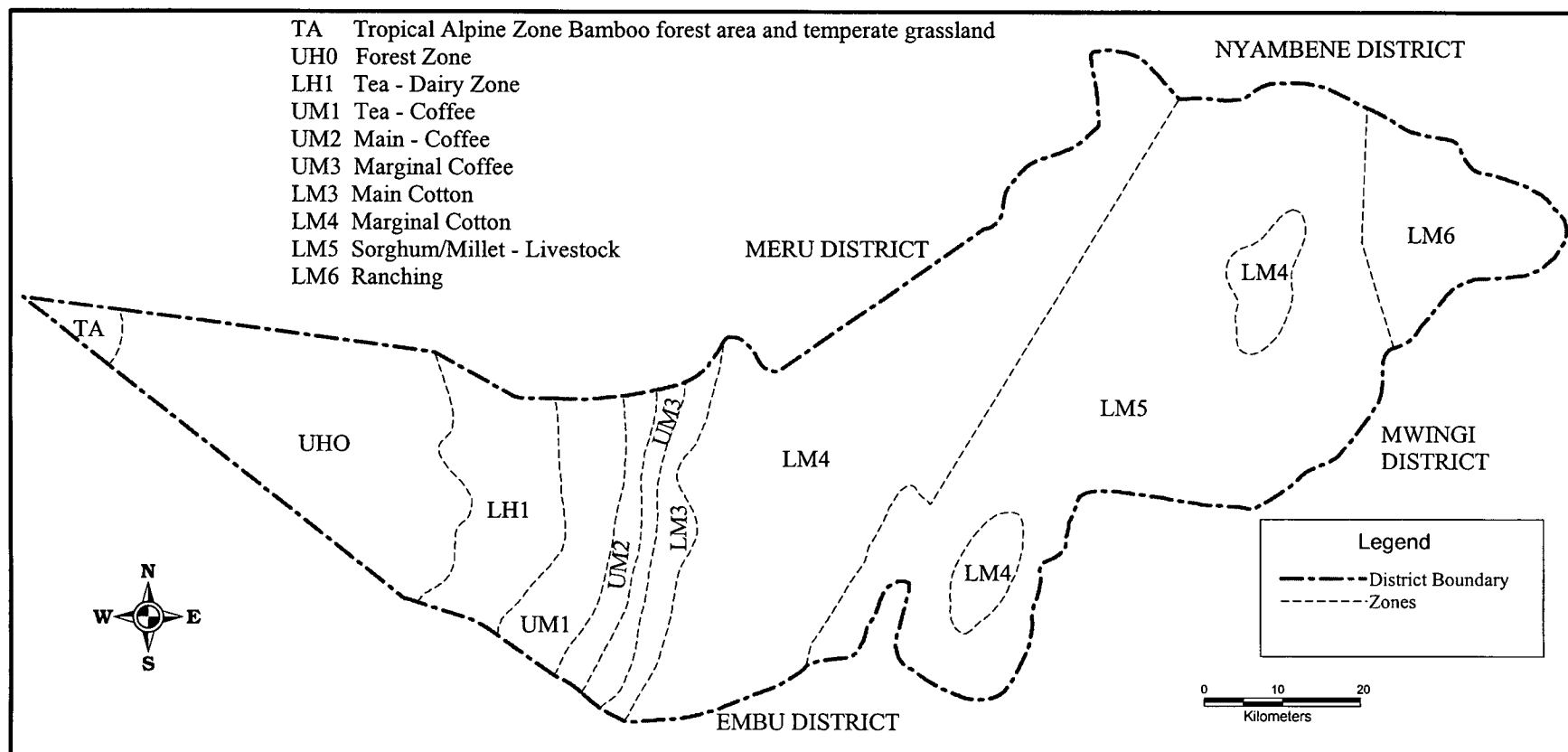


FIG. 1.2: THARAKA - NITHI DISTRICT AGRO - ECOLOGICAL ZONES.

Source: Tharaka - Nithi District Development Plan 1997 - 2001

1.9.3 Agricultural Activities in the Study Area

Crop growing and livestock keeping are the two major resources being exploited in the district. Agricultural activities are determined by the amount of rainfall received during the two rainy seasons experienced in the district. There is adequate rainfall in the divisions of Muthambi, Mwimbi, Magumoni and Chuka. In the lower division of Igambang'ombe, only drought resistant crops such as millet, and sorghum are grown. The district's agricultural activities fall under the category of small farm sector. There are various agricultural activities practiced by farmers in the study area, which may be grouped into four, namely; commercial farming, subsistence farming, horticultural farming and livestock farming.

Coffee, tea, tobacco and cotton are the main cash crops grown in the study. These crops are grown in Chuka, Mwimbi, Muthambi and Magumoni Divisions. Coffee production has fluctuated overtime largely due to unfavourable market conditions and as such no potential exists for its expansion. Cotton and tobacco mainly thrives in Igambang'ombe Division. Tobacco is grown in the mid latitude areas of Mwimbi, Muthambi, Chuka and Magumoni Divisions. Other cash crops grown in the study area but on a small scale include macadamia and sunflower.

Horticultural crop production has a great potential that has not been exploited in the study area. The full exploitation is inhibited by inadequate irrigation facilities. The main horticultural crops grown include tomatoes, Irish potatoes, cabbages, carrots and French beans. To a lesser extent, sunflower, onions, tomatoes, kales, macadamia, mangoes, chilies and brinjals are also grown.

Livestock is also kept in the study area, which include: cattle, sheep, goats, poultry, rabbits and pigs. There are both exotic and indigenous breeds of cattle. The indigenous cattle breeds are for instance Zebu and Boran, while the exotic breeds include Friesian, Jersey, Ayshire and Guernsey. Some farmers keep cattle using modern management practices such as zero grazing to produce high quality meat and milk while still others manage their cattle the traditional way.

1.9.3:1 Maize Farming

The origin of maize is thought to be Central Mexico and was brought into East Africa by the Boer settlers in the early part of the last century. Maize cultivation in Kenya was enforced in the 1920s by the British colonial administration. The millet crop failure due to locusts in 1918 contributed to increased acceptance of maize and it soon surpassed millet as the most feasible and widely used, if not the most highly cherished crop (Ngugi 1978). Maize, introduced into Kenya in the early 1900s has become the number one food choice, and its production and consumption play a major role in Kenya's economy and food security for the country (KARI May/June 2001).

The importance of maize in Kenya was recognized by USA in 1967 when technical assistance was provided to the maize-breeding program at KARI's maize research center. Since then, continuous maize-breeding work has aimed at improving varieties especially those with potential for increased yield. Maize is the most important crop grown in the study area for subsistence purposes. It is also an important livestock food both as silage and as a grain, and is also used industrially for starch and oil extraction. Maize is also sold to meet household financial requirements. It is the staple food for

over 80% of the Kenyan population and is therefore crucial to the country's food security.

The physiography, climatic conditions and soil characteristics of the study area are suitable for maize growing. Maize grows well where temperatures average 24°C, with a minimum of 10°C in order to germinate. Maize does well with 600mm-900mm of rain falling during the growing period, while high yields are obtained at 2,200 metres above sea level. Soils for maize production should be fertile, well aerated alluvial or loam soils with a pH of 6.0-7.0. They should be free draining, as maize is intolerant of waterlogging.

Maize requires little water during the first five weeks of its life. From five weeks onwards, the maize plant is less drought resistant. The most critical period is the silking when a small degree of wilting can cause incomplete pollination and ultimately low yields (Ngetich 1989). Towards the time of harvesting, dry conditions are required to facilitate drying of grains. The crop is cut and staked for several weeks after which cobs are removed by hands. The grains are then detached from the cobs by shelling.

Maize does well when grown in rotation with other crops such as beans tobacco and cotton. It takes considerable amount of fertility from the soil and thus can only be grown continuously on the richest soils or when heavily fertilized. Land should be ploughed as early as possible after the previous crop and preferably whilst there is still some moisture in the ground to assist in rotting down any plant material that is ploughed in. A fine seedbed is not required for maize growing.

Some farmers use the local seed. However to obtain higher yields, hybrid seed or composite seeds should be planted. The local seed is low yielding, usually well sheathed and so more resistant to weevil attack in storage, possibly more palatable to local tastes. The hybrid seed is high yielding but requires larger amounts of fertilizer.

As hybrid is obtained by crossing two varieties, the subsequent crops using saved seed will not have the same characteristics as the original seed planted and yields will be much lower. New hybrid seeds are therefore required each season. The composites such as Katumani and Coast composites are stabilized varieties and new seed is not required each new season. Composites will usually yield more than local varieties. Maize seed Variety recommendation is usually based on the altitude range as shown in table 1.4 and 1.5.

Maize should be planted just before or at the beginning of the rains. Delays in planting will mean that the yields will be considerably reduced. For example a two-week delay in planting can mean a yield loss of up to 25%. The young maize plant prefers the conditions found at the beginning of the rains. Late planting means that the ground may be too wet for good early growth, and then the maize fails to fill out because the soil becomes too dry.

Table 1.4: Hybrid Maize Seed Varieties

Variety	Altitude range	Average yield/Ha (Bags)	Length of rainy season
Hybrid 614D	1500-2100	94	5-7 months
Hybrid 625	1500-2100	98	5-7 months
Hybrid 626	1500-2100	107	5-7 months
Hybrid 622	1000-1700	67	4-6 months
Hybrid 632	1000-1700	69	4-6 months
Hybrid 511	1000-1700	44	3-4 months
Hybrid 512	1000-1700	50	3-4 months
Pwani Hybrid 1	1-1500	40	3-4 months

Source: DEC office, Chuka, 2002.

Table 1.5: Open Pollinated Maize Seed Varieties

Variety	Altitude range	Average yield/Ha (Bags)	Length of rainy season
Katamani composite	1000-1900	33	2-3 months
Coast composite	1-1000	44	3-4 months
DLC 1	1000-1900	27	2-3 months

Source: DEC office, Chuka, 2002

According to calculations and findings by various authorities, it is estimated that maize yields of about 10,000 and 14,000 kg/Ha/ year (two seasons) can be achieved, this being the potential production (maximum), which is determined by climatic and soil conditions. The anticipated or expected production from maize farms is calculated at between 60% to 80% of the potential production because of farmer resource disposition and other intervening variables, hence 6,000 to 8,400 kg/Ha/year, and the third measurement is the actual production of the farmers (Acland 1971 in Mutoro 1997).

An analysis of maize yields harvested in Chuka Division between 1996 and the year 2000 reveals that the division has been experiencing reduction of yields over the years, except in 1996 when the actual yields were higher than the expected yields (Table 1.6).

Table 1.6: Maize Yields Obtained in Chuka Division, 1996-2000

Year	Hectares	Expected yield	Actual yield	Total yield (90 Kgs. bags)	
				Expected	Actual
1996	2850	10 bags/Ha.	15 bags/Ha.	28500	42750
1997	2957	30 bags/Ha.	20 bags /Ha.	88710	59140
1998	3254	25 bags/Ha.	20 bags/Ha.	81350	65080
1999	4000	27 bags/Ha.	4 bags/Ha.	108000	16000
2000	3850	15 bags/Ha.	0.125 bags/Ha.	57750	481.25

Source: DEC Office, Chuka, 2001.

The continuous decline in maize yields since 1997 has rendered households in the study area insecure in terms of food security. Although climatic conditions partly account for the low yields, the extension has a significant role to play in reversing this trend. Lack of relevant farming information is a major constraint towards increased maize production in the study area. Farming information can be disseminated to the farmers through such channels as farming demonstrations, training, field days and show attendance.

1.10 Organization of the Thesis

The thesis is organized into five chapters. **Chapter one**, the introduction, outlines the subject of the study and the importance of agricultural extension services, and provides a justification on the emphasis on maize production. It also presents a statement of the problem and the research hypotheses. Other sub-topics are the study area, scope and delimitation. The chapter concludes with the organization of the thesis. **Chapter two** discusses the literature review and the conceptual framework, which guided the study.

Chapter three outlines the research methodology adopted in sampling, data collection and data analysis. **Chapter four** presents data analysis and a vivid discussion on the key findings. And **Chapter five** presents conclusions drawn based on the discussion in chapter four and finally the recommendations made for effective delivery and adoption of extension services, and recommendations on areas for further research.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

In the words of Lester Brown,

"When the world is changing very slowly, you don't need much information. But when change is rapid, then there is a premium on information to guide the process of Change." (Hawkins, H.S. and Ban, D., 1988).

This chapter presents a review of literature on agricultural extension covering such issues as farmer training, farming demonstration, on-farm trials, developing and testing innovations and in bridging the gap between research and the farmer. The chapter also discusses the conceptual framework guiding the study and finally a summary of the chapter is given.

However novel the concept of agricultural extension might seem in a situation of declining agricultural productivity in the study area in particular, and the rural Kenya in general, it is only just to mention that several scholars have been concerned with it earlier and have made important contributions on agricultural extension. Often, ideas come again and or differ in scope. The current study picks from the point of departure of the literary works on extension.

2.2 Literature on Agricultural Extension

The meaning of the term "extension" is well known and accepted by people who work in extension organizations and services, but is not well understood in the wider community. There is no single accepted definition of extension. Agricultural extension came into use in the early 20th century in the USA, when the cooperative extension services were formed in each state in association with the land grant colleges. The federal government had granted each state of the union land on which to develop agricultural experiment stations and to build associated educational or agricultural colleges.

People may be influenced through extension in different ways, as illustrated by the following words, which are used instead of extension. The Dutch use the word *voorlichting*, which means lighting the pathway ahead to help people find their way. In Indonesia, the word *penyuluhan* is used instead of extension. This word means lighting the way ahead with a torch. In Malaysia where a very similar language to that of Indonesia is spoken, the word *perkembangan* is used. The British and the Germans talk of advisory work (*beratung*), which implies that an expert can give advice on the best way to reach your goal but leaves you with the final responsibility for selecting the way.

The Germans stress that the goal of agricultural extension is to teach people to solve problems themselves. Austrians speak of "furthering" or stimulating you to go in a desirable direction. This is similar to the Korean term "rural guidance". The French speak of *vulgarization* which stresses the need to simplify the message for the

"common man", while the Spanish sometimes use the word *capacitacion* which indicates the intention to improve people's abilities, although normally it means training.

According to Hawkins, H.S., and Ban, D., (1988), there are some common meanings for the term extension, one of which is that extension involves the conscious use of communication of information to help people form sound opinions and make good decisions. The emphasis is on helping people make decisions by choosing from alternative solutions to their problems. Special attention should be paid to farmers' awareness of their problems and how they clarify their goals and opportunities, in situations where the extension officer leaves the farmer to make his own optimal decisions to suit his personal goals and conditions.

The World Bank (2000), writing on institutional factors constraining agricultural development in Africa identifies two main institutional factors, which account for persistent food shortages as being bad agricultural policies and institutional failures. Further, prolonged periods of unfavourable agricultural incentives, rural public investments and lack of institutional support has limited the opportunities for African farmers. Improvement in policies and institutional operations could go along way in ensuring food security in Africa.

For the case of Kenya, policies directly impacting on agriculture include agricultural extension services. These services have not hitherto significantly contributed to agricultural development, and this has eventually led to food insecurity in most parts of the country. Agricultural extension has the role of information dissemination

through training the farmers, conducting farming demonstrations, developing and testing new technologies and conducting on-farm experiments. These would go along way in achieving sustainable agricultural development and eventually food security, not only in the study area, but also in rural Kenya in general. Stressing the pivotal role of an effective extension service, the GoK in sessional paper No.1 of 1986, notes that:

“Successful extension service lies in its ability to put well-trained officers into the field, supply them with timely and useful advice for farmers, and maximize the number of contacts that officers have with the farmers.”

While emphasizing the importance of extension advice among the farming communities, Staudt (1978) in Mutoro (1997) observed that the success of any innovation among the farmers depends on the extent to which extension advice is given to the recipients, and the channels used. Ipara (1991) on Socio-Economic Factors Affecting the Participation of Women in Agroforestry Activities in Sabatia Division, Kakamega District Kenya, asserts that the success of an extension scheme is measured by the extent to which a given innovation has been adopted and implemented by the target population. The farmer's exposure to up-to-date extension advice is the key to his/her efforts in updating knowledge on different agricultural practices and therefore the envisaged increased crop yields.

Della (1991), Murphy and Merchant (1988), Benor and Baxter (1984) write that closely linked to the problem of adoption of wrong technological innovations is inadequate extension and public sensitization. Agricultural development has been constrained by limited application of research findings and information flow from the extension officers to the farmers and from the farmers to the researchers.

A study by Njue et al. (1999), on the status of maize technologies adoption in Kisii highlands of Kenya recognizes the important role of agricultural extension in increasing maize production in Kisii highlands. The study revealed that farmers in the region continued to grow maize under poor husbandry practices and minimal application of inputs and poor farm management. The study evaluated such agricultural aspects as seedbed preparation, time of planting, maize varieties, plant population, cropping systems, soil fertility and weed management and cropping systems.

In view of the fact that agricultural extension has several roles, developing and extending technological innovations being one of them, this study fills the existing gap on agricultural extension in such aspects as training, demonstrations and on-farm experiments. A related study was carried out by Jarma et al, (KARI 1999), on the potential of improved fallows in improving and conserving the fertility of nutrient depleted soils of Western Kenya. This study evaluated maize yields in relation to improved and natural fallows. The study revealed that adoption of fertility improving technologies led to increase in maize yields. The extension machinery therefore has to extend such knowledge to the farmers by for instance engaging in farming demonstrations.

Elsewhere, a study by Nadar (1983), on maize was conducted in Machakos, and it focused on maize yield response to row spacing and population densities (KARI 1983). The study revealed that plant spacing and the number of plants per hill significantly influenced the yields. Maize planted at 60cm and 75cm spacing yielded higher than that planted at 90cm row spacing, and that two plants per hill yielded

significantly higher than one per hill. Extension officers have a role in enlightening the farmers on such dimensions of production, and going beyond that, to organize for on-farm demonstrations.

According to Ashcroft (1979), the extension machinery though making a valiant effort is not specifically geared to the rapid development of Kenya's smallholders. This machinery is not efficiently utilized for rapid introduction of innovation, which is a means to an end in rejuvenating and invigorating the agricultural sector and hence achieving food security. Key constraints hampering efficiency in provision of extension advice include for instance lack of timely information to be passed to the farmers, lack of means of transport for wide area coverage, poor remuneration, overwhelming number of farmers per extension officer, low upward mobility for extension workers and conflicting policy issues.

The farmers training centers which could be effectively utilized for group extension methods are not able to recruit enough farmers to fill their classes and usually work at less than 50 per cent capacity due to poor advertisement. Worse still majority of farmer trainees in the training centers, are not farmers but they could be agricultural officials and traders, and at times the large-scale farmers often referred to as "progressive farmers".

Mutoro's (1985) study supports Ashcroft's (1979), and Chessa's (1992) standpoint on the scope of extension services. According to Mutoro, government services such as extension, and credit provision favour the large progressive farmers thus aggravating the inequality within the smallholder areas. Such an extension strategy partly

explains why production on small-scale farms has been declining. Mutoro further points out that there is no government program to provide seasoned crop credit to farmers who have less than 15 acres of wheat, maize or any other crops.

The successful and rapid introduction of a prosperity increasing innovation requires the co-ordination and integration of various services such as extension of inputs, disease control, marketing, transport and processing services. This view is held by Kinara (1981), who observes that extension services in most government projects are directed to the most progressive farmers, with the expectation that the adoption of innovations would trickle down to the small-scale farmers.

Currently there is lack of co-ordination in the provision of extension and research advice in Kenya, which has hampered the achievement of the envisaged objectives of extension such as stepping up agricultural production especially among the small-scale farmers. When extension efforts are directed towards the most progressive farmers, the divisions and inequalities existing among rural society farmers are actually enhanced.

Della (1991) observes that food policies as they relate to extension services influence the decision-making environment of producers, distributors and consumers. She further argues that most production decisions in African countries are made in smallholder households, villages and fields. Thus, before food policies are made, there is a dire need to understand the actual decision making environments affecting the farmers. The extension officers ought to interact with the farmers before making any recommendations, which are bound to affect them either directly or indirectly.

They also need to evaluate the empirical worth of technical recommendations once implemented by the farmers under their particular conditions, in order to provide feedback to the researchers.

Kareri (1985) in a study on Nyeri farming systems viewed from physical and socio-economic aspects, vividly captures the role of agricultural extension when he notes that,

"in areas where the farmers have no other way of obtaining information related to farm management, failure to offer the right ample advice, may keep some farmers at low levels of production through employing traditional methods of crop and animal husbandry."

