THE EFFECT OF THE NATIONAL AGRICULTURE AND LIVESTOCK EXTENSION PROGRAM (NALEP) INTERVENTIONS ON THE FARM OUTPUT IN KIRINYAGA DISTRICT-CENTRAL PROVINCE

BY

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DECLARATION

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

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ACRONYMS

DAO - District Agricultural Officer

ERS - Economic Recovery Strategy for wealth and Employment Creation

GDP - Gross Domestic Product

F.A - Focal Area

FEW - Frontline Extension worker

FMO - Farm Management Officer

FSAP - Farm Specific Action Plan

HTFCP- Horticultural and Traditional Food Crops Promotion

IFAD - International Fund for Agricultural Development

KARI - Kenya Agricultural Research Institute

LDC - Least Developed Country

MOALD- Ministry of Agriculture and Livestock Development

MOARD- Ministry of Agriculture and Rural Development

NALEP- National Agriculture and Livestock Extension Programme

NAEP - National Agriculture Extension Policy

NGO - Non-Governmental Organization

NSWP - National Soil and Water Project

PRRDS - Poverty Reduction and Rural Development Strategy

SRA - Strategy for Revitalizing Agriculture

ABSTRACT

The study seeks to establish the effect of the National Agriculture and Livestock Extension Program (NALEP) phase I interventions towards improving farm output in Kirinyaga District. Two focal areas, Nduini, Rwaithanga and their adjacent non-focal areas were considered for the study.

The study sample consisted of 120 randomly selected households from within and outside the focal area. Those within the focal area had been exposed to the NALEP interventions and those outside had not. Semi- structured questionnaires were administered to gather primary data. Discussions with the extension agents were also used to gather additional information about the program in general.

Data on maize and banana production for the year 2003 was collected from farmers who are within the focal area (NALEP Extension strategy) and also from those outside the focal areas. Gross margins for the selected crops, maize and bananas, in the two groups were computed and compared.

It is evident from the survey results that the NALEP extension program achieved reasonable improvement on banana gross margins (Ksh 46,488) in the focal area compared with (Ksh 23,232) out

side the focal area. The results support the policy of the farmer-oriented extension service designed to meet the needs and demands of the small-scale farming population. However for maize gross margins (Ksh 5,930 and Ksh 4,296) within and outside the focal area respectively, the program has not yet achieved a significant effect in the study area as farmers continue to achieve negative gross margins. The effectiveness of the extension program interventions on maize production should be improved. The NALEP extension strategy and the link to the appropriate extension stakeholders such as the credits or money lending institutions should be fully enhanced. This would help to address the problems encountered by many farmers especially in maize production.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND INFORMATION

1.1.1 THE ROLE OF EXTENSION IN AGRICULTURAL DEVELOPMENT

The agricultural sector in Kenya is faced with several serious challenges: the spiraling demand for food, declining farm size per person or per house hold due to population pressure, declining agricultural productivity due to natural resource degradation, and increasing competition in international markets (Strategy for Revitalizing Agriculture 2004-2014). The government of Kenya in its Economic Recovery Strategy (ERS) for wealth and employment creation has identified agriculture as an important tool and vehicle for the realization of its objective, namely to create employment and reduce poverty in Kenya. The agricultural sector remains the backbone of the national economy, contributing directly 26% of Gross Domestic Product (GDP) and 60% of the export earnings. (Ministry of Planning, 2003). One fundamental element in meeting these challenges is the adaptation of improved agricultural production and marketing techniques by farmers and other rural entrepreneurs. This transition from a resource based to a technology - based system of agriculture, however, places greater responsibility on the agricultural extension sector (Bisco, 1993). National agricultural extension services have a very important role to

play in agricultural sector growth and therefore have a strong bearing on the economy of the country. Agricultural extension is defined as an informal out of school educational service for training and influencing farmers and their families to adopt improved practices in crop and livestock production, management, conservation and marketing (Arnon, 1987). Agricultural extension is a vital conduit of new agricultural information and technologies to farmers as well as a conduit back to researchers and policy makers of farmer's problems, needs and concerns (Umali & Schwartz, 1994). The government of Kenya has traditionally taken the dominant role in the provision of agricultural extension services because of the important contribution it makes to agricultural development. Extension services need to be re-oriented to transform and modernize agricultural production from subsistence smallholder farming to commercial, profit - oriented undertakings. For this to happen, appropriate extension strategy is necessary. (Strategy for Revitalizing Agriculture, 2004-2010).

Although the extension service in Kenya is well developed, it often fails to meet efficiency in extension delivery. Some of the barriers to efficiency in Kenya include: inadequate supporting facilities especially transport, educational aids and information about socio-economic background of the farm

families, poor communication among the different extension levels, poor communication between the extension and research personnel and indiscipline within the extension service (Van den Ban and Hawkins, 1994).

1.2 EXTENSION APPROACHES IN KENYA

A number of extension approaches have been used in Kenya, including:

Training and visit (T&V) and National Extension Program II (NEP II) and the National Agriculture and Livestock Extension Program (NALEP).

1.2.1 The Training and Visit System of Extension (T&V)

The training and visit system developed by Benor and Harrison, (1977) was implemented in Kenya with the aim of: strengthening hierarchy and monitorable performance targets at all levels, particularly in terms of the types and frequency of contact farmers; and the provision of technical back up through subject matter specialists (Benor and Harrison, 1977). The system operated through village- level workers with comparatively low standards of education, supported by the subject matter specialists, working within a management structure which established a clear single line of responsibility based on a systematic, time bound programme of visits and training (Arnon,

1987). The T&V approach emphasized extension activities at the local level, which involved training of extension staffs that would then pass the messages to the farmers. This was in three phases as follows:

(i) Monthly Workshops - where researchers and the extension officers discussed technical agricultural subjects, and the practical technical recommendations were formulated.

(ii) Fortnightly Training Sessions- practical and technical recommendations, formulated in the monthly workshops were passed on to frontline extension workers.

(iii) The frontline- extension worker after receiving the formulated recommendations was expected to go and train their selected contact farmers. The other farmers were expected to learn from the contact farmer during this training (Arnon, 1987).

By 1985 the T & V system had been established as a mode of extension throughout the country. Some of the benefits brought about by the implementation of the T & V system included: improved extension research linkages enabling the smooth transfer of available technology as well as joint planning, implementation and evaluation of on-farm trials; and more relevant technology as constructive pressure from farmers was brought to bear on research for few relevant technologies and the actual visual impact of the program was seen on farmers'

fields, showing adoption of the various newly recommended practices (Onyango, 1987).

The T & V system had six drawbacks. First, it was a high cost exercise that required a large number of personnel and equipment, with its high recurrent costs to the national program. Second, its constant requirement from research that created pressure on research to deliver messages. Third, the messages the farmers received were not individualized. Each recommendation spanned a large area or agro-ecological zone. Fourth, the centralized hierarchy led to communication gaps and an excessive bureaucracy. It also precluded the decentralization and institutional flexibility of research and extension essential in meeting the requirement of small-scale resource poor farmers. Fifth, weakness of feedback from farmer to the researcher. Finally, the problems associated with the concept of the contact farmer such as selection criteria and the danger that the innovative characteristics required would place him/her apart from those who were supposed to learn from him (Onyango, 1987).

Criticisms of T &V system led to proposed amendments to its mode of operation, which led to the introduction of the National Extension Program II (NEP II) (Sagar and Farrington, 1988).

1.2.2 The National Extension Program II (NEP II)

This was a follow-up project of the Training and Visits extension system, which was a collaborative effort involving both Farming System Research (FSR) and T & V (Schwartz and Kernben, 1994). It was meant to induce the elements of decentralization and enhance farmers' demands on the research agenda. It also emphasized the need to make the frontline extension workers more sensitive to the farming context. The extension workers were also made to adjust their message accordingly for continued support of the mixed farming areas and expand coverage to the arid and semi-arid lands (ASAL) (Schwartz and Kernben, 1994).

1.2.3 Criticisms of these extension systems

A number of studies have been done on extension in Kenya and various problems cited. Chambers, (1994) identified the various problems and disincentives. These include lack of regular supervision of the field staffs, weak linkages between researches, extension and the other extension stake holders, rigid bureaucracy and management structure, low quality and suitability of innovations. Communication between the lowest hierarchical levels in the field and policy makers at the top may therefore have been fairly slow and it may have taken a long time before perceived problems were communicated from the field.

According to the Strategies for Revitalizing Agriculture 2004-2014, the extension system is ineffective and inadequate, and is considered as one of the main causes of poor performance in the agricultural sector. Indeed, the general feeling by the majority of farmers is that, the extension service system is virtually dead because they no longer see the extension worker as often as they would wish (Strategy for Revitalizing Agriculture-2004-2014).

In 1995 the then Ministry of Agriculture and Rural Development (MOARD) undertook a review of the second National Extension Project (NEP II). The need to review the program arose because the extension interventions were no longer reflecting farmers' demands for intervention and that the approach in reaching the farming community through appointed contact farmers was not effective (NALEP Focal Area Extension Planning, 2001).

1.3 THE NATIONAL AGRICULTURAL EXTENSION POLICY (NAEP)

With the identification of the above highlighted shortcomings on the T&V and the NEP II extension programs, an urgent need for Agricultural extension policy guidelines was required. The need to have a national agricultural extension policy became a major priority in order to provide guidance and conducive environment to other extension service providers. The National Agricultural

Extension Policy (NAEP) was developed in 1999 in an effort to harmonize approaches in the country's extension services. The policy aimed at a broader and more farmer-oriented extension service that was better designed to meet the needs and demands of the small-scale farming population. It advocated for a decentralized participatory extension program planning and activity budgeting based on the beneficiaries' needs and which involved all the relevant agricultural stakeholders. Six key issues were highlighted in the policy document: First, it was realized that Kenya has diverse agro-ecological zones and no single extension approach was appropriate for all of them. Thus, extension managers required flexibility to accommodate the variations in ecological zones. Second, the policy would encourage extension workers and researchers to share their experiences with farmers. Hence emphasis would be on participatory research and extension programs where all stakeholders were involved. Third, farmers and processors are the direct beneficiaries of public extension services and they have a right to determine the kind of agricultural development required in their respective areas. To this end, where appropriate, extension services would sensitize the beneficiaries on the need to be self-reliant and form user groups or associations to manage facilities that are put in place by the government for sustainable operations. Fourth, the

policy would be gender sensitive in the implementation of agricultural and livestock extension programs. Fifth, extension programs would be based on participatory planning and activity budgeting with strong emphasis on bottom- up approach that is planning to be initiated from the farmer's level. Beneficiary and stakeholders fora would be created for participatory planning and learning. Farmers will be sensitized and trained on their rights and needs in public extension. Sixth the monitoring and evaluation guidelines would be integrated in extension projects (National Agriculture Extension Policy (NAEP)- For Extension Planning, 1998).

1.4 THE NATIONAL AGRICULTURE AND LIVESTOCK EXTENSION PROGRAM (NALEP) PHASE I: SCOPE AND ORIGIN

In the year 1999, the Ministry of Agriculture and Livestock Development (MOALD) developed a model for agricultural extension in line with the extension policy framework described above. Until 1998, public extension services on crop and livestock management had been provided by the Ministry of Agriculture and Rural Development (MOARD) through the National Extension Programme (NEP II). The NEP II ended in the year 1997 since it was agreed that the communicated advice no longer reflected farmers' demands and that the approach in reaching the farming community through appointed contact farmers had not been

effective. In the years following the end of the NEPII implementation period, funding for extension services was reduced, as donor support was not available. During this period funding for extension services was solely from the government of Kenya. Due to reduced funding, the effectiveness of extension services was curtailed by reduced staff mobility and lack of funds to support fieldwork (MOA, 2002).

