INCENTIVES FOR INCREASING THE PRODUCTION OF FOODCROPS AMONG

SMALL SCALE FARMERS: A CASE STUDY OF SIAYA DISTRICT

BY

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This Research Paper is My Original Work and has not been presented for a degree in any other University.

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ABSTRACT

There has been increasing concern over the food requirements for the country due to the rapid population increase. This is reflected in the various policy measures taken by the government to increase food production and employment opportunities for the population.

Siava District is one of the food deficit districts in the country despite measures which have been taken to increase food production. This study was aimed at finding out why the District is food deficit and what can be done to increase food production. It was also aimed at analysing the agricultural situation in the district in terms of the agricultural practices, what incentives exist what problems are faced by farmers and how these problems can be solved in order to increase agricultural production.

A field survey was carried out in Siava District to collect data necessary for the study. A designed questionnaire was administered to farmers who were sampled using stratified random sampling procedure. The ordinary least squares technique was used to estimate the specified model. An output function was estimated. Results showed that Acreage under maize and hired labour were significant in determining the level of output. When fertilizer was considered, extension services was also significant in determining the level of output.

From the study it was found that agriculture in the district is mainly of subsistence nature and only a very small proportion of the produce is sold to meet cash obligations. Farmers face a number of problems among which are lack of access to agricultural credit, high cost of inputs and long distance to the source. Lack of good infrastructural and storage facilities are among the constraints. There are also no official marketing channels and long distance to the local markets combined with lack of transport, discourage farmers from selling their produce.

It was concluded that in order to increase food production in the district, a package of measures need to be taken instead of taking isolated measures individually.

Two policy areas were drawn from the study. These are policies to increase food production through increasing acreage under crop and the policies to increase food production through increasing yield per acre. Policies to increase output should emphasize the availability of inputs like labour, and the complementary factors and extension services while policies to increase yield per acre should consider the leval of technology and extension services which is related to it. The proper use of fertilizers in quantity and timing is important in realizing increase in yield. Both policies should however ultimately emphasize the existence of a suitable package of incentives for it to be effective. The study concludes that a package of

incentives including credit facilities, inputs, market outlets, extension services, favourable prices and a good infrastructure is necessary for agricultural production to increase in Siaya District.

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CHAPTER ONE

INTRODUCTION

1:1 Background

Agriculture plays an important role in the process of a country's Economic development. This is because it provides food supplies to the country's population at low prices and saves the country from importing food thus saving scarce foreign exchange. Agriculture also provides raw materials to the agro-based industries at low cost, increases export earnings and raises rural incomes thereby raising the rural living standards. Increased agricultural productivity is also important to meet the increased demand for wage goods from the industrial sector of which food is one. In addition, agriculture is expected to provide a satisfactory nutritional status for the population.

Immediately after independence, Kenya experienced rapid increase in agricultural production. This was made possible by various measures taken by the government. The rapid adoption of high yielding varieties of crops and improved cattle breeds was a major factor in this area. The subdivision of former large farms among small scale farmers, the provision of extension services and the encouragement of small scale farmers to increase their efforts in farming also contributed to this increased agricultural production. However, it has been observed that the distribution of these development efforts with respect to commodities have been heavily biased towards export crops. (Heyer 1976, Senga 1976).

In the recent years however, increased agricultural productivity has been limited due to lack of new research break through in agriculture and limited availability of good agricultural land. Even so, the limited growth cannot be wholly attributed to the above factors alone. Kenya is endowed with land of different agricultural potentials which can be used to produce a variety of agricultural products. Certain food crops which are drought resistant can be grown in low potential areas while small scale farmers engaged in food crop production can increase their production of particular crops where they are suited. A good incentive system should facilitate the production of various crops in different parts of the country at different times in order to increase availability of agricultural products.

1:1:1   Land Resources in Kenya

Before saying anything about agriculture in Kenya we should look at the availability of land resource currently. This is important because the availability of agricultural land will dictate which approach should be taken to increase agricultural production. There is very limited agricultural land which puts a constraint to expansion of land area under cultivation. By 1976, there was a total of 8,650,700 hectares of agricultural land in Kenya. Of this, 1,155,900 hectares was under forest leaving only 7,494,800 hectares for agriculture. Only 38.4% of this agricultural land in Kenya was under crop.(leaving 61.6% uncropped).(Kenya 1981).

Scarce productive land is of central importance to

Kenya's agriculture. Out of the total land area of 44.6 million hectares, only 8.6 million is medium to high potential agricultural land (Kenya, 1986).

The potential for increased agricultural food production is very limited. There is little potential in central and eastern provinces for the expansion in the area of good quality land devoted to food production. Only 7% and 32% of agricultural land in these provinces respectively is being cropped, the remaining supporting livestock. Any major increase in food production must therefore come from increase in crop yield and adoption of more intensive production techniques. In Nyanza and Western province, there is more scope for expansion in the area devoted to production of food crops. This scope is however not unlimited. (Kenya, 1986). The availability of agricultural land is a major constraint to increased food production and conservation measures should be taken to increase the productivity of the available land.

1:1:2   The Role of Agriculture in Kenya

In Kenya agriculture plays an important role in the economy. Apart from being a major foreign exchange earner to the economy, it has been the largest contributor to Gross Domestic Product (GDP Table 1:1). Percentage shares of agriculture in GDP compared to certain sectors for the period 1976-1985 are given in Table 1:1 below. From the table, it is clear that the share of agriculture in GDP since independence has been high.

TABLE 1:1 PERCENTAGE SHARE OF AGRICULTURE AND OTHER SECTORS TO GDP (1976 -85)

Sector Year	Agriculture	Manufact- uring	Government Services	Trade and Hotel	Trans- port and Storage
1976	37.1	11.3	18.0	10.4	5.4
1977	37.2	12.0	17.5	10.3	5.3
1978	36.0	12.7	13.9	10.6	5.5
1979	34.2	13.1	14.3	10.7	5.7
1980	32.8	13.0	14.7	11.8	5.5
1981	33.3	12.7	14.9	11.2	6.4
1982	31.1	12.6	15.1	10.2	6.7
1983	30.0	12.8	15.1	11.1	6.6
1984	29.7	13.3	15.4	10.6	6.6
1985	29.5	13.3	15.5	11.0	6.5

Source: Kenya Government, Statistical Abstracts, Various issues (1964 - 1985)

Agriculture is a major foreign exchange earner in Kenya as it has the highest share of exports. Agricultural exports constitute over 50% of total exports.

TABLE 1.2 TOTAL EXPORTS BY ECONOMIC CATEGORIES (PERCENTAGE SHARES) 1984-85

Export	1984	1985
Food and Beverages	61.9	62.8
Industrial Supplies (Non food)	15.0	16.3
Fuel and Lubricants	18.8	16.1
Others	4.3	4.8
Total	100.0	100.0

Source: Economic Survey 1987.

Agricultural exports constituted 62.8% of total exports in 1985 and 61.9% in 1984. If the country is to continue

earning foreign exchange, then the agricultural sector can not be neglected.

Agriculture is also a major source of employment both directly and indirectly. The importance of agriculture's contribution to employment is demonstrated by the fact that it is only second to community, social and personal services. In the private sector, it is one of the largest employer.

Table 1:3 shows the position of agriculture in wage employment by sector for 1984 and 1985.

TABLE 1:3: WAGE EMPLOYMENT BY INDUSTRY AND SECTOR 1984 -85

('000'S)

	1984	1985
Agriculture and Forestry	235.4	240.0
Mining and Quarrying	4.1	4.8
Manufacturing	153.1	153.8
Electricity and Water	17.5	17.7
Construction	49.2	49.9
Wholesale,Retail trade,Restaurant/hotels	84.8	94.7
Transport and Communication	54.1	55.7
Finance,Ins., Real Estate,Business Serv.	50.1	53.4
Community,social and Personal Services	471.1	503.5
Total	1119.7	1174.4

Source: Economic Survey, 1987.

From the table, agriculture is the largest contributor to wage employment in the private sector, while in the

public sector. it is only second to community social and
personal services.

Agriculture is therefore an important sector in the
Kenyan economy and for the overall development of the
economy, the development of agricultural sector should be
emphasized.