Kareri regards extension officers as "the main vehicles" that carry information on research findings from the research institutions to the farmers, which emphasizes the research-extension-farmer linkage in information dissemination. Kareri (ibid.) further writes that the extension machinery has a role to play in ensuring high yields by organizing for farmers' training either in the farmers' training centers or during the field days, where they are given short duration courses on the various agricultural aspects, for instance land preparation and use of inputs.

Muturo (1985) carried out a related study, focusing on selected environmental and socio-economic factors affecting agricultural production in South Maragori Location, Western Province of Kenya. The study revealed that land tenure system, land-use systems, rainfall and population significantly influence agricultural production. Additionally the study revealed that technological innovations too, played a significant role. She attributed the level of innovation adoption to the extension

services provided. The level of technological innovation adoption in the study area is relatively low, and constraints to the adoption of innovations were identified, the major cause being the fear of obtaining low yields after adoption.

Ipara (1991) observes that although the extension service is faced with some problems, it is generally accepted that it is by far the most widely used technique for updating and disseminating knowledge on new innovations to the farming communities. According to Ipara, this essentially means that extensionists disseminate advice among their rural practitioners through various channels such as barazas, mass media, and FTCs. To facilitate the farmer's understanding, demonstrations are organized on selected farmers' plots. Intensive training at nearby FTCs supplements and compliments information disseminated through other techniques.

KARI (1999) while writing on technological innovations observes that appropriate technology for agriculture in Kenya has progressed in a slow pace as compared with socio-economic human activity. Lack of appropriate technologies, in many situations have led to situations where marginal lands have increasingly been opened up and thus losing their natural vegetation. Soil structures have deteriorated and as a consequence, agricultural production has continued to decline. Technologies developed in specific climate conditions need to be tested before adoption in other areas, to ascertain their viability. The extension officers have a key role in ensuring that the farmers adopt the right technology for increased yields and hence food security both at the household and national level.

Mariam (1986) notes that a rural survey carried out by the Central Statistical Office, Ethiopia, on the reasons for the peasants not expanding their cultivated land, revealed that majority of the farmers almost (42 per cent) identified lack of oxen as their primary reason. Others were unavailability of land, lack of manpower, poor land, lack of market for their produce and land being too weedy. This is indicative of the crucial role of technological innovations in agricultural development.

Muturo (1985) observes that adoption of technological innovations is not adequate in explaining improvement in agricultural production. The question of technical and economic efficiency must be well articulated. The extension machinery is well placed in evaluating whether the process of adopting the various innovations is achieving the desired goals or not, and if not, extension is supposed to provide feedback to the researchers for further investigations and or modifications

Kenya is one of the leading countries in Africa in terms of annual population growth, with an estimated annual increase of 2.1% and a projection of total population of 30.3 Million people (WB 2000). Sustainable agricultural development must be concerned with ways to use the available land to provide food as well as industrial requirements for the fast expanding population without allowing the land to deteriorate. This had been observed by Ominde (1988), who cautioned that Kenya would be faced with the problem of finding ways to intensify agricultural land use for increased food production to cater for an increasing population. The rural populations are increasing rapidly and more people are demanding more land, thus increased land fragmentation and decreased farm output.

In the past provisions have been made by clearing non-gazetted forests and savanna lands, and bringing them under cultivation. This option is currently not viable in Kenya or in the study area, on environmental considerations for sustainable development. Bruins and Lithwick (1998), Boserup (1965), (1981), argue that population growth is the main cause of agricultural intensification. As land fragmentation increases, agricultural production tends to decrease as a result of population pressure. Population pressure and increased land fragmentation has led to over use of land and planting of too many crops on one piece of land.

On the other hand, over use of land and over inter-cropping have stimulated soil erosion and loss of soil fertility. All the four have led to a decrease in agricultural production manifested in food insecurity especially for the rural dwellers whose main occupation is agriculture. Agricultural extension has a duty to promote sound agricultural practices in the current state of continued land fragmentation. This is for instance by promoting the application of such agricultural inputs as fertilizers, herbicides, pesticides and proper intercropping. Others are soil conservation and crop rotation which replenishes soil fertility.

Closely linked with population, is the concept of adequacy or inadequacy of manpower. KARI (1999) notes that agricultural productions systems in Kenya today are heavily dependent on human effort in form of labour. The majority of small-scale farmers in the country are women and they provide for well over 80% of domestic food requirement in the rural areas and over 80% of the agricultural labour force. Women therefore deserve recognition in all extension programmes and projects whether they are private or public (GoK 2001). This calls for the extension machinery

to correct the gender bias for effective information dissemination (Mutoro 1997, GoK 2001a, and Kiragu 2002).

The availability of infrastructure and its efficient operation are major determinants to the cost of production, quality and timeliness of response to product and service demand (KARI 1999). An effective road transport network is a prerequisite for wide area extension coverage. The road network is particularly very important in integrating the various production and population centers and in facilitating mobility in both urban and rural areas. Poor road network and lack of means of transport are major constraints in the provision of extension services in Kenya.

In the rural Kenya, the transport network is not well developed which hampers mobility of the extension officers especially during the rainy seasons when they should be actively involved in information dissemination. The current inadequate state of Kenya's infrastructure acts as a major disincentive and threatens the realizations of the goal of food sufficiency in Kenya (GoK 1997, K.I.E 1985, Ominde 1988, GoK 1996, 1998).

KARI (1999), Harrison (1996) notes that some of the environmental factors which have led to deterioration of the agricultural sector and consequently to food insecurity in Kenya are rainfall, sudden environmental shocks such as droughts and continuous decline in soil fertility. Kenya's agriculture is still on a very weak foundation, plagued as it is with frequent droughts and famine conditions.

Droughts in Kenya can be explained as a function of annual variability and unreliability of rainfall, which hamper efforts towards achieving food security in the country (Ominde 1988, KARI 1999). Other climatic factors such as high temperatures, high winds and low relative humidity are often associated with droughts, in many regions of the world and can significantly aggravate the occurrence of droughts. Whether or not a drought becomes a disaster depends on how people have been managing their land before the drought (Glantz 1987, Rau 1991, and Curtis et al. 1988).

In an effort to ensure food security in the Kenya, agricultural extension has a major role to play in relation to drought and famine coping strategies. Extension officers need to provide information to the farmers on such calamities early enough so that the farmers can put in place mitigation measures. Equally important, the extension officers should promote the growing of drought resistant crops such as cassava and fast maturing maize seed varieties such as Katumani in the periods of drought. The relationship between drought and famine however is not a direct one. Drought is not a sufficient condition to explain famine (Saina 1996, De Wilde 1967). In areas prone to recurrent drought, the inhabitants develop coping strategies, which mediate between drought and famine, and it is when these strategies are unable to cope, that food crisis occurs (Carter 1986, Kareithi 2000).

The extension officers should explaining to the farmers the rainfall requirements of the various maize seed varieties, which can thrive well in different agro-ecological zones (AEZs) in Kenya. Different AEZs offer varying opportunities for land resource utilization. Ominde (1988) classifies Kenya's land into high potential land, which

receives an annual rainfall of between 750mm-1000mm, medium potential land, which receives an annual rainfall of between (625mm-750mm), and low potential land (ASALs) which receives 625 mm and below. It is possible to estimate fairly accurately the production potential of each zone and the extension officers can base their advice on the amount of rainfall received in different zones and rainfall requirements of different maize varieties.

2.2.1 Key Steps in Analyzing the Role of Agricultural Extension Services

The role of extension services in agricultural development can best be analyzed under the following steps which Della (1991) regards as steps in any farming systems research, and extension program (FSRE): Description and diagnosis, designing alternative technologies, testing the alternatives and eventually extension.

For effective agricultural extension, the extension officers should have the following goals:

1. To identify and understand the existing local farming systems.
2. To identify recommendation domains (Categories of farms and farmers that are homogeneous enough so that one set of recommendations will fit all).
3. To identify circumstances within the system where resources are not used as efficiently as possible e.g. compromises on technically optimum production technologies.

The first step in FSRE is description and diagnosis of a farming problem. This step involves reviewing secondary data as well as conducting on-farm interviews and observations. Secondary information gives the extension officers information for instance on soils, rainfall patterns, population distribution, economic flows, (crop and livestock sales, and purchases of inputs, location of markets, availability of inputs).

Research and extension staff has a role to play in gathering information on smallholder complaints and identifying ways in which smallholder practices differ from research and extension recommendations. In extension research, on-farm interviews and observations must supplement interviews with extension staff and the farmers for ground-truthing. This helps in verifying verbal information with observation. In FRSE, the smallholder farmers are the ultimate clients and actual participants and partners in the research process. They have great deal of experience with local conditions and know what they are trying to accomplish with their multiple enterprises although they may not be able to articulate their goals clearly. The research team has a duty to involve and support smallholder participation in analyzing, presenting, testing and evaluating technologies and systems.

The general methodology of farming systems research is incorporation of farmers and the research staff and the use of multi-disciplinary research teams. This is because the unit being investigated (the farming system), is complex and involves a wide variety of factors. The descriptive and diagnostic stage ends with the identification of high priority targets for adaptive research. The extension staff must recognize that the goal of the research into the farming systems at this stage is rapid development of appropriate technology, which the Smallholders can and will use. The most important

criterion for evaluating the success of the farming system is the extent to which Smallholders adopt technologies developed. Innovative technologies that are not adoptive are failures.

Designing alternative technologies is the second step in FRSE programs. The alternative technologies are intended to improve the smallholder's utilization of the biological potential of his or her environment (Collinson 1980). Designing alternative technologies is based on the diagnosis of high priorities for research and on a clear understanding of the resource capabilities of farmers in the recommendation domain. The proposed alternatives are usually intended to modify the existing systems rather than drastically changing it. The modification process should be gradual because smallholders are usually reluctant to undertake radical changes that entail a lot of uncertainty.

Designing alternative technologies is followed by testing the alternatives and eventually extension. This step occurs when the tested innovation proves to be good and an acceptable modification of the system. At this stage, the extension has a site-tested, adopted innovation that has been tested and approved by local farmers as well as through research. If the process of testing alternative technologies reveals problems, then the extension does not occur until the innovation is finally adaptable.

Involvement of the extension staff in on-farm testing is very vital for successful extension services, as the staff becomes aware of the reasoning behind the process and the innovation and thus the need for close collaboration between the farmers and the extension staff. Adoption of the proposed innovation(s) is the single most important

criterion by which the FSRE program is evaluated. In order to evaluate the success of the program, Della (Ibid.) suggests that the best way is to re-survey the locality two or three years after starting the extension step to test how many smallholders are adopting the alternatives, and to analyze any reasons for delays in adoption or failure after adoption.

The success of any extension programme, calls for concerted efforts by the farmers and the extension staff which include the Frontline Extension Worker (FEW), District Agricultural and Livestock Extension Officer (DALEO), Divisional Extension Co-ordinator (DEC), and the Subject Matter Specialist (SMS). The FEW is the extension worker with the responsibility of teaching production recommendations to farmers. He/she is as specialized and professional as other extension workers. Other extension staff has a responsibility to make the FEW more effective in his work.

The FEW has to receive intense support and guidance and must not be overburdened with non-extension functions. He is charged with the responsibility of visiting the farmers on a regular basis and convincing them to adopt the recommendations and advises the farmers on the price and availability of necessary inputs and market conditions. The FEW should report to the extension co-ordinator farmer responses to recommendations, production problems, input demand and availability, and market conditions. Days when the FEW is not on a regular schedule visit are used for makeup visits, farm trials and field days. The FEW has also to attend training sessions given by the subject matter specialists and a review meeting with the extension co-ordinator

DALEO has the role of facilitating the DEC's and SMSs to achieve workplan-agreed activities, facilitate stakeholder fora at the district headquarters and harmonize divisional work-plans and activity budgets to form district workplan for the next year. He/she hold regular meetings with district SMSs to review progress of NALEP, collaborate and co-operate with other extension providers and correctly interpret extension policies to the users. DALEO also ensures that project resources are used as planned and link with regional and international research and environmental right groups.

He holds quarterly meetings with DEC's to review implementation of the project and monitor extension performance and beneficiary satisfaction. DALEO usually visits the FEWs under his jurisdiction while in the field. This is to make sure that farmers are visited regularly by the FEWs and that the recommendations they receive are appropriate and adopted. He reviews selection of the farmers, delineation of farmers' groups and evaluates whether all the farmers are aware of the FEW's visit. He takes part in the field days, training and review meetings.

DEC has overall responsibility for effective agricultural extension in the division. He has to ensure that extension has a significant impact on agricultural production. The Divisional Extension Co-ordinator is active in two main areas- field visits and training. DEC also co-ordinates information on the actual and likely supply of agricultural inputs and on market conditions in his division. He organizes, convenes and is the leader of the training sessions. DEC should also ensure that the extension staff in the division receives adequate and appropriate special training.

SMS provides technical training and guidance to the FEWs. He has an important role in formulation of production recommendations and is a focus of links between extension and research. SMSs are present at the divisional, district and at the headquarters level. They make field visits, to train extension staff and to be trained and exposed to research. During the training sessions, SMSs ensure that recommendations disseminated to the farmers are correct and assess the farmers' reactions to the recommendations. They evaluate aspects that require additional recommendations or referral to research. In addition to the training sessions, they also offer short courses especially to the FEWs. Research staff trains SMSs, and thus SMSs visit research stations, attend specialized training courses given by research staff, and conduct farm trials.

Frequent contact between the FEW and all the farmers in an extension unit is not possible. However, while being responsible to all the farmers, the FEW focuses on a small, selected number of farmers in each farmers group and meets with any other farmers who are willing and are interested to attend his visits and seek advice. These farmers are identified by the FEW and the DEC, with assistance of the local villagers, especially the village elders. They are selected according to the following characteristics:

- (1) They should represent proportionately the main socio-economic and farming conditions of their group and be regarded by other farmers as able and worth of imitation.
- (2) They should be practicing farmers.

- (3) They should be willing to adopt relevant recommendations on at least a part of their land, allow other farmers to observe the practices, and explain the practices to them.
- (4) As far as size and composition of farmers' groups permit, they should come from different families.
- (5) Their farms should be dispersed throughout the group area.

Effective extension depends on extension messages reaching many farmers, and many farmer's problems reaching the extension staff, quickly, effectively and regularly. To achieve this, fixed visits are made by the FEWs to specific groups of farmers within a precisely defined area (unit). The size of the unit is derived from a broad ratio of effective operating farm families to a FEW. It is based on the compactness of settlement, the ease of communications, and the intensity of agriculture. However, there is no standard rule for determining the number of operating farm families to a FEW.

2.2.2 Monitoring and Evaluation in Agricultural Extension

Monitoring and evaluation are integral components of agricultural extension. Monitoring activities ascertain whether the extension services are being made available to the farmers, whether the farmers are taking advantage of them, whether they are adopting the recommendations on a sustained basis, and with what immediate consequences (Murphy and Merchant 1988). Monitoring is a continuous, analytical process through which extensionists receive frequent updates on three key questions:

- (1) Are agricultural programmes and projects being implemented as planned, on schedule and within budget?
- (2) Are the programmes and projects leading to expected results?
- (3) What is causing delay or unexpected results, and is there necessity to revise or modify the original plans?

It can therefore be ascertained that monitoring and evaluation data ranges from that of the extension staff, financial situation, inventory of equipment to reviews and explanations of the farmers' reactions to the services provided and of the benefits derived.

Monitoring function encompasses all activities related to the coordination, analysis, interpretation and reporting of the data obtained for instance at the farm level. This function provides feedback on the nature and extent of progress achieved in implementing the various activities compared with what had been planned. Evaluation function on the other hand seeks to explain and if possible measure the level of efficiency of implementation of the planned activities, in relation to costs and accrued benefits, to re-assess the relevance of the objectives and eventually its contribution to overall development.

Evaluation therefore focuses on the performance of the program in achieving its objectives, output, effects and eventually impact of the program and its economic and financial efficiency of the program. Information on agricultural extension monitoring and evaluation is presented in form of formal progress reports, problem diagnostic reports, and monitoring briefs. Formal progress reports are periodic reports that

establish the current status of the activities being monitored and accomplishment of the work program. The progress being reported should be compared with what had been planned. The current or potential problems should be discussed. A progress report reviews all activities on the work program for the review period.

Problem diagnostic reports are limited to the findings on a specific problem. These reports should be short, highlighting the causes of the problem studied, their consequences for extension program and possible course of action. Monitoring briefs are short (2-3 pages maximum) reports, which convey key findings or bring a specific problem to the attention of the extension officers. Monitoring briefs can be in the form of a memo addressed to named individuals and can be used in conjunction with a longer report for a brief review of the key findings.

2.3 Conceptual Framework

2.3.1 Nagel's Agricultural Knowledge System Model

Uwe Jens Nagel of the technical University of Berlin (1980), is credited as the one who first introduced and elaborated the concept of agricultural knowledge system for extension. The function of this concept is to produce and safeguard a stream of new technological knowledge and a flow of industrial inputs in which the new knowledge is embodied, complemented by investments in general education and in production education for farmers and by efforts to transform institutions to be consistent with the new growth potentials.

The system includes:

1. A research sub-system.
2. A dissemination sub-system.
3. A user sub-system.

The system must perform six basic functions in order to ensure initiation and perpetuation of the information flow process:

4. Identification of knowledge needs at the producer level.
5. Generation of innovations.
6. Operationalization for utilization.
7. Dissemination.
8. Utilization.
9. Evaluation of experiences.

The basic model combining the sub-systems and the six basic functions is given in figure 2.1. The model emphasizes the flow of information from users, both as need for information and evaluation. The agricultural knowledge system is interactive, not a one-way flow.

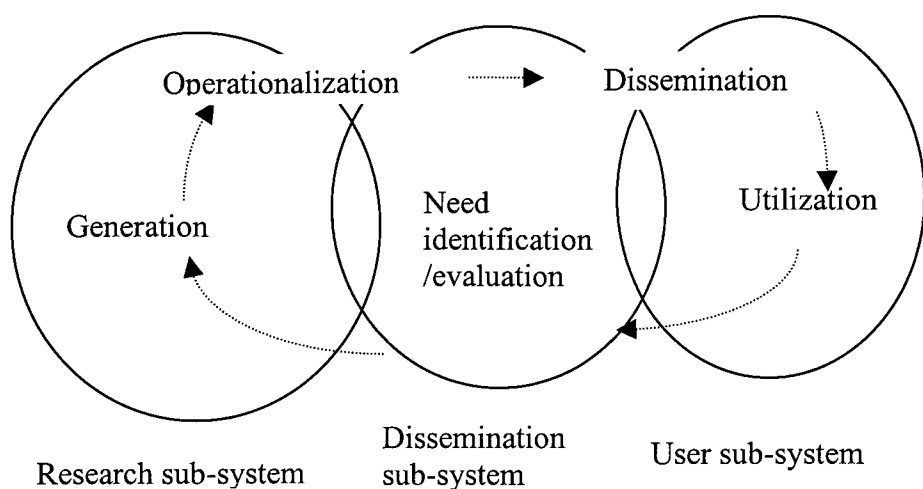


Fig. 2.1: Basic Elements of the Agricultural Knowledge System Model

A shortcoming of Nagel's model is that it suggests that solutions come from research and problems come from the farmers, as if farmers do not carry out some of their own research and solve many of their farming problems. To fill this gap, this study adopted the participatory approach, which recognizes the place of the farmer in research and extension.

2.3.2 Diffusion Methodological Approach

Gould, Taaffe and Morrill (1963) made one of the earliest contributions to spatial diffusion as a mode of analysis of development. They viewed the expansion of the transportation networks of Ghana and Nigeria as a process of spatial diffusion. By their application of this methodology, certain broad regularities were brought to light thus furnishing a descriptive generalization of an ideal-typical sequence of transportation development.

Six sequences of transportation developments were posited ranging from the initial stages of scattered ports, penetration lines and port concentration to complete interconnection and emergence of priority routes between ports and roads. Later in 1964, Gould noted that the process of modernization diffuses through the space of a nation-state and that one geographical contribution to the analysis of modernization would be to trace the way its components have diffused spatially within a specific time period. Gould pointed out that spatial diffusion may be examined at the micro level in terms of the spread of ideas and innovations from person to person and also at the macro level of aggregation by measuring the spatial spread of institutions.