Following a review of the NAEP, the MOARD decided to adapt and extend the National Soil and Water Conservation Program (NSWCP) approach to advisory services on crop and livestock within the formulated NAEP discussed in section 1.3 above. In preparation for the new program, the National Agricultural and Livestock Extension Program (NALEP), extensive discussions were held with the main stakeholders, which are, the Soil and Water Conservation Branch, the Extension Management Branch, Kenya Agricultural Research Institute (KARI), the Regional Land Management unit (RELMA), and other "advocacy groups" comprising East African Wildlife Society, Forest Action Network, Resource Project Kenya and representative farmers. A concept paper that was developed as a result of the consultative process was discussed in a goal project-planning workshop that led to the preparation of a logical framework for a specific extension programme in selected districts i.e. the NALEP Focal Area

Approach. The NALEP was to provide extension services in 42 districts from July 2000 supported by Swedish International Development Agency (SIDA), in addition to government funding (NALEP-Focal area Report, 2002).

The main objectives of the NALEP are:

To enhance participatory, effective and demand driven extension services. The extension workers of the ministry create a forum where the farmer plays a leading role in identifying their production problems and opportunities for farm improvement;

To provide and facilitate pluralistic and efficient extension services for increased production, food security, higher incomes and improved environment, (NALEP focal area planning, 2000).

The program also emphasizes strong collaboration between the agricultural extension workers and other extension stakeholders/providers in a participatory approach. In a participatory extension process, functions and roles of extension agents are changed from instructor to facilitator as farmers take a lead in determining their destiny. (NALEP focal area planning, 2000).

Consistent with the Strategy for Revitalizing Agriculture (SRA) and NAEP, the strength of NALEP focal area extension strategy is pillared on demand-driven, pluralistic and participatory

extension delivery system. These pillars are aimed at transforming the conventional agricultural extension to a broader and more farmer-oriented extension, better equipped to meet the needs and demands of the small scale farming population. Unlike the other previous top-down extension systems where information to be delivered to the farmers was decided on their behalf, the NALEP strategy is based on the recognition of the rights of farmers to demand public extension services as well as having access to a variety of service providers. The NALEP, as a national program targets the entire rural populations who are engaged in crop and livestock production and/or fisheries and are entitled to access to public extension services, (NALEP- focal area Extension Planning, 2001).

1.4.1 NALEP Focal Area Extension Strategies.

Focal area extension planning entails concentration of effort and resources in one geographical area per division on a specific number of 400 farmers for a particular time period of one year. Both the farmers and the technical staffs in the ministry do the random identification and selection of the focal area during a public barazas. Farmers take the lead because they know their farming problems, social interactions, cohesiveness and aspirations. As a starting point, the focal area communities go through participatory sessions using various PRA tools to

identify the farming problems in their focal area. Then together with the technical workers and other stakeholders, the farmers draw a community action plan, which defines the roles and responsibilities among the community itself as well as among the extension providers.

In its first phase the program started in 42 pilot districts in the year 2000 in Kenya. The extension staff in each division in the 42 districts was to work in one focal area of about 400 farmers per year. The extension workers of the ministry are supposed to create a forum where the farmers play a leading role in identifying their production problems and opportunities. Each farm within the focal area is visited and a Farm Specific Action Plan (FSAP) is developed jointly with the farmer, looking at production challenges and opportunities to improve the farm enterprises. The (FSAP) is an extension plan discussed and agreed between the farmer and the technical staff. It is prepared in two stages. The first stage is called the Preliminary Farm Specific Action Plan (PFSAP) and is an outcome of the FEW/farmer dialogue. The second stage includes a set of interventions by the Divisional Subject Matter Specialists (DSMS) and other relevant stakeholders as per the farmers demand to bridge the production gaps. These include detailed interventions and the expected gross margins (NALEP- focal area

Extension Planning, 2001). The demanded interventions are the opportunities for farm development. By interventions it is meant that the farmers specifically in the selected NALEP focal areas play a leading role in identifying their production problems and opportunities for improvement. The farmers receive intensified producer oriented information and activities aimed at increasing the efficiency of the production process depending on the problems identified. There is also more collaboration between the agricultural extension staffs and other extension providers in this participatory approach. This is the major characteristic of these interventions. Those outside the NALEP focal areas have not been exposed to the interventions and are still under the previous extension approaches. They receive common farming messages decided on their behalf by the extension officers. They do not receive any interventions from this program (NALEP-Focal area Report, 2002).

1.5 PROBLEM STATEMENT

As the objectives of NALEP are to increase farmers' production and income, enhance participatory, effective and demand driven extension services its impact must be measured in the field. Impact may be evaluated from the quantitative effect of such indicators as yield and areas planted in accordance with the recommended practices, the impression of visitors to the field

where the system is operating, farmer's reactions to the new system, and the reactions of the extension staffs themselves to their new mode of work. Attributing a particular share of production increases to extension is difficult as agriculture is a complex activity with many interacting factors. These make it hard to determine with precision what part of any increase in production is due to which variable. However, it is not so difficult to identify particular practices that farmers are pursuing after having learnt from extension or from other farmers who have done so (Benor and Harrison, 1977).

Since the inception of the NALEP in Kirinyaga district, in the year 2000 it is expected to have made significant effect on the farmers' farms in terms of productivity. These effects should be documented for future planning of extension programs by the policy makers and the government. The study analyzed the effect of NALEP interventions on farm gross margins by comparing farms in selected focal areas with neighboring farms outside the focal areas.

1.6 JUSTIFICATION OF THE STUDY

With the establishment and apparent implementation of the NALEP for the past six years it is not evident that the program has achieved reasonable level of performance in line with the set

objectives. Several questions will be answered regarding this program. This will offer information to the researchers, policy makers and the government too. These questions are:

Has participatory, effective and demand driven extension services been enhanced.

What are the impacts of the NALEP on the productivity on the farmers' farms and their income?

Has there been strong collaboration between the agricultural extension workers and other extension stakeholders/providers in a participatory approach?

This study tried to provide answers to these questions in order to evaluate the program and provide information for better planning and performance of the extension programs in the future.

1.7 OBJECTIVE OF THE STUDY

The broad objective of the study was to examine the extent to which farmers have benefited from the extension interventions being offered by the NALEP program. Among the possible benefits, should be significant differences in gross margins of the selected crops, realized after the interventions.

1.7.1 Specific Objectives

The specific objectives of the study were to:

(i) To establish whether there are any significant differences in gross margins achieved by farmers who are within the focal area compared with those outside the focal area;

(iv) Determine whether there has been strong collaboration between the agricultural extension workers and other extension stakeholders/providers in a participatory approach

(iii) Establish whether participatory, effective and demand driven extension services been enhanced.

1.8 HYPOTHESIS

The null hypothesis is that both groups of farmers, i.e. those who have been exposed to the NALEP interventions and those who have not, have the same level of gross margins of the selected crops. The alternative hypothesis is that the farmers in the NALEP Focal areas exposed to the interventions have higher gross margins than the ones outside the Focal area.

CHAPTER 2

LITERATURE REVIEW

2.1 ISSUES ON AGRICULTURAL EXTENSION, TRAINING AND HUMAN CAPITAL

Agricultural extension strategy involves professional body of agricultural experts and the relevant stakeholders often teaching improved methods of farming, demonstrating innovations and helping farmers to organize and solve their problems. Extension acts as a link between farmers, to transfer the best practices of one farmer to another and as a channel to introduce and sometimes enforce agricultural policies. It is a vital conduit of new agricultural information and technologies to farmers as well as a conduit back to researchers and policy makers of farmers' problems, needs and concerns (Umali and Schwartz, 1994). Equally important, extension education itself provides one of the most important means of change by increasing the basis for understanding changes within agriculture, which may improve welfare. (Mellor, 1971)

2.1.1 IMPORTANCE OF GOOD EXTENSION APPROACHES

According to FAO, (2000) no single system of agricultural message is suitable for all situations and, therefore, extension approaches and methodologies should be developed according to the specific situation at hand. For this reason, it is possible

that different methodologies may be needed for different situations. Various people have criticized the top-down nature of extension services. Thompson, (1995) had the following observations /recommendations on extension education. Strong farmer participation is essential if, first, farmers' objectives, problems and opportunities are to be properly identified. Second, interventions for example, demonstrations are to reflect farmers practices and resource base and third, technologies and support systems are to be evaluated accurately for their relevance. Many existing organizations will have to transform their approaches to extension from ones that are based on top-down teaching and a narrow orientation to production to one that is farmer-centered, learning-oriented and participatory. The issue here is one of the contributions that farmers can make through articulation of their objectives, problems, opportunities and indigenous technical knowledge.

The Neuchatel Group, (1999) stated that agricultural extension services should be organized and staffed by educators who work side by side with farmers. The extension workers should concentrate on the farm and it's holdings with the farmer being encouraged to participate in identifying the production problems in the farm. Blanket recommendations cannot be precisely suited to the situation on each farm. The old practice of delivering

the same technical messages to all farmers using the same extension methodology should be gradually replaced by client-focused approaches. Hence farmers will learn to make the requisite judgments concerning innovation. A good extension program can help farmers see what factors influence decisions. The modalities of using both public and non-public institutions for delivering extension services to farming community, called pluralistic extension system, is gaining popularity. The obvious rationale is the pooling of all available resources in order to reduce unhealthy redundancy of extension services and compensate for low Ministry of Agriculture budgets (FAO, 1994).

2.1.2 FAILURES AND LIMITATIONS OF EXTENSION

Various authors have suggested reasons for shortfalls in the potential of extension to improve farmers' livelihoods. Leonard (1987) in his study in Kenya on peasant farmers' system and practices noted that information is lost as the number of communication links to farmer increases. District and provincial agricultural specialists who receive their information on extension messages direct from the research stations are generally better informed than the divisional agricultural officers and the junior worker who receive their briefing second hand. He observed that hierarchical formalism hampers upward communication of problems and insights. He also stressed the

importance of adapting agricultural programmes and technical recommendations to local conditions and of the farmers.

Similarly, Orie (1982) studied the perception of agricultural extension problems in Kenya by policy makers, supervisors and field personnel. He pointed out that the hierarchy of the extension system is fairly tall and the head offices are quite removed from the rural areas because of poor communication networks. Communication between the lowest hierarchical level in the field and policy makers at the top may therefore have been fairly slow and it may have taken a long time before perceived problems were communicated from the field to the head offices.

The Strategy for Revitalizing Agriculture, (2004-2014) indicated that resources allocated to extension services, which in the first two decades were about 5.9% of the total government annual budget, declined steadily to about 1.7% in financial year 2003/2004. As a result of the severe budgetary constraints coupled with the widespread misuse of even the little resources that were available, provision of extension services declined significantly. This sorry state of extension led to the low competency of extension workers and quality of extension services.

2.2 RELEVANT EMPIRICAL STUDIES ON AGRICULTURAL EXTENSION

The importance of Agricultural extension and its contribution to increased productivity have long been recognized. A substantial amount of literature has also been produced on the problems of extension. Most of these literatures have addressed the various aspects of problems and importance of extension as the short review below, taken to be representative of the various categories of available literature, illustrates.

It is noteworthy that the trend for the previous decades laid emphasis and efforts on the conventional inputs as the determinants of farm outputs. The model used bore the form: y=f (conventional inputs) and explicitly y=f (land, labour, capital). Recently the non-conventional model began to be considered as equally important in contributing to the farm output. With the model bearing y=f (conventional inputs, non-conventional thus y=f (land, labour, capital, education, research, extension health……), (Mugerwa, 1983).

Some research carried on earlier did not also focus on the effects of farmers' participation in demanding for extension messages and participation of other extension stakeholders in provision of extension. Further more, it appears there is lack of literature on the activities of the NALEP, initiated to

redress the problem of extension services provided to the farmers in terms of the importance of farmers participation in determining their production problem and pluralistic extension services provision. Several studies have been done in Kenya on extension. Few however have focused on the assessment of the different extension programs offered to farmers since their inception. The T&V wound up and the NEPII was introduced and their impacts on the farm production were not widely done. It is therefore important to assess the NALEP impacts in the farm level to establish its effectiveness towards achieving its objectives. This study is hoped to fill some of the gaps in the studies done previously on extension.

In our quest for rapid rural development, we cannot afford to ignore the role of extension. Farmers must be equipped and effectively mobilized in all phases of decision-making, and implementation in order to ensure extension program address actual production in their farms. Several reasons have been given to explain why farmers have not fully benefited from the previous extension programs. They ranged from, weak linkages between research, extension and the other extension stake holders, rigid bureaucracy and management structure, low quality and suitability of innovations. Other important reasons include slow communication between the lowest hierarchical levels in the

field and policy makers at the top that led to longer time being taken before perceived problems were communicated from the field Chambers, (1994).