1:1:3 Agricultural Policy in Kenya

The importance attached to agriculture is also echoed
in the Sessional Paper Number 1 of 1986 on Economic
Management for Renewed growth. Agriculture is to continue
to lead the country in economic development for the rest of
the century. Agriculture has to provide food security for
the increasing population, generate farm income, absorb new
farm workers and stipulate the growth of production of farm
activities (Republic of Kenya 1986 pp.62). Kenya's food
security remains a major government objective. The
intensification of maize and milk production is one of the
challenges. The paper also notes that to attain goals of
agricultural production, the widespread localized marketing
of inputs, especially fertilizers will be crucial. It is
also stated that to maintain self sufficiency in maize will
require a concentrated effort to increase land productivity
through improved technology and intensification of input use
combined with sound pricing and marketing policies (Kenya
1986).

Farmers are encouraged to adopt more productive practices especially wide use of improved varieties of crops, fertilizers and use disease and pest control. The pricing policy, marketing policy and institutions together with extension services will be the main instruments in achieving much higher yields through the known technologies. Research into new varieties is also to be encouraged.

The main concern of the inputs policy is the increase in hybrid seeds. Fertilizers and information about its use are to be made available to farmers through out the country. Credit should also be obtainable for farmers to use the fertilizers the sessional paper number 1 of 1986 also notes that small holders have difficulty in obtaining fertilizers even when available national for reasons like long distance, price and the minimum package of 50 kg. being too much for most small-holders. The removal of these impediments is to play an important role in increasing agricultural productivity and stimulate marketing activities. These were to be achieved by:

- Government licensing established dealers.
- Control prices to be set for distribution centres and retailers allowed to set their own prices in order to encourage them to move fertilizers to remote centres.
- the extension services are to actively promote fertilizer use, and publicize suitable types for each location.
- the government is to increase the amount of credit available to farmers and some degree of subsidy is necessary.

The 1984-88 Development Plan recognizes the imbalance between food demand and food supply. It therefore outlines policies and programmes to be formulated with special attention to small farmers through improved crop and livestock husbandry practices. Also included are the price policy since farmers have shown themselves to be price responsive. More attention is to be given to the annual price review, considering a fair return to the investment in farming and terms of trade between agriculture and other sectors. The improvement in marketing are to be accorded high priority. The need to improve farmers' access to markets, better and efficient distribution countrywide, elimination of local food shortages and improved national food security are all important policy considerations. Parallel with this is the grain storage and on farm storage - to be implemented to improve storage efficiency and provide additional storage capacity. The use of hand and ox-tools by smallholders to ease labour bottlenecks and facilitate the introduction of improved husbandry practices for small-scale farmers. The extension services are also to be emphasized (Kenya,1984).

Kenya has a national food policy as outlined in the Sessional paper number 4 of 1981 and other policy documents which outline the policy framework and programmes to meet their objectives. Among the policies outlined in this Sessional paper the food security policy aims at increasing food production in all areas of the country, giving more

emphasis to drought resistant crops and minor crops such as sorghum, millet and cassava. The accumulation of a multi-commodity strategic food reserve from domestic surpluses is also a major component of this policy (Kenya 1981). The price policy of the major food commodities will be among the most important factors determining whether food self sufficiency is acquired. The government was to establish guaranteed minimum prices for sorghum and millet as incentive for increased production of drought resistant crops.

The policy is also to ensure that adequate inputs are made available at the lowest prices possible and they are used at the right time. The development of a wide range of appropriate technology is to be emphasized. The strengthening of extension services is seen as necessary for the flow of information to farmers'. In addition, the increased employment in agriculture is to be a major source of employment in rural areas.

The land tenure policy has been pursued with programmes to transform the customary land tenure to freehold tenure. This is mainly through land consolidation and registration. Accelerated land adjudication and registration of titles was a major objective of the 1984-88 Development Plan.

Since 1950's, land adjudication and registration programmes have been transforming customary land rights into freehold land as a precondition for increasing land

productivity.   This   was   by   preventing   uneconomic fragmentation encouraging long term investments in land and by creating the collateral for farm credit (Kenya 1979). The 1979-83 Development Plan also emphasized the efforts to intensify the adjudication in the remaining high potential land areas, while New District land registries were to be opened or expanded in Kirinyaga, Elegeyo-Marakwet, Taita, South Nyanza, Siaya Kisumu and Others (Kenya 1979).

The Kenyan policy on land tenure has therefore been geared towards the privatization of land as means of increasing agricultural production.   The private land ownership is to be respected and steps are to be taken to induce land owners to put underutilized land to more production.

Despite efforts made by the Government to increase food production, some districts have not been able to produce to their potential level.   Such districts therefore have low agricultural production and are food deficit not because possibilities for increasing food production have been exhausted, but because of reasons which can be attributed to lack of suitable incentives and the existence of certain constraints which hinder increased production among farmers. It is therefore relevant to understand the incentive structure existing in certain districts and to what extent they can be used to increase food production in such areas. Increased agricultural productivity has been identified as a more   effective   measure   to   improve   household   food

consumption, hence its important (Ateng B.A.1986).

1:2   Statement of Research Problem

The Government of Kenya has increasingly emphasized the need to increase production among small scale farmers.

A lot of measures have been taken to increase food production among small scale farmers as has been noted earlier. Despite such measures, Siaya District still has poor agricultural performance considering its potential production level. Siaya is a food deficit district with low food availability and poor nutrition status. (Kenya 1982).

TABLE 1:4:   MAIZE BALANCE PROJECTIONS   FOR NYANZA PROVINCE 1980 AND 1990* ('000 TONNES)

DISTRICT	1980	1990
SIAYA	- 9,676	-20,293
KISII	-24,712	-41,996
KISUMU	-32.056	-51.441
SOUTH NYANZA	-16,770	- 2,935

* Projection based on 2% yield growth of 1980 yield

Source:- Situation Analysis of children and women in Kenya: section 2 Development Policies and issues CBS 1984, page 29

Table 1:4 shows that there was a negative food balance in the district in 1980 and there is likely to be a large

deficit in the future if nothing is done to change the situation.

Siaya is a regular importer of food grains from the neighbouring districts (CBS 1984). It has a considerable potential however for increased agricultural production through intensification of crop and animal husbandry on land utilized at present. But the achievement of these needs cash, inputs, skills and markets which are in short supply especially among the rural poor. Surplus production in the district is possible given that the district has a potential for producing a wide variety of crops and increasing livestock production above the present level (KREMU 1986).It is therefore necessary to find out why such a situation exists in the district.

Average maize yields have been shown to be very low compared to district where improved farming methods are used. Siaya district has 81% of its land classified as high potential, 17% as medium potential with no low potential land (FNPU 1985). There is therefore the potential for increasing food production in the district above the present level. It can then be asserted that in addition to the present measures taken, a good incentive system is needed to help the adoption of such measures and hence increase food production. The effectiveness of these measures therefore depends on the existence of a suitable incentive package to farmers.

We need to establish the status of incentives in Siaya District. More specifically, we shall need to address the following questions:-

1.   What is the state of credit facilities in the district? Do farmers use such facilities to increase their production? How do farmers respond to the availability of such facilities and how can that response be explained?

2.   What is the state of agricultural inputs to farmers? Are they available in the right quantity, at the right time and at short distance easily reached by most farmers? Are their prices affordable by most farmers?

3.   How are the marketing arrangements for the disposal of the produce? Does the price system in these markets act as an incentives to increased production of foodcrops?

4.   What is the state of extension services to farmers?

5.   What is the nature of land tenure system in the District and how does it affect land utilization in so far as it can be used as a collateral for credit?

6.   What is the nature of infrastructural arrangements
        in the district in so far as they are related to
        agricultural production?

7.   Generally, what kind of incentives exist in Siaya,
        or should be needed in order to increase
        agricultural production?