Chitere and Mutiso (1991) on diffusion of innovations model notes that the model shows the way social change could be brought about in a given community through adoption of innovations by the members of the community. The model emphasizes adoption of innovations by individual members of communities. According to schonherr and Mbugua (1973), in Chitere and Mutiso (1991), innovations could be introduced to a few members of a social unit e.g. a village. From these few members, innovations could diffuse, trickle down or be communicated to other members of the social unit.

The factors which influence the diffusion process include, the innovation decision process (Figure 2.1), personal characteristics of adopters which include the speed at which the adopters are found to adopt new ideas, the willingness to take risks and how open they are to new ideas. Other factors include attributes of an innovation which show the relative advantage which is the degree to which a new idea is perceived as being better than the old idea it replaces, and the process of communication of

innovations to their would be adopters (Rogers and Shoemaker, 1971, and Lionberger and Gwin, 1982).

The communication process model involves sending message from the sender, through a given channel whereby several barriers have to be overcome before the message is received by the receiver. The process is usually not complete without a feedback from receiver to the sender and vice versa (Figure 2.2).

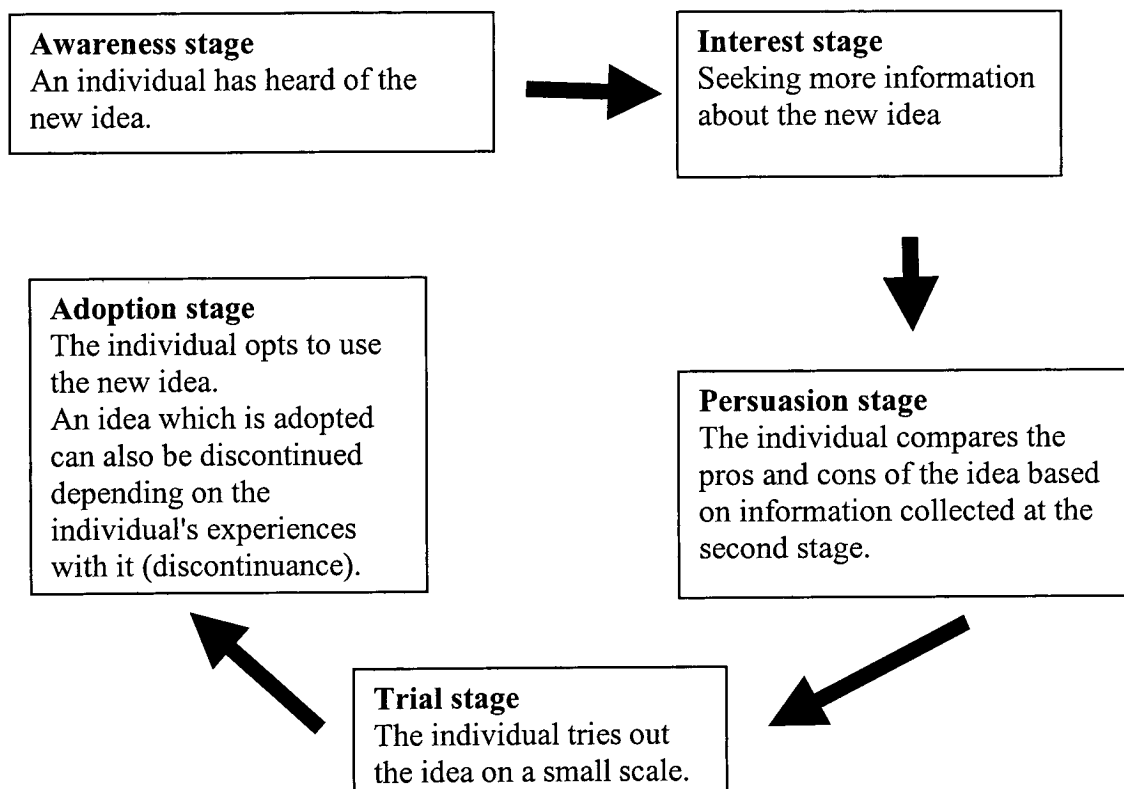


Fig. 2.2: Innovation Decision Process

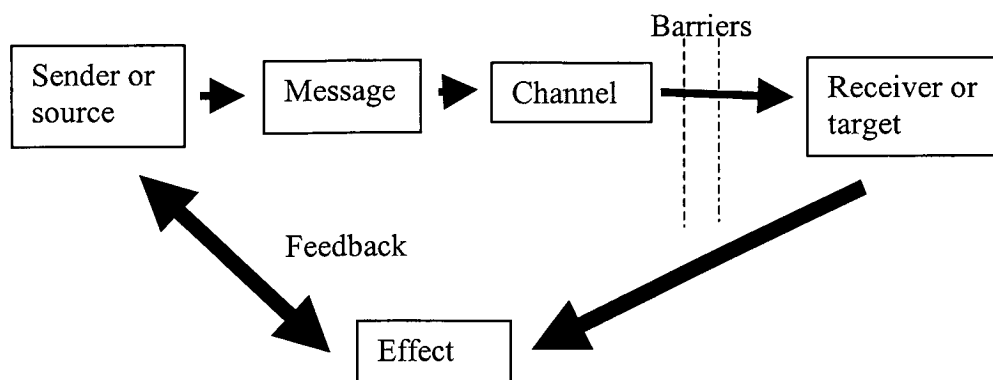


Fig. 2.3: Communication Process

The communication process (figure 2.3), is affected by factors which include the type of media used, target population, opinion leadership, channels used, language used and outlook of the agent (Roling and ascroft, 1971; Lionberger and Gwin, 1982). The application of spatial diffusion in the study of development and underdevelopment merges with spatial differentiation and spatial integration approaches. In spatial differentiation, typical characteristics of development are identified and their spatial distribution or variation established. In the context of the current study issues to be evaluated in relation to the role of agricultural extension services in maize production in Tharaka-Nithi District included delivery and adoption of research and extension advice.

Spatial diffusion concerns itself with how the identified characteristics or at least a selection of them are diffused from one area or from one agent to another. In the focal area approach for instance, the extension officers are charged with the duty of extending the various services to the selected farmers. This is through channels such

as farmers' training, farming systems demonstrations, on-farm trials. It is hoped that information will eventually diffuse to the rest of the farmers. For the case of a farming demonstration the extension officer sets up a demonstration from where the other farmers can learn and adopt what they learn in their farms.

In spatial integration, on the other hand, the focus is on how the characteristics of development identified in spatial differentiation, and diffused according to spatial diffusion, are integrated by the end users. In the current study, adoption of agricultural innovations and incorporation of extension advice into the existing farming systems were analyzed to establish the level of adoption and its utility in promoting maize production in the study area. The diffusion theory provides an ideal mode of analysis of how innovations emanate from the extension officers and are eventually adopted by the farmers. However emphasis is largely laid on the role of the extension officer in ensuring that the farmers adopt the desired innovations.

Lack of recognition of the role of the farmer in the process of developing and adoption of the innovations has often led to situations whereby farmers have shown reluctance or even complete refusal to adopt recommended technological innovations or even taking up research and extension advises as was established by this study. To supplement this shortcoming, participatory methodological approach was adopted and is discussed in the section that follows.

2.3.3 Participatory Methodological Approach

Leeuwis (2000) highlights the participatory methodology as a key methodological principle for intervention practice. Participatory methodologies primarily perceive participation as a process in which actors supposedly participate in planning, decision-making and or social learning. Such methodologies include Participatory Rural Appraisal (PRA), Participatory Action Research (PAR), Participatory Technology Development (PTD) and Farmer Participatory Research (FPR). They are key methodologies in making a community-based situational analysis for further local action, problem solving and or project identification (Chambers 1994, Rahman 1993).

Engel (1965) suggests Rapid Appraisal of agricultural knowledge (RAAKs) as an additional methodology in participatory approach. Engel notes that RAAKs is particularly important in making a diagnosis on how inter-institutional network functions in order to identify the opportunities and to improve the innovative capacity of the network. These methodologies are important in evaluating the role of the government in facilitating extension, which is very important in explaining the performance of the extension machinery in provision of both research and extension advice.

The concept of participation is significant in this study because it advocates farmer involvement in developing alternative technologies that are adapted to their local farming situations. This concept would greatly aid in the process of adopting technologies since the farmers would feel that they actually participated in the process

of developing the innovations, and that the extension machinery is not imposing the innovations on them.

On the other hand, FPR is important in enhancing farmers' adoption of the research findings. This method increases farmers' enthusiasm in utilizing knowledge they have participated in generating. FPR and PTD are particularly suitable in solving socio-technical problems in the development of low external-input sustainable agricultural (LEISA) systems. Leeuwis (2000) advances several arguments on the applicability of this approach:

- (1) The wish to gain access to relevant information networks and target groups.
- (2) The idea that people never change without motivation or involvement of some kind or another.
- (3) The conviction that actors have a wish, moral right and/or duty to participate in an effort to change their own situation.
- (4) The wish to emancipate and empower particular groups in society for instance the farmers.

All the above arguments justify the viability of this approach in sustainable development. However the rationale for using a particular methodology vary from context to context. All the five methodologies recognize and emphasize the existence of different stakeholders in a problem situation. In the current study, the extension agents who can be regarded as forces of change and the farmers are the main stakeholders.

The methods and techniques utilized in this approach use a mixture of planning, decision-making and social learning models as the organizing principle in participatory approach. Planning and decision-making involve such activities as situation analysis, problem identification, goal formulation, selection and evaluation of alternatives, implementation and evaluation. Planning and decision-making models propose that change comes about (or should come about) through the above processes. It is through them that effective extension services can be provided.

After problem identification, (for instance declining maize production), the extension machinery has to set goals whose achievement will justify the extension services. The recognition that such a problem is not a result of one constraint presents the need to set and evaluate alternatives to the same problem. Implementation of the best alternative should be followed by evaluation to ascertain its success or failure for further action.

This approach stresses PRA as the first step in a formal planning process. Chambers (1994) sees PRA as the start of a process in which people have enhanced knowledge and competence, an ability to make demands and to sustain action. When applied to planning, RAAKs consists of two phases: situation analysis (problem definition and system identification), and constraint and opportunity analysis. In relation to the current study, inefficient agricultural extension was identified as a partial constraint in agricultural development. Participatory approach is particularly important in facilitating for people to be able to conceptualize their problems and plan for remedial action usually for improvement.

This approach advocates for participation by the stakeholders in problem identification goal setting, implementation and evaluation. It also stresses ranking as an important tool in decision-making. Ranking lays the basis for identifying the most important problems, which warrant immediate attention and the most feasible opportunities for solving them. It is thus a tool for making democratic community decisions about future action strategies and projects. This sets the stage for community action, intervention projects, and on-farm demonstrations and experiments. This then calls for prioritizing of extension operations for systematic implementation.

2.4 Chapter Summary

The foregoing chapter has presented a review of literature on the role of agricultural extension services. The review has demonstrated that agricultural extension has a major role in information dissemination by conducting farmers training, on-farm trials, farming demonstrations and developing, testing and extension of innovations in collaboration with researchers. The review has also indicated that extension has a role in linking the farmers and researchers and therefore filling the gap in research-farmer linkage.

The extension officers have a role in promoting agricultural research by taking part in on-farm and off farm trials, diagnosing farming problems, interpreting research findings to the farmers and providing feedback from the farmers to the researchers on the process of innovation adoption which is very important since it forms the basis of further research. The place of monitoring and evaluation in agricultural extension has

also been discussed. It has been shown that monitoring and evaluation are crucial in ensuring the proper utilization of programme or project resources to achieve the set short and long term goals and objectives.

Finally the chapter has discussed the conceptual framework guiding the study. Nagel's agricultural knowledge system model, Diffusion and participatory methodological approaches have been brought out as being important in information dissemination and adoption of research and extension advice. Nagel's model has demonstrated that the agricultural knowledge system must perform six basic functions in extension. However, the model has been criticized as being inadequate on the grounds that it assumes that the solutions to farmers' problems come from research while problems come from the farmers. The reality on the ground though is that farmers often carry out research on their own and solve many of their farming problems.

The diffusion methodology has demonstrated that extension advice must diffuse from the extension officers to the farmers, while the farmers have to actually incorporate the extension recommendations into their farming systems if the envisaged results are to be realized. The participatory approach advocates for farmer participation in both research and extension activities. Such activities include developing and testing technological innovations. This is bound to increase farmers' enthusiasm in adopting extension recommendations. This is bound to increase farmers' enthusiasm in adopting extension recommendations, which justifies the entire extension process.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter presents the methodology of the study. Specifically, the chapter discusses the sampling procedure, data collection and the techniques of data analysis.

3.2. Population of the Study

The Ministry of Agriculture officers in the district (district and divisional agricultural officers, extension officers), and the farmers formed the population from where the sample was drawn. Sampling was done on the population for the purpose of data collection. The study sample comprised of 130 respondents who included 10 extension officers drawn using purposive sampling strategy and 120 farmers drawn through simple random sampling.

3.3 Sampling Design

The 120 farmers who constituted the study sample were drawn from the six locations in Chuka Division. Chuka Division was selected on considerations that it houses the district headquarters and the ministry of agriculture offices. The division is also fairly accessible by road network a factor that facilitates increased interaction between the farmers and the extension officers. Chuka Division has also the highest number of locations in the district, and data was collected from all the six locations namely Karingani, Kiang'onde, Muiru, Mugwe, Kithangani and Gitareni

3.3.1 Purposive Sampling

Key informants were identified from the Ministry of Agriculture office in the division, who included ten (10) frontline extension workers from a total of twenty-five (25) officers dealing with the provision of extension services. A self-administered questionnaire was used to obtain the desired information from the extension officers operating in the six locations in Chuka Division.

3.3.2 Simple Random Sampling Strategy

Simple random sampling strategy was used to draw a sample of 120 farmers who provided the desired information for this study. From the 1999 population census, Tharaka-Nithi District had a total of 46,984 households, while Chuka Division had a total of 12,596 households (GoK 2001C, GoK 2001d). The division had a total of twenty sub-locations, and data was collected in all the sub-locations. Sampling was done proportionately and therefore the sample distribution per location depended of the number of sub-locations in a particular location.

Six farmers were drawn from each sub-location. Karingani Location had a total of five Sub-locations and therefore provided 30 farmers. Kiang'onde and Kithangani had four Sub-locations each and thus provided 24 farmers each for the survey sample. Gatareni Location had three Sub-locations and 18 farmers were sampled. Muiru and Mugwe Locations had two Sub-locations each and 12 farmers were drawn from each of the two locations.

The figure 12,596 (households in Chuka Division) was taken as the population "N" and a sample of 120 households was taken as "n". Each household provided one respondent herein referred to as the farmer. The assistant chiefs (administrators of the Sub-Locations) and village headmen (administrators of the villages) provided lists of households under their jurisdiction. From the lists, The households were given folio numbers, which were in duplicate. The duplicates were mixed together from where six of them were randomly picked and counterchecked against the households to ascertain the six households from where six household representatives would be included in the survey sample for interviewing in each of the twenty sub-locations. Random sampling was used so that every household had equal probability of being picked for interviewing.

3.4 Validity and Reliability of the Research Instruments

Validity of a research instrument is demonstrated when the instrument is seen to be asking the right question framed in the least ambiguous way. It therefore answers the question, "are my findings true?" (Kathuri and Pals, 1993). To test the validity of the instruments used in this study, the instruments were availed to selected researchers at Moi University who commented and advised the researcher accordingly as regards the quality of the instruments. A pilot study, which was carried out before the actual data collection also, served to test the validity of the research instrument.

Reliability on the other hand refers to the consistency an instrument demonstrates when applied repeatedly under similar conditions. In determining the reliability of the

research instruments, the researcher used the spreadsheet computer software package statistical package for social sciences (SPSS).

3.5 Training of the Research Assistant

The researcher engaged one research assistant who assisted in data collection. The research assistant had a thorough knowledge of the study area having been born and brought up within it, and had experience in data collection. He was a good communicator who portrayed natural curiosity and interest in the respondents. He assisted in examining records in the ministry of Agriculture offices, making field observations and administering questionnaires to the farmers. The research assistant was trained on such aspects as:

- (1) How to use the questionnaire to avoid mistakes in the recording.
- (2) How to make and record certain observations on the farm.
- (3) The meaning of each item in the observation form and the questionnaire.
- (4) How to rephrase questions not understood by the respondents.

The researcher having made a thorough review of the questionnaire with the assistant, the researcher carried out an interview with the research assistant as the respondent. The flexibility of the questionnaire was stressed with the researcher demonstrating the value of follow-up questions. This was important in order that the research assistant could grasp the complexity of some of the questions and to ensure effective translation.

During the survey the researcher worked in collaboration with the assistant in order to motivate him, resolve any problems that may arise in completing the instruments and to mediate any problems of cooperation between the research assistant and the respondents. The questionnaire was checked constantly for incorrect recording, lack of data and inconsistency in information.

3.6 Data Collection

3.6.1 Pilot Study

The research instruments were pilot tested before the actual data collection to verify whether the questions asked and the observations made would be useful in achieving the objectives of the study. Twelve farmers were interviewed in the pilot study, two from each of the six locations. Two key informants were identified for the purpose of the pilot study. The pilot study did not necessitate significant changes on the research instruments and therefore the respondents in the pilot study were included in the sample population.

3.6.2 Primary Data

Primary data was collected from a sample of 130 respondents who comprised of 120 farmers and 10 extension officers. The study adopted the following two methods in collection of primary data.

- Questionnaires.
- Observation schedule.

A combination of these methods was used for gathering data in any one particular situation.

3.6.2:1 Questionnaire

A questionnaire, which was administered orally, and in a face-to-face basis, was used to collect information from a sample of 120 farmers. A self-administered questionnaire was used to collect desired information from ten (10) extension officers. The interviews were conducted in an informal manner and the researcher and his assistant ensured a relaxed atmosphere. As much as possible the impression that the interview was some kind of oral quiz was avoided.

The questions were read out to the respondents slowly and exactly the way they were worded to maintain consistency. In instances where the respondents did not understand English, the questions were rephrased into Kiswahili or the local Kimeru language. The respondents were free to ask for clarification where they did not fully understand the question. The questionnaire was designed in such a way that each section was in line with a particular objective which the study hoped to achieve.

3.6.2:2 Observation Schedule

Through this method of data collection, the researcher and his assistant visited a total of 120 household farms belonging to the 120 farmers who comprised the study sample. Before conducting the observations, the researcher and his assistant explained to the farmers why they wanted to undertake such an activity. This was very

important in reducing suspicion on the intention of the field observation. Usually the farmer accompanied the researcher or the assistant and showed them round the farm in a relaxed manner. This method proved very important in concretizing some aspects, which featured in the questionnaire such as the level of innovation adoption by the farmers. This method was used to collect information on:

- Varieties of maize grown,
- Soil conservation measures,
- The level of weed control,
- Spacing and plant population,
- Crops and farming practices demonstrations,
- If there are any on-farm experiments in progress.

By adopting this method the researcher could easily notice some issues, which were taken for granted by the respondent and may not be reported in the questionnaire. Moreover, observation is independent of the respondents' willingness to respond to the questions asked. This method enabled the researcher to discover the situation on the ground rather than relying wholly on information from the respondents.

Use of personal observation and questionnaire was chosen to enhance reliability and validity of data collected. This technique is an accepted method in research, commonly known as triangulation. It lends credibility to the findings of a study when they are based on several accounts and sources. Moreover, most of these data cannot be adequately gathered from the current literature by use of a single method or from one source.

3.6.3 Secondary Data

Secondary data was collected from documented published and unpublished literature in libraries, resource centers, and offices. These materials are for instance textbooks, development plans, sessional papers, reports and policy papers, journals and newspapers. Secondary data provided background information on the type of researches that have already been carried out concerning agricultural extension and what remains to be done. It also provided information on factors influencing maize production and particularly as it relates to extension services, and efforts being made by the farmers and the government to address the problem of declining maize production in the study area. Secondary data supplemented the questionnaire and observation techniques in gathering the desired information.

3.6.3:1 Examination of Records

The researcher conducted a physical survey of records in the ministry of Agriculture offices in the division and collected information for instance on extension officers, records of maize yields, and annual rainfall.

3.7 Data Analysis

The aim of the data analysis was to summarize the findings of the study in such a way that generates answers to the research objectives. Data was analyzed using a variety of methods that were appropriate to the data collected. Content analysis on data obtained was extensively used, followed by simple statistical analysis. Patterns, categories and themes that emerged from an analysis of data collected were edited, coded and

summarized in suitable tables and diagrams. In addition to these methods, statistical analysis using the spreadsheet computer software package, Statistical Package for Social Sciences (SPSS) was done to bring out relationships. The study hypotheses were subjected to a chi-square test, at 0.05 significance level for acceptance or rejection of the null hypotheses.