Various researchers on extension education and its benefits to the farmers have also made other varying observations. Huffman, (1978) assessing returns to agricultural extension using production function approach identified four potential sources of bias in the measurements of returns to extension, first, production function estimates, which focus on the effect of extension on production, do not capture the effect on the factor of choice of the enterprise (down ward bias), second, extension is typically treated as current input rather than a capital input (upward bias), third, most studies on extension except Evenson and Jha neglect the interaction between research and extension (upward bias) and fourth, none of the studies include the effect of the private sectors information activities (Upward bias). Huffman then concluded that after taking into account the potential sources of bias, the rate of return to extension is modest. Huffman's observations create a lot of interest on whether extension is really worth investing on. His study was justified at that time because not many extension programmes had been tried more so in Kenya. However in spite of these conclusions this study may not be a conclusive picture about

extension as many changes have occurred in the extension service delivery. The observation that none of the studies include the effect of the private sectors information activities as an upward bias by Huffman is one of the areas the present study has recognized and is focused on determining whether there possible influence by other extension stakeholders on increased farm productivity.

2.2.1 STUDIES ON THE ECONOMICS OF EXTENSION

Andreou, (1974), studying on the economics of extension stated that, extension education and training are also important in motivating farmers, through opening the eyes of the farmers and their children to a broader view of the world and to possibilities of change in consumption and production. Perhaps more important, extension education motivates farmers and prospective farmers to change. This study concerns itself only with teaching and securing adoption of a particular practice but does not tell more on the change of the outlook of the farmer to a point where he will be receptive to, and on his own initiative continuously demand for means of improving his farm production. The definition does tend to assume that it will always be in the interests of the farmer to adopt the prescribed recommendation, which may not necessarily be the case. The present study attempted to address the importance of farmers' participation in

demanding for information to address his farm production problems and hence change in farm productivity.

Rogers (1997) says that the role of extension worker should be to strengthen farmer's existing capacity to create knowledge- to question, to analyze and to test possible solutions themselves. The extension worker should start with the farmer, their existing knowledge and the gaps in that knowledge. This concurs with the present study as it has shown the importance of the extension worker's effort in understand the farmers' problem as a stating point in addressing farm productivity. However the study does not explicitly relate the importance of the created knowledge to the farmer by the extension worker to farm productivity. The present study attempts to investigate this aspect by assessing the effects of the NALEP interventions on farm out put.

According to Umali and Schwartz, 1994, discussing on public and private agricultural extension, stated that production-oriented extension education programs have important primary roles and objectives. First, they may serve to stimulate a framework of changing farmer's attitudes and aspirations, conducive to acceptance of technological changes. This may call for stimulating the desire for purchased goods and services and

create awareness of the potentially positive value of change. Second, stimulating the acceptance of change may represent the most important function in early stages of agricultural development. This is when farmers are still largely traditionally bound and only just beginning to emerge from a period when change in general had unprofitable results. Third, the function of a production oriented extension program is that of providing training and guidance to farmers in decision - making. Good farm management involves the acceptance of applicable and profitable innovations. Perhaps even more important, is the rejection of inapplicable and unprofitable innovations. Without extension guidance farmers are often unable to fully exploit the farming opportunities available to them. Effective extension provides the vehicle for increasing agricultural productivity. This study seem to support the present study in its attempt to look at the importance of extension education being able to offer guidance in decision making on farm production and the importance of other extension stakeholders.

Leagans (1971) undertook a study on the role of extension education on modernization of agriculture, using a theoretical production function. He suggested that extension education was a necessary condition for increased farm productivity because

researchers may create very useful knowledge but the knowledge may be useless without extension service to farmers on its use. This suggests the need for combined efforts and interaction between researchers and the extension services in order to develop successful extension programmes. He however did not cover the aspect of the extension worker interaction with the farmers so as to understand farmers' production problem. Additionally the study did not relate farmers' participation in identifying production problems on farm productivity. The present study covered this aspect by assessing NALEP interventions.

Peterson (1971) dealt at length on the economics of extension education in general. He noted for instance, "human capital" requires both tools and knowledge to be productive regardless of the long pay-off period of investment. Since human capital like the non-human form of capital, also suffers from depreciation, there is need for continuous training. The human form of depreciation arises due to changing technology-creating obsolescence and due to the inherent weakness of man to forget learned items. Peterson's study should have continued to assess the effects of these knowledge to the farmers on the farm productivity, which is the gap this study seeks to assess.

Wolf, 1995 stated that the economic quality of the population remains low when there is little knowledge of what natural resources are available, the alternative production on techniques that are possible, the necessary skills, and the institutions that might be created to favor economizing effort and economic rationality. An improvement in the quality of "human factor" is then as essential as investment in physical capital. An advance in knowledge and the diffusion of new ideas and objectives are necessary to remove economic backwardness and instill the human abilities and motivations that are more favorable to economic achievement.

Evenson and Jha (1986) Studying on productivity change in extension noted that extension and index of maturity of extension program, contribute significantly to agricultural productivity change only through interaction with research programs. Investments in extension programs yield a 15%-25% social rate of return.

Griliches (1974) carried out a research and used a production function to analyze on the United States agriculture. He concluded that when investment in extension and research were included in the production function, the two proved significant and important as a source of increased farm output. In a cross

sectional survey he noted that significant increases in grain yields were realized as a result of modern technology. He pointed out that that if the momentum is to be sustained; substantial investments have to be undertaken not only in industrial capacity, irrigation or other physical projects, but also in the education of the agricultural producers. However his study did not consider the need to understand the farmer's level of production before introducing the new technology. The present study considered this aspect.

Berdegue (1992) in the study of the Farming Systems and Research (FSR) noted that it is easy to blame extension for the slow rate of adoption of new technologies and that extension has not yet accepted that effective transfer of technology often begins with better understanding of what the clients need. Hence there remains much more room for improvement on both sides. He further stated that much more emphasis must be placed on the development of stronger research -extension linkages and more direct participation of extension workers in technology generation processes. The same assumption is held in this study where by focus is on determining whether there possible effect of first understanding farmers production problems and then addressing them as opportunities for farm improvement.

A study on diffusion of technologies by Saucer, (1979) observed that the diffusion of better husbandry practices of crop and livestock varieties has been a major source of productivity growth in agriculture in the United States. The problem of economic growth, both of the individual farm and the entire agricultural sector, was cast firmly within the context of reorganizing production inputs to achieve increase in outputs per unit of input by improving the efficiency within which the existing inputs are allocated. Models developed emphasized the relationship between diffusion rates and the personality characteristics and educational accomplishments of the farm operators. The insights into the dynamics of the diffusion process contributed to the effectiveness of the agricultural extension services and strengthened the confidence of the agricultural administrators and the policy makers in the validity of the diffusion model.

Anyane (1986) writing on the economics of agricultural development observed that the importance of agricultural extension education is that it provides a technique for enhancing the chances for increasing production without any significant quantitative increases in the basic factors of production -land, labour and capital. It serves primarily to improve entrepreneurship and managerial ability. If properly

utilized, the increase in return, which is not easily quantifiable, may be enormous and continuous.

2.2.2 KENYAN EXPERIENCE

Several studies have been undertaken in Kenya concerning agricultural extension education and its related fields. Studying on the research and extension linkages in Kajiampau Meru district, Cochrane (1994) found that extension services enhance adoption of recommendations of research findings. She attributed this to the close contact between the farmer and the extension worker and the fact that majority of the farmers rely on extension workers as their source of agricultural information. Though the study recognizes the importance of the extension worker interaction with the farmer, which is similar to the present study, it did not go into great depth in discussing the outcome of the close contact of the farmer and the extension worker in regard to farm productivity. The study emphasizes more on the importance of extension worker closeness to the farmer as a source of information. However, the present study attempts to address this gap and come up with information on the importance of farmers' interaction with the extension worker towards improved farm productivity.

Mocks, (1993) noted that the interaction between farmers and the extension providers had a positive effect on the managerial ability of the maize farmers in Vihiga division. Mock also noted the positive effect of education (formal) on the managerial ability of maize farmers in the division. Mocks study seems to lay more emphasis on formal education on the managerial abilities that tend not to be the case in the present study. He pointed out the importance of the farmers' formal education in broadening his horizon to be able to allocate resources between alternative competing ends, and to create efficient use of resources. Though the present study too considers farmer's formal education, emphasis is more on the farmers' participation in understanding their farm productivity problems and being able to demand for information to address them.

Suradisatra, (1992) in his study of farmers' perception of extension activities in Western Kenya found out that the extent of farmers' exposure to extension activities differs among geographical locations. The greater the family size, farm size, and crops grown and the number of livestock raised, the more likely the farmer will interact more with the extension workers. Younger, better-educated farmers are more likely to be exposed to extension media. The study also showed that farmers with

greater exposure to extension personnel tended to use more inputs in livestock and crop production.

Mugerwa, (1983) analyzed the impact of Farmers Training Centers (FTCs) on farm output in Homabay District using the multiple regression and correlation analysis. The results of his study showed that farmer trainings in the FTCs are an important factor in determine farm output. The results imply that the knowledge skills acquired in the training centers enables farmers to increase efficiency of resource use. The study shows the importance these institutions and the role of extension towards improving farm output. At the time of Mugerwa's study the T&v program was in operation and controlling the messages being given to the farmers. The study seems to suggest that farmers receive common production information during these trainings to improve their farm output. It is not clearly defined whether the farmers' needs were first identified before such trainings were conducted for the farmers in these institutions. The present study lays a lot of emphasis on identifying farmers' production problems first before offering any extension advice or training.

Cochrane, (1994) did an analysis on the ways extension and researches are carried out in Kanjiampau Meru District. The result of her study showed that the role of an extension agent

is viewed as that of helping farmers form sound opinions and make good decisions by communicating with them and providing them with information they need. Her work did not involve explaining further what these information are, and their effect on the farms. The present study seeks to address similar issues though more emphasis is laid on the effect of these information on the farm output.

The studies that have been reviewed above represent some of the effort done previously by different researchers to investigate on the effect of extension on the farm. These studies are considered relevant as they offer good examples of the various approaches to studies on extension services. However few studies have been conducted on the impacts of the extension programmes on the farms in order to bring out the link between extension policies and agricultural extension performance. This study attempted to do so. The study attempts to examine the NALEP interventions and the effect it has made to the farmers' farms in its focal area extension strategy in regard to the NAEP concept. It is more oriented to the Thompson's study but on a much smaller scale. It also portrays the characteristics of the Neuchatel Group study.

2.3 DESCRIPTION OF THE STUDY AREA

The study was conducted in Kirinyaga district in the Central province of Kenya. Kirinyaga District offers appropriate study area as it is one of the 42 districts that the NALEP extension program phase I were first availed to, in the year 2000. The district is administratively made up of four divisions namely: Gichugu, Mwea, Ndia and Central. It covers an area of 1437km^2 with Mount Kenya forest, which is located to the north of the district occupying 21% of the total area of the district (Kirinyaga District development Plan, 1997-2001).

2.3.1 District Population

The district population is estimated to be 553,123 people with a total population of 65,000 farm families (District Planning Unit, Kerugoya, 2001). The population is composed of Kikuyu people who are the majority, Akamba and a few Mbeere. The average land size is 2.5 acres per household (Kirinyaga District Annual Report 2000).

2.3.2 Economic Environment

The majority of people in Kirinyaga District are small- holders of between 1-3 hectares of land per holding. The farms are subdivided into small plots where mainly maize, bananas, coffee, beans, tea and horticultural crops are grown. Maize and rice are

the main staple food. In the black cotton soil area in Mwea division, rice is the major cash crop. Almost all the households practice livestock farming where indigenous goats and cattle are kept. Dairy production is the main livestock activity in the district. It contributes about 80% in terms of value and volume of livestock production. Dairy farming is mainly practiced in the higher potential areas of Gichugu and Ndia divisions mainly as a small-scale activity due to the small size of the farm holdings, which average between .5-1.5 hectares. However the numbers of each type of animals kept vary from holding to holding.