        At this point, it may be necessary to clarify what kind
of incentives are to be considered in this study. The state
of incentives should be such that it is profitable for
farmers to undertake modernizing investments that would
increase their productivity in agriculture. The incentives
to which farmers respond is the economic information that
they use in calculating their expected costs (including
risks) against the returns they expect to receive (Schultz
1978). According to Schultz, in terms of costs, farmers
consider the rate of interest on agricultural loan, rent on
land, payment for equipment, fertilizer and labour costs.
On returns, expectations include the value placed on farm
product to be utilized in the farm household and the
expected price of the product to be sold. The availability
of technical possibilities that are favourable for increased
agricultural production require the existence of profitable
incentives to enable farmers make use of such technical
developments. It is therefore important to determine the
condition that are both necessary and sufficient to attain
the optimum increase in agricultural productivity. The
agricultural techniques like new forms of capital equipment,

machines, availability of superior seeds, fertilizers, pesticides are necessary for increased agricultural productivity, but these are not sufficient. For the effectiveness of these efforts, the provision of proper incentives is necessary. Such incentives include improvement in the land tenure system, to encourage more investments on land where necessary and the provision of agricultural credit at low interest rates to enable the farmer acquire new recommended inputs. Ensuring favourable prices for inputs and output prices to justify the investments, provision of extension services to educate the farmer about agricultural research findings and their benefits, and ensuring market outlets for the surplus produce are also very important incentives. A good system of infrastructure will also facilitate the easy implementation of research recommendations.

From the foregoing, the importance of agricultural incentives in realizing increased agricultural productivity can be felt. This paper adopts a similar view about the significance of agricultural incentives with few modification. The efforts and measures taken by the Kenya Government toward increasing agricultural production among small scale farmers has been noted earlier. However, the goals that such measures were aimed at achieving have not been fully realized. The incentive package which the study aims at analysing are specifically as follows. The availability of agricultural credit facilities and farmers' access to them. The availability of agricultural inputs in

good time and quantity like seeds, fertilizers and others, and farmers' access to them and their awareness about the existence of such facilities is also important. Input prices and output prices and how they are related to farmers production decisions, is important. The availability of market outlets for surplus production, provision of extension services to farmers and their reaction to them are necessary. Ownership of land title deeds and how important this is to them in terms of loan

acquisition and farm investment should be established. The nature of the infrastructural arrangements and how it affects agriculture, is also important. It will therefore be necessary to find out what incentives exist and farmers response to them. If the focus of increasing food production in the district is on small scale farmers, it should be considered whether such incentives take into account the objectives of the farmers and their priorities which are crucial in determining how the farmers respond to improved technology. This study will therefore aim at finding out whether there exists incentives in the district and how they can be used in increasing food production among small scale farmers. If arm level production is low because of lack of adoption of modern farming techniques, then incentives are needed to induce farmers into such practices and thus increase output. The nature of the incentives to be given is important in the realization of what they are intended to achieve.

1:3 Objectives of the Study

The present study will aim at achieving the following objectives.

1. To describe the nature of agricultural activities in Siaya District and determine the main constraints hindering increased agricultural production in the district.

2. To determine the nature of incentive system that is available to the farmers and to assess their impact on the farm level production by farmers.

3. From the above objectives, to come up with feasible ways by which agricultural production can be increased in the district.

Specifically, the study will aim at achieving the following objectives:-

(a) To determine if there exist credit facilities at favourable rates to enable farmers implement the improved agricultural recommendations in Siaya District. To establish if the farmers are aware of the existence of such facilities and how far have they utilized them. If they are not aware, what efforts are being made to make them aware?

(b) To determine if input prices are such that farmers can easily afford them and if not, what arrangements exist to make them so. To find out if

these inputs are available to farmers at the right time and quantity.

(c)   To find out if there is an assured market outlet for the produce, both NCPB and local markets and how far do farmers use them. It will also be necessary to find out the nature of producer prices in these markets.

(d)   To find out the land tenure arrangements and more specifically, whether   farmers have title deeds for their land. How far is the title deed used as a means of increasing farm production through loan acquisition.

(e)   To describe the infrastructure in the area in terms of main roads, rural access roads, markets, water facilities both for domestic use and stock, and how this influences agricultural production.

(f)   To establish whether the above mentioned incentives exist and if they have been effective in increasing agricultural production. If they do not exist, how can they be made available so that they can help farmers in increasing their production.

1:4   <u>Justification of the Study</u>

Agriculture plays an important role in Kenya and is

expected to help in meeting the nation's food requirement. By finding out the nature of the incentive system available to farmers and their impact on farm level production, this study will be able to generate information which can be useful in achieving some of the stated national food policy objectives.

In the past, small scale agricultural production has increased very fast. However, it has been shown that small scale cash crops producers have benefited more than those producing food crops. Siaya District consists mainly of small scale agricultural activities aimed at meeting subsistence requirements. A study on how food crop production can be increased in the District is therefore relevant. In addition, very little information exists on the constraints hindering increased agricultural production in Siaya District and how they can be overcome. This study will therefore be useful in providing information on which incentives are needed to increase production and their effectiveness in farm production in addition to providing a framework for correcting the situation for the benefit of the farmers. Increased production of minor food crops and drought resistant crops has been among the food policy objectives in the country, yet no empirical work has been done on the possibility of using incentives to increase their production. This study will be useful in providing such information at least at the district level. The study will also provide information on problems that hinder farmers' response to new agricultural innovations and will

therefore be a basis for formulating future incentive structure for increased agricultural production. Finally the study will form a basis for further research on the incentives in other district in the country.

1.5 Organization of the Paper

This research paper is composed of six chapters. Chapter one is the introduction of the paper. Section 1 gives the background of agriculture in Kenya which highlights Land resources, the role of agriculture and the agricultural policy in Kenya. The statement of the problems is presented in section 1:2. The objectives of the study falls under section 1:3 and justification of the study in section 1:4. Chapter two gives the literature review. Here both theoretical and empirical findings are presented. The limitation of past studies is presented in the last section. Chapter three deals with the research methodology. Section 3:1 gives the analytical Framework. Section 3:2 gives the data source in which the operational definitions of the variables as used in the study are given and the source also specified. Section 3:3 gives the sampling unit. The sampling procedure and area of study are presented in section 3:4. Chapter four is the analysis of .data and results. A general description of Agriculture in Siaya as observed from the field survey is presented in sections 4:1. Section 4:2 presents a summary of the constraints hindering agricultural production in the District. Chapter Five presents the results of the regression and conclusions based on the findings. In Chapter six, a summary, policy

implications and limitations of the study are given. The appendix gives the questionnaire used to collect the data.

CHAPTER TWO

LITERATURE REVIEW

2:1 General Literature

According to Schultz (1964) once traditional agriculture is established, the equilibrium is not readily changeable. He further hypothesizes that there are comparatively few inefficiencies in the allocation of factors of production in the traditional agriculture. The traditional farmers are therefore poor but efficient. This implies that no appreciable increase in agriculture can be had by reallocating the factors at the farmers' disposal since all factors are already fully employed. To increase production, in this kind of economy, there is need for a total transformation of the agricultural practices. Transforming traditional agriculture into a highly productive sector depends on the investment made on agriculture and the form it takes make it profitable (schultz 1964). Agriculture is treated as a source of economic growth which can act as an engine of development, but the form of investment is important for the realization of this goal. Incentives to guide and reward farmers are seen as an important component of the investment to increase agricultural production. This points to the need for incentives in agricultural transformation in peasant agriculture. Incentives for the farmer to work more are weak because the marginal productivity of labor is very low and incentives to save more than they do are weak because the marginal productivity of capital is also very low. There is

little adoption to change and farmers are more secure about what they know about traditional agriculture than adopting and learning how to use new factors of production. The types of risk and uncertainty about yield associated with the advance in knowledge are of real concern to the farmers who produce so little barely enough to meet subsistence requirements. Schultz also suggests that traditional agriculture is resistant to change because introducing new factors mean coping with problems of risk and uncertainty associated with the productivity of the new factor. The rate at which traditional farmers adopt new factors is therefore subject to the allowance for risk and uncertainty.

Schultz (1978) observed that agricultural revolutions are presently suppressed by lack of adequate incentives. He states that the state of incentives is such that in many countries it is unprofitable for farmers to undertake modernizing investment that would increase the productivity of agriculture. An incentive in this case is the product of economic information from which the farmer derives his expectations. The cost expectation encompasses the rate of interest, rent on land, payment for equipment, fertilizer, labor and the farmer's time devoted to farming. On returns, expectations encompass the value placed on the farm products to be utilized in the farm household and the expected price of the product to be sold. Optimum economic incentives provide the information that leads producers to allocate resources in ways that result in maximum production. Governments by various means often alter open competitive

market incentives.