3.8 Ethical Considerations

The researcher observed high code of ethics in the process of reviewing the relevant literature, data collection and in report writing. The researcher and the assistant sought the consent of the respondents to be engaged in this study. This ensured that they participated in the interviews in a relaxed manner, as it was a show of courtesy, which recognized their worth in this study. The purpose and significance of the study was explained to the respondents as it relates to agricultural extension and maize production. Simple language was used in carrying out interviews and where necessary questions were translated into Kiswahili or the local Kimeru language. This ensured that the respondents understood fully the questions asked and thus they were in a position to respond effectively.

The researcher and his assistant maintained objectivity in the process of data collection. The level of interaction with the respondents was checked to avoid undue bias, which would lead to being given information for the sake of pleasing the researcher. All the respondents were treated with respect and equality. The researcher and the assistant assured them of confidentiality of the information availed and that it would only be used for the purposes of this study. All the published and unpublished

literature made reference to is cited in the references to avoid plagiarism. All the support received either morally or in kind is acknowledged.

3.9 Limitations of the Study

There were several limitations to the study, which were experienced, but were appropriately addressed. Communication barrier was a major limitation in this study. This is because the majority of the residents were not able to communicate in English. This limitation was overcome by use of both Kiswahili and where necessary the local Kimeru language, which were then translated into English for the purpose of filling out the questionnaire. Language barrier was experienced mainly with the farmers.

The residents were uneasy and suspicious of the researcher and his assistant. This may have been as a result of the problem of insecurity, child abduction and still the researcher and the assistant could have been mistaken to be on a “spying “ mission for instance on the use of illegal arms. The uneasiness and suspicion was resolved through explanation of the actual intention of the research.

Tharaka-Nithi District has become used to occasional relief food supplies. The interest of the research team was mistaken to be an assessment of the food situation and more so prevalence of hunger with the intention of making the findings known worldwide. This reduced enthusiasm on the part of some respondents. However, this problem was overcome through elaborate explanation of the intention of the study and

planning for continuous field studies other than paying inconsistent short visits to the farmers and the key informants.

Although Chuka Division is served by Thuci-Nkubu tarmac road, generally the division has not achieved a well-developed road network. The feeder roads are mostly dry-weather, loose surface roads, which become muddy and flooded during the rainy season. Most of them are impassable under such conditions. Although these areas are well served with feeder roads there is hardly any means of public transport operating on these feeder roads. Thus lack of an efficient means of transport was a major limitation of this study. However the researcher and his assistant utilized alternative means of transport such as cycling or visits on foot.

Despite these limitations, efforts were made to make the study a success. All the 120 farmers who formed the study sample were visited and interviewed within the stipulated time of data collection. Additionally, all the 120 household farms belonging to the 120 farmers were visited for the purpose of making field observations.

CHAPTER FOUR

4.0 DATA ANALYSIS AND PRESENTATION

4.1 Introduction

The previous chapters have presented background to the study, literature review and the methodology adopted in sampling, data collection and analysis. This chapter presents the findings of the study on the role of agricultural extension services in maize production in Chuka Division, Tharaka-Nithi District, Kenya. The chapter is organized into five sections. The first section presents the respondents' characteristics. The study objective that the spatial location of the farmers influences the provision of extension services and farming activities in the study area is presented in section two.

Section three discusses the timeliness of agricultural extension services in the study area, while section four examines the status of farmer training and farming demonstration in relation to maize production. The various methods used by the extension officers in information dissemination, constraints to effective delivery and adoption of extension services are presented in the fifth section. Recommendations for effective delivery of extension services are presented in section six.

4.2 Characteristics of the Respondents

The sample population for this study comprised of 130 respondents who included 120 farmers and 10 frontline extension workers (FEW). The farmers were drawn from the six locations in Chuka division, which were divided into core and periphery locations.

The core locations which were at a distance of 0-10 kilometres from Chuka Town comprised of Kiang'ondu, Karingani and Mugwe Locations. Peripheral locations were those at a distance of 11 Kilometres and beyond, which included Muiru, Kithangani and Gitareni Locations.

4.2.1 General Characteristics of the Farmers

The farmers were requested to provide some general information relating to their demographic and socio-economic background. Such information was on gender, marital status, age, level of education, form of employment and the nature of land tenure they occupied. The study investigated into these variables since they play a vital role in adoption of extension recommendations and land resource utilization.

On gender, out of the 120 contact farmers involved in the study, 82 (68.34%) were males, 50 (41.67%) from the core locations and 32 (26.67%) from the periphery. Female respondents were 38 (31.6%) in number, 16 (13.33%) from the core locations and 22 (18.33%) from the periphery. The characteristics of the farmers are summarized in table 4.1.

The gender discrepancy reflected in the survey sample was not by coincidence. The culture in the study area demands that the man should talk on behalf of the family. Employing women proved much more difficult than men, largely because of cultural constraints restricting their freedom to lead in a talk when the man is around. In instances where the man and the woman were available for interviewing, it is the man who would lead the talk.

Further, women were found to be timid to talk and especially when the husbands were around. Women required a higher investment of both time and energy. It was difficult for them to be engaged since their daily chores could rarely be postponed. In such instances the researcher and his assistant arranged for another time when such a respondent would be free to participate in the interview.

Men were more inclined to lay down the task at hand and participate in the interview. This reflects a male culture, which sets aside time and space for communal debate. Men generally talked with greater ease for long periods of time without faltering whereas women usually needed much more encouragement.

Gender bias was evident in the provision of extension services. The respondents reported that the extension officers mostly preferred talking to the man as the head of the household. However, in view of the fact that women provide most of the farm labour, this significantly influences the adoption of extension advice from the extension officers. Kiragu (2002) and Mutoro (1997), have argued that female dominance in agriculture means that the agricultural extension programme which assumes a male farming system especially in the developing countries is inappropriate. Masinde (1991) while addressing this anomaly has argued that under this framework men are perceived as producers in agriculture while women are seen as cooks or home managers.

Table 4.1: Farmers' Characteristics

RESPONSE	PERCENTAGE		Chuka Division
Locational distribution of the sample	Core locations-(0-10Kms). (Kiang'ondeu,Karingani, Mugwe)	Peripheral locations- 11 Kms. and beyond (Muiru, Gitareni, Kithangani)	
	66 (55%)	54 (45%)	120 (100%)
TOTAL	66 (55%)	54 (45%)	120 (100%)
Gender			
Male	50 (41.67%)	32 (26.67%)	82 (68.34%)
Female	16 (13.33%)	22 (18.33%)	38 (31.66%)
Total	66 (55%)	54 (45%)	120 (100%)
Marital status of the respondents			
Single	4 (3.33%)	3 (2.5%)	7 (5.83%)
Married	58 (48.33%)	49 (40.83%)	107 (89.16%)
Separated	1 (0.83%)	0	1 (0.83%)
Widowed	3 (2.5%)	2 (1.67%)	5 (4.17%)
Total	66 (54.99%)	54 (45%)	120 (99.99%)*
Number of household members			
1-6	30 (25%)	24 (20%)	54 (45%)
7-13	35 (30.00%)	28 (22.50%)	63 (52.5%)
Above 13	1 (0.83%)	2 (1.67%)	3 (2.5%)
Total	66 (55%)	54 (45%)	120 (100%)
Main ways of generating income			
Only farming			
Business	46 (38.33%)	33 (27.5%)	79 (65.83%)
Formal employment	13 (10.83%)	16 (13.33%)	29 (24.16%)
	7 (5.83%)	5 (4.17%)	12 (10%)
Total	66 (54.99%)	54 (45%)	120 (99.99%)*
Educational level of respondents			
None			
Primary	4 (3.33%)	7 (5.83%)	11 (9.16%)
Secondary	29 (24.17%)	25 (20.83%)	54 (45%)
Tertiary	24 (20%)	18 (15%)	42 (35%)
University	8 (6.67%)	4 (3.33%)	12 (10%)
	1 (0.83%)	0	1 (0.83%)
Total	66 (55%)	54 (45%)	120 (99.99%)*

Source: Author's Survey, 2001/2002.

Women in Kenya are both home managers and are instrumental in agricultural production and hence the need to redesign the context and approach of agricultural extension. As Masinde (1991) rightly puts it, improvement in agricultural production and utilization depends on the extent to which women are actively involved in agricultural transformation. As such the place of women in such an economy as Kenya's which is heavily dependent on agriculture should not be over looked or underestimated.

Regarding the age of the respondents, the study found that one respondent was aged between 18-25 years, 8 (6.7%) were aged between 26-33 years, 32 (26.7%) 34-41 years, 16 (13.3%) between 42-49 years, 27 (14.2%) between 50-58 years, 17 (14.2%) 59-66 years and 19 (15.8%) were aged above 66 years.

In relation to the marital status of the respondents, most of the farmers interviewed (107) reported that they were married. Out of these, 58 (48.33%) respondents were from the core and 49 (40.83%) were from the periphery. A total of seven farmers were single, one farmer was separated while five were widowed. This shows that a significant percentage of the married respondents were from the core zone. Figure 4.1 shows the marital status of the farmers.

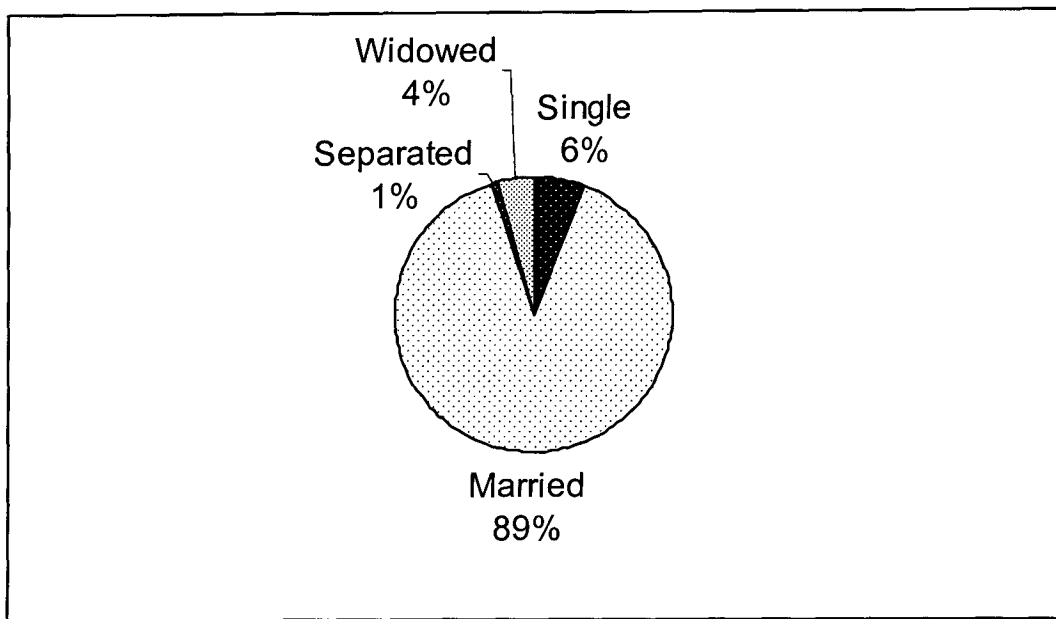


Figure 4.1: Marital Status of the Farmers

The study also collected information regarding the sizes of the households in the study area. The results showed that most of the households 63 (52.5%) had between 7-13 members. Households with 1-6 members were reported by 54 (45.0%) of the respondents, 30 (25%) in the core locations and 24 (20%) from the periphery. On the number of household members living on the farm, 90 (75.0%) gave a response of 1-6 members, 29 (24.2%) 7-13 members and 1 (0.8%) above 13 members.

As indicated in the results, more than half of the household units had between 7-13 members, while a significant majority had between 1-6 household members living on the household farm. This variable was investigated to act as a basis for commenting on the possible causes of inadequacy of the maize produce obtained by the household. It is thus plausible to argue that the low produce obtained, some of it sold to meet

other household financial requirements cannot adequately cater for the household members in terms of food.

The number of household members was sought to establish whether this could partially explain rise in food insecurity at the household level. The 52.5% of households with 7-13 members represent a significant value which against a background of continued land fragmentation and adverse climatic conditions, this has partly led to food shortages.

Majority of the farmers in the core locations (46, 38.33%) relied only on farming as a way of income generating. A total of 79 (65.83%) respondents, both in the core and in the periphery depended solely on farming not just as their main way of generating income, but also as a way of living. More respondents from the peripheral zone 16 (13.33%) cited business as their main way of generating income as opposed to 13 (10.83%) from the core zone. However more respondents 7 (5.83%) in the core zone were in formal employment as compared to 5 (4.17%) in the peripheral areas.

An investigation into the main ways of income generation was necessary in order to ascertain the place of farming as an enterprise in the overall socio-economic organization of the survey sample. As it emerged from the study, most of the farmers were engaged in farming. This is indicative of the centrality of farming in the study area and hence the important role extension could play in promoting farming, which would lead to a rise in income levels for the local population. Economic diversification may be seen as a way of minimizing risks and vulnerability at the household level. However, this does not solely imply a response to declining maize

yields since diversification has been part and parcel of the economic organization of the local community.

The study established that literacy level was higher in the core than in the periphery. In the core zone, 29 (24.17%) respondents had attained primary school level of education as compared to 25 (20.83%) in the periphery. On secondary level of education, majority of the respondents 24 (20%) in the core and 18 (15%) in the periphery had attained this level, while 12 (10.0%) farmers, 8 (8.67%) from the core and 4 (3.33%) from the periphery had attained tertiary level of education. It was found that only one (0.8%) respondent from the core had attained university education. In total, 11 (9.16%) farmers did not attend any formal schooling (Fig. 4.2).

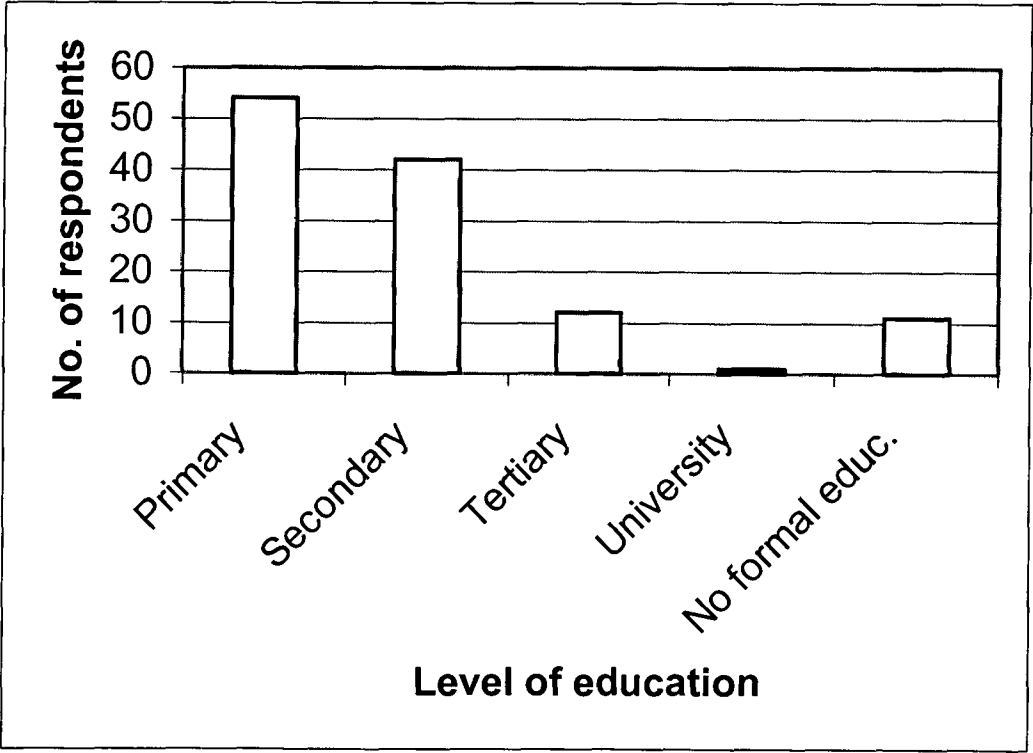


Fig 4.2: Farmers' Level of Education

Majority of the contact farmers (90.83%) reported having acquired formal education. The effectiveness of this variable in enhancing farmers' adoption of extension recommendations is constrained by the limited access to extension advice on a regular basis for instance through training and demonstrations. Both formal and informal education are key factors influencing the process of extension.

Further, education is very important in land resource management and utilization by promoting environmentally sound practices such as soil conservation and preservation. This is vital in avoiding environmental degradation, improve and sustain land productivity. Scholars such as Ipara (1991), Nigel et al. (1993) have advanced the view that farmers with a better educational background have a higher perception of agricultural systems and practices that can alleviate environmental problems facing many rural areas in Africa, and are willing to adopt and implement sound land management practices.

4.2.2 Characteristics of the Extension Officers

A total of ten extension officers (key informants) were involved in the study, half of them males while the other half were females. Five of them were aged between 34-41 years while none of them was aged below 34 years or above 58 years as illustrated in table 4.2. It was also investigated into the highest level of education attained by the extension officers. The levels were categorized into primary, secondary (O-level), tertiary and university. Seven of the extension officers had attained tertiary level (certificate and diploma), three had attained O-Level (secondary), while none was a

degree holder. Half of the key informants had undergone a refresher course since they began working as extension officers.

Table 4.2: Key Informants' Age and Level of Education

Response	Frequency
Age	
34-41	5
42-49	4
50-58	1
Total	10
Highest level of education	
Primary	0
0-Level	3
Tertiary	7
University	0
Total	10

Source: Author's Survey, 2001/2002.

4.3 Spatial Location of the Farmers and Farming Activities

This section presents the study findings and discussion on the influence of spatial location of the farmers in provision of extension services and on farming activities. In the process of sampling as cited earlier in the discussion, the farmers for the study were drawn from the six locations of Chuka Division, which were grouped into core and periphery locations. Majority of the farmers 66 (55%) were drawn from the core, while 54 (45%) were drawn from the periphery. The highest number of farmers were drawn from Karingani location, 30 (25.0 %), followed by Kiang'onde and Kithangani,

24 (20.0 %) each, 18 (15.0%) from Gitareni, and 12 (10.0%) from Muiru location and Mugwe each. Figure 4.3 illustrates the distribution of the sample by locations.

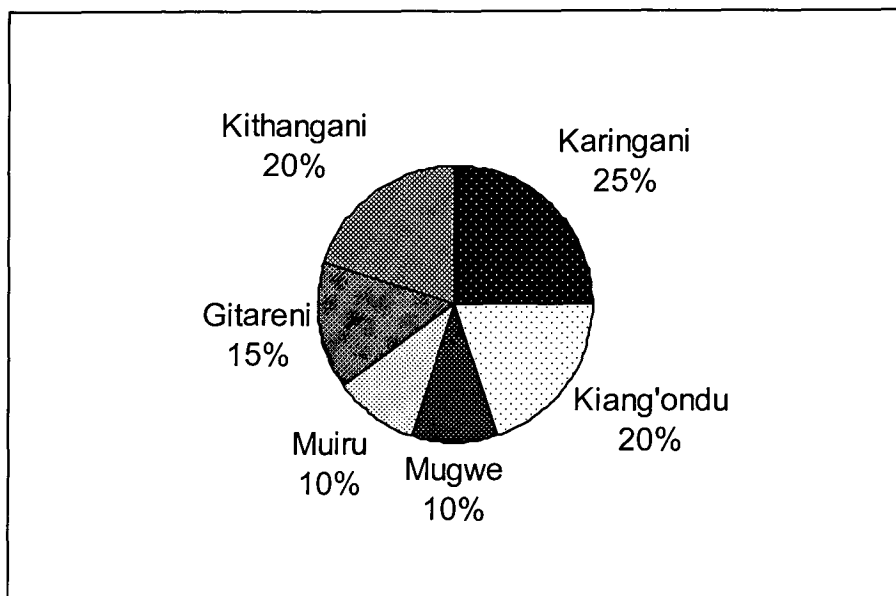


Figure 4.3: Distribution of the Survey Sample by Locations

A bi-variate analysis was carried out through cross tabulation, on the spatial location of the farmers (distance from Chuka Town), and the frequency of visits by the extension officers. This was in order to assess the relationship between the two variables and the results are summarized in table 4.3.