2.3.3 Topography and Climate

The district's landscape can be divided into three distinct relief features. The area between 1,480m and 2,000m above sea level forms most of Mwea division and consists of gently rolling plains and isolated hills. It also forms part of Tana River basin. The middle area between 2,000m and 4,800m above sea level consist of the middle part of Gichugu and Ndia Divisions and the area rising 4,800m to cover 6,800m, which consist mostly the highlands, and includes Mt. Kenya forest.

The district experiences two rainfall seasons. The first rains occur in March to early June. These are long rains with average precipitation of 1100mm per month. The second rains occur from

mid October to early December. These are the short rains, which average to 800mm per month. Annual average rainfall received is 950mm (Kirinyaga District Annual Report 2001).

2.3.4 Soils

There are several types of soils in Kirinyaga District and their fertility varies considerably from one area to the other. The soils are predominantly loam soils, however some parts of the district have black cotton soils especially the lower zones. The soils are fairly fertile (Kirinyaga District Annual Report 2001).

2.4 STUDY AREAS

The study was conducted in two randomly selected focal areas (Rwaithanga and Nduini) and their adjacent non-focal areas. It assumed that the findings would reflect the performance of the NALEP in Kirinyaga.

2.4.1 Rwaithanga Focal Area

Rwaithanga focal area is located in Nguiguini sub location, Kiine north location, Ndia Division. The area covers 400 farms under the NALEP focal area strategy. The average farm size is one hectare. The area lies in the main coffee zone; upper midland zone 2 (UM_2) and experiences bimodal type of rainfall

with the long rain averaging 1350mm and short rains 1100mm. The long rain falls in the months of March to May and the short rains in October to December. The soils are moderate nitsols with some parts having silt loam and sandy loams soils. The main crops grown in this area are sweet potatoes, bananas, paw paws, French beans, maize, beans, coffee, macadamia, tomatoes, onions and various horticultural crops. Livestock is also widely kept in this area. Most of the farm produce is marketed in the two nearest markets, namely Kibirigwi and Karatina markets. Some produce such as sweet potatoes is sold in Nairobi. Farmers relies on coffee co-operative society for credit facilities and other financial institutions such as the Kirinyaga Sacco. Various farm inputs including the fertilizers and seeds are readily available in the local stockists (Rwaithaga Focal area Participatory Rural Appraisal (PRA) Report 2001).

2.4.2 Nduini Focal Area

Nduini focal area is located in Nduini sub-location, Koroma location of Central Division. It lies in the agro-ecological upper midland zone (UM_3), which is a coffee-maize zone. The area receives a bimodal type of rainfall, with an average of 1300mm during the long rains (March -May) and 1100mm during the short rains (October- December). The soils are mainly nitsols of moderate fertility, deep and well drained. The focal area covers

400 farms. On average each household has three-acre farm. The main crops grown in this area include maize, beans, kales, tomatoes, bananas and the horticultural crops. Most of the farm produce is marketed in the nearest Kutus market and the rest taken to Nairobi. The farmers also rely on coffee co-operative society (Kirinyaga Sacco) for credit facilities. Farm inputs such, as the fertilizers are readily available in the local stockists Nduini Focal Area (PRA) report 2001).

CHAPTER THREE

METHODOLGY

3.1 Theoretical framework

3.1.1 Participatory and demand driven Extension Approach model

Extension services are a major source of technical information for farmers. Relevant and adequate information to farmers is an essential ingredient for efficient decision-making process aimed at optimizing the performance of farm enterprises.

Members of the farming household have four basic types of inputs land, labour, capital and management. Management involves allocating these inputs to different activities or processes for example crops, crops, livestock, or off farm activities and implementing the resulting farm plan. Farmers have to make decisions on how to allocate their inputs in producing one or more products. These decisions will come as close as possible to fulfilling the household objectives for example, maximizing their income, producing enough food for the family. The objectives may vary from farmer to farmer. Once they have made sure they are producing enough food to feed their family, many farmers will to want to maximize their incomes. The resulting combination of enterprises (that is crops, livestock and off farm enterprises) is the existing production system. However the extents to which the farm family can fulfill their objectives

depend on their managerial skills, including their ability to make good decisions in the allocation of inputs in an uncertain agricultural environment (Anandajayasekeram, 1996).

Farmers are the only people who can make effective decisions about how to manage their farms within the many environmental and social constraints they face. The total environment in which the farming household operates consists of two parts:
The technical that is, natural or biophysical elements and the human element that is, social cultural and economic. Some parts of environment that influence farming are outside the control of the individual farming family, hence causing uncertainty to the farmer. The technical elements determine the types of livestock kept and crops grown and their biological potential. The human element is also important in determining the actual farming system and consists of two types of factors, exogenous and endogenous. The exogenous factor, social environment are those which lie outside the system and are not basically within the control of the individual farming family, example, community structures, norms and beliefs, external institutions, demographic factors. The endogenous factors are those that occur within the farming system and that the individual farming household can control to some degree. These include land use, labour, capita and management (Norman et al, 1994).

Farmers can and do make wise decisions about their problems if they are given full information including possible alternative solutions. By making decisions farmers gain self-confidence. Extension, therefore presents facts, helps people to solve problems and encourages farmers to adopt decisions, which they made themselves than in those, which are imposed upon them (Chambers et al, 1994).

An extension approach based on bottom-up approach and a narrowly oriented on production, farmer centered and participatory may enhance productivity at the farm level. It is hypothesized that contact and high interaction with the extension agents increase the adoption of the learnt technologies and thus increases farm production (Thomson, 1995). Effective communication and interaction between the farmer and the extension agent is a major factor in determining the production level of the farmer. This interaction enhances problem solving and builds the capacity of the farmer to adopt the learnt technologies (Matata, Wandera and Dixon, 2002).

For this study the treatment groups are defined, as the farmers within the NALEP focal area, where the extension worker of the ministry are supposed to create a forum where the farmers play a leading role in identifying their production problems and

opportunities. In order to determine whether the NALEP interventions have significant effect on the gross margins, the relative importance of different factors influencing agricultural productivity were determined using multiple regression analysis. Two dependent variables, banana and maize gross margins were used in the analysis. The gross margins are thus arrived as follows:

$Gm=\Sigma piyi-ci$ (1=1, 2.... n) (1)

Where:

Gm= Gross Margins

Pi=Farm gate price of the crop Ksh/Kg

Yi=Yield of the crop bags/acre

Ci=Total variable cost production Ksh/acre

1,2……n=Number of crop

3.1.1.1 Banana and maize Gross margins

Explanatory variables include:

X1-Age of the farmer

X2-Formal education of the farmer

X3-Credit access

X4-Land size

X5- Member of NALEP focal area

X6-Source of income

X7- distance to the market

X8-Income expenditure

X9-Family labour

X10-Hired labour

The model can be represented generally as:

$Y=f(x)$.... (2)

Where x is a vector of variables as defined above. The variables x1, x2, x3,.. were taken care of by the use of dummy variables. The variables in equation (2) are described here below.

3.1.1.2 Land size

It is apparent that in some densely populated countries, the area of available land is an effective limitation on agricultural output. Indeed up to a certain limit, crop yield achieved increases with the area of land in which a certain amount of capital is invested. Land becomes an effective limitation in agricultural production where its access is limited because under a given level of technology, the total output will be increased by putting more land under cultivation. In household where agriculture is the main source of income, accessibility to land becomes a major factor in determining the income level of the household (Mwangi and Verkurji, 2003). The average size of land in hectares for the two groups in the study area is used in the analysis.

3.1.1.3 Labour use

Like input use per hectare, labour use per hectare, measured in terms of man-days, also shows the production intensity on a given area of land. It was assumed that using more labour per hectare allows production activities, like weeding, fertilizer application, control of insects and diseases, to be done more effectively thereby, increasing crop yields and hence output per hectare. Labour use per hectare was expected to positively affect productivity. The study made considerations for age and differences in capacity to work in this case (18-55) years expressed in man-days. The number of hired labour and the number of family members available for supply of labour were considered in the analysis.

3.1.1.4 Formal Education of the farmer

The level of education of the farmer was used in this study a proxy for the level of management. A farmer with a higher level of education is assumed to have better management at the farm level and hence higher output. In this study education was measured by the highest number of years of schooling completed by the farmer. It was expected that with each increase of level of education, production be also expected to increase.

3.1.1.4 Member of NALEP focal area

The NALEP interventions offered to the farmers within the focal area emphasizes farmers participating in identifying the production problems in his/her farm and together with the extension worker comes up with the opportunities for closing up these production gaps identified. A farmer who was led through and understands well the problems hampering higher production in his farm and the expected profits/benefits can mobilize the available resources to improve production and thus was expected to have higher productivity. A dummy, 1 represented the variable if the farmer was within the focal area and 0 if outside the focal area.

3.1.1.5 Credit Access

It was noteworthy that credit was used to overcome shortages in capital input where potential for increasing production exists. Osuntogun and Adeyemo, (1986) showed that total farm operating expenses such as input cost, labour, were the second most important explanatory predictor of total crop production. Farmers who have access to credit have more options to acquire or adopt new technologies such as improved seeds or fertilizers (Mwangi and Verkurji, 2003). Availing credit to farmers for the purchase of farm inputs implements and for hiring labour was expected to improve productivity. A dummy, 1 represented the

variable if the farmer has access to farm credits and 0 if no access to.

3.1.1.6 Distance to the market

Farmers with easy access to the market would have an advantage of selling their produce at better prices as compared to those who are at longer distances. The effect of the distance to the market is considered in this study. The variable is represented by two levels, 1=farmers at a distance of less than five kilometers from the market and 0=five kilometers and above.

3.1.1.7 Source of income

A household source of income has a direct bearing on the productivity at the farm level. A household heads occupation has a corresponding implication on his or her income and on the amount of this income spent on farm improvement (Mwangi and Verkurji, 2003). A house hold head who supplements farm income with permanent employment has an assured income and is therefore more likely to hire labour or implement the recommended practices by the extension workers. Source of income in this study is expected to be an important factor influencing the gross margins. Farmers who have other sources of income other than farm income are likely to invest part of this income and this would increases the probability of implementation of the

recommended practices. This fact will be tested in the analysis. A dummy, 1 unit if main income source is from the farm, 0 from off-farm income.

3.1.1.8 Age of the Farmer

Farmer's age has a direct bearing on his/her approach, open or conservative to levels of exposure to new technologies. Further more, age has a bearing as some agricultural technologies need physical labor input to implement. The chronological age of farmer was considered in the analysis.

3.1.1.9 Income Expenditure

The level of investing back the acquired income from the farm highly depend on farmers priority where the drive to generate more from the farm would drive the farmer to invest back the income generated from the farm more than any other activity (Mwangi and Verkurji, 2003). The percentages on how farmers use their income were considered in the analysis.

Given the above variables the banana and maize gross margins model was represented thus as:

$$Y=a+ b_1x_1+b_2x_2+b_3x_3+b_4x_4+e \qquad (3)$$

Where a is constant, b_1……b_n are the regression coefficients of the different variables,

$x_1 \ldots\ldots\ldots x_n$, are the independent variables and

e the random error assumed to be independently and randomly distributed.

The equation was estimated using the ordinary Least Square (OLS) method. The main aim of the equation is to establish a relationship between the dependent variable i.e. the maize and banana gross margins and the independent variables and not to create a production function. Also, the fact that a number of the explanatory variables were dummy variables justified the use of a linear model. The linear model was also expected to give the best results in terms of the number of significant variables and the coefficient of determination R^2.

3.2 SAMPLING AND DATA COLLECTION

3.2.1 Sampling procedures

The study involved the population within the focal area and the adjacent non-focal area residents who formed two strata. The stratum exposed to the NALEP interventions composed of those within the focal area under the NALEP extension strategy. The 400 households within the focal area were stratified into those growing and not growing maize and bananas. Another list of 400 households' names in the extension unit who have not been exposed to the interventions was also obtained and stratified

into the two stratum. This was replicated in the second focal area and non-focal area to enhance wide area of data collection.