The agriculture production effects of what Governments do is a measure of the value the government places on agriculture. The technological possibilities have become increasingly more favorable but the economic opportunities that are required for farmers in the low income countries to realize their potential are far from favourable. Due to lack of profitable incentives, farmers are not making the necessary investments including purchase of superior inputs. Schultz suggests that government intervention is the primary cause of lack of optimum incentives. It therefore becomes important to determine the conditions that are both necessary and sufficient to attain the optimum increase in agricultural productivity. The better agricultural inputs and techniques have been seen to be necessary, but the availability of superior seeds, fertilizers, pesticides and animals along with other forms of new capital is not sufficient to achieve large increases in agricultural productivity. The critical allocative role that producer incentives play in attaining the optimum increase in productivity is important. There has been real progress in scientific agricultural research oriented to the requirements of poor people, but the utilization of the contribution of this research is being impaired by distortions of producer incentives. Having achieved real progress in agricultural research along with considerable additional capital for agricultural development, the primary constraint that currently accounts for the persistent

disequilibrium is lack of optimum incentives available to farmers. In Kenya, there has been alot of technological breakthrough in agriculture with the introduction of improved crop varieties and livestock breeds. Research breakthroughs and innovations in agriculture are therefore not the most pressing constraints hindering increased agricultural production. The issue is what should be done to establish suitable incentives which can accelerate the use of the research findings. We need to consider Schultz's argument in relation to the agricultural situation in Siaya. To what technological findings. Does there exist a suitable incentive package which can induce farmers to take progress in scientific research oriented to the requirements of poor people. How far the research findings are related to the needs of small scale farmers in Kenya should be considered. This study should therefore establish the suitability of agricultural research findings and how the incentive structure favours them.

Collinson (1972) emphasizes the importance of survival to the farmer and notes that any attempt to increase farmer' production has to assure them of continued food supply. In government sponsored innovations, the motivations and priorities of peasant farmers as a basis for devising a product that meets their needs is therefore important. The two aspects of survival considered are personal security and assured food supply. As a result, the cropping pattern used is determined by yield expectations and household size. The importance of survival in traditional agriculture is shown

by the traditional husbandry practices with insurance techniques like intercropping and staggered planting to allow a variety of crop inventory and flatten out seasonal labour peaks. Where input are purchased, the farmers willingness to purchase them is limited by his expected yield which is characteristically low for subsistence farmers. The expectations of yield likely to accrue from the use of credit will determine his willingness to incur debts. Farmers' expectations are therefore an important consideration in the impact of programmes to increase production. Farmers' priorities however can change but at a slower rate, therefore incentives are needed to change them faster. Small scale farmers are known to be risk averse and this may be a major hindrance to the use of agricultural credit and improved farming practices. This has been shown to be true in Kenya (Heyer 1972). We need to establish whether risk averseness explains the farming practices in Siaya and what can be done about it.

Clayton (1964) noted the importance of land tenure arrangements in peasant agriculture as a factor impeding progress in agriculture. Labour difficulties due to the seasonal nature of peasant farm organization are also important in determining output. Unsatisfactory marketing arrangements for farm produce and long distance or poor communication resulting in high transport cost hamper the peasant farmer as these may make the sale of surplus unnecessary and not worth while, thus hindering agricultural growth. Poor farming practices are a further difficulty in

peasant agriculture. Clayton also noted that it is important to know the problems facing peasant agriculture if they are related to raising agricultural productivity. Attempts to remedy the defects of peasant agriculture have often failed because such attempts impinge on non-farm aspects of the indigenous ways of life. Schemes to improve agriculture exclusively concern themselves with the farming problem, neglecting other aspects of farmers' activity especially their social obligation. The Kenyan land tenure system is geared towards the privatization of land so as encourage more investment on land and hence more productivity. The study should determine whether this has been an incentive (issuing land title deeds) and how effective it has been in Siaya.

2:2 Empirical Findings

. Studies have been done on farm level production both in Kenya and outside. Jaylook (1986) looked at the provision of credit as a major policy in South East Brazil. He notes the technological barriers facing the traditional farmers which results in the ineffectiveness of the programmes One observation here is that increased investment in mechanized equipment and fertilizer alone is not enough to increase crop production, rather, better management information and utilization of resources should be equally emphasized if the potential grains are to be realized. The study concludes that the results of a programme instituted to increase production of traditional farmers was not a success and instead, was in support of Schultz's "poor but efficient"

hypothesis. This implies that no increase in production can be realized by reallocating the existing factors of production. This is not the case in Kenya, especially Siaya since some factors are underutilized and therefore can be put to more use. The issue is how can these resources be put under production. Farmers also do not face technological barriers in Kenya.

A study on farmers' response to economic incentives in India was done by Jhala (1979). Specifically, he looked at the inter-regional supply response in the case of groundnuts for a period of time. He looked at the use of incentives like price support, input subsidies, subsidized institutional credit and subsidized food prices as means of stipulating growth and achieving welfare objectives. The influence of techno-institutional factors on decision making of groundnut farmers is noted. The Nerlovian adjusted lag model was used to estimate the acreage response to economic incentives. The conclusion was that agro-climatic factors like yield and sowing period exert significant influence on groundnut acreage.

A study by Welch (1965) looked at the response to economic incentives by Abakaliki farmers in Eastern Nigeria. The results of the study are consistent with the hypothesis that farmers respond to economic incentives by allocating efficiently the factors of production at their disposal. The study looked at the introduction of rice as a cash crop into a typically traditional type of agriculture. Both

linear and Cobb-Douglas functions were fitted for data collected on physical quantities of the inputs and output. The combination of enterprises in the farm were examined, specifically to determine why factors are diverted from yam to rice production. It was found that yams were still more profitable even at an opportunity cost of zero, yet rice acreage expanded alot. The response of farmers to economic incentives was further examined in relation to their saving and investment behavior. The relationship between investment decisions on capital and human resources was not revealing. Farmers did not use fertilizers, implying that farmers expected much higher returns on other investments than on fertilizers. The study concludes that there is evidence of considerable response to economic incentives by farmers in the Abakaliki area of, East Nigeria. The smallholders demonstrated that they will adopt new inputs if they are profitable and available. The way in which Siaya farmers would respond to the available incentives in the presence of a new cash-crop is at the focus of this study. The aim is to determine how they have responded to the available incentives.

In Kenya, Heyer (1976) concluded that subsistence farmers have not increased their production greatly compared to cash crop producers. Only export based small scale farmers have been able to increase their production significantly. She noted that a large mass of subsistence farmers are still by bypassed by much of the development efforts. The growth of marketed output has been limited to

high potential areas and the contrast between high potential areas and other areas is serious.

Senga (1976) also concluded that the distribution of development efforts with respect to commodities have been heavily biased towards export crops, apart from maize and wheat. However, wheat is a large scale farms' crop thus leaving only maize to the small scale farmers. He observed that there is dichotomy between small scale and large scale farms, having colonial origins. Research on food crops has been greatly neglected. At the same time little research seems to have been done on the implication of new technology for farming systems in the small scale farming sector. He notes that there is the need to integrate technological research with economic research so that the technological findings can be evaluated in terms of farmers requirements for inputs, marketing services, credit availability and extension services. The neglect of such factors mean inappropriate research to small scale farmers. In terms of product mix, he states that government effort has not been adequately directly to the production of staple foods and as a result, majority of small scale farmers still try to provide the bulk of their own food requirements regardless of whether they are in good producing areas or not and regardless of the opportunity cost. Another problem noted with research is that relevant research results are not made available to the farmers or they are unable to follow the recommendations due to poor extension system. It should be noted that the situation has changed with respect to

research on subsistence crops as exemplified by new varieties of maize, serena sorghum and other crops. The situation has also changed on the integration of technological research with economic research. With the introduction of (T&V) approach to extension, farmers are given intensive training on new agricultural findings and their implications. The training of the frontline staff further goes to integrate technological findings with farmers' requirements for inputs, marketing, credit and extension. The major problem is to determined how best these incentives can be used.