It was observed that the highest frequency of visits by the extension officers was once per week. The three farmers who reported being visited once per week were all from the core zone. Equally of the 15 farmers who were visited fortnightly 11 of them were from the core zone and 4 from the periphery. This trend was observed with the farmers who were visited once per month and once in 2-3 months. This trend appears to change from the frequency of six months onwards. The majority of the farmers

visited once in six months, on request, once per year, those who stopped being visited or have never been visited were from the periphery (Table 4.3). From these findings it can be deduced that there is a relationship between the spatial location of the farmer and the frequency of visits by the extension officers. It was also noted that farmers who were located along the roads were visited more frequently as compared to those who were located in the interior. This was noted in both the core and the periphery zones. Although the frequency of visits differed sharply between the core and the periphery zones, the aspect of the relationship between closeness to the roads and frequent visits was evident in these two zones.

The study had hypothesized that the spatial location of farmers does not significantly influence the provision of extension services in Chuka Division. The computed value was found to be 104.81513 and the critical table value was 101.879, with 80 degrees of freedom. The computed value is thus greater than the critical value at 0.05 significance level and hence the rejection of this hypothesis and acceptance of the alternative hypothesis that the spatial location of farmers significantly influences the provision of extension services in Chuka Division.

Table 4.3: Distance From Chuka Town Viz. a Viz. the Frequency of Visits by the Extension Officers

Response (Frequency of visits)	Core (0-10 Kms.) (No. of farmers)	Periphery (11 Kms. and beyond) (No. of farmers)	Chuka Division (No. of farmers)
Once per week	3	0	3 (2.5%)
Fortnightly	11	4	15 (12.5%)
Once a month	16	0	16 (13.3%)
Once in 2-3 months	3	1	4 (3.3%)
Once in six months	11	18	29 (24.2%)
Once in six months, on request	0	1	1 (0.8%)
Visited on request	8	10	18 (15.0%)
Once in a year	5	7	12 (10.0%)
Stopped being visited	5	6	11 (9.2%)
Never been visited	4	7	11 (9.2%)
Total			120 (100%)

Source: Author's survey, 2001/2002.

Land scarcity was widespread in the core zone than in the periphery. Although all the respondents 120 (100.0 %) reported that they lived on own land, majority of respondents in the core 47 (39.17%) had between 1.0-4.9 acres of land as compared to 33 (27.5%) in the periphery, while more farmers had above five acres of land in the periphery. Majority of the farmers had set aside below one acre of land for maize production in the core as compared to between 1.0 and 4.9 acres in the peripheral zone.

The investigation into this variable was necessary in order to understand whether the size of land set aside for maize production had a bearing on the overall yields obtained. The study found that the farmers who had set aside large tracts of land tended to have higher yields as compared to those who had set aside a small piece of land

All the farmers (100%) interviewed reported that they lived on own land. This variable is significant in respect to proper land management for optimal and sustained production. Due to adverse climatic conditions, lack of relevant information, high cost of inputs and sometimes counterfeit ones, optimal production has not been achieved in the study area as evidenced by declining yields. Most of the farmers 80 (66.67%) reported owning between 1-4 acres.

Further, 54.2% farmers had land elsewhere in addition to the own land, with majority of them 52.3% having between 1.0-4.9 acres. More than half of the farmers (66.66 %) had between 1.0-4.9 acres of land set aside for Maize production, from the total land either own land, rented or leased land. The farmers who had acquired more land elsewhere reported that this was a move geared towards increasing their yields. A summary of farming information is summarized in table 4.4.

The study sought to establish the relationship between the size of land set aside for maize production and Maize yields. A cross tabulation was done on the two variables. The farmers were in two categories, those from the core 66 (55%), and those from the periphery 54 (45%). The size of land was categorized into three: below 1 acre, 1.0-4.9 acres, 5 acres and above. On the other hand, the yields were in three categories: 1-10 bags, 11-20 bags, and 21-30 bags (Table 4.5).

Table 4.4: Respondents' Farming Information

RESPONSE	CORE	PERIPHERY	CHUKA DIVISION
Farm size			
Below 1 acre	1 (0.83%)	3 (2.5%)	4 (3.33%)
1.0-4.9 acres	47 (39.17%)	33 (27.5%)	80 (66.67%)
5.0-8.9 acres	9 (7.5%)	10 (8.33%)	19 (15.83%)
9.0-12.9 acres	3 (2.5%)	7 (5.83%)	10 (8.33%)
Above 13 acres	1 (0.83%)	6 (5%)	7 (5.83%)
Total	61 (50.83%)	59 (49.16%)	120 (99.99%)*
Additional land	YES (n=65)	YES (n=65)	
Own land	26 (40%)	24 (36.92%)	50 (76.92%)
Rented	5 (7.69%)	7 (10.77%)	12 (18.46%)
Leased	1 (1.54%)	2 (3.08%)	3 (4.62%)
TOTAL	32(49.23%)	33(50.77%)	65(100%)
Size of additional land	(n=65)	(n=65)	
Below 1 acre	2 (3.08%)	2 (3.08%)	4 (6.16%)
1.0-4.9 acres	17 (26.15%)	17 (26.15%)	34 (52.3%)
5.0-8.9 acres	6 (9.23%)	8 (12.31%)	14 (21.54%)
9.0-12.9 acres	6 (9.23%)	4 (6.15%)	10 (15.38%)
Above 13 acres	1 (1.54%)	2 (3.08%)	3 (4.62%)
Total	32 (49.23%)	33 (50.77%)	65 (100%)
Land set aside for maize production			
Below 1 acre	26 (21.67%)	11 (9.17%)	37 (30.84%)
1.0-4.9 acres	39 (32.50%)	41 (34.16%)	80 (66.66%)
Above 5 acres	1 (0.83%)	2 (1.67%)	3 (2.5%)
Total	66 (55%)	54 (45%)	120 (100%)

*Error due to rounding of figures

Source: Author's survey, 2001/2002.

**Table 4.5: Cross Tabulation: Size of land Set Aside for Maize Growing Viz. a
Viz. the Yields Obtained by Zones**

Size of land set aside for maize growing (acres)	Yields obtained in (90 Kgs. Bags)	Response	
		Core	Periphery
Below 1 acre	1-10	20	7
	11-20	4	3
	21-30	2	1
Total		26 (21.67%)	11 (9.17%)
1.0-4.9 Acres	1-10	4	5
	11-20	23	29
	21-30	10	9
Total		37 (30.83%)	43 (35.83%)
5 acres and above	1-10	0	0
	11-20	0	0
	21-30	1	2
Total		1 (0.83%)	2 (1.67%)
CHUKA DIVISION		66 (55%)	54 (45%)

Source: Author's survey, 2001/2002.

Results of the cross tabulation indicated that out of the 26 farmers who owned below 1 acre of land in the core zone, majority of them (20), harvested between 1-10 bags of maize. This was also observed to be the case among the 11 farmers from the periphery whereby majority of them obtained similar yields. The tabulation showed that an increase in the size of land set aside for maize growing, led to an increase in the yields for the majority of farmers who owned between 1.0-4.9 acres of land. Out of the 39 farmers in the core who owned between 1.0-4.9 acres of land, 25 of them harvested between 11-20 bags of maize, while out of the 41 farmers in the periphery, 27 obtained a similar range of yields.

This was further illustrated through an analysis of the three farmers who owned 5 acres of land and above. One of the farmers was from the core while the other two were from the periphery. The cross tabulation indicated that all the three farmers harvested between 21-30 bags of maize. The results showed that with the increase in land, the yields too increased, and therefore it can be argued that the size of land set aside for maize production significantly influences the yields obtained.

This hypothesis was further confirmed by chi-square results. The computed value was found to be 31.82984 and the critical table value was 24.9958, with 15 degrees of freedom. The computed value is thus greater than the critical value at 0.05 significance level and hence the acceptance of this hypothesis.

The majority of the farmers in Chuka Division 40 (33.3%) harvested between 11-20 bags of maize (1 bag =90kg,) in a good year comprising of two seasons. This is far below the optional yield of 20-30 bags/Ha /season. Majority of them 88 (73.3%) reported that the yields were inadequate for household consumption. In the situation of a shortfall in Maize production, the farmers compensated for the deficit through multiple ways, which included relief food donations, food for work arrangement and reliance on the extended family and friends. Yields obtained can partially be explained in terms of the size of land owned by the farmer. Attempts to acquire land elsewhere either in rented or leased farms indicate efforts by the farmers to increase their yields. This also indicates land shortage, which aid in explaining the low level of yields in the study area.

4.4 Timeliness of Agricultural Extension Services

The farmers were requested to give information on whether the extension services were timely enough to be of greatest use in farming, and the majority of them 82 stated that the services were not timely. The timeliness referred to the services provided coinciding with the various farming activities such as land preparation, planting, general care of the growing plants, harvesting and post-harvest handling of the yields. The study sought to ascertain whether the timeliness of the extension services influenced the yields obtained by the farmers. To achieve this, a cross tabulation was carried out between the two variables (Table 4.6).

From the cross tabulation, significant observations were made. Among the farmers who owned below one acre of land, majority of them harvested between 1-10 bags of maize. In the core, out of the 26 farmers who owned below one acre of land, 16 farmers reported that the services were not timely. However all the four farmers in this category of land who harvested between 11-20 bags were of the view that the services were timely. This was also the case with the two farmers who harvested between 21-30 bags of maize.

Among the 11 farmers who owned below 1 acre of land in the periphery, only one farmer was of the view that the extension services were timely. This farmer indicated a harvest of between 21-30 bags of maize. There appears to be a close relationship between the farmers who reported that the services were timely and high yields. Of the 39 farmers who owned between 1.0-4.9 acres of land, most of them (22), were of the opinion that the extension services were timely.

Table 4.6: Cross Tabulation: Size of Land Set Aside for Maize Growing, Yields Obtained and Timeliness of Extension Services

Size of land	Yields (Bags)	Response					
		Core (No. of farmers)	Timely	Not timely	Periphery (No. of farmers)	Timely	Not timely
Below 1 acre	1-10	20	4	16	7	0	7
	11-20	4	4	0	3	0	3
	21-30	2	2	0	1	1	0
Total		26 (21.67%)	10	16	11 (9.17%)	1	10
1.0-4.9 Acres	1-10	4	2	2	5	0	5
	11-20	25	13	12	27	0	27
	21-30	10	7	3	9	2	7
Total		39 (32.50%)	22	17	41 (34.16%)	2	39
5 acres and above	1-10	0	0	0	0	0	0
	11-20	0	0	0	0	0	0
	21-30	1	1	0	2	2	0
Total		1 (0.83%)	1	0	2 (1.67%)	2	0

Source: Author's survey, 2001/2002.

The majority of the farmers harvested between 11-20 and 20-30 bags of maize. The farmers in the periphery zone who owned between 1.0-4.9 acres of land equally demonstrated consistency between timeliness and high yields. Although only two farmers reported that the services were timely, they obtained high yields of between 21-30 bags of maize, further demonstrating that there is a relationship between timeliness of extension services and high yields.

This was also evidenced by responses from the farmers who owned above 5 acres of land both from the core and the periphery. The one farmer from the core, harvested 21-30 bags of maize and was of the view that the extension services were timely. On

the other hand, the two farmers from the periphery reported that they harvested between 21-30 bags of maize. In response to the question on timeliness of extension services, the two farmers were of the view that these services were timely. From these findings, it can be concluded that there is a close relationship between the timeliness of agricultural extension services and the yields obtained.

A chi-square test was administered to test whether the frequency and timeliness of provision of agricultural extension services significantly influence the yields obtained. The computed value was found to be 63.34484 and the critical table value was 61.63165, with 45 DF. The computed value is thus greater than the critical value at 0.05 significance level. The null hypothesis that the frequency and timeliness of provision of agricultural extension services does significantly influence the yields obtained was rejected and the alternative hypothesis accepted.

In the overall extension organisation, the frontline extension workers are supposed to interact with the farmers almost on a daily basis. Briefing sessions are on the other hand supposed to be organised for instance with subject specialists and the senior staff such as the extension co-ordinator, divisional and district agricultural officers. The FEWs are required to work with the farmers from the beginning of the season to post harvest period. In this way the extension officers would be in a position to identify the various problems confronting the farmers for appropriate action. This work-plan would also enable research information get to the farmers on time for trials and subsequent incorporation into their farming activities.

Equally, the frontline extension workers would be in a better position to provide feedback from the farmers to the researchers on which further research can be conducted or for clarification. In the event of the FEWs advising the farmers once in a season, it follows that the services rendered may not meet the expectations of the farmers since they may not be problem oriented. Further there is the tendency to overlook the various problems inherent in farming at the expense of what the extension officer feels is more important to the farmers. From this discourse, it is evident that the idea of farmer participation which is a key element of the participatory approach in extension is very vital. Otherwise the extension worker is bound to be seen as an “outsider”, and hence the naivety of the farmers towards him/her.

There is need for the extension worker to recognize that the farmers are pretty aware of their problems, have suggestions on how these problems can be solved for increased yields, but they may lack the technical capability and financial ability to solve them. Close interaction with the farmers will enable the extension officers to grasp farming problems as they arise and hence be in a better position to provide timely services.

The study aimed at establishing how gender played a role in the delivery of extension services. To elicit this information, the farmers were asked whom the extension officers preferred talking to when they were visited. Majority of them 72 (60.0%) stated that the officers usually talked to the head of the household especially the man, 47 (39.2%) reported that the officers talked to any member of the household involved in farming while one farmer stated that the extension officers talked to any household

member whether involved in farming or not. This revelation of gender bias in the provision of extension services is in resonance with the findings by several researchers such as Kiragu (2002), Ipara (1991), Masinde (1991), Nigel et al. (1993) and Mutoro (1997).

The respondents were requested to provide information on whether they had been advised specifically on maize production. Ninety-one respondents (75.8%) said yes while 29 (24.2) said no. The respondents were then asked to specify the various issues advised on, specifically as it relates to maize production and the responses include the following:

- Rainfall requirements.
- Land/seedbed preparation.
- Maize seed varieties.
- Herbicides, pesticides and application.
- Types of fertilizers and manure application.
- Soil conservation.
- General care of the growing maize.
- Harvesting and storage.
- Marketing of produce
- Credit facilities/opportunities.
- Planting requirements e.g. spacing.
- Monocropping systems.

Through the observation method it was noted that majority of the households (56), planted non-hybrid maize seed varieties, 53 households planted hybrid maize varieties, while 11 mixed both hybrid and not hybrid varieties. This variable was investigated into in order to have a basis for commenting on the level of innovation adoption (hybrid seeds), and also to make it possible administer a chi-square test to establish whether there is a relationship between the seed variety planted and the yields obtained. The study had hypothesized that the variety of maize seed planted significantly determines maize yields. To determine this relationship, the two variables were tabulated. (Table 4.7).

Table 4.7: Cross Tabulation: Maize Seed Variety Planted Viz. a Viz. the Yields Obtained

Size of land	Yields (Bags)	Response							
		Core				Periphery			
		No. of Farmers	Hybrid	Non-hybrid	Hybrid, Non-hybrid	No. of Farmers	Hybrid	Non-hybrid	Hybrid, Non-hybrid
Below 1 acre	1-10	20	3	15	2	7	2	4	1
	11-20	4	3	0	1	3	3	0	0
	21-30	2	2	0	0	1	1	0	0
1.0-4.9 Acres	1-10	4	1	3	0	5	1	4	0
	11-20	25	8	15	2	27	14	13	1
	21-30	10	7	1	2	9	5	2	2
5 acres and above	1-10	0				0			
	11-20	0				0			
	21-30	1	1	0	0	2	2	0	0
Total Chuka Division		66	25	34	7	54	28	22	4

Source: Author's survey, 2001/2002.

The cross tabulation on the seed variety planted and the yields obtained showed that farmers who harvested between 1-10 bags of maize mainly planted non-hybrid maize seed varieties. This was evident in the category of farmers who owned below one acre of land both in the core and the periphery zones. However, farmers who harvested 11-20 bags of maize in the category of farmers owning 1.0-4.9 acres of land, mainly planted hybrid seed varieties. This was also found to be true with farmers who harvested between 21-30 bags of maize in this category.

This trend was also evident among the farmers who owned 5 acres of land and above. One farmer in the core harvested between 21-30 bags of maize and reported use of hybrid seed varieties, while the two farmers from the periphery who harvested 21-30 bags equally planted hybrid seed varieties. These results indicates that, there exists a relationship between use of non-hybrid seed varieties and low yields, and on the other hand use of hybrid seed varieties and high yields.

A chi-square test was administered to establish the relationship between the two variables. The computed value was found to be 20.51249 and the critical table value was 18.3070, with 10 DF. The computed value is thus greater than the critical value at 0.05 significance level and hence the acceptance of this hypothesis. The test revealed that there is a significant relationship between the two variables. It is therefore plausible to argue that adoption of hybrid seeds will lead to an increase in yields as compared to non-hybrid seed varieties.

The study also established that different spacing systems were used and especially when the farmers practiced inter-cropping. Generally, the difference came in the

length between one row and another, the distance between one plant and the next one and also on the number of plants per hill. For instance, the 3x1x1 system refers to three feet between the rows, one foot between the plants and one plant per hill. A system of four feet and above between the rows was mostly adopted in instances where intercropping was practiced. These systems were dominant in cases where the farmers mostly planted beans while maize took a secondary position. Where more than one system was adopted, it was observed that the farmers had a separate maize plantation and in another plot, intercropping was practiced. A summary of the various systems adopted by the farmers is illustrated in table 4.8. The system adopted had a bearing on nutrient utilization and subsequent yield.

Table 4.8: Row and Seed System Practiced by the Farmers

Observations	Frequency	%
3X1X1	36	30
3X1X1, 4X1X1	5	4.2
3X1X1, 8X1X1	4	3.3
3X1X1/2	31	25.8
3X1X1/2, 2.5 X1X1/2	1	0.8
3X1X1/2, 2.5X1X1/2, 8X1X1	1	0.8
3X1X1/2, 4X1X1	2	1.7
3X1X1/2, 6X1X2	1	0.8
3X1X1/2, 8X1X1	3	2.5
2.5X1X1/2	29	24.2
2.5X1X1/2, 4X1X1	1	0.8
2.5X1X1/2, 6X1X2	1	0.8
2.5X1X1/2, 8X1X1	1	0.8
4X1X1	1	0.8
3.5X1X1	2	1.7
8X1X1	1	0.8
Total	120	100

Source: Author's Survey, 2001/2002.

It was also observed that 42 (35.0 %) farmers practiced mono-cropping and 78 (65.0%) practiced inter-cropping. The major crops inter-cropped with maize were food crops: beans, millet, cassava, Irish potatoes, sweet potatoes, pigeon peas, yams, bananas. Cash crops: tea, coffee. Horticultural crops: tomatoes, onions and vegetables. Weed was controlled in 67 (55.8%) household farms, 37 (30.8%) partially controlled and not controlled in 16 (13.3%) household farms. Soil conservation was observed to have been achieved in 102 (85.0%) household farms while soil erosion was evident in 18 (15.0%) household farms.

4.5 Farmer Training and Farming Demonstration

The extension officers were asked whether they participated in farmer training and farming demonstrations. All the ten extension officers reported that they participated in these aspects of information dissemination. They further explained that the farmers are not charged for attending the demonstrations, which mostly took place on any farmer's farm. There were efforts to incorporate even school children in the extension system. The extension officers explained that such a move would ensure continuity of farming knowledge, as the children were the future farmers.

Regarding technological innovations, only two extension officers reported being involved in developing technological innovations. One extension officer was involved in research and especially on maize while the other nine were not. It was further inquired into the nature of the researches conducted, and the following was reported:

- Late/early planting and their effect on the plant growth and subsequent yields,
- Adoption of various spacing and seed population systems and how they affect the general plant growth and yields.
- Use of fertilizers versus manure.

Demonstration plots were present in two household farms. In one of the plots, crops demonstrated included carrots, sukumawiki and pumpkin growing using the drip-line method of irrigation. On the remaining farm, arrowroots growing was demonstrated.

The farmers were asked whether they had undergone any training for the last five years for instance by attending a course and or a seminar on farming, 72 (60.0%) farmers reported that they had not, while 48 (49.0%) reported having attended. The 48 (40.0%) respondents, who had undergone training were further asked the major issues taught and they responded as illustrated in table 4.9. It was also inquired into whether the respondents had attended at least one field day for the last five years and 94 (78.3%) said yes, while 26(21.7%) said no.