Lists of 85, 90, 96 and 100 households producing maize and bananas were obtained from the four strata respectively. From these lists, 30 households were selected from each stratum to form the study sample. Random selection of the 30 households was arrived by using equation (4) below:

$$N/n = k \qquad (4)$$

Where;

N=the number of households producing maize and bananas;

K=the number obtained to determine the sampling interval and n= the sample size required. Then selecting systematically by counting the k^{th} number in each group. The first sampling unit was selected from the total of sampling units at random by use of random numbers generated by computer programme.

3.2.2 Sampling Frame

Names of all focal areas in Kirinyaga District in the year 2003 were obtained from the District Agricultural Offices. Out of these names, two focal areas were randomly selected to form the basis of the study area with the treatment. Outside the focal areas are those adjacent to the focal area who formed the control group. Names of farmers within the focal area producing

maize and bananas were obtained from the agricultural division office with the help of the frontline extension workers in the respective focal area. Farmers' names outside the focal area were obtained from the location agricultural extension office with the help of extension worker in charge of that area. The study sample size consisted of 120 households in total.

3.2.3 Data Collection

Data for the year 2003 was used to ascertain the relationship of farm production output of the selected crops, and the identified variables. Primary data was collected by use of semi-structured questionnaires from the respondents. The specific variables for which primary data were collected are: Age of the farmer, formal education of the farmer, credit access, Land size, and member of the NALEP focal area, source of income, distance to the market, income expenditures, family labour and hired labour.

The questions embodied in the questionnaires were in line with the specific objectives of the study. The questionnaires were pre-tested and amendments made before they were administered to the respondents. Trained enumerators under the supervision of the principal researcher carried out questionnaire administration. Informal interviews were also carried out with the extension officers at the district and the divisional level about the program. The interviews with the extension officers,

in combination with published materials and reports were used to gather the relevant secondary data on the NALEP focal area extension strategy.

3.3 DATA ANALYSIS

Data were analyzed by use of Statistical Package for the Social Sciences (SPSS) computer program whereby the cross tabulations on characteristics of the households of the two groups were done. Descriptive statistics including frequencies and means were computed for household characteristics. Chi-square statistical test was used to test for differences in household characteristics. The second stage of data analysis involved a multiple regression analysis with the aim of establishing causal relationships of the dependent and the independent variables as defined in table 3.1. The dependent variables were banana and maize gross margins analyzed separately. The expected relationships are outlined in Table 3.1 below.

Table 3.1 Expected Outcomes of the independent variables

Variable	Description	Expected Relationship
1.Labour availability	Supply of Labour (18-55) Years expressed in man-days.The number of family members available for Provision of labour, the number of Hired man-days to supplement Family labour.	Increase in labour is expected to have positive effect on farm output.
2.Age	Chorological age of the household head.	The farmers age can have a positive or negative effect on farm output.
3.Within NALEP focal area.	Value of 1 if farmer is within the Focal area,0 if not	Access to NALEP interventions will enable the farmer to use better production methods thus higher output.
4.Credit facilities	Value of 1 if farmer received any credit to facilitate production,0 if not.	Credits access is expected to have a positive effect on the Farm output.
5. Farm size	Total land holding in hectares	Total farm output increases or decreases depending on the size of land under cultivation
6. Level of education	Highest formal schooling completed by the farmer in years.	Higher level of education is assumed to provide better management hence higher output
7. Income source	Value of 1 if main income source is from the farm,0 for off farm income	The higher the farm income the higher the farm output is expected to be.
8. Distance to the market	Value of 1 if farmer is at a distance of less than 5km from the market and 0 if farmer is at 5km	Distance to the market can have a positive or negative relationship on the farm output
9. Income expenditure	The percentage of how income is used in each of the household activities.	The more a farmer invest back in farm development the higher The farm output is expected to be.

3.3.1 Regression Analysis

In order to determine whether NALEP has had a significant effect on the farm output, the relative importance of different factors influencing farm output were determined using a multiple linear regression analysis.

Two regressions, one for banana gross margins and the other for maize gross margins were estimated with the independent variables listed in table 3.1. There are various ways of measuring farm performance such as the net farm income, cash returns and the gross margins. The use of such measures is however best under certain conditions largely determined by the database. The use of cash returns was found inappropriate because a big proportion of farm produce is consumed at home without market evaluation. The exact value of produce eaten at home would be anybody's guess. Secondly not all farmers deal in direct cash inputs. With these shortcomings, the use of gross margins for maize and bananas was seen to be the only appropriate measure to use. Gross margin is the difference between gross income and total variable cost. It is convenient because it provides a measure of returns over variable cost and is a step in the direction of measuring profitability. It is simple, as it does not consider fixed costs, which can often be

difficult to allocate to individual enterprises (Norman et. al; 2001).

3.3.2 Diagnostic Tests on the Empirical model

Multiple linear regression models were estimated to isolate the determinants of both banana and maize gross margins. The usual assumptions underlying multiple regressions and multiple correlations were recognized in the initial models that were estimated. These assumptions include:

(i) The dependent variables and independent variables have a linear relationship.

(ii) All the disturbance terms have the same variance and are not correlated with one another.

(iii) The residuals, computed by $y-y_i$ are normally distributed with a mean of zero.

(iv) Successive observations of the dependent variables are uncorrelated. Violation of this assumption would result into autocorrelation.

(v) The number of observations is greater than the number of independent variables.

The models were fitted to data using the statistical package for the social science (SPSS) and diagnostic tests performed as follows:

(i) One of diagnostics was that the signs of coefficients attached to the explanatory variables should be in agreement with economic theory and the logic of small-scale farm production so that the function is economically meaningful.

(ii) Correlation coefficients between independent variables were calculated to identify any variables that were highly correlated and a decision was made to exclude one of them from the model.

(iii) t-statistics were used to determine the significant variables in the model. A decision was made to retain the significant variables and any non-significant variables on the basis of economic theory.

3.3.3 Goodness of Fit

A goodness of fit measure is a summary statistic indicating the accuracy with which a model approximates the observed data. To measure the goodness of fit in conventional regression, Greene (1994) suggested use of coefficient of multiple determinations R^2. This is the percent of the variation explained by the regression model. It measures the goodness of fit by showing the amount of variation in the dependent variable that is explained by the change in the explanatory variables. The higher the R^2

value the higher the percentage of the variation accounted for. It is with these criteria that the regression equations in table 4.13 and 4.14 were selected to be the best functions for banana and maize gross margins.

CHAPTER FOUR

RESULTS

4.1 RESULTS

4.1.1 CHARACTERISTICS OF RESPONDENTS AND HOLDINGS

This chapter presents results of the analysis of data obtained in the study area from the respondents by use of semi-structured questionnaires. Information from the in-depth discussions with the extension officers in the division and at the district level is also included. Data was analyzed by use of the SPSS computer package.

Several characteristics of the holdings were analyzed which include: Age of the respondents, formal education of the respondents, land size, family labour, hired labour, sources of extension information, NALEP interventions, access to credit and utilization, investments in tools and mechanization equipment, income sources and expenditure, access to market, causes of low maize production and crop outputs.

4.1.1.1 Farmers' Age

In this case the farmer's age was considered being the decision maker in production matters, who could be either male or female. Table 4.1 shows the distribution of age among the sampled

respondents in different ranges of age brackets for both the treatment and control group in the study area.

Table 4.1: Farmer's Age Outside/Within Focal Area

Farmer's Age (yrs).	Within F.A (%) N=60	Outside F.A (%) N=60
30-35	3.4	3.3
36-40	5.0	5.3
41-45	23.1	15.2
46-50	25.4	23.1
51-55	16.1	21.6
56-60	10.2	10.0
61-65	3.7	5.0
66-70	4.6	8.4
71-75	3.2	5.0
76-80	2.6	3.4
81-85	2.7	0.0

Most farmers (83.1%) within the focal area involved in farming ranged from the age of 41-70 years. 25.4% within the focal area are in the age bracket of 46-50 years. For those outside the focal area, (23.1%) was in the age bracket of 46-50 years. This age group has majority of the farmers (Table 4.1) in both focal and outside focal area. For the farmers in the study area the group engaged in farming was concentrated in the age bracket of

41-55. Age distribution for the two groups was not significantly different as supported by the chi-square result (x^2=. 505)

4.1.1.2 Farmer's Formal Education

Farmer's education was the level of education of the household head who could be either male or female. The educational level of the farmer was considered by the number of years of schooling that the farmer has completed. Table 4.3 shows the relative levels in years of farmers in the study area. Majority of the farmers in the sample area had received some formal education.

Table 4.2 Respondent's Education Outside/Within F.A

Respondents Education (yrs)	Within F.A (%)	Outside F.A (%)
0	6.3	6.3
1-2	8.3	8
3-4	8.7	7
5-6	6.7	6.7
7-8	29	27.3
9-10	11.7	13
11-12	24	23.6
13-14	3.7	6.7
15-16	1.6	2.4

It is hypothesized that education, enhances the ability of farmers to acquire, synthesize and quickly respond to disequilibria, thereby increasing the probability of adoption of an innovation. The highest level of education attained by most farmers in the sample area was 11-12 years with 24% being from with the focal area and 23.6% from outside the focal area. This result suggests that, there was no significant difference between the treatment and control group in education attainment. The chi-square statistic was P = 0.752 and was not significant at 5%.

4.1.1.3 The Land size

Smallholder production faces several constraints, among which size of the holding is an important one. Indeed up to a certain limit, crop yields achieved increase with the area of land in which a certain amount of capital is invested (Mwangi and Verkurji, 2003). An increase in the acreage cultivated leads to an increase in both the average and marginal product of labour up to the point of the technical optimum. Table 4.3 shows the size of the farm sizes in the study area.

Table 4.3: Land size (hectares) outside/within F.A

Land size (ha)	Within F.A (%)	Outside F.A (%)
0-0.4	13.4	11.0
0.5-0.8	36.7	23.3
0.9-1.2	18.4	25.0
1.3-1.6	15.0	15.6
1.7-2	6.7	10.0
2.1-2.4	5.0	6.7
2.5-2.8	1.7	1.7
2.9-3.2	1.7	3.3
3.3-above	1.4	3.4

Farmers outside the focal area were found to have slightly bigger land size compared with those within the focal area as shown in Table 4.3. About a quarter of the farmers outside F.A have land size ranging from 0.9-1.2 hectares as compared to 18.4% of those within the focal area. Whereas 36.7% of the farmers within the focal area own land ranging from 0.5-0.8 hectares, the corresponding figure is 23.3% of the farmers outside the focal area. The results show that the average land size is generally small, in most cases less than one hectare per holding for both the treatment and the control group. However there was no significant difference in land size holding (x^2= 0.505) at 5% level.

4.1.1.4 Land tenure

The smallholder farmers live on smallholding of an average size of one hectare. The land tenure system is mostly free hold (88.3%) and (93.3%) in treatment and control groups respectively. Only a small percentage (11.7%) of farmers within the focal area and (6.7%) outside the focal area have leased, rented or were given pieces of land by relatives or friends to supplement their small size of land in crop production. It is assumed that the more secure the land tenure system, the higher the agricultural production. This higher agricultural production is assumed to be as a result of land tenure security affecting productivity positively through increased investment in land improvements (Karanja, 1990).

4.1.1.5 Labour

The size of family has some relationship with the level of output, be it commercial or for domestic consumption (Mwangi and Verkuji, 2003). Considerations were made for age with capacity to work, with the age bracket considered being 18-55 years for both sexes. Family labour was adequate in both groups. Most farmers in the sample area have family labour of two people per family who were fully involved in providing labour for farming activities.

Men and women were assigned similar units of man-days, as the rate for payment for hired labour in the study area is the same regardless of the sex of the worker. Hired labour was prevalent but only necessary during the peak periods of planting, weeding and harvesting especially for maize. This is due to the small size of land holdings that the family labour available can comfortably work on. However more farmers (31.1%) within the focal area hired more labour of about two man-days as compared to those outside the focal area (16.7%). This was thought to be due to the more innovations the farmers within the focal area are involved in after receiving the interventions and in implementing the recommendations from the extension workers. Thus there is a significant difference as supported by the chi-square test ($p=0.006$) at 5% level, of hired labour within the focal area and outside the focal area.