Wolgin (1973) studies farmers' response to price in small holder agriculture in Kenya. He started by noting the uncertainty about weather conditions affecting subsistence crops and how it makes resource allocation decision difficult to farmers in Kenya. Any study which fails to take account of the risk component is then rendered in appropriate. This risk component he notes is compounded by the nature of maize marketing in Kenya. Due to large costs of marketing and distribution, there exists a large wedge between the producer price and the consumer price. Such uncertainties leads a farmer not to produce for the market.

The importance of the creation of marketing structure which provides the farmers with the right price signals is noted. In Kenya, producer and consumer prices for maize are fixed at all stages. The dual pricing policy compounds the risk involved in agricultural production in Kenya, leading

most farmers to produce just enough for the family. At the same time, uncertainty makes them grow a variety of crops.

The conclusion is that farmers are constrained in the total quantity of resources they are able to use by factor market imperfections. Farmers were found to be inefficient in resource allocation within crops, but efficient in resource allocation across crops. They are also risk averse and employ few resources in more risky crops.

The suggestion is that the government should take on some of the farmers' risk by guaranteeing minimum expected return. The government could also reduce the gap between buying and selling price. Measures to shift maize to the category of cash-crop can also help.

The significance of risk in agricultural decision is once again clear. Do the institutional arrangements compound farmers' risk in Siava? We need to determine how this affects production among the farmers.

Jabara (1985) looked at agricultural pricing policy in Kenya and observed that Kenya has had one of the highest rates of growth for agriculture in the developing countries since independence. The study examines the agricultural pricing policy in Kenya and its impact on the marketed surplus and also the extent to which the benefits of agricultural pricing policy has been shared among small and large scale farmers. Real producer prices are used to

examine the impact of agricultural pricing policy on producer incentive and income earned from agriculture. She states that Kenya farmers are very responsive to prices. To evaluate the incidence of Kenya's agricultural development strategy, indices of real producer prices and real incomes earned from production for small holders versus large farmers were constructed. The result shows that Kenya's agricultural pricing policy has been beneficial for small holders, but this she observes, has only been achieved ;with cost to the treasury or to Kenyan consumers. Increased producer prices for staples resulted in an income transfer to producers from domestic consumers. The establishment of the buying centers to promote smallholder sale of maize and other produce to the National Cereals and Produce Board (NCPB) greatly increased the board's overhead expenditure, which it had difficulty in passing to Kenyan consumers. The conclusion is that Kenya has used agricultural pricing policy to create incentives for increased agricultural production to meet its development goals of promoting smallholder production. However, it is not clear that all segments of smallholders in Kenya have benefitted. The study however doesn't show whether the buying centres exist in Siaya and of what benefit they have been to the farmers. This should be the objective of this study in addition to finding how effective the pricing policy is in Siaya District.

The results presented in the paper suggested that real increase in prices for drought crops, and livestock have not

provided incentives for increased production. Further
activities are therefore required in the areas of pricing
and market development. It should be suggested which actions
are needed in pricing and market development in order to
improve the incentive system.

Ateng (1986) analysed the food policy situation in
Kenya and observed that in addition to the physical
possibilities of increasing food production, economic
possibilities are more relevant since policies, markets and
programmes are needed to help farmers produce according to
these physical possibilities. He concluded that
inappropriate agricultural policies are responsible for poor
performance in the food sector, resulting in seasonal food
shortages. The same conclusion has been reached by other
researchers (Schmidt 1977, Heyer 1976). In addition to the
increased food production, the provision of basic marketing
infrastructure and storage facilities are important
incentives to increased food production. If these
incentives are necessary, we need to establish to what
extent they exist in Siaya District and how effective they
have been in ensuring increased agricultural production. If
not then how can they be made available? This is one of the
objectives of this study.

Heyer (1972) analysed peasant farm production under
conditions of uncertainty in semi arid parts of Kenya. She
used Linear programming approach with resources constraints
like labour and land. She observed the complexity of small

farm production and the importance of timely operations with
timely allocation of labour, limited land and the necessity
for balancing cash needs with the need for a sure and varied
food supply. Her main emphasis was on the constraints on
farm system, how they affect the farm system and what would
be the result of reducing some of the critical constraints.
The linear programming model used had as its objective
function the maximization of farm output at local market
prices, subject to resource constraints like labour and
arable land. A range of outcomes associated with different
optimal strategies are examined and a basis for choice,
taking account of uncertainties is provided. If risk is an
important factors affecting farm decision among small scale
farmers, then what measures do we need to reduce the
riskiness of agricultural productivity?

Aldington (1971) studied producer incentives as a means
of promoting agricultural development, looking specifically
at the case of cotton in Kenya. He used Linear regression
to analyse the situation and observed that lack of knowledge
and motivation of farmers leads to low yield due to
inefficient methods of information dissemination. However
producer prices are responsible for lack of motivation and
hence poor husbandry standards. He criticizes some policies
for poor performance like burdening the agricultural sector
with responsibilities like extension and research and the
running of high cost marketing boards. The study was mainly
on a cashcrop. Given these conclusions, is it possible for
us to arrive at the same conclusions for foodcrops? This

needs empirical testing which is the purpose of this paper.

Opiyo (1986) studied the incentives for increased production. The gross margin analysis method was used to get an index of potential which gives a measure as to whether a farm system is potentially capable of producing high gross margin. An index of performance is calculated and together they show whether there is a weakness in the farm system or in the production performance. He concluded that the state of farm incentives for oil crops is poor to encourage their production. Their relative profitability, uncertainty about seed availability and poor policy of extension all militate against the production of oil crops. There is therefore the need to restructure the extension policy, formulate pricing policy to consider farmers' returns in growing oil crops and consider good quality milling to increase the demand for the final product.

Rukadema (1977) studied resource utilization and productivity of small scale farmers in Kakamega district and analysed mainly the constraints within which small scale farmers operate and the implication for introducing new production techniques. In determining factors which determine the productivity of inputs, he observed that production technology was rudimentary and policies of technology change should be considered.

In his study, the mean farm sizes for the two villages were taken and land/labour ratios also taken the results

indicated land scarcity was obvious in one village, while in other village, there was labour scarcity. The results show that the two farming types therefore require different approaches to their problems, which conflicts with the argument that maximization of yield per unit of land is an inappropriate goal in traditional agriculture because labour and not land is the major constraint. He concludes that generalizations in agriculture from particular cases can lead to a waste of scarce factors (resources).

In estimation, the linear and Cobb-Douglas functions were estimated. He also found that the most important intercrop beans does not compete with for space or nutrients. The conclusion is that labour productivity is low and local market transactions in maize are disadvantageous to farmers because they sell when prices are low and buy back when prices have soared. Exposure to outside influence was also associated with yields, while the level of education was not associated with yield. He also observed that resource utilization in maize production is highly seasonal, governed by the seasonal distribution of rainfall. Given the results that different farming methods need different approaches to their problems, we need to find out the farming methods in Siaya and how problems facing them can be solved. Reasons for low labour productivity as concluded by the study should also be considered.

Gwyer (1972) looked at labour measurements and their limitations. He notes that memories of work input in the

activity by the individual worker, despite its limitations. The observation is that districts with high degree of crop diversity have a flat profile of labour throughout the year, while districts like Siaya with a low degree of crop diversity has a labour profile which shows marked variation in labour input throughout the year. This is because maize has marked labour peaks at land preparation and weeding. District with low degree of crop diversity have labour profiles dominated by maize and hence have marked seasonality in labour requirements throughout the year.

2:2:1   Limitation of Past Studies

A survey of empirical work on small farm production shows that not much has been done on the possibility of increasing the production of foodcrops among small scale farmers through the use of incentives. Studies so far have focused on contribution of agriculture to the economic growth in Kenya and the impact of agricultural development efforts with respect to small scale farmers versus large scale farmers. (Heyer 1976 Senga 1976). Also considered in such studies are the extent to which food crop producers have benefited from such studies. Studies on incentives (Opiyo 1986, Aldington 1971) looked at cash crops mainly oil crops and cotton respectively. Both studies concluded that there are not enough incentives to encourage the production of such crops. However, there is reason for reviewing the current situation on such crops. Market studies have looked at the factors determining marketed output, not at the factors determining farm level production. The role of

small-scale farmers in increased agricultural output has
been emphasized while the incentives which can facilitate
the realization of such a goal have not been adequately
considered. Which incentives exist, or should exist, and
farmers' response to them in output increase has not been
looked.