Table 4.9: Course Attendance, Field Day, Farming Demonstration, Agricultural Show

Response	Course/Seminar		Field Day		Demonstration		Agric. show	
	F	%	F	%	F	%	F	%
Rainfall requirements	2	2.5	3	1.8	0	0	0	0
Land preparation	5	6.2	10	6.1	6	7.0	20	30.3
Maize seed varieties	14	17.3	38	23.0	17	20.0	12	18.1
Herbicides, pesticides & their application	6	7.4	10	6.1	8	9.4	3	4.55
Types of fertilizers & manure application	14	17.3	25	15.2	13	15.3	10	15.1
Soil conservation	4	4.9	4	2.4	0	0	7	10.6
Caring for the growing maize	8	9.9	16	9.7	6	7.0	4	6.06
Harvesting and storage	5	6.2	3	1.8	0	0	0	0
Marketing	1	1.2	1	0.6	0	0	0	0
Credit facilities	0	0	2	1.2	0	0	0	0
Planting requirements	21	25.9	51	30.9	35	41.2	4	6.06
Cropping systems	1	1.2	2	1.2	0	0	6	9.09
Total	81	100	165	100	85	99.9*	66	100

Source: Author's survey, 2001/2002.

- Error due to rounding of figures

A cross tabulation was carried out to establish the relationship between field day attendance and yields obtained. The results are illustrated in table 4.10.

Table 4.10: Cross Tabulation: Farmer Field Day Attendance Viz. a Viz. the Maize Yields Obtained

Size of land	Yields (Bags)	Core (No. of Farmers)	Field day attendance	Periphery (No. of Farmers)	Field day attendance
Below 1 acre	1-10	20	18	7	5
	11-20	4	3	3	2
	21-30	2	2	1	0
	1-10	4	4	5	5
1.0-4.9 Acres	11-20	25	21	29	19
	21-30	10	8	9	6
	1-10	0		0	
5 acres and above	11-20	0		0	
	21-30	1	0	2	1
Total		66	56	54	38

Source: Author's survey, 2001/2002.

Results of the cross tabulation summarized in the above table negate the hypothesis that field day attendance significantly influences maize yields obtained. The hypothesis formulated in relation to this hypothesis was that farmers who attended field days would obtain higher yields as compared to those who did not. This was shown not to be the case since for instance in the category of the farmers who owned below one acre of land, majority of the farmers who had attended field days both in the core and in the periphery harvested the least yields (1-10 bags).

Among the farmers who owned between 1.0-4.9 acres of land both in the core and in the periphery, the majority of farmers who had attended field days harvested mainly

between 11-20 bags of maize. Further, the one farmer who harvested between 21-30 bags in the category of farmers owning 5 acres and above reported that he had not attended any field day. These results showed no direct relationship between field day attendance and yields obtained. The hypothesis that field day attendance by the farmer significantly influences maize production was subjected to a chi-square test. The computed value was found to be 6.30258 with 5 degrees of freedom (DF), while the critical table value was 11.0705. Thus the computed value is less than the critical value at 0.05 significance level. This hypothesis was rejected.

On the question if the respondents had attended a farming demonstration at least once for the last five years, half of them 60 (50.0%) said yes, and the remaining half 60 (50.0%) had not. Of the 60 (50.0%) who said yes, 48 (80.0%) reported that issues on maize production were demonstrated while the remaining 12 (20.0%) said that issues on maize were not demonstrated.

On whether the respondents had attended an agricultural show in any part of the country at least once for the last five years the majority of them 66 (55.0%) said yes and the rest 54 (45.0%) said no. Those who said yes were asked the duration of time they spent at the Show-ground and responded as shown in table 4.11.

Table 4.11: Respondent's Duration at the Show Ground

Response	F	%
Few hours in one day	16	24.2
Few hours in two days	1	1.5
Few hours in three days	2	3.0
1 Full day	29	43.9
2 Full days	12	18.2
3 Full days	6	9.1
Total	66	99.9*

Source: Author's Survey 2001/2002.

* Error due to rounding of figures

Majority of the show attendants 46 (69.7%) visited the agricultural inputs stands while 20 (30.7%) did not. Asked to specify any new inputs they learnt about, the 46 responded that: 7 (15.2%) new maize seed varieties, 14 (30.4%) new maize seed varieties and grain storage chemicals, 6 (13.0%) new maize seed varieties and fertilizers while 19 (41.3%) learnt of the four inputs. Thirty-one farmers (56.1%) visited the farming practices demonstration section while 29 (43.9%) did not.

Although training and demonstration are key strategies for information dissemination several questions have to be addressed if these methods are to play the vital role of information dissemination and especially in relation to maize production, which include:

- (1) Whether during the training sessions, issues on maize production are covered.

- (2) If during farming demonstrations the various aspects of maize production are demonstrated.
- (3) If farmers are given advice on maize production during field days.
- (4) If when the farmers attend agricultural shows they visit the relevant stands exhibiting For instance maize seed varieties, herbicides, pesticides and fertilizers and whether they visit maize demonstration plots.
- (5) Whether the farmers attempt to practice what they learn.

The fact that a farmer may attend a field day, training, demonstration or an agricultural show does not necessarily imply that he/she will put into practice what has been learnt. The extension officers have a role to encourage the farmers to put into practice the knowledge gained. Various, application of what has been learnt implies a demonstrable value for attending the field days, demonstrations and agricultural shows.

Although the study results showed that an encouraging number of farmers had attended field days (94), more than half of the farmers (66) had attended an agricultural show, while 48 had undergone training on farming for the last five years and 60 farmers had attended farming demonstrations, one is confronted with the following question:

“What explains the low level of adoption of extension recommendations and subsequent low yields in the study area?”

The answer to the above query may be deduced from the already discussed issue of frequency and timeliness of extension services. The chi-square test on the

relationship between farmer field day attendance and yields obtained makes it even more clearer that farmers have to actually adopt the extension recommendations and what is learnt from training for an impact to be realised in the yields obtained. Additionally, the training should be timely in order to offer prompt solutions to existing and emerging farming problems confronting the farmers.

A follow-up on training should be undertaken by the extension officers to ascertain that what was offered in training is actually implemented at the farm level. Monitoring and evaluation will serve a great deal in the process of adoption and in the end results which should help in determining whether the training has had an impact on yields obtained and if not, identify the various reasons for the failure.

From the field observation, it was established that only two farms had demonstration plots and none of the plots demonstrated maize production. This appalling situation in relation to farming demonstration was compounded by the fact that the study area had no public demonstration farm or plot from where the farmers could learn the various farming aspects. However, attempts have been made whereby a privately managed demonstration farm has been developed at Kirege Primary School farm. Various aspects of farming were demonstrated at the farm, which included, intercropping, Soil conservation, experimental trials on the use of fertilisers and manure in differing quantities.

4.6. Methods of Information Dissemination and Constraints to Effective Agricultural Extension

4.6.1 Extension Methods

Effective agricultural extension is not just a matter of availability of information and extension agents. It is also an issue of the methodology adopted in ensuring that the available information reaches the majority of the farmers. The extension officers were requested to provide on one part, information on the main methods they used in passing information to the farmers, and second to identify the constraints hampering effective delivery of extension services by the extension officers and adoption by the farmers and thirdly, the likely reasons behind the low adoption of extension recommendations by the farmers.

Several options were provided from where the extension officers were to choose the methods they used in information delivery. These methods were categorized into mass media (newspapers, magazines, radio and television.), group methods (speeches or talks, demonstration, discussion and excursions), and individual visits. As presented in Chapter four, the most widely used method was group method followed by mass media while one of the key informants cited use of the individual visits. An elaborate discussion on each of these methods is desirable.

The duration of training usually ranged between 2-4 hours depending on the topic or theme under discussion. On-farm training was practiced by eight of the key informants, while training in public venues e.g. at the local primary schools was reported by the remaining two extension officers. The most widely used forum in

passing information to the farmers was the Chief's baraza. The other extension methods and the frequency of their utilization by the extension officers are illustrated in table 4.12.

Table 4.12: Methods of Information Dissemination

Response	F (n=30)	%	Rank
Group methods Through:			
Chief's baraza	10	33.3	1
Local Primary Schools	8	26.7	2
Churches	6	20	3
Mass Media Posters	1	16.7	4
Individual visits	1	3.3	5

Source: Author's Survey, 2001/2002.

4.6.1:1 The Mass Media

Regarding the mass media, more specifically the use of posters was cited as the most widely used method. The extension officers explained that they placed the various posters in strategic public places such as at the market centres, road junctions and churches. Print and electronic media such as newspapers, posters, radio and television help extension agents to reach large number of farmers simultaneously. One drawback of the mass media as a method of information dissemination is that there is little opportunity for the farmers to interact among themselves or to provide feedback

to the extension agents. Media are important for making farmers aware of innovations and for stimulating their interest.

However, the media appear to have little direct influence when finally it is time to make a decision. At this point then, farmers value the judgment of known and trusted individuals with whom they have interacted and worked with previously and hence the important role of the extension agents in information dissemination.

Another drawback associated with the mass media and especially the electronic media is that the sender and the receiver (the farmer in this case), tend to employ several selective processes when using mass media, which often result in the receiver distorting the sender's message. Farmers may have limited access to mass media for several reasons which includes illiteracy, limited distribution of newspapers in the rural areas and even when available may be too expensive for most families. Television is also too expensive for many or there may be no electric power supply in the rural areas.

The physical availability of mass media is not the only crucial factor. There is also need to consider the extent to which their messages are written and programmed for rural audiences. All these factors hinder the wide use of mass media in extension. This is especially when the information being passed is tailored to the needs of a small localized group of farmers. It would definitely appear uneconomical to pass information to a few farmers located in a small village for instance through the radio and or television. If the extension agents took this into consideration, then it would

appear more economical and agriculturally rewarding to utilize group methods, which would ensure that more farmers receive the information simultaneously.

This could be the reason behind the zero-usage of newspapers, and television as an extension method in the study area. However, in a more generalized manner, the mass media fulfill certain functions in extension information dissemination, which includes setting the agenda of important discussion topics, transferring knowledge, forming and changing opinions and changing behaviour.

Although only posters were used in the study area as part of the mass media, its place in extension information dissemination remains very important viewed from both the local and national level. The posters are usually attractive and specific in message, clearly depicting a specific agricultural aspect and hence their wide usage.

4.6.1:2 Group Methods

The extension officers identified group methods as the most widely methods in passing information to the farmers. Group extension methods have an advantage over mass media because of better feedback, which makes it possible to reduce some of the mis-understandings that may develop between an extension agent and the farmers. Greater interaction between the farmers is also enhanced which provides the opportunity to exchange beneficial or useful experiences as well as to exert influence on group members' behaviour. Group methods are specific on the target group depending on the information being passed and the activities the farmers are engaged in.

The extension officers were requested to give information on how they effected information dissemination through speeches as a group method. They cited such fora as the chief's baraza, local primary schools and churches. The most widely used forum was the chief's baraza, which was used by all the ten extension officers. Speeches or talks have some specific advantages which includes:

1. The speaker can modify the content of his talk to meet the specific needs and interests of his audience as well as their level of education.
2. The speaker can take account of audience responses during his talk and modify his approach accordingly.
3. The audience gets to know the speaker better and receives a clearer impression of his feelings about his topic through his gestures and facial expressions. Talks usually provide an opportunity for audience to ask questions and discuss issues in greater depth.

Several disadvantages are however associated with talks, which include:

- (1) The spoken word is usually forgotten more easily than the written word.
- (2) It is also difficult to maintain an audience's attention on the subject of a talk for longer periods unless the speaker is extremely dynamic and interesting.
- (3) People's thoughts tend to wander to other unrelated issues while the talk is going on thereby reducing the level of concentration.

According to Rolling (1988), effective talks are often followed by a discussion period in which questions are asked either to clarify some points. A lecture followed by a

discussion may for instance be used to focus public attention on a problem. A good speech or talk must be well prepared. Some important points to consider in preparation of a good talk are:

- (1) The extension agent must study the literature well considering that a good talk is not to tell everything one knows, but to highlight the main points.
- (2) The extension agent must take the account of his audience (the farmers), what problems confront them and how much they know already.
- (3) The extension agent must decide how to arrange the content of his talk. He needs to outline the main points first, which are also illustrated with different examples.
- (4) A clear summary ought to be given at the end of the talk.

The study results show that use of demonstrations as a group method was moderate. Demonstrations may stimulate farmers to try out innovations themselves. They can show causes of problems and possible solutions without complicated technical details. Demonstrations can be given on demonstration field/farms specifically set aside for that purpose. The farmers visit the demonstration farm or a selected farmer's farm to learn what is under demonstration. In seeing how a method works in practice, this is bound to convince them on the viability of the technique.

Demonstrations must show clear differences between traditional and recommended practices. Demonstration plots ought to be simple, preferably comparing only the traditional with the improved method. The choice of the demonstration farm or farmer should be discussed with the village leaders and farmers. It is of great importance for the extension agent to ensure that demonstration succeed since failures lead to loss of

faith in the innovation which may take a long time to overcome because of the psychological resistance to demonstrations. A consideration for effective adoption of demonstration results is that a demonstration has to be given under conditions similar to those in which the methods or results will be applied. This will prevent farmers from dismissing the applicability of the demonstration in their situations by saying:

“Yes it works there, but it will never work in my situation.”

Additionally, the extension officers should have a clear idea of what they are trying to demonstrate and what is the role of the demonstration in the extension programme. They should also know whether farmers really feel a need for the information they can gain from the demonstration and whether they are well informed about it. In order for more farmers to be stimulated to use the new information on their own farms, it is very important to organize a field day at the demonstration site. Agricultural shows are very popular sites for agricultural demonstrations. They are also opportunities for displays of modern farming machinery and techniques by commercial manufacturers.

Excursions were cited by none of the extension officers as a method used in information dissemination. However this method merits a discussion in this section in view of its importance in information dissemination. Farmers on excursions are shown farms and sometimes-experimental fields outside their own area. Excursions provide great opportunities for farmers to observe the effects of different farm practices and to discuss these practices with other experienced farmers. They also provide an excellent opportunity to show farmers practices or farm organizations, which are not yet available in their area. Excursions will have to be followed up by

other extension methods until farmer's interest is converted into action. Although participants may appear to accept innovations, resistance to the ideas may arise due to such factors as: Conditions may differ from the home area of the visitors and secondly, excursions often visit the best farms of the areas, which are not perceived to be typical.

However, participants may regard an excursion as credible if the farmer they are visiting, other than the local extension agent, describes his experiences. Extension agents need to plan excursions carefully such that the farmers are not overwhelmed with information. Participants should also be given background information before the visit, which helps them to place what they see and hear in context with their own situations. This helps them to think systematically about what and how they can apply innovations at home, and helps make the excursion rather more than just a pleasant outing.

Group discussions is a key method in extension. The study revealed that none of the extension officers used this method in information dissemination. Group discussion helps members identify and find solutions to their problems. Further, they provide opportunities to influence participants' behaviour. The extension agents in speeches and talks are usually the expert source of information and are perceived to be above their audience in status. The agents participate as group members who join all other group members in identifying and solving problems.

This method plays an important role in increasing knowledge with the transfer of knowledge from an expert to the group. They also help in the process of attitude

change by creation of awareness of problems and feelings, concrete formulation of problems, change in norms and formation of opinions. They also help a great deal in members' behaviour change through individual and collective decision-making and confirmation of the choice among the group members.

Advantages of this method include:

- (1) Participants discuss more aspects than extension agent does on his own.
- (2) The participants are better judges than the extension agent whether possible solutions are practical.
- (3) In group discussion, there is strong tie with daily practice that is not usually present in a speech.
- (4) The language used in discussion is more familiar to participants.
- (5) The participants can ask questions, present opposing ideas and may improve assimilation of what is said.
- (6) Group discussions highly stimulate participants' own activities, and the participants have more opportunity to discover unknown aspects of the problems.
- (7) The participants will generally be more interested because they can exert influence on the choice of problems to be discussed.
- (8) Group discussions have a significant effect on decision making as well as on transfer of information.
- (9) Group norms can be considered at a group discussion and changed by the group.

In conclusion, organized groups may be seen to play two very important roles in agricultural extension. First, they make it easier to reach farmers because they bring

them together for meetings and group discussions, and second, they enable the farmers to work together for their collective interests such as having extension service, which serves their needs.

4.6.1:3 Individual Visits

The study found that individual visit was another extension method used by the extension officers. This method was not widely used by the extension officers as only one extension officer reported using it in information dissemination. Individual visits are also referred to as individual extension. Farmers strongly favour this method of extension, which emphasizes individualized dialogue. Several advantages are associated with this extension method which include:

- (1) It is a very good way of supplying information required for solving a unique problem such as a major investment decision.
- (2) Individual visits give an extension officer the opportunity to get to know the individual farmer very well especially during farm and home visits.
- (3) It is possible to integrate information from the farmer with that from the extension officer.
- (4) The extension officer can help the farmer to clarify his feelings and to choose between conflicting goals.
- (5) The extension officer can increase the farmer's trust in him by showing interest in the farmer as a person, his farming situation and his ideas.

Several disadvantages associated with this method include:

- (1) Costs are high for instance in the provision of transport facilities.
- (2) A small proportion of the target group is usually reached through this method.
- (3) An extension officer can give incorrect information for instance if he is not prepared to admit that he does not have the necessary information. The method is based on high level of trust between farmer and the extension officer. The farmer will neither seek help nor disclose confidential information about himself if this trust is lacking, because he will be concerned that the extension agent might not use such information in the farmer's best interests.

This method of extension is seldom a solution for the promotion of collective interests. For instance a farmer may have a specific problem which is also being experienced by the other farmers and while the farmers could be advised in a collective manner, much time and financial resources will be spent as the extension officer visit few farmers within his area of operation. Discussions conducted during the personal visits are meant to help farmers develop personally as well as find solutions to their problems.

Farmers must also find time to invest in mutual discussions, which have to pass through four phases, which include establishing what the problems are, searching for a solution, choosing a solution, evaluation. For maximum benefits from this method, the farmer and the extension agent have to take part in these four phases, which can be regarded as means towards identifying a suitable solution to an existing problem.

4.6.2 Constraints to Effective Delivery of Extension Services

Dissemination of knowledge to hundreds and thousands of scattered farmers is enormously difficult. As shown in table 4.8, the number of farmers per extension officer is very high for efficient dissemination of extension services. The ratio of extension officers to farmers was found to be 1:2126. Effective extension services cannot be rendered by such a small number of extension officers to such a high number of farmers. This study established that as a result of this high number of farmers per extension officer, the dissemination of extension advice was mostly done through group methods such as the barazas, churches and field days.

It can therefore be argued that due to inadequate transport and lack of enough extension officers, coupled with the large number of farmers per extension officer, the individual visits technique was not widely used. Four of the extension officers had between 1001-2000 farmers whom they provided their services (Table 4.13).

Table 4.13: Number of Farmers Per Extension Officer

Response	F (n=9)	%
Below 1000	3	33.3
1001-2000	4	44.4
2001-3000	0	0
3001-4000	1	11.1
Above 4000	1	11.1
Total	9	100

Source: Author's Survey, 2001/2002.

The extension officers were requested to give their opinion on whether the number of farmers they attended to was too high, moderate or low. All of them were of the opinion that the number of farmers per officer was too high for effective dissemination of information and this acted as a major constraint in delivery of extension services.

Six extension officers cited incidences of farmers' refusal to adopt some recommendation such as the row spacing and seed population system of 75x25x1. The farmers opted for 90x30x1. In this respect, the role of demonstration farms/plots is therefore very important. This study found that the extension officers participated in farming demonstrations. Lack of adoption cannot be explained from the point of view that the farmers are conservative and unwilling to learn and innovate. Farmers tend to be shrewd and realistic in their evaluation of new ideas being handed out by government officials. The farmers are bound to consider the risks involved in hasty application of new ideas, and naturally want to make sure that experiments are not undertaken at their expense.

The key informants were required to comment on the problems they encountered in their work. The majority of them (9), stated lack of means of transport. This greatly hampered wide area coverage and therefore they could not render their services effectively especially to the farmers in the peripheral zone.

Lack of adequate and timely research findings was identified as another factor contributing to the low performance in the delivery of extension services. The extension officers are supposed to bridge the gap between the researchers and the

farmers. In this way they avail the research findings to the farmers and provide feedback from the farmers to the researchers. Due to the fact that the extension officers have not been fully incorporated into research, this places them in a situation whereby they may not effectively avail research findings to the farmers. This then calls for intensified on-farm trials involving researchers, extension officers and the farmers and the three should work as a system, which is not complete without any of the three.