The hired Labour in the study area was temporary. Only 23.3% of farmers within the focal area hire one permanent worker, which is same as the 23.7% of farmers outside the focal area who have one permanent worker. This is also attributed to the small size of the land, which the family Labour can manage, and the fluctuation of labour demands in different farming seasons. Farmers also supplemented labor demands by use of friends, relatives and neighbors who help them during the peak periods of

labour demands. All farmers within the focal area felt that labour was adequately available when needed whereas 93.3% of farmers outside the focal area also felt the same.

4.1.1.6 Source of Extension Information to the Farmers

Table 4.4 below shows how information on improved crop varieties/technologies, which would be of interest to the farmers, is received. Here access to extension information is not only confined to the extension provided by the government officers but also from other organizations such as KARI, NGOs as well as other relevant extension stakeholders.

Table 4.4: Source of Information on Improved Crop Varieties/Technology

Source	Within FA %	Outside FA %
Extension	75	55
Other sources Neighbours, Friends, relatives)	25	45

Within the focal area 75% of farmers receive their information through the extension agents as compared with 55% of the farmers outside the focal area (Table 4.4). Farmers outside the focal area supplement their source of information from friends,

relatives, and neighbors. Thus farmers within the focal area have higher collaborations with the KARI extension providers who also collaborate with other institutions such the Jomo Kenyatta University as compared with those outside the focal area. The source of information depends on the group thus there is a significant difference at 5% level (p=0.001) as supported by the chi-square output on how information on improved crops varieties/technologies are received by the two groups. The differences in favor of farmers within the focal area are probably due to the constant interactions and visits between the extension workers and the farmers. The extension workers are more obliged to transmit any improved technologies or any released crop variety to the farmers more than to those outside the focal area. From the discussions with the divisional extension officers regarding the farm visits in the control group, it was reported that these visits are irregular, a factor that reflects more inefficiency in delivery of the extension messages to the farmers outside the focal areas. The more concentration of the available extension resources in the focal area such as transport and staff allowances suggest that the extension workers within the focal area are more mobilized to reach the farmer, compared to the ones outside the focal area. However the current staff farmer ratio of 1:400 was viewed to be inappropriate during the discussions as 400 is a big number of

farmers, which affects the intensity of farmer extension interaction.

4.1.1.7 NALEP Interventions

As discussed in the previous sections, the NALEP program emphasizes participation and involvement of farmers in diagnosing their production problems and seeking solutions for them. This is a professional participatory dialogue where the farmers within the focal area are fully involved in the discussion with the frontline extension worker on identifying the production gaps and develops a Farm Specific Action Plan (FSAP). The farmer gets prepared for it and is able to demand the relevant interventions. These interventions provide opportunities for farm development, and increase production and productivity. Participation by the farmers in identifying their production problems and developing solutions is expected to have an impact on the farmer's production. Outside the focal area, the other extension worker not within the NALEP program visit farmers for delivery of already developed extension message. This section is intended to test whether there are any significant differences in the level of participation in identifying production problems between the farmers within the focal area and those outside the focal area (Table 4.5).

Table 4.5: Participation in determining production problems

Responses	Within FA (%)	Outside FA (%)
Yes	91.7	20
No	0	78
Partly	0.3	2

The participation of farmers in determining production problems significantly depends on whether the farmer is within or outside the focal area. Within the focal area (91.7%) fully participate in determining production problems compared with only (20%) outside the focal area. A two-sided chi-square test applied to the variables was found at 5% level of probability that there was significant difference in the two groups (p=0.000).

4.1.1.8 Access to Credit

The table below shows the proportion of the farmers within and outside the focal area who reported having received credit in the year 2003.

Table 4.6: Access to credit

Responses	Within FA (%)	Outside FA (%)
Yes	35.0	38.3
No	65.0	61.7

Farmers in the focal area (35%) and the non-focal area (38.3%) have almost similar opportunities for accessing credit. This shows that there is no significant difference between farmers within and outside the focal area in access to credit. Both groups have almost equal access to credit for farm development although the highest numbers of farmers in the study area do not have access to credit.

4.1.1.9 Utilization of Credit

Table 4.7 below shows the different ways farmers utilize the credit they obtain.

Table 4.7: Utilization of Credit

Area	Within FA (%)	Outside FA (%)
Farm Development	35.0	23.3
School fees	10.0	25.0
N/A (no credit)	55.0	51.7

Farmers within the focal area (35%) utilize the acquired credit on farm development such as purchase of inputs, soil conservation activities coffee improvement as compared to 23.3% of farmers outside the focal areas. This suggests that farmers within the focal area spend a lot of their acquired credit to

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Farmers within the focal area (35%) utilize the acquired credit on farm development such as purchase of inputs, soil conservation activities coffee improvement as compared to 23.3% of farmers outside the focal areas. This suggests that farmers within the focal area spend a lot of their acquired credit to

implement the technical advice offered by the frontline extension workers. Within the non-focal area, residents spend a bigger percentage of credit (25%) on school fees. Most of the farmers in the study area obtain their credit from the co-operative societies where they deliver their coffee. Part of the credit is diverted to food crop production while the rest is channeled to coffee improvement.

4.1.1.10 Investment in Tools and Mechanization Equipment

Forked jembes, jembes and pangas are the common farming tools where 95% and 96% of farmers within and outside the focal area respectively own. The use of oxen plough is also prominent in supplementing the farming tools where some farmers have their own ox ploughs and those who do not have hire from their neighbors or friends. Investment in farming tools and mechanization equipments increases opportunities to undertake most of the farming activities. The ability of a farmer to own or have access to these tools will increase the probability of implementing the recommended technology.

4.1.1.11 Income Source

The two sources of income considered were farming activities or other non-farming activities farmers engage themselves in to

generate income. The table below shows the different sources of income for the sampled farmers.

Table 4.8: Sources of income

Source	Within FA (%)	Outside FA (%)
Farming	96.7	98.3
Non-farming activities	3.3	1.7

The main source of income in the study area for both groups of farmers, is farming from crop and livestock sales. About three percent of income comes from off farm activities such as full time employment of one of the spouses or other businesses other than farming. A household, which has an assured source of income other than farming, is therefore more likely to hire labour and adopt recommended agricultural practices.

4.1.1.12 Income Expenditure

Income generated from the farm is utilized in various ways depending on the immediate needs of the family. Table 4.13 shows the different categories the respondents from both groups; spend the income derived from the farm.

Table 4.9: Income Expenditure

How income is spent	Within FA (%)	- Outside FA (%)
Farm development	48.0	34.3
School fees	28.7	41.7
Purchase of food	20.0	20.0
Clothing	4.3	2.0
Improvements on Housing	3.3%	2.0

Most of the farmers in the study area spend their income derived from farming by ploughing it back for farm development activities, which include, purchase of farm inputs and land preparation. Within the focal area, a bigger share 48%, of this income is spent on farm development as compared to 34.3% outside the focal area. However it was observed that an equal share of income (20%) for the two groups is spent on food purchases. This calls for a further investigation to establish the cause of this purchasing of the foodstuffs especially for the farmers within the focal area.

4.1.1.13 Market Access

The effect of distance to market on farm produce was considered in the study. Farmers with easy access to market would have an

advantage of selling their produce at better prices as compared to those who are further away from the markets. There are two major markets in the district that are located within the study area namely Kibirigwi and Kutus markets. The outside and within focal area residents in one location sell their farm produce to Kibirigwi market whereas the outside and within focal area residents in the other location sell to Kutus market. Table 4.10 shows the level of market access for the two groups in the study area.

Table 4.10: Access to Market

Distance to the market	Within FA (%)	Outside FA (%)
Less than 5km	100.0	96.7
Over 5km	0	3.3

From the responses of the respondents, 100% of the farmers within the focal area and 96% of farmers outside the focal area reside at a distance less than five kilometers from the market respectively. The mode of transport to the market is the same for both groups as majority of them use oxen to transport their produce to the market, which they either own or hire. Others

prefer to transport their produce on their backs especially those who are closer to the market.

4.1.1.14 Causes of low maize yields

Most respondents in both groups in the study area (88.4%) indicated that maize production was often characterized by low yield. The possible causes of low yields were identified. The causes as cited by the respondents are shown in table 4.11 below.

Table 4.11 Causes of low maize yields

Causes	Within FA (%) N =60	Outside FA % N =60
Lack of extension services	2	7.7
Inadequate rainfall	13.3	16.3
Lack of credit,	20.7	16.0
High input prices,	20.0	20
Poor marketing outlets	15.0	17
Poor prices	25.0	23
N/A	4.0	0

From the results shown in table 4.11 above 80.7% and 76% from within and outside the focal area respectively felt that the most important factors to low maize yields were, lack of credit,

high input prices such as for fertilizers, poor market prices and marketing outlets. Other factors such as inadequate rainfall also emerged as causes of low yields. Lack of credit, poor prices High input prices and lack of organized marketing outlets are major constraints in maize production and consequently low income.

4.1.1.15 Yield comparisons

The means of the yields of both bananas and maize were also considered in the analysis. Table 4.12 shows comparisons of these yields for within and outside focal area farmers.

Table 4.12: Comparison of Yields and Revenue in and Outside the Focal Area

Yields and revenues	Within F.A Mean	Outside F.A Mean	P. Value
MAIZE			
Maize yield/acre /90 kg bags	13	12	0.086
Maize price per bag (ksh)	1249	1224	.358
Total output (maize) (ksh)	18543	14472	.221
Total variable costs (ksh)	12509	11161	.229
Maize gross margins (ksh)	5930	4296	.377
BANANAS			
Banana yields (bunches)/acre/yr	193	132	.000
Banana price (ksh/bunch)	250	230	.357
Total variable costs (ksh)	40689	25394	.001
Total banana output (ksh)	39598	19370	.016
Banana gross margins (ksh)	46488	23232	.003

The prices of maize within and outside the focal area are not significantly different (P = 0.358) as the average prices for maize in the sample area is 1200 shillings per 90kg bag. This was attributed to the price liberalization on almost all of the farm produce, thus maize per bag can fetch different price in the same market depending on the buyer and the seller. A two-sided chi-square test applied to the variable cost was found at 5% level of probability that there was no significant difference in the two groups (p=0.229). Farmers in the sample area also purchase their farming inputs in the same markets. The identified causes of low maize yields (Table 4.11) that is poor prices, high input prices lack of credit and lack of organized marketing outlets has led to some farmers in both groups not to break-even in maize production. The maize gross margins within and outside the focal area have no significant difference statistically as indicated by chi-square at 10% level of significance (p=0. 377). However the banana yields in terms of banana bunches are significantly different (p=0.000). This may be attributed to improved banana management and introduction of improved varieties after interventions. The variable cost for banana production within and outside the focal area differs significantly. This difference was thought to be due to the intensive use of inputs within the focal area while implementing the recommended management practices after interventions in

banana production. This leads to a significant difference in banana gross margins within and outside the focal area.

4.2 REGRESSION RESULTS

The sample used in the study had one hundred and twenty respondents; drawn from both within the focal area and outside the focal area. Equal numbers of respondents were drawn from the two groups, that is, 60 from within and 60 from outside the focal area respectively.

4.2.1 Regression Results for Banana Gross Margins Model

The main objective of the study was to find out whether the NALEP Interventions have had effect on the farm output, with the farmers within the focal area compared with those outside the focal area. To find this, a regression analysis was run involving banana gross margins as the dependent variable and farmer's education, age, land, hired labour, family labour, source of income, access to credit, income expenditure, land size, and NALEP interventions as independent variables. The highly correlated variables with each other were not included in the analysis. The results are shown in table 4.13 below.