The present study will deviate from past studies by
attempting to find out which incentives are needed presently
to increase production of foodcrops. The constraints that
face farmers, what incentives exist and the impact of such
incentives will be considered. If no incentives currently
exist, then the incentive likely to be needed will be
suggested. The study will also discuss how farmers'
priorities can be changed so as to enable them improve their
farming practices and hence increase their production. In
addition to price, other incentives will be considered also,
and the overall impact of such an incentive package will be
of interest. The impact of uncertainty on small scale
farmers' decision have also been analysed. without looking
at what can be done to reduce such uncertainties associated
with small farm production.

2:2:2   A Note On Methodologies

Studies on agricultural problems of small scale farmers
at different levels have used various methods of analysis.
As has been said above, some of the studies have aimed at
finding out the impact of uncertainty on small scale farmers
decisions, using linear programming approach. This approach

has also been used to find out the most important constraint on farm productivity and which enterprises optimize the farmers' objective function. In both cases, the farmer is assumed to maximize his objective function subject to an allowance for some subsistence requirements and a minimum level of risk. The farmer is constrained in his objective function by the available resources. The result of the programm shows which resource is the most constraining and which if therefore relaxed could result in an increase in production. While this method is suitable to the analysis of farm activity with different enterprises, the specification of the input output coefficients presents a technical problem. The data for the coefficients can be obtained from agricultural research stations, but its use is limited by the fact that the agronomic conditions prevailing at the research centers diverge greatly from the farm level realities. The use of average input/output coefficients is further limited by the fact that the average input does not necessarily result in average output. Using linear programming technique to analyse the effect of incentives on agricultural production is limited by the qualitative nature of some incentives, making it difficult to determine how much incentives are needed to produce a unit of a given product.

Supply response models have been used to analyse acreage response to price by farmers using time series data. The method is advantageous in analysing farmers response to economic factors like prices and technology overtime.

However, the use of such a model to study farmers' response
to economic incentives is limited by lack of data on crop
yields (especially food crops) over time since subsistence
farmers are unlikely to keep record of their yearly
production. Besides, supply response models are lagged,
which is not well suited to cross sectional data.

Complete cost accounting has also been used to determine
which incentives are needed to increase the production. The
use of this method in the case of food crops, especially
among small scale farmers is limited by the difficulty in
getting the marketed value of production and how to
apportion the cost of inputs to different inputs used in the
production process.

The traditional production functions have been used to
analyse the productivity of farm resources. It is suitable
for the application of both time series and cross section
data. The use of multiple regression helps to determine
which farm resources are important in determining output.
Both linear and log-linear forms can be used and the form
which suits the situation most is used. In the log-linear
form, the estimated coefficients are the estimates of the
production elasticities with respect to the relevant inputs.
In case of incentives, the estimated regression coefficients
give production elasticities with respect to the relevant
incentives. The importance of such factors can be tested
using statistical tests and conclusions made on that basis.

CHAPTER THREE

RESEARCH METHODOLOGY

3:1 Analytical Framework

This study uses a production function model taking both the linear and the non-linear (Cobb-Douglas) forms. The ordinary least squares technique was used in the estimation of the regression equations to determine the response of yield and output of maize to different factors of production and incentives. Both the linear and non-linear forms were estimated. The linear production function takes the form: $Q = a + \sum_{i=1}^{n} b_i X_i + U_i$

Where Q is the dependent variable which in this case is the output of maize.

a is the constant term of the regression

$\sum_{i=1}^{n}$ is the summation of the n inputs used in the production process.

b_i is the regression coefficient of the ith input.

X_i is the ith input used in production.

U is the error term.

The main objections to the linear production function are that it assumes that the Marginal product of factor, b_i is constant regardless of the level of the factor employed (X_i) relative to other factors. It is also assumed that output is positive $(a>0)$ or negative $(a<0)$ even when there is no input involved (Rukadema 1977). This problem can be avoided by taking the Cobb-Douglas production function.

The power function takes the form

$$Q = AX_1{}^{b1} X_2{}^{b2} \ldots X^b e^u$$

Where Q is the dependent variable which in this case is output of maize.

A is the constant term of the regression

X_i is the ith variable in the production process

b_i is the elasticity of output with respect to the ith variable.

U is the error term.

e is the base of natural Logarithms

In this form, the estimated regression coefficient (B_i) give the production elasticities with respect to the relevant input.

The production function of any farmer is determined by resource availability of the farmer. In agriculture, the production function consists of land, labour and capital as the basic factors of production . The expected relationship between output and land is that as more land is brought under production, output is increased. However in reality, there is a limit beyond which more land can not be brought under production and therefore other measures are needed to . increase output with fixed land. Increased use of labour on a fixed amount of land and capital results in diminishing returns being realized. Therefore in addition to the available factors of production, the need to increase agricultural production requires the existence of certain incentives. To find out the impact of these incentives on farm level production on small scale farmers in Siaya

District, the functional relationship was specified as follows:-

$$Q=f(N,L,Kp,P,E,Cr,Ed)$$

where

Q = Output of Maize

N = Acreage under Maize

Kp = Physical Capital (Monetary value)

L = Labour

P = Price of Maize

E = Extension Services

F = Fertilizer use

Cr = Credit

Ed = Education

Using OLS technique, the coefficients of the above variables were estimated. Both the Linear and the log-linear forms have been estimated.

In this study, labour was disaggregated into both family and hired labour so as to avoid the problem of specification bias. It has been shown that if labour aggregate is defined as the total of family and hired labour, then the resulting production function estimates will be subject to specification bias, which will render empirical tests of the issue invalid (Berman and Squire 1978). To avoid this problem, family labour and hired labour were fitted separately in the model. For the purpose of the study, both of the two categories of labour were arrived at by taking the totals of labour used for land preparation and planting (L_p), labour used for weeding (L_w)

and labour used for harvesting (L_H). The total family labour used in the production process is defined as $LF = L_p + L_w + L_H$ while the total hired labour used by the farmer is defined as $L_H = L_p + L_w + L_H$. Thus total labour(L) is composed of family labour (L_F) and hired labour (L_H). Their effects are estimated separately. The coefficient of each of these is estimated to determine the importance of either in the production process.

Capital is defined as consisting of fertilizers and physical capital For physical capital, the monetary value was used.. In agriculture, capital is composed of more variables but for the purposes of this study, where only small scale subsistence farmers are considered, only these are most relevant. Capital therefore does not appear in its aggregate form, but its influence is reflected through the individual components. Physical capital was defined here as the value of farm implements, ox-ploughs and oxen. Fertilizer used and credit availability are taken as the amount received or used by the farmer during the period under survey. It is known that livestock is a form of farm capital. However, for the purpose of this study only oxen was considered. This is because although people kept other forms of livestock, they are not used in agricultural production. Their only contribution which was considered was by providing manure, which was analysed separately. Livestock is a form of farm enterprise and contributes economically to the farmer by providing milk and meeting urgent cash requirements. However, Livestock as an

enterprise was not the interest of this study and therefore its related issues were not dealt with.

In addition to the regression analysis, other descriptive statistics have been used to find out how the yield of small scale farmers behave with respect to certain factors. For example, comparing the yield of intercropped maize with maize on pure stands. Given that only a few farmers used credit facilities, it was not included in the regression analysis. It's impact was however analysed using cross-tabulations and other descriptive statistics. As for fertilizer, only 30% of the sampled farmers had used fertilizers during that period. As a result, a separate regression analysis done for the farms with used fertilizer application to determine its influence on farm production. Reasons for non use of such facilities has also been analysed outside the regression model. To find the effect of education, an equation with education as the number of years spent in school was estimated. In general, cross-tabulations and other descriptive statistics were also employed to explain agricultural activity in Siaya (using data collected from the field survey) in terms of acreage under crops, average land ownership, different types of crops grown, and problems facing farmers.