The other two factors hampering extension delivery in Chuka Division may be seen as relating to the farmers, yet they directly affect the extension officers. They include lack of enthusiasm by farmers to adopt extension recommendations and poor relations between the. Lack of enthusiasm on the part of the farmers implies that they are not fully motivated to incorporate extension recommendations into their farming. In most instances, farmers through their situational evaluation may opt to stick to their traditional production techniques other than embrace new ideas whose results they are not very sure of. This then calls for intensified extension involving theory and practical aspects of farming such as demonstration, field days, seminars, attending agricultural shows and conducting on-farm trials. These strategies would go a long way in effecting attitude change on the part of the farmers.

Poor relations among the farmers means that the envisaged diffusion process is curtailed. In diffusion of technological innovations, it is usually hoped that the farmers who first receive the extension services from the extension officers will serve to pass this information to the rest of the farmers. The extension officers ought to be very selective in identifying the first-contact farmers since they determine whether

innovations diffuse to the rest of the farmers or not. The extension officers should ensure that these farmers possess such qualities as:

1. The farmers should be active, social and willing to learn new ideas.
2. They should show interest in farming, and should be popular with their neighbours.
3. The farmers should be able to purchase the recommended inputs by the extension officers.

A summary of the Constraints to effective delivery of extension services is given in table 4.14.

Table 4.14: Constraints to Effective Delivery of Extension Services

Response	F (n=22)	%
Lack of means of transport	9	40.9
Number of farmers is too high	5	22.7
Lack of adequate and timely research findings	4	18.2
Lack of enthusiasm by farmers to adopt research and extension recommendations	3	13.6
Poor relations between the farmers	1	4.6
Total	22	100

Source: Author's Survey, 2001/2002.

The study further inquired into the various ways in which the extension machinery has attempted to solve the above constraints and the extension officers reported:

utilization of other channels of information dissemination such as through churches and chief's barazas, using bicycle to solve the problem of transport, use of extension units and focal area approach and adoption of group contact approach.

The key informants were also required to rank the major farming problems faced by the farmers in Chuka Division, beginning with the most severe (scale 1) to the least severe (scale 11). This is illustrated in table 4.15.

Table 4.15: Major Farming Problems Faced by the Farmers

Response	Rank	F (n=33)	%
Unpredictable Climatic Change	1	8	24.2
Lack of knowledge on specific crop requirements	2	6	18.3
Marketing the Produce	3	4	12.1
Control of Pest-related diseases	4	3	9.1
Lack of knowledge on varieties of seeds	4	3	9.1
Depleted Soils	4	3	9.1
Use of low quality seeds	5	2	6.1
Inability to Purchase inputs e.g. fertilizers	6	1	3.0
Inability to control weeds	5	2	6.1
High levels of soil acidity (pH)	6	1	3.0
Total		33	100

Source: Author's survey, 2001/2002.

The extension officers addressed the above problems in various ways, which included:

- (1) By giving technical advice to the farmers for instance on improving the soil fertility by practicing crop rotation.

- (2) By intensifying field days, field visits, demonstration and training to pass information to the farmers.
- (3) By utilization of different channels of communication such as the mass media, individual visits and group methods.
- (4) By advising the farmers on kitchen gardening for instance through drip-line irrigation to counter food shortages.
- (5) By encouraging farmers to incorporate drought resistant crops into their farming systems.
- (6) Advising farmers on soil conservation and preservation measures.

4.6.3 Constraints to Effective Adoption of Extension Services

The general level of adoption of research and extension recommendations in Chuka Division is low. The study found that majority of the respondents (96.7%) were hesitant to incorporate new farming knowledge into their farming systems. Full adoption of extension recommendations has been hampered by a myriad of factors the greatest factors being the fear of low yields after adoption and high cost of recommended inputs. This then calls for on-farm trials and actual demonstration of for instance the use of inputs such as new seed varieties and fertilizers.

The farmers would be in a position to ascertain for themselves the benefits associated with innovations, which would highly complement information from the extension agents. The farmers were requested to identify the single most important factor contributing to their low level of adoption of extension recommendations. Most of them identified fear of low yields after adoption as the major factor, followed by the

high cost of the recommended inputs. Several other constraints to adoption of extension recommendations were identified, as illustrated in table 4.16.

Table 4.16: Factors Hampering Adoption of Extension Recommendations

Response	F (n=120)	%
Language barrier between FEW and the farmer	15	12.5
Lack of technical knowledge in adoption	17	14.2
Lack of practical adaptability of recommendations	19	15.8
Recommendations not being timely	19	15.8
High cost of inputs recommended	20	16.7
Fear of low yields after adoption	30	25.0
Total	120	100

Source: Author's survey, 2001/2002

Adoption of agricultural extension recommendations by the farmers justifies the overall process of information dissemination. This also justifies the efforts by the government through the Ministry of Agriculture and other stakeholders concerned with improvement in the agricultural sector. Adoption of extension advice may be seen as the culmination of a long process of information diffusion from researchers and extension officers to the farmers usually with a feedback from the farmers. The extension officers are the agents of change, whereby the success of this change is judged by the level of innovation adoption displayed by the farmers. A high level of

adoption indicates successful change and on the other hand, low adoption depicts failure.

The element of fear indicates that the farmers are not conservative towards extension recommendations. If motivated or the fear eliminated, it follows that the level of adoption among the farmers would rise. This in essence relates directly to the crucial role of the extension officers in enhancing adoption of extension advice by the farmers. Other than availing information to the farmers, the extension agents need to go ahead and motivate the farmers to take up the various advices. This could be through strategies such as intensifying individual visits by the extension officers to the farmers' homes and farms, establishing farming demonstrations and on-farm experiments, since learning is highly enhanced by demonstrating the various theoretical concepts.

A significant number of farmers identified the high cost of inputs as another major factor contributing to the low level of extension adoption. This has been worsened by the infiltration of counterfeit inputs in the local market. Although the farmers may get the information from the extension officers, without the farmers acquiring the recommended inputs, the envisaged impact may not be realized.

Infiltration of counterfeit inputs such as seeds into the local market in the study area has led to a situation whereby farmers' hopes of high yields have been shattered in the event of the farmers harvesting low yields than expected. This has reduced farmers' enthusiasm in taking up extension recommendations which was also identified by the extension officers as one of the major constraints behind their ineffective

dissemination of extension advice by the extension officers. Lack of technical knowledge in adoption was identified by a significant number of farmers as hampering adoption of extension recommendations. Lack of adaptability reflects a lapse in agricultural extension. This situation cannot be blamed on low literacy levels, since most of the farmers in the study area were found to be literate. Rather, this hints on the crucial role farming demonstrations would play in enlightening the farmers on the technical aspects of recommendations emanating from the extension officers.

Language barrier was also identified as a constraint to adoption of extension services in the study area. It is expected that at least the frontline extension workers should be able to speak the local language spoken by most of the farmers in their area of operation. The problem of language as a constraint is not just restricted to speech but as pertaining to technicalities such as translating research findings in such a way that they can be clearly understood by the farmers. This calls for the extension officers first being articulate in their interpretation of the information to be disseminated to the farmers.

Equally, the extension officers ought to be engaged in research and further in conducting on-farm trials so that they can assess the practicality of some of the recommendations to be made to the farmers. The officers ought to use simple language, which can be understood by the farmers for high extension adoption, which would lead to an increase in the yields.

Agricultural extension may be seen as playing a key role in:

1. Helping farmers to analyze their present and future farming situation through the provision of timely information. Farmers' opinions and decisions are based on their image of the reality in which they live and on their expectations of the consequences of their actions in this reality. These expectations are not always correct because the farmers' image of reality sometimes never agrees with the reality itself. The extension agent therefore has the task of helping the farmers come to terms with the reality and map the way forward towards increased yields. This is essentially helping farmers form sound opinions and make effective decisions.
2. Extension has the role of increasing farmer's knowledge and helping to structure his existing knowledge for instance through on-farm trials and demonstrations. Assuming that farmers lack even slightest farming knowledge is self-defeating. Farmers have knowledge of their farming situations, which sometimes may not be clearly defined.
3. Extension helps farmers acquire specific knowledge related to certain problem solutions and their consequences so that they can act on possible alternatives. In this way the farmers are able to make responsible choices, which in their opinion are optimal for their situations. The extension also increases farmers' motivation to implement their choices for instance through individual visit to the farmers by the extension agents.

4. Agricultural extension is crucial in bridging the gap between research and the farmers. Research findings in Kenya have not been widely adopted by the farmers. The extension therefore has a noble duty of ensuring that the findings not only get to the farmers, but actually the farmers are incorporating these findings into their farming. This will in turn reduce the wide gaps between the yields, which could be obtained through use of available production technologies, and the yields obtained by the majority of farmers. The extension should provide feedback from the field to the researchers on which further research can be based on.

4.7 Suggestions for Effective Delivery of Extension Services

Both the key informants and the farmers were requested to make suggestions for effective delivery of extension services. This was in recognition of the fact that the farmers had an opinion on how best they could be assisted by the extension officers, and equally the extensionists were aware of the problems, which hampered the efficient provision of extension services. One set of suggestions was therefore provided by the extension officers and the other one by the farmers. The farmers made the following suggestions (Table 4.17).

Table 4. 17: Suggestions by the Farmers for Improved Extension

RESPONSE	F (n=264)	%
The extension services should be timely	29	11.0
Extension officers should visit the farmers regularly	58	14.4
Extension officers should organize regular field days	38	14.4
Demonstration farms /plots to be developed in Chuka Division	51	19.3
A Show-ground to be developed in Tharaka-Nithi District.	24	9.1
Establish a FTC in the district.	13	4.9
Different methods of information dissemination should be utilized	16	6.1
Improvement should be made in advertisement	11	4.2
Local area/group contact should be promoted	9	3.4
On-farm experiments and trials should be promoted in the study area	3	1.1
Private sector should participation in providing extension services	1	0.4
More of extension officers should be recruited and trained	31	11.7
TOTAL	264	100

Source: Author's survey, 2001/2002.

On the other hand, the extension officers made the following suggestions for improvement in the delivery of extension services (Table 4.18).

As evident in table 4.17, the farmers made suggestions mainly focusing on the organization and operations of the extension machinery, while the extension officers made suggestions that mainly dealt with policy issues (Table 4.18). This approach of the respondents participating in generating suggestions was in order to avoid the "outsider's opinion" in research. The approach recognizes the role of the farmers and the extension officers in determining inherent problems and possible solutions, which is in line with the principle of participatory approach discussed in the theoretical and conceptual framework.

Table 4.18: Suggestions by Extension Officers for Improved Extension

RESPONSE	F	Rank
Better means of transport should be provided for wide area coverage	10	1
Provision of refresher course to the extension officers.	10	1
Increase the frequency of field days, seminars and training	8	2
Incorporation of frontline extension officers in research.	8	2
More extension staff to be recruited and trained.	7	3
Research findings should be availed to the extension officers in time for onward transmission to the farmers	6	4
Total	49	

Source: Author's survey, 2001/2002.

From the study, it emerged that the farmers were pretty aware of the existence of extension services in Chuka Division. Majority of the farmers reported that they were not visited frequently by the extension officers. They therefore suggested that extension services should be timely and that the extension officers should visit the farmers regularly. Based on this suggestion, it can be inferred that the gap between the farmers and the extension has continuously widened over time to a point where these services seem to have been withdrawn.

However, this should not be the case as extension is part of the overall agricultural policy in Kenya charged with information dissemination and agricultural research in collaboration with research oriented institutions such as Kenya Agricultural Research

Institute (KARI). Some of the farmers who were least visited by the extension officers wondered whether extension services were still operational. One of the farmers on being asked whether he was aware of the existence of agricultural extension services in Chuka Division, responded with uncertainty that:

"Ndaugaga kithomo kia urimi nigiterwe riria thoko ya kaua yathukire?" (I thought that extension services were withdrawn when the coffee market deteriorated.)

For improved extension, the farmers further recommended that the extension officers should organize field days, demonstrations and on-farm trials. These are very important knowledge acquisition strategies, which if employed would aid a great deal in enlightening the farmers. These methods would also serve a large number of farmers for faster flow of agricultural information.

The establishment of a farmers' training center (FTC) and an agricultural show ground in the district, recommended by the farmers is indeed overdue. Such establishments are very important in serving large groups of farmers. A Farmers training center would enable the farmers undergo short-term courses which are highly participatory and practical in orientation and would enable the farmers access farming information all year round. The center would also serve as an experimental site for various agricultural trials. This would compliment the roles of trial sites and demonstration farms/plots, which the farmers also recommended to be developed in the study area. The farmers took cognizance of the fact that the high number of farmers to be served

by a relatively small number of extension officers overwhelmed the extension officers.

Both the extension officers and the farmers towards this observation suggested that the government should recruit and train more extension officers. As a short-term measure the farmers recommended that the extension officers should utilize group methods in provision of extension services which would benefit a large number of farmers. The extension methods should be reinforced by advertisements for prior creation of awareness among the farmers. Lack of awareness on the extension officer's visit could lead to situations whereby the farmers missed these vital services simply because of lack of prior information.

The farmers also suggested that the government should provide for private entry into agricultural extension. Although this may seem a good alternative against a backdrop of government's reduced funding to MoARD, such a move should be guided by clear policies which ensure that the private sector operates within the set extension guidelines to avoid farmer exploitation and a compromise in the quality of the services rendered.

The extension officers cited lack of means of transport as the main factor behind their inability to reach out to most of the farmers. Although they usually resulted to walking and sometimes use of the bicycle as an alternative means of transport, these modes of transport are not efficient to serve majority of the farmers. The extension officers therefore suggested that the government through MoARD should provide them with efficient means of transport such as motor vehicles or motor cycles. In

order to fill the existing gap between research and the farmer, the extension officers were of the view that research findings should be availed to them on time for onward transmission to the farmers. For enhanced understanding and easy interpretation of research findings, the extension officers should be incorporated in research and on-farm trials.

Refresher courses should be provided to extension officers. Such courses are very important in enlightening the extension officers on new approaches to extension. This would also ensure that the extension officers effectively fill the gap between research and the farmer. With the current explosion in information technology (IT), refresher courses are inevitable. The process of globalization whereby an extension officer cannot operate in isolation also necessitates provision of refresher courses to the extension officers. The extension officers can longer operate in isolation from the other stakeholders in farming. This will promote information exchange for quick diagnosis of farming problems and provide timely solutions for increased yields.

4.8 Chapter Summary

The survey sample comprised of 130 respondents, 120 farmers and 10 extension officers. On gender, majority of the farmers were males (82, 68.90%), while females were 38 (31.66%) in number. Half of the key informants were males. Out of the 120 farmers, 66 were drawn from the core while the remaining 54 were from the periphery zone. The majority of the farmers 32 (26.7%) were aged between 34-41 years. Half of the key informants were in the 34-41 years age bracket.

The study findings show that majority of the farmers 107 (89.16%) were married. Most of the households 63 (52.5%) had between 7-13 members, while 90 (75.0%) households had between 1-6 members living on the household farm. The study established that most of the farmers 79 (65.83%) relied on farming not just as a way of earning income but also as a way of life. The level of literacy was also found to be high among the farmers. The majority of them (90.83%) had acquired formal education. Seven of the key informants were found to have attained tertiary level of education.

Following the data analysis, the results of the study showed that the spatial location of the farmers significantly influenced the provision of extension services. The farmers close to Chuka Town within a distance of 0-10 kilometres where the district and divisional agricultural offices are located, received the extension services more frequently as compared to the farmers who were located far away from the town at a distance beyond 11kilometres. It was also established that the farmers who were located along the roads received the extension services more frequently as compared to those located far in the interior, both in the core and in the periphery.

It was also established that there is a significant relationship between the size of land set aside for maize growing and the yields obtained. A cross tabulation between the two variables showed that as the size of land increased from below one acre of land to five acres and above, correspondingly the yields increased. This was confirmed through a chi-square test which led to the acceptance of the hypothesis that the size of land set aside for maize production significantly determines the yields obtained.

Results of the study also indicated that the majority of the farmers, 82 (68.33%) did not access timely extension services. Farmers who received timely extension services tended to have higher yields. The timeliness referred to the extension services coinciding with the various farming activities within a season. This relationship was brought out through a cross tabulation and a chi-square test administered which confirmed that the timeliness of the extension services significantly influences the yields obtained.

The study evaluated the relationship between the maize seed variety planted and the yields obtained. A cross tabulation of the two variables showed that farmers who planted hybrid seed varieties obtained higher yields as compared to those who planted non-hybrid seed varieties or a mixture of hybrid and non-hybrid varieties. A chi-square test administered, confirmed that the variety of maize seed planted significantly determined the quantity of maize yields obtained.

The status of farmer training in the study area was found to be low. Only 48 farmers reported having attended a course and or a seminar, half of the farmers had attended a farming demonstration, while 94 (78.3%) farmers had attended a farmers' field day at least once for the last five years. A cross tabulation of field day attendance and the yields obtained showed that there is no relationship between the two variables. Further, chi-square results led to the rejection of the hypothesis that field day attendance by the farmer significantly influences maize yields.

The study established that the extension officers employed different methods of information dissemination. These methods included group, media and individual

visits by the extension officers. The most widely used method was found to be group method whereby the most popular forum was through the chief's baraza.

The study aimed at identifying the various constraints to effective delivery and adoption of extension services. The study results showed that the main constraints to extension delivery were lack of means of transport for wide area coverage by the extension officers and the high number of farmers per extension officer. On the other hand, the main constraints to adoption of extension advice by the farmers were the fear of obtaining low yields after adoption and the high cost of inputs. In conclusion, agricultural extension services are a prerequisite for increased maize yields.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This study was an evaluation of the role of agricultural extension services in maize production in Chuka Division, Tharaka-Nithi District. It was guided by the premise that dissemination of extension advice significantly influences maize Production. Results of the study have been presented in the previous chapter. In this chapter, a summary of research findings is presented, conclusions are drawn and recommendations made towards effective delivery and adoption of extension services. Areas that require further research are also suggested.

5.2 Conclusions

The study found that farmers located within a distance of 0-10 kilometres from Chuka Town received extension services more frequently as compared to those located 11 kilometres and beyond. This led to the acceptance of the study hypothesis that the spatial location of the farmer significantly influences the provision of extension services and the farming activities. This was shown by cross tabulation of the two variables.

Further, this hypothesis was subjected to a chi-square test and upheld. On farming activities the study found out that farmers who owned between 1.0-4.9 acres of land

were mostly from the core zone 47 (39.17%) as compared with 33 (27.5%) from the periphery. Majority of the farmers who owned above five acres of land were from the periphery. From these findings, it can be concluded that land scarcity was widespread in the core locations than in the periphery.

Majority of the farmers in Chuka Division 40 (33.3%) harvested between 11-20 bags of maize in a “good year” with favourable climatic conditions. This is far below the optimal yield of 20-30 bags/season, considering that the 11-20 bags range is the sum total of yields for two seasons. It is therefore concluded that the farmers harvest below optimal yields, which were inadequate for household consumption. To support this assertion, the farmers were requested to give information on whether the yields they obtained per year were adequate for their household consumption. Eighty-eight farmers (73.3%) reported that the yields they obtained were inadequate for household consumption and so they were forced to compensate for the deficit.

Regarding the timeliness of agricultural extension services in the study area, the study found that the extension services in the study area were not timely. The data collected showed that majority of the farmers 82 (68.33%) did not access timely extension services. This led to the acceptance of the study hypothesis that the timeliness of the extension services had an impact on the yields obtained. This hypothesis was tested by the use of chi-square statistics and demonstrated through a cross tabulation.

Majority of the farmers reported that the extension officers advised them once in six months. Although the study found out that the extension agents mostly employed group methods in delivery of extension services, this question was framed in such a

way to cater for both individual extension and also the group methods. On the basis of these findings, it is therefore concluded extension services in Chuka Division are not timely.

The status of farmer training and farming demonstration in relation to maize production in the study area was also evaluated. It was established that the status of farmer training in the study area was low, while farming demonstration was moderate. Majority of the farmers 72 (60%) reported that they had not attended any course and or a seminar for the last five years. Half of the farmers 60 (50.0%) had attended a farming demonstration.