Table 4.13 Regression results of the banana gross margins

Predictor	B	SE	T-ratio
Constant	4.03384	2.0408	1.9766
Respondent's Age(X_1)	3.6276	1.829	1.9833**
Hired Labour(X_{10})	2.6026	1.2203	2.1328**
Land Size(X_4)	0.2993	0.668	0.4481
Income Exp.(X_8)	4.5848	2.0742	2.2104**
Source of Income(X_6)	0.23453	0.798	0.2939
Farmer's Educ.(X_2)	1.91270	1.1480	1.6662*
Access Credit(X_3)	0.23765	0.638	0.3725
NALEP inter. (X_5)	3.09895	1.4530	2.1328**
Family Labour(X_9)	0.18107	0.724	0.2500
Dist. to Market(X_7)	0.1255	0.1861	0.6747
R2=. 69			F=44.08

**Significant at 10% *Significant at 5%

4.2.2 Regression Results for Maize Gross Margins Model

A regression analysis was also run involving maize gross margins as the dependent variable and respondent's education, age, land hired labour, family labour, source of income, access to credit, land size, access to the market, and NALEP interventions as independent variables. The highly correlated variables with each other were not included in the analysis. The results are shown in table 4.14 below.

Table 4.14 Regression results of the maize gross margins

Predictor	B	SE	T
Constant	6.03492	3.0369	1.9872
Family Labour(X_9)	0.03918	0.246	0.1593
Farmer's Educ.(X_2)	0.05458	0.3230	0.169
Land Size(X_4)	5.0123	2.581	1.9420*
NALEP inter (X_5)	0.08463	0.874	0.096
Credit Access(X_3)	2.08552	1.0042	2.0768**
Respondents Age(X_1)	0.0745	0.354	0.2104
Hired Labour(X_{10})	0.03790	0.754	0.0502
Source of Income(X_6)	3.5878	1.6530	2.1705**
Distance to market(X_7)	0.0942	0.9002	0.1046
R2=. 64			F=42.68

**Significant at 10% *Significant at 5%

In the focal areas farmers highly associated the interventions they receive from the extension workers with their improved production and improved management as shown in table 4.15 below.

TABLE 4.15: Brief comments on how NALEP interventions have helped * Outside/Within F.A

Brief comments on how NALEP interventions have helped		Within FA	Outside FA
Increase in contact With extension only	Count	7	
	%	11.7	
Increase Production and Information	Count	27	
	%	44.0	
More production Information only	Count	10	
	%	16.7	
Improved Management only	Count	11	
	%	17.6	
Increased trainings And Improved management	Count	5	
	%	10.0	
N/A	Count		60
	%		100
Total	Count	60	60
	%	100	100

CHAPTER FIVE

DISCUSSIONS

The main aim of the regression was to establish the relationship between the dependent variables, which were banana and maize gross margins, and the independent variables. By comparing the computer outputs, the linear model was found to give the best output in terms of the number of significant variables. Goodness of. fit measures indicated by the R^2 indicated that the explanatory variables are jointly significant in explaining both banana and maize gross margins in the study area.

5.1 Banana Gross Margins

NALEP interventions, age, farmer's education, income expenditure and hired labour are significant in explaining the banana gross margins. The other variables land size, distance to the market, source of income, family labour, and access to credit though they have positive signs showed non-significant relationship in explaining banana gross margins.

The F value shows that the independent variables were jointly significant in explaining the banana gross margins in the study. The coefficient of determination R^2 of .69 indicates that the regression function explains 68 percent of the total variation.

About 31 percent is unexplained and can be attributed to omitted factors.

The variable income expenditure with the estimated coefficient of 4.584 was found to have an impact on the banana gross margins. This was attributed to the fact that, as farmers implement the new technologies of planting the tissue culture bananas, more capital is required. They will either have to borrow more money to purchase the inputs required, or they will have to commit more of their own resources to the farm operations, in this case the income derived from the farm production. Brown, (1970) pointed out that the so called Green Revolution in rice and wheat production was not based on miracle seed only, but that the key to sharply increased yields, is the use of seeds in combination with a package of new practices including land clearing, fertilizer applications and use of pesticides. These practices demand higher level of capital input, which is usually in short supply for smallholders and hence they have to rely on the income derived from the farm proceeds.

The variable respondent age with the coefficient of 3.627 was also found to have an impact on the banana gross margins. In the present study 64.6% of the farmers in the focal area are

concentrated in the age bracket of 41-55 years. This result is similar to that of Osuntogun and Adeyemo (1986) who found that those who adopt farm production practices were young in age with less number of years of experience in farming but with greater contact with extension agents.

The variable hired labour with the estimated coefficient of 2.602 was also found to have an impact on the banana gross margins. For the farmers in the present study, hired labour was more prevalent in the focal area. Farmers within the focal area hired a bigger number of laborers to supplement the available family labour as compared with those outside the focal area. This suggests that farmers within the focal area hired more labour in order to implement the recommended management practices in banana production. It is assumed that using more labour per hectare allows activities, like weeding, fertilizer application, control of pests and disease, to be done more thoroughly thereby increasing crop yields and hence output per hectare, Mwangi and Verkuji (2003).

Regression results also showed coefficient of education 1.912 was positive and significant, indicating the importance of education and its effect on banana production. This suggested that high levels of education positively influences farmers'

decisions on production and affect productivity by increasing the ability of the farmers to produce more output from given resources.

The NALEP Interventions showed a significant relationship in banana gross margins. This being a dummy variable, the estimated coefficient of 3.098 indicates the differences between the farmers within and outside the focal area in the banana production. It can be deduced that farmers within the focal area fully participate in understanding production problems and demand for their interventions from the frontline extension worker who has been trained. With this kind of information the farmers are mobilized to use the available resources under their potential to achieve these yields.

The low establishment of bananas outside the focal area can be attributed to low interactions between the extension workers and the farmers as cited in the discussions with the extension officers at the district level. According to these discussions frontline extension workers outside the focal area have a tendency of working with few farmers conveniently located. They have fewer visits to the farmers, compared to the ones within the focal area who have frequent visits and supervision to the farmers because they are more motivated, trained and mobilized.

The frontline extension worker in the NALEP program is able to bring the farmer into the point of understanding his/her production problem, the expected returns or output, compared with the extension worker outside the focal area.

Farmers within the focal area have higher gross margins in banana production than those outside the focal area (Table 4.12). This could also be explained by the fact that farmers within the focal area had constant interactions with the extension workers and other stakeholders that allowed more exposure to information, technologies and more improved management practices. For example, the information on improved banana varieties such as the tissue culture bananas developed by the Jomo Kenyatta University was more concentrated within the focal area than the non-focal area. Schwartz and Kern Bern (1994) suggested that co-operation with private sector was an important part of strengthening the extension programme. The NALEP close co-operation with other extension stakeholders such as Jomo Kenyatta University of Agriculture, the seed companies and others has helped to strengthen farmers and extension linkages. Reports in the agricultural offices in the divisions indicate that Jomo Kenyatta University has established bulking sites for these tissue culture bananas in these focal areas where farmers buy these improved banana varieties. In the focal areas farmers highly associated the interventions they receive

from the extension workers with their improved production and improved management. However it also emerged in the discussions that this period of one-year stay of the program in one focal area was too short.

5.2 Maize Gross Margins

Table 4.14 shows the variables that are clearly associated with the maize gross margins. These are, land size, source of income and access to credit. The other variables farmer's education, age, family labour, hired labour, and NALEP interventions though positive are not significant in explaining the maize gross margins.

The coefficient of determination R^2 is .64 implying that the included variables explain 64 percent of the total variation in the maize gross margins. The F value (42.68), also obtained in the ANOVA results is significant at five percent level of significance, showing that explanatory variables taken jointly have a significant effect on the maize gross margins.

The variable, credit access with the estimated coefficient of 2.085 showed that this factor was significant in determining the maize gross margins. Lack of credit for the purchase of inputs has constrained the production of maize. The cited causes of low

maize yields by the two groups in the descriptive analysis, which included high cost of inputs, like fertilizers, seeds, pesticides and poor marketing outlets, also explain why both groups in the study area experience low and even negative gross margins in maize production. This may be associated with the reason why 20% of farmers within the focal area experience food shortages at times and are purchasing maize from the market. This phenomenon needs to be studied and ways of solving this low maize yield identified. The NALEP program can try to come-up with ways that would address the issue of low maize yields. In addition, the fact that most of the farmers in the sample area were producing at a subsistence level, and technologies with large variable costs are least readily adopted at the level of subsistence production, little difference could be expected to be shown by those who had been exposed to the NALEP interventions. Hence, despite the fact that they are exposed to NALEP Interventions, their maize gross margins could hardly be better than those outside the focal area.

From the regression results in table 4.14, land size with a coefficient of 5.012 was shown to have a positive relationship with the maize gross margins. The descriptive analysis also shows that the average size of the farms for the two groups was one hectare. Bearing in mind the different activities and

practices being undertaken in the farm and that most farmers have invested in production of various crops, this leaves small areas for maize production. In calculating the gross margin for a crop, the size of land under the enterprise is an important factor.

The results have also shown that the source of income for the respondents with a coefficient of 3.587 is an important factor in explaining the maize gross margins. Agriculture is still the main activity of the region, and crop and livestock sales are the major source of income for most households. Money for school fees, hiring of labour for farm activities, purchase of farm inputs and food in periods of scarcity is often secured from the sale of these farm produce (MOA, 2000). This fact supports why there is low maize production for the two groups as their source of income mostly comes from the farm and seems over committed. Considering the fact that maize production is characterized by high input cost, poor prices, lack of credit and lack of organized markets outlets, those within the focal area also experienced negative gross margins. These results also concur with other studies that have been done on maize gross margins at subsistence level and concur with the logical reasoning that maize production is constrained by use of expensive inputs such as fertilizers, pesticides (Mwangi and Verkuji, 2003). This

support the reason why farmers within the focal area also have low maize gross margins despite being exposed to the NALEP Interventions.

The variable NALEP Intervention had no significant effect in maize gross margins for the two groups. This indicates that despite the fact that farmers within the focal area are exposed to the NALEP interventions, this factor has not enhanced their maize yield per acre. The hypothesis that farmers within the focal area have high maize gross margins than those outside the focal area is rejected by the regression results (Table 4.14). This calls for the NALEP program to come-up with projects or program that would help farmers in areas where they can have access to credits or low cost inputs in maize production, as maize is still the main staple food in this region.

5.4 STUDY LIMITATIONS

The major problems encountered in the study arose mainly because of the farmers' response towards certain questions in the questionnaires. The biggest limitation arose from the collection of reliable input and output data. The respondents kept sketchy or no records and they relied mostly on their memories to answer the questions. The enumerators had to guide the farmers to use the immediate past season to recall these details.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSIONS

The study was meant to reveal the extent to which NALEP has achieved its objectives. It was intended to draw the attention of the extension policy makers the need for evaluating extension programmes and their impact on the farm.

In conclusion, it is evident from the survey results that:

(i) The NALEP interventions achieved reasonable effects towards the farm output especially in banana production in the focal area as compared with the outside the focal area. The evidence from the study reveals that the interventions offered by (NALEP) to the farmers in the focal areas are important factor in determining the level of farm output.

(ii) Farmer's full participation in determining the production problems together with the extension worker and demanding for information and ways to address these problems is important. This has played a leading role in enhancing the differences in the gross margins for the two groups. The interventions mobilize farmers in use of the resources and also enhance allocative measures of the

scarce resources given updated information about inputs, output prices, and the expected returns of output.

(iii) The NALEP focal area extension approach is an effective approach in enhancing farmer-extension worker contact, interactions and linkage as the extension worker was cited as the most important source of information in the descriptive analysis.

(iv) The incorporation of the other extension stakeholders in the NALEP focal area strategy had great contributions towards enhancing farm output.

However on the maize production, farmers not implementing the recommended interventions by the extension staff might not have been the cause of the low maize gross margins for the farmers within the focal area. There are more important constraints that contribute to their low maize gross margins despite being within the focal areas. The fact that maize is characterized by high input cost, poor prices, lack of credits and lack of organized markets outlets in its production were also considered in the present study as the contributing factors to low maize yields. NALEP Interventions have not yet had a significant effect in the maize production. The professional extension cannot in isolation solve all agricultural development problems. Among other things the whole range of agricultural services, from the provision of improved seeds, credits, marketing and other supporting inputs

must also be improved to achieve a real and sustainable impact of the program. What would be more important is for the NALEP program to look into ways and means that would help farmers in maize production if they have to continue producing maize since maize is a staple food.