For purposes of running the regression, only maize, being the major foodcrop grown by over 98% of the sampled farmers has been used. The other crops are not grown by some farmers and even where they are, they take a very small

some farmers and even where they are, they take a very small proportion of agricultural activity. From the yield observation, most of the farmers' efforts in crop cultivation are devoted to maize cultivation. As has been mentioned earlier, cross tabulations are used here to explain the production of other food crops apart from maize. Statistical tests of significance were carried out to determine which factors are important in determining the level of farm production. From the tests, the appropriate incentives which should be used to increase food production can be arrived at.

In this study it was assumed that agricultural and food production can be increased either by increasing acreage under the crop or increasing yield per acre. Increasing acreage under the crop is possible because as been shown earlier in the paper (section 1:2) there is agricultural land which has not been fully utilized in Siaya. In chapter four, the scope for expanding acreage in Siaya is dealt with in more detail .It was therefore found necessary to find out which factors are necessary in realizing these possibilites. Since the two possibilities can be achieved from the production function analysis, a production function for maize was specified, with total output of maize as dependent variable.

The production function was specified as follows:-

$$(1) \quad Q = f(N,L,K,p,M,E,Ed.Ic)$$

Here N = Total output of maize

The other variables are as defined earlier.

   - Both linear and log-linear forms were estimated.

In the log-linear form, the observations that had zero values were given the value 0.001. This was because a zero does not have a logarithm defined. 0.001 was used as an approximate to zero because it is near zero and does not affect the values.

Following from the analysis, the following hypotheses will also be tested.

(1) $\frac{dy}{dL} > 0$ It is hypothesized that yield is a positive

    function of both family and hired labour. As labour availability increases, it is expected that yield would increase, since the problems of labour shortage resulting in late planting, late or inadequate weeding and wastage of crop due to lack of harvesting labour would be minimized and hence yield would increase.

(2) $\frac{dy}{dp} > 0$ It is hypothesized that yield is positively

    related to price of product. The higher the anticipated price, of the product is, the more a farmer would be motivated to increase the

production of that crop.

(3) $\frac{dy}{dE} > 0$ It is hypothesized that yield is positively

    related to the availability of extension services. The more a farmer receives extension services, the

more likely he will be to undertake farming practices which are likely to increase his yield as opposed to those who do not receive extension services.

(4) $\frac{dQ}{dN} > 0$ Output is hypothesized to be positively related to acreage. As acreage increases, output will increase.

(5) $\frac{dQ}{dL} > 0$ It is hypothesized that output is positively related to labour (Both family and hired). Its labour input increases, output is likely to increase. A decrease in labour will lead to fall in output.

(6) $\frac{dQ}{dp} > 0$ Output is hypothesized to be positively related to the price of the output. As the price increases, farmers are likely to be induced to produce more.

(7) $\frac{dQ}{dE} > 0$ Output is positively related to the availability of extension services. The more a farmer receives extension services, the more his output will increase, and vice versa.

The last hypothesis to be tested is that farmers who receive credit, and use fertilizers, are also more involved in cash crop production (especially coffee) than those who do not use these resources.

3:2 Data Type and Source

Cross-sectional data on farm output of maize for 1987 long rains season was used. Data was also collected for other crops like sorghum, millet, beans, cassava, groundnuts, and cash crops like coffee and cotton. The data was collected using a designed questionnaire which was administered to sampled farmers in Siaya District. The sampling procedure is explained below. Data on the different variables specified above were estimated as follows:-

(1) The dependent variable:- Output of maize for the 1987 long rains season was taken. The number of bags harvested by the farmer was used in this case for all the crops being considered. For maize, since most farmers are subsistence farmers, some proportion of their output was consumed on the farm, therefore deflating the harvested output to some extent. Due to this problem, it was decided that the on farm consumption by the family be estimated so that the farm level production is not very much underestimated. The way to reach the approximate figure on on-farm consumption involved asking the farmer questions concerning the nature of his on farm consumption together with the size of his family. The process involved deviating from the designed questionnaire for sometime. The estimated figure was then added to the harvested production to get total production for each

harvested production to get total production for each farm. For the other crops, there was no consumption, when the crop is green except for cassava which as was observed, was only harvested as the need arose. For this reason, what was emphasized was acreage under the crop during that particular period.

(2) Explanatory Variables:-

(a) As has been mentioned earlier, data on labour was dissaggregated into both family and hired labour. Each of these was estimated by taking the total of planting labour, weeding labour and harvesting labour in each case. Labour units were taken as man days devoted to the particular activity. The labour units were weighted as follows:-

$$0-10 \text{ years} = 0.0 \text{ man day}$$
$$11-15 \text{ years} = 0.5 \text{ man day}$$
$$16-59 \text{ years} = 1.0 \text{ man day}$$
$$60 \text{ years} + = 0.5 \text{ man day}$$

In addition to this assumption, it was further assumed that there is no difference in agricultural productivity between men and women of the same age. Therefore if for example a man and a woman over 60 years old worked on a farm for one day, this was taken as one manday. The standard time worked by an individual was an average of six hours per day and this was therefore taken as constituting one manday. For purposes of estimation, family labour and hired labour have been taken as two separate variables. This in addition, will enable us to visualize better the importance of each category of labour in farm production. A problem

encountered was in finding out how much labour was devoted to maize production. Farmers were not able to differentiate how much labour was devoted to each activity. However, from the collected data, all farmers surveyed devoted over two thirds of their agricultural activity to maize production. In the case of intercropped maize, it was assumed that maize production is the main activity. This was actually the case as it was found that farm decisions on hiring labour were governed by the size of the maize farm. It was therefore considered safe to assume that maize production took at least two thirds of resources devoted to farm activity., It has been observed that districts with a low degree of crop diversity like Siaya have labour profiles dominated by maize, and hence have a marked seasonality in labour requirements throughout the year (Gwyer G 1972). Following this argument and the observed fact that maize was the major crop grown by all farmers surveyed, it was taken that maize production took at least two thirds of total labour input during the 1987 long season crop year. Thus labour input for maize was taken as two thirds of total labour used.

(b) Physical capital was estimated by taking the monetary value of the farm implements used by the farmer during the survey period. In agriculture the term capital can include many things like farm tools, equipment, buildings, livestock, treecrops, planting materials and fertilizers. Here however, the term capital has been restricted to physical capital (farm tools and equipment) which were directly in use during the survey

period. Particularly considered here were hoes
(jembes) ploughs, shovels, pangas and wheelbarrows. It
is obvious that the use of an ox-plough is only
facilitated by using a team of oxen. Because of this
an ox-plough was only recorded as being in use if the
farmer owned it in addition to a team of oxen, but
where the farmer only owned an ox-plough without a team
of oxen, it was taken that the farmer had no ox-plough.
Since the plough is not productive, and the farmer
cannot hire oxen only. This is because from the field
work, it was observed that hiring oxen alone is not
common practice in Siaya. Where the farmer was recorded
to be having an ox-plough, it is therefore assumed that
he also had a team of oxen ranging from two to eight,
and therefore, the value of oxen need not appear since
its existence is implicit in the ox-plough. Where ox-
plough was hired, the amount paid was taken as the
value. Other aspects of physical capital were also
included like the quantity of farm tools and equipment
used by the farmer. Most farmers however used only
simple tools like hoes, pangas shovels and to an extent
wheelbarrows. Tools like fork-jembe and manure jembe
were only used by farmers getting in to coffee
cultivation enterprise. In the case of wheelbarrows,
it was only recorded as being in use if it was being
used by the farmer directly in farm activities like
carrying of manure. The quantity of physical capital
owned by the farmer alone is not enough to give the
extent of farm capitalization. All these were

translated into monetary terms. The monetary value of physical capital was therefore used to capture the qualitative nature of the capital owned by the farmer. The aim was to identify how the value of capital owned by a farmer would influence his agricultural productivity. In other words, is farm capitalization an important factor in influencing farm productivity and as a result, what action is necessary regarding farm capitalization.