Farmer training and demonstration are important in extension but for the intended impact to be realized which in this case increased yields, the farmers have not only to be encouraged verbally to practice what is learnt, but they have to be motivated to actually put what is in theory into practice for instance through individual home and farm visits by the extension officers. The discussion on the status of farmer training and farming demonstration necessitates the following conclusions to be drawn:

- (1) Although the level of farmer training in the study area is high, this has not translated into actual adoption of extension recommendation at the farm level.
- (2) The data collected indicated that demonstration was a moderately utilized method in information dissemination in the study area. Half of the farmers 60 (50%), reported having attended a farming demonstration for the last five years.

On the basis of the study results, it was established that the extension officers used different methods of information dissemination, which can be categorized into mass media, group methods and individual visits. By rank, group methods were the most widely used, followed by the mass media (posters) while individual visits was least utilized. Use of the chief's baraza was the most widely used forum in group methods. It can therefore be concluded that provision of extension through individualised method was minimal. Although this method is relatively costly as compared with the group methods in terms of time and financial implications, individual visit has the greatest impact due to its personalised approach in solving farmer's problems.

The study also identified the various constraints to delivery and adoption of extension services. The data collected show that lack of means of transport and the high number of farmers per extension officer were the main factors that hampered effective delivery of extension services. On the other hand, fear of low yields and the high cost of inputs were the main factors contributing to the low adoption of extension advice by the farmers in Chuka Division. The study findings indicate that the majority of the farmers (96.7%) were hesitant to incorporate new farming knowledge into their farming systems. It is therefore concluded that the level of adoption of extension recommendations in Chuka Division is low.

5.3 Recommendations

From the first objective of the study, it was concluded that farmers located within a distance of 0-10 kilometres from Chuka town received extension services more frequently as compared to those located 11 kilometres and beyond. To reverse this

trend and ensure that farmers received extension services frequently regardless of their spatial location, this study recommends that:

- The extension officers should be provided with means of transport (mobility). This will enable them to efficiently visit farmers located near and far from the district headquarters. It will further enable the extension officer to visit the farmers more regularly. This will inevitably reverse the current scenario whereby farmers located far away from Chuka Town do not receive extension services frequently.

Following a discussion on the timeliness of extension services in the study area, it was concluded that extension services in Chuka Division were not timely.

Following the above conclusion, the following recommendation is made:

- Efforts by the extension officers should be made to ensure that the farmers are visited on a regular basis. This will particularly be enhanced by provision of means of transport, which will enable the extension officers to frequently visit even the farmers located far from Chuka Town.

In relation to the third objective of the study, it was concluded that the provision of training, and farming demonstrations cannot directly influence the yields obtained. Therefore, the question of whether the farmer puts into practice what is learnt arises to explain the role of the extension methods in obtaining high yields. Farmer training and demonstration are important in extension but for the intended impact to be

realised, which in this case is increased yields, the farmers have to put what is learnt into practice. The following conclusions were made from the discussion on the status of farmer training and farming demonstrations in relation to maize production.

Farmer training in the study area was low, while demonstration attendance was moderately. Half of the farmers 60 (50%), reported having attended a farming demonstration for the last five years.

Based on these conclusions, the study therefore makes the following recommendations:

- Farmer training should be upheld, and the farmers motivated to adopt what they learn during training. The motivation could be in the form of individualised visits to the farmers' homes and farms by the extension officers to ascertain the progress in adoption of recommendations. Further a farmers' training centre (FTC) should be established in the district from where the farmers can learn the various aspects of farming.
- The study also recommends that an agricultural show ground should be developed in the district. In addition to farmers learning about farming, they are bound to develop a culture of competition among themselves whereby the best products and high quality breeds are exhibited at the shows. On the other hand, such an undertaking will ensure that farmers do not spend money on travelling to other districts to attend the annual agricultural exhibitions (shows).

Based on the fourth objective of the study, the following conclusions were made:

- (1) Provision of extension through individualised method was not widely used.
- (2) Lack of means of transport and the high number of farmers per extension officer were the main factors that hampered delivery of extension services.
- (3) Fear of low yields and the high cost of inputs led to low adoption of extension advice by the farmers.

From the above conclusions the following recommendations are suggested:

- Attempts should be made by the extension machinery to step up individual visits to the farmers. This will ensure that the extension officers are in constant communication with the farmers for quick responses to farmer problems.
- More extension officers should be recruited and trained. This will ensure that the extension officers are not overwhelmed in their efforts to provide extension services to the farmers.
- The extension officers should provide to the farmers viable recommendations which have been tried out through on-farm trials and demonstrations. This will ensure that the inherent fear in farmers to take up new farming ideas is eliminated. Consequently this will lead to an increase in the rate of adoption of extension recommendations.

5.4 Areas for Further Research

5.4.1 Training needs assessment for the extension officers

The study proposes further research to be undertaken to identify the training needs of the extension officers. This recommendation is based on the rising need for more extension officers to be recruited and trained in order to strengthen the current extension machinery operating in the study area. The study found that the current number of extension officers could not serve the farmers effectively. Such an assessment will ensure that the extension officers are trained on modern and emerging issues in extension for effective delivery of extension services.

5.4.2 Effective methods of information dissemination to the farmers

It is suggested that studies should be carried out to establish effective methods of information dissemination. Such a study should compare the various methods, which are categorized into mass media, group and individual visits and establish the best methods for greatest impact.

5.4.3 Gender relations in agricultural extension

Further research is required to evaluate gender relations in agricultural extension and especially the impact/effects of gender discrimination in provision of extension services. The study established that gender bias was evident in determining whom the

extension officers talked to. Such a study is very important, as it will establish whether the bias has a bearing in the overall adoption of extension recommendations.

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APPENDICES

Appendix 1

QUESTIONNAIRE FOR THE CONTACT FARMERS

THE ROLE OF AGRICULTURAL EXTENSION SERVICES IN MAIZE (*Zea mays*) PRODUCTION IN CHUKA DIVISION, THARAKA-NITHI DISTRICT, KENYA

QUESTIONNAIRE NO.

DATE

PREAMBLE

My name is Elias Muriithi Nabeba. I am a graduate student at Moi University carrying out a research on **The Role of Agricultural Extension Services in Maize (*Zea mays*) Production in Chuka Division, Tharaka-Nithi District, Kenya**. I shall be grateful if you kindly spare a little of your time to assist me by responding to some questions in this study. Your responses will be treated with high confidentiality and purposely for this study.

(A) Respondent’s Identification and Household Characteristics

- 1. Name of respondent.....
- 2. Highest level of education.....
- 3. Location..... Sub-location.....
- 4. Gender: Male [1] Female [2]
- 5. Age of the respondent.....(Years)

6. Marital status:

Single [1]	Married [2]	Separated [3]	Widowed [4]	Divorced [5]
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7. (i) Total number of household members

.....

(ii) Number of household members living on the farm

8. (i) Have you been living in Chuka Division for the last 20 years? Yes [1] No [2]

(ii) If NO above, where were you living before you migrated into Chuka Division

.....

(iii) When did you migrate into this division?.....

9. What were your reasons for migrating into this division?

Lack of land in the former settlement area [1]	High population [2]
Poor soils to support food production [3]	Harsh climatic conditions [4]

Any other (specify) [5].....

10. Other than farming, what other income generating activities do you engage in?

.....

.....

(B) Respondent Spatial Location and Farming Characteristics

11. Distance from Chuka town.....(Kms.)

12. What is the size of this farm in acres (1 Acre = 0.4 Ha.).....

13. Do you own, rent or lease this land? Own [1] Rent [2] Lease[3]

14. (i) Do you have additional land elsewhere? Yes [1] No [2]

(ii) If YES above, is the land: Own land [1] Rented [2] Leased [3]

(iii) If (ii) above is applicable, what is the total size of land?(acres).

15. (i)Approximately what portion of your land have you set aside for maize production, in the total land either own land, rented or leased?..... (acres).

16. How many kilograms (Kgs.) of maize do you normally produce in a “good year” from the total land owned? Kgs. (1bag = 90 Kgs.)

17. (i) Is the maize produced in a “good year” adequate for the household in terms of food? Yes [1] No [2]

(ii) If [1] above, do you usually have surplus maize produce to sell? Yes [1] No [2]

18. If NO in 17 (i) above, how do you compensate for any shortfall in maize production?

(a) By purchasing [1]

(b) By relying on relief food donations [2]

(c) Relying on food for work programmes [3]

(d) Relying on food donations from relatives [4]

(e) Others (specify) [5].....

19. (i)Do you leave any portion of your land fallow? Yes [1] No [2]

(ii) If NO, what are the reasons?

Land is too small to leave fallow [1]	Need for more maize production [2]
---------------------------------------	------------------------------------

Any other (specify) [3].....

(C) Availability, Frequency and Timeliness of Extension Services

20. Are you aware of the existence of agricultural extension services in Chuka

Division? Yes [1]

No [2]

21. If YES above, how often have you been advised by the area extension officer(s)?

Once a week [1]	Once per two weeks [2]	Once a month [3]
Once in six months [4]	Once in a year [5]	Never been visited [6]

Others (specify) [7].....

22. Usually whom does the extension officer prefer talking to when he/she visits your household?

(a) Head of the household [1]

(b) Any member of the household involved in farming [2]

(c) Any member of the household whether involved in farming or not [3]

23. On which of the following farm enterprises have you been advised on in the past by the extension officer(s)?

Cash crops [1]	Food crops [2]	Cash crops and food crops [3]
Horticultural crops [4]	Livestock [5]	All of the above [6].

24. Are the extension services timely enough to be of greatest use by coinciding with the various activities in a season and more specifically as it relates to maize production? YES [1] NO [2]

25. (i) Did the extension officer advise you specifically on maize production?

Yes [1]

No [2]

(ii) If YES above, which of these issue(s) were you advised on in regard to maize production?

(a) Rainfall requirements of the various maize varieties [1]

(b) Land preparation [2]

(c) Varieties of maize seeds [3]

(d) Herbicides, pesticides [4]

(e) Types of fertilizers, manure application [5]

(f) Soil erosion control measures [6]

(g) General care of the growing maize [7]

(h) Harvesting and storage [8]

(i) Marketing of maize produce [9]

(j) Credit facilities [10]

(k) Planting requirements such as depth, spacing, plant population [11]

(l) Cropping systems [12]

(m) Others (specify).....

(D) Methods of Information Dissemination

26. (i) Have you attended a course on farming since you started working on this farm or for the last five years? Yes [1] NO [2]

(ii) If YES state the date and duration.....

37. Did you visit the farming practices demonstrations section? Yes [1] No [2]

38. What issues did you learn in respect to maize production?

.....

(E) Farmer's Adoption of Extension Recommendations

39 (i). Have you put into practice what you learnt on maize production from training, farming practices demonstrations, field days and by attending agricultural show(s)?

YES [1]

NO [2]

(ii). If YES above, how do you compare your maize yields before and after?

Increased [1]	No improvement [2]	Yields have been decreasing [3]
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Others (specify).....

If NO in above, what reasons could be hampering your adoption of research and extension recommendations?

(a) I can't understand the recommendations due to language barrier. [1]

(b) Lack of technical know how in adoption. [2]

(c) Recommendations are not adaptable on my farm. [3]

(d) Recommendations are not timely. [4]

(e) Fear of low yields after adoption.[5]

(f) Inputs recommended are too costly to purchase. [6]

(g) Others (specify)[7].....

.....

(F) Suggestions for Effective Delivery of Extension Services

40. What suggestions can you make for effective delivery of extension services in this division?

.....

.....

.....

41. Who should help meet the recommendations?

Government officials [1]	NGOs [2]	Farmers themselves [3]
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Others (specify) [4]

.....

.....

Thank you.

Appendix 2

QUESTIONNAIRE FOR THE EXTENSION OFFICERS

THE ROLE OF AGRICULTURAL EXTENSION SERVICES IN MAIZE (*Zea mays*) PRODUCTION IN CHUKA DIVISION, THARAKA-NITHI DISTRICT, KENYA

QUESTIONNAIRE NO.

DATE

PREAMBLE

My name is Elias Muriithi Nabea. I am a graduate student at Moi University carrying out a research on **The Role of Agricultural Extension Services in Maize Production in Chuka Division, Tharaka-Nithi District, Kenya**. I shall be grateful if you kindly spare a little of your time to assist me by responding to some questions in this study. Your responses will be treated with high confidentiality and purposely for this study.

(A) Respondent's Characteristics

Name of the respondent.....

Age.....(Years)

Highest level of education.....

Location..... Sub-location.....

(B) Job Characteristics

1. When did you begin working as an agricultural extension officer in Chuka Division?.....
2. (i). Have you undergone any refresher course or training since you started working as an extension officer? YES [1] NO [2]
- (ii) If YES Please state the year
3. As an agricultural extension officer in this division, please give information on your role in linking the researchers and the farmers?
.....
.....
4. In your opinion, how important are extension services in maize production Chuka Division? Not important [1] Important [2] Very important [3]
5. Do you have farmers whom you visit regularly? YES [1] NO [2]
6. If YES, how regularly do you visit them?.....
7. What criteria do you use in selecting the farmers?
.....
.....
8. (1). How many farmers are within your area of operation?.....
- (ii) Do you think that number is:
 Too small [1]
 Average [2]
 Too high [3]

9.What are the major farming problems faced by the farmers in Chuka Division in regard to maize production?

Soils are very poor [1]	Unpredictable climatic changes [2]	Weed control [3]
Pests control [4]	Lack of knowledge on seeds [5]	Storage of produce [6]
Crops requirements [7]	Marketing the produce [8]	

Any other (specify) [9].....

10. How has the extension machinery attempted to address these problems?

.....

.....

(c) Training, Demonstration and Research

11.Do you organize or participate in farmers' training? YES [1] NO [2]

How do you ensure that farmers get the news on training? **Through:**

Chief's barazas [1]	Posters [2]	The print media e.g. newspapers [3]
Churches [4]	Radio & T.V [5]	Local primary schools [6]

Others (specify) [7]

12.Are the farmers usually supposed to pay for the training? YES [1] NO [2]

13. What method do you use in the training?

Lecture method [1] Discussion method [2]

Others (specify) [3].....

.....

14. Usually how long do the training sessions take?

15. Where does the training take place?.....

16. (i) Do you organize or participate in farming practices demonstrations?

YES [2]

NO [2]

(ii) If YES above, are the demonstrations carried out on:

Selected farms [1]

On any farm [2]

17. Are the demonstrations attended by:

Any farmer [1]

Selected farmers only [2]

18. (i) In your capacity as an extension officer, do you participate in developing

technological innovations in respect to maize production? YES [1] NO [2]

(ii) If YES, please give details.....

.....

19. What process is followed before a particular technological innovation is recommended for adoption by the farmers?

.....

.....

20. (i) Do you participate in agricultural research in this division, and in particular

researches on maize production? YES [1] NO [2]

(ii) If YES above, please explain how you participate or have participated

.....

.....

21. How do you ensure that the research findings are adopted into the farming systems in this division?

(a) By availing the findings to the farmers in written form, and thereafter a follow-up

(b) By organizing seminars, workshops and thereafter a follow-up [2]

(c) By starting demonstration plots in some farmers' farms [3]

Any other (specify) [4].....

22. What is the general level of adoption of extension recommendations by the farmers in this division?

(a) Very low [1] (b) Low [2] (c) Moderate [3]

(d) High [4] (e) Very high [5]

23. (i) Are there any recommendations on maize varieties or farming practices that the farmers resisted or refused to accept? YES [1] NO [2]

(ii) If YES above, please explain.

.....

24. What reasons could have led to their refusal?

(a) Farmers did not understand the recommendations due to language barrier. [1]

(b) Lack of technical know how in adoption. [2]

(c) Recommendations were not adaptable on the farms. [3]

(d) Recommendations were not timely. [4]

(e) Fear of low yields after adoption. [5]

(f) Inputs recommended were too costly to purchase. [6]

(g) Others (specify) [7].....

(D) Constraints to Delivery of Extension Services

25. How has been the delivery of agricultural extension services in this division?

Ineffective [1]	Effective [2]	Very effective [3]
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26. What problems if any, do you encounter in the process of performing your duties?

- (a) Farmers are sparsely distributed [1]
- (b) Farmers are too many [2]
- (c) Lack of means of transport to reach to the farmers [3]
- (d) Lack of adequate and timely research findings [4]
- (e) Lack of enthusiasm by the farmers to adopt the recommendations [5]
- (f) Poor relations between farmers [6]
- (g) Others (specify).....

27. What attempts have been made to solve these constraints?

.....

.....

.....

.....

(E)Suggestions for Improvement

28.What do you suggest should be done to improve on delivery of research and extension recommendations in this division?

.....

.....

.....

29.Who should do it?

.....

.....

Thank you.

Appendix 3

OBSERVATION SCHEDULE

THE ROLE OF AGRICULTURAL EXTENSION SERVICES IN MAIZE (*Zea mays*) PRODUCTION IN CHUKA DIVISION, THARAKA-NITHI DISTRICT, KENYA

CORRESPONDING QUESTIONNAIRE NO.

DATE

INSTRUCTIONS

the researcher /research assistant to visit the respondent’s farm after the interview, observe and record the following aspects:

- 1.Approximately the land under maize production.....(acres).

- 2. General state of weed control
.....

- 3. General level of soil conservation.....

- 4. The system of cropping.
.....

- 5. System of row spacing and seed population adopted
.....

- 6.On-farm experiments.
.....

7. Are there demonstration plot(s) on the farm? YES [1]

NO [2]

8. Farming practice(s) under demonstration.....

.....

.....

9. Any on-farm experiments and the farming practices under experimentation.

.....

.....

Appendix 4

Kenya's Food Policy

Sessional paper number 4 of 1981, on National Food Policy was an attempt to address Kenya's food security. A key objective of this policy was that Kenya should maintain a position of broad self-sufficiency in the main foodstuffs without using the scarce foreign exchange on food imports intensified production is necessary. The paper envisaged a situation where the country would achieve a calculated degree security of food supply for each area of the country and that these foodstuffs are distributed in such a manner that, every member of the population has a nutritionally adequate diet (GoK 1981).

These strong points are echoed by the Sessional paper number 2 of 1994 on food policy which notes that there is a clear need for the country to continue with these major policies documented in sessional paper number 1 of 1981. The practicality of such documents definitely calls for translating the various concepts into results. This has led to the GoK formulating strategies aimed at addressing the question of food security. These include projects and programmes, credit, research and extension, marketing and distribution, strategic reserves mounting and early warning, nutrition and dietary practices.

Projects and programmes are identified as key aspects in achieving and sustaining food security in Kenya. Usually specific and temporal in nature, they aim at achieving the specified aims and objectives within a stipulated period of time.

Although they are autonomous in nature they operate within specific guidelines as per the national agricultural policies. For increased food production access to land, inputs and markets are imperative. For instance, the agricultural inputs policy aims at ensuring that adequate and quality inputs, mainly certified seeds and fertilizers are available to majority of the farmers at the right time and in the right quantities.

However, use of hybrid seeds and fertilizers for food crop production has been low especially for the smallholders. This has been attributed mainly to the high cost of these inputs and lack of clear knowledge on them. In respect to this, government subsidy to these inputs would ensure that farmers afford them for increased production. The extension staff on the other hand has a duty in ensuring that relevant and timely information and innovation are disseminated to the farmers.

The Kenya government recognizes research and extension as important in creation and dissemination of agricultural knowledge and innovation to the farmers. This is in relation to on-farm and off-farm research, on-farm trials, training, demonstration and conducting field days. Research and extension has the core objective of continued research for more productive and affordable crop varieties, improving yields of the already established variation, and breeding pest and disease resistant varieties. In this way, the extension machinery bridges the gap between the research and the farmers and provides the feedback from the farmers to the researchers.

The government policy on marketing and distribution is that changes in food security can be identified overtime by using the market as an incentive to the farmers. The farmers would put more of their land under food crops while an effective distribution

system will guarantee availability of food in the market. The strategy of strategic reserves stocks enable the government to stabilize prices in a scenario of drastic price fluctuations dictated by the market forces of demand and supply.

Although this strategy provides a plausible source of food, due to entitlement crisis, households may not be in a position to obtain these food reserves due to weak purchasing power. Household food insecurity is variously seen as a lack of access to adequate food, due to inequalities in the distribution of purchasing power and the existence of seasonal but localized food shortages.

The early warning programme is based on the premise that food insecurity occurs from lack of information that would necessitate early and appropriate intervention. However farmers usually tend to follow the weather patterns they are used to whether warned on weather changes or not. Extension officers have a duty to provide information to the farmers for instance on an impending drought and famine so that the farmers can develop coping strategies in time.