The study also concludes that farmers should invest more in crops that have got high returns and take farming as a business much more than a traditional practice.

The results of this study have also indicated that NALEP is an important extension management tool as revealed in the discussions with extension workers. It has instituted a sense of accountability leading to full utilization of extension resources thus improving the efficiency in extension services delivery. It exposes the extension workers to real life situations of the farming conditions, which offers challenges to them to look for information updates, introduces new technologies to the farmers and enhances staff-farmer interactions. The program also motivates and mobilizes the community to use their own available resources other than depending on the government for the supply of inputs, thus they can appreciate their effort. However various observations were made about the program such as:

(i) The co-operation of the relevant stakeholders in the program is an important factor in the smallholder production thus the Stakeholders' cohesiveness in the program needs to be fully enhanced.

(ii) The program also needs to consider the real life setting of the farmer. So much is expected from the farmer in terms of achievements within the one-year period whereas the farmer needs time to go through the adoption processes, which cannot be fulfilled within the one-year period.

(iii) The concentration of resources in one focal area tends to create the differences in enhancing the improvement of the farm output, as the extension staffs in the non-focal areas are not fully mobilized and motivated thus they are less utilized. They also have a tendency of selecting and concentrating on a few number of farmers conveniently located compared to the ones within the focal area.

The efforts of the NALEP approach are commendable when one considers the other previous extension approaches (Table 4.15). To an extent the program has supported promotion of participatory activities with bottom-up approach, and the policy of pluralistic approach to extension. This reflects the priorities of the National Agriculture and Extension Policy

(NAEP), which advocate demand driven extension services, and participation of other players in the delivery of the extension services. Various stakeholders in agriculture and extension were found to be involved more in the focal areas.

6.2 RECOMMENDATIONS

The positive correlation observed between the NALEP interventions and the levels of farm output in the focal area suggest the importance of the program.

(i) Greater efforts should be made at national level to intensify this extension approach to the other non-focal area as much as possible.

The ministry of Agriculture, ministry of livestock and fisheries development and other relevant stakeholders in agriculture should adopt and invest more on this integrated approach. This would simultaneously increase the number of farmers reached by the program and utilize fully the other extension staffs not previously within the program. The policies to strengthen the participation of the other stakeholders can be reviewed at the national level for effective implementation of the agricultural activities in the focal areas.

(ii) For the program to have greater impacts on the farmers there is need to improve farmers and extension workers personal contact, given the present staff: farmer ratio of 1:400 which

was viewed to be inappropriate. A staff: farmers' ratio of 1:200 would be appropriate in order to enhance the personal contact between the farmer and the extension staff. (iii) The length of time the program takes in the selected focal area need to be reviewed. The current period of one year as expressed by the extension officers was viewed to be very short. For farmers to have acquainted themselves with the interventions' recommendations from the extension workers stated that there is need for the program to have a longer stay in one focal area than one-year. A 2-3 years stay would be appropriate which should be followed by gradual withdrawal of the extension staffs from the focal area for one year.

(iv) Financial matters and obtaining of inputs cannot be met by the extension workers especially the resource poor farmers who are afflicted more by the problem in production. The NALEP program should come up with ways of supporting the smallholder farmers in their production. This would include review of policies at the national level that would enhance full incorporation of co-operative societies as stakeholders as the main source of credit supply for most farm inputs. The availability of credit to most farmers in the focal area would enhance the implementations of the recommended practices by the extension workers. This would go along with improving the farm output especially in maize production.

(v) The extension workers should emphasize more to farmer that they should put more effort on planting crops that have low-costs and are of higher returns.

To complement the above recommendations, it is suggested that a study be done to specifically establish fully how the issue of high input cost, poor prices, lack of credits and lack of organized marketing outlets, in maize production can be addressed in these focal areas.

In conclusion with respect to the Kenya smallholder farmer, the efforts of the NALEP focal areas strategy in the program areas are justified. Enhancement of a wider coverage of the program would be an effective way of making more farmers depart from their traditional way of farming and take farming as business.

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APPENDICES

APPENDIX I

RESEARCH QUESTIONNAIRE

Question No: ☐
H/Hold No: ☐

SECTION I Socio - Demographic

A) Date of Interview .....
District ..... Division ..... Location .....
Name of Focal Areas .....
Indicate 1 = with focal area ☐
2 = outside the focal area ☐
Name of interviewer .....
Name of respondent .....

B) Household members

Serial No	Name of Respondent	Sex	Age	Marital status	Relationship to H of H/h	Education	Main occupation
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							

Codes

Sex	Marital status	relationship to HHH	Main Occupation	education
1= Male	1= Married	1= Head of H/ hold	1= Farming	0=Not attended school
2= female	2= Single	2= Wife	2= Civil Servant	1=One Unit/year spent in school
	3= Separated/ divorced	3= Son/daughter	3= carpenter	
	4= Windowed Parent	4= Servant	4= Household worker	
	5= others specify	5= Parent to H/h	5= Student	
		6=Others (specify	6=Agric. Labour	

SECTION II SOCIO - ECONOMIC AND INSTITUTIONAL DEVELOPMENT

(A) LANDHOLDING

Land size	Land tenure	Total cultivated	Total area under crops	Total area under maize	Total area under bananas	Total area under Livestock	Total area for other uses.

Codes

Land tenure

1= Own title deed

2= Leased

3= Rented

4= others specify

(B) LABOUR AVAILABILTY

(i) Family Labour

Serial No	Name	Sex	Age Over 15-55 yrs	Estimated Number of hours worked on the farm per day
1				
2				
3				
4				
5				
6				

Hired/Permanent labour

Serial No	Name	Sex	Age	Hired/Permanent	Number of hours working on the farm
1					
2					
3					
4					
5					
6					

Other source of labour

Any other source of Labour	Comment on labour availability

Codes

Sex
1=Male
2=Female

Estimated no. of hours worked on farm
1=Less than 4hrs
2=4-8hrs
3=8-12hrs

Age(years)
1=15-25
2=25-35
3=35-45
4=45-55

Hired/permanent workers
1= permanent
2= Hired

Any other source of Labour
1= Friends, relatives, neighbors
2= Other sources, e.g. Church assisted e.t.c

Remarks on Labour
1= Adequate
2=Not adequate
3= Very scarce

SECTION III - INSTITUTIONAL SUPPORT

Are you in the F.A	Do you receive any training from NALFP F.A.A	How do you identify your production problems?	Do you participate in determining your production problems/interventions	How do you receive information on new/improved crop varieties/ technologies	Any other source of Extension services	Indicate the most provider of extension services in your farm.	How would ra services provid if your answ were NALEP as most Extens provider.

Codes

F.A
1= within F.A
2= outside F.A

NALEP
1= Yes
2= No

Trainings Identifying Production
1= helped by Extension agent
2= By myself
3= Helped by friends, neighbors, Relatives e.t.c.
4= through other extension providers'

Participation in determination production
1= Yes
2= No
3= Partly

How information on improved crop/ Problems received
1=Through Extension
2= Direct from KARI
3= From neighbors, friends, relatives
4= From other extension providers
5= Others - specify

Others sources of Extension
1 = KARI
2 = KEFRI
3 = PLAN International
4 = Catholic Diocese
5 = A.C.K Diocese
6 = Other NGOs
7 = Any other - specify

Most Extension provider
1 = NALEP
2 = KARI
3 = KEFRI
4 = PLAN
5 = Catholic Diocese
6 = ACK Diocese
7 = NGOs
8=others-specify

Rate of Extension services provided by (NALEP)
1 = Highly relevant
2 = Just relevant
3 = Not adequate relevant
4 = Not relevant

(ii) If your most extension provider is NALEP, please give a brief comment on how the interventions have helped you in your production practices in your farm.

.....

.....

(ii) How else do you think these interventions should be conducted/improved in order to help you more?

.....

.....

SECTION IV

MAIN ENTERPRISES PRODUCTIONS AND GROSS MARGINS (ANNUAL -2003)

Crop CODE

1= Maize
2= Bananas

(A)

(i)

OUT PUT (Ksh.) per year	VARIABLE COSTS. (Ksh) per year
1. Crop	1. Land preparation cost (man days).....
2. Acreage ..... (acre)	2. Seed costs .....
3. Total yield	3. Fertilizer (total costs) .....
4. Average price	4. Manure .....
5. Total output (3 x 4).....	5. Pest & disease control cost .....
	6. Total labour cost (Man days) -planting, weeding harvesting e.t.c .....
	7. Dusting .....
	8. Gunny bags .....

Total output ..... Total variable costs .....

Gross Margin = Total output less Total variable costs.

= .....

(ii)

OUT PUT (Ksh.) per year	VARIABLE COSTS. (Ksh) per year
1. Crop ..... (man days).....	1. Land preparation and digging of holes
2. Total no. of stools	2. Seeding costs .....
3. Total yield (total no of bunches per yr).....	3. Fertilizer (total costs) .....
4. Average price .....per bunch...	4. Manure .....
5. Total output (3 x 4).....	5. Pest & disease control cost .....
	6. Total labor cost (Man days) -planting, weeding, harvesting e.t.c.....
	7 Marketing costs e.g. transport to the market .....
	8.Other costs .....
Total output	Total variable costs .....

Gross Margin = Total output less Total variable costs.

= .....

(B) Total production output for maize and bananas

.....

(C)

Comment on these enter price production	Indicate possible contribution to increase in production if your answer is increase in order of importance	Indicate possible contribution to Decrease in production if your answer is decrease in order of importance
Crop Code ☐☐☐☐		

Codes:

Trends of production

1 = Increase
2 = Decrease

possible contribution of increase in production

1 = NALEP Interventions
2 = Your level of education
3 = Labour availability
4 = Credit availability
5 = Others specify

Possible contribution to decrease in production

1= Lack of extension services
2 = Inadequate rainfall
3 = Lack of labour
4 = Lack of credits

SECTION V – FARM EQUIPMENT

Types of farm Equipments/tools in your farm	Level of mechanization in your farm	Source of mechanization equipments	Comment on the availability of these mechanization equipment

Codes:

Types of farm equipment/tools

1 = Jembes, pangas, forked jembes
2 = Ox plough
3 = Tractors
4 = Others specify

Level of Mechanization

1 = Human power
2 = Draft power
3 = Tractors
4 = Others specify

Source of mechanization equipment

1 = Owned
2 = Hired
3 = From friends, relatives
4 = Others specify

Comment on availability of mechanization equipments

1 = Adequate
2 = Not adequate
3 = Very scarce

SECTION V - INCOME AND EXPENDITURE

Indicate the source of income in order of importance	Indicate in order of importance how the income is spent.

Codes

Source of income

1 = farming -crop production
2 = other out farm business
3 = other employment e.g. teaching
4 = Agric. Labour
5 = other - specify

Income expenditures

1 = Farm dev. (purchase of inputs, labour e.t.c)
2 = School fees
3 = Purchases of food
4 = Clothing
5 = Improvement on the farm e.g. construction of new house, fence e.t.c.

B) CREDIT FACILITIES.

Do you have access to credit facilities	State the source of your credit	how do you spend the credit?

Codes

Access to credit facilities
1= Yes

2= No

Source of the credit
1= Group savings e.g. merry go rounds

2= Micro-financiers e.g. KWFT
3= Banks e.g. Co-op bank

4= Others specify

How credit is spent
1=Farm development e.g. input purchases
2= School fees
3= Other developments e.g. house building

(c) MARKET ACCESS.

Are you accessible to the market	market transport availability e.g. cars	Estimate the distance from your home to the nearest market.

Codes

Access to the market
1= Yes
2= Partly
3= Market very far - more than 20km

Market Transport
1= easily available
2= not available

Distance to the market
1= Less than 5km
2= 10km - 15km
3= 15km - 20km
4= More than

APPENDIX II

Rate of extension services provided by NALEP

Rate of extension services provided by NALEP		Within FA	Outside FA
Highly relevant	Count	49	
	%	75.0	
Just relevant	Count	11	
	%	25.0	
N/A	Count	60	
	%	100.0	