(c) Price was taken as the price of the produce at which the farmer sold his surplus. Where the farmer did not sell any of his produce during that season, the price taken was the price at which the farmer expected to sell his produce during planting, that is suppose he was to sell a portion of his produce, what price had he expected to sell it at. It was assumed that this is the price which influenced his planting decision. Prices that influence farmers decisions are the National Cereals and Produce Board (NCPB) prices and the local market price. Here local market price is the one taken because from the survey, all farmers sold their produce through local markets and not to the NCPB depots. These are therefore the prices on which farmers base their decisions. A quantitative comparison of the importance of NCPB prices as compared to local market prices is given elsewhere in the study.

(d) Extension Services: The availability of extension

services to farmers was taken as the number of times a farmer received visits by extension officers during the crop season under consideration. Due to the existence of Training and Visit (T & V), the number of times a farmer visited a contact farmer was taken as equivalent to visits by an extension officer. For a contact farmer, the visits to a (T & V) course was taken as the number of days taken at the course, so that one day at the course was considered equivalent to one visit by an extension officer. Agricultural information is also passed through farmers' Training Centres (FTC). Farmers' visit to FTC was taken as the number of days taken by the farmer at the FTC so that a day at the FTC was considered equivalent to one visit by an extension officer. Attendance of agricultural field demonstration was also considered as a method of agricultural extension services. The availability of extension services to farmers was therefore estimated as the total number of times that a farmer received these services. Farmers' opinion about the dissemination of agricultural information through extension and other means was also sought in order to shed some light on the quality of such services.

(e) Credit Facilities: The availability of agricultural credit facilities and farmers' access to it was estimated by taking the amount of credit received by a farmer, the source and the purpose of that credit. Farmers' opinion about the availability of agricultural

credit was also sought. Of importance to this study however is agricultural credit received by a farmer, either financially or in form of farm input therefore only this was considered. However, only 13 (16%) out of the sampled farmers had received credit of any form. Credit as a variable did not therefore appear in the regression.

(f) Fertilizer use was taken as the number of bags used by the farmer during the crop season. As has been mentioned earlier, only 24 (30%) of the farmers surveyed used fertilizers. A separate regression was therefore run for the farmers using fertilizers. The use of animal manure was also considered although the amount used by each farmer was not recorded. It was only recorded whether the farmer used animal manure or not, it was also not considered as fertilizer.

The importance of intercropping was determined by the use of cross-tabulations, comparing yield of intercropped maize and that of pure stands.

(g) Education: This was taken as a formal schooling plus other formal or informal training. The level of education was taken as the number of years taken in from schooling or any training. The level of education was categorized as follows:-

No schooling = 0

Primary Education = 1

Secondary Education = 2

University/College

Polytechnic = 3

The existence of adequate infrastructural facilities was captured by considering the distance from the main road (where main road here was taken to mean an all-weather road); and market centres. In addition, the types of storage facilities used and availability of water facilities were also recorded plus the problems associated with the given facilities.

3:3 Sampling Unit

The data was collected from individual farmers engaged in crop cultivation. Since the study mainly focussed on small-scale farming in Siaya district, only farmers with land area not exceeding twenty hectares were considered eligible for the interview. In any sampled household, the person interviewed was the head of that household who was considered to be responsible for making major farm decisions, like how much and to cultivate, when to start planting, whether to hire labour, which inputs to use and any other important decisions. In a situation where the head of the household was not present either because he/she was employed outside the village or was away on other commitment elsewhere, then the person to be interviewed was the one who could act on his behalf and execute such decisions. For example in a polygamous home where the

husband was absent, the first wife was interviewed since she is the one who acts on the husband's behalf.

Apart from the individual farmers, the District Agricultural Officer was also interviewed in connection with the use of various inputs, availability of credit facilities to farmers, and the availability of extension services, and farmers's response to such facilities.

3:4 Sampling Procedure

The procedure employed to sample out farmers for interview was as follows:-

The first step involved the stratification of the district into different Agro-Ecological Zones (AEZs). These were Um_1 (with the highest annual rainfall). LM_1, LM_2, LM_3 and LM_4. The reason for stratifying according to the AEZs was that the zones reflect more than administrative divisions the agricultural practices undertaken in an area as determined by the natural conditions in that particular region. The division according to AEZs is therefore the same as division according to different agricultural practices. ' These zones cut across administrative boundaries therefore not allowing for the use of administrative units.

The next step was to classify all the sub-locations in the district according to their respective AEZs. (This classification was obtained from the Siaya district Field

Trial Agronomist). Out of all the sub-locations, twenty four were selected. This resulted from selecting six sublocations from each AEZ. Since the Uml Zone covers a very small portion, it was combined with the LM. Zone so that there was a total of four zones. Out of the selected sub-locations, twelve of them were selected for the study using systematic random sampling procedure so that finally at least two sub-locations were surveyed from each AEZ. This means that a table of random numbers was used to determine the random start. The random interval was arrived at using the formula ($^N/_n$) where N is the population size, (in this case the sublocations) and n is the required sample size. This was 2 in this case.

The following step was to select farmers for interview from each of the sampled sub-locations. A sample of eighty four was considered adequate for the study. To get this sample, seven respondent farmers were drawn from each sub-location using a systematic sampling procedure. The sampling frame was obtained with the assistance of assistant chiefs in the particular sub-locations who helped in giving the names of the farmers. It should be noted here that not individual households were considered, but rather homesteads were considered, and the name listed was that by which the home is known administratively to the assistant chief. From the list of farmers, a random start was obtained using a table of random number then thereafter the random interval was used to sample out farmers. As a result, the whole district was covered by the study. The size of the sample

selected was determined by the available resources and time allocated to the study. A sample of 84, was considered adequate given the constraints.

The decision to cover the whole district followed from the fact that the study was aimed at giving representative information about agricultural situation in Siaya District. There is however no single administrative unit such as a division or location which could give a representative situation of agriculture in the district. Agriculture practices in terms of number of seasons, and cropping pattern vary from one region to another according to the AEZs. The best alternative left was therefore to ignore the administrative divisions for a while and use the AEZs which cut across administrative boundaries and only use them at the sub-locational level . In this way, the different agricultural practices as determined by the natural conditions in the district were captured. The results are therefore expected to show what exists in Siaya district agriculturally.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS

This chapter presents a description of the agricultural practices in Siaya and the problems faced by farmers.

4.1 Agricultural Practices in Siaya District

4:1:1   Physical Characteristics of Siaya District

Siaya District covers an area of 3,528 square kilometers. The District is traversed by rivers Nzoia and Yala flowing South Westwards and entering Lake Victoria via the Yala Swamp. The average altitude of the district is rising from about 1140m at the lake shore in the south to about 1300m in the North and East.

The rainfall amounts and distribution are largely determined by the altitude and wind direction. The highlands in the North receive high rainfall while the lower areas in the centre and the West receive lower rainfall.

The rainfall in the District is extreme. The 60% rainfall probability during first rains varies from 350 mm. to 900mm and during second rains, from 50 mm to 800 mm.

The distribution of soil types and their fertility in the District is of great variability in depths and types.

Large areas in the centre of the District have shallow coverings of soils derived from igneous rocks. Most of such soils are badly leached and eroded. The resultant low soil fertility is due to leaching,erosion,and continuous cropping.

The table below (Table 4.1) shows land classes in Siaya District.

Table 4.1 LAND CLASSES IN SIAYA DISTRICT 1984(AREAS IN KMS2

	BONDO	BORO	YALA	UKWALA	TOTAL
Total Area	975	612	383	492	2642
Agricultural Land:-					
Area	799	481	344	444	2098
Percentage	82	76	90	90	85
Non-Agricultural Land					
Unsuitable Steep Slopes	33	6	-	-	39
Forest Reserve					
Lakes, Swamps	46	70	-	-	116
Agricultural Land					
Per household per ha	3.49	2.32	1.65	1.75	2.14

Source: Appraisal Report: Farmers groups and Community Support project vol.11 1984

There are also some areas of high soil fertility with high yield potential, but are difficult to make full use of without skilled management and even modern agricultural equipment in some cases.

Land is the major natural resource in the District. The average farm size range are 1-5 hectares in Bondo, 1-4 ha in Yala 1-6 ha in Ukwala and 1-9 hectares in Boro. This resource however, has not been fully utilized. Only a small portion of the available land is under cultivation, leaving much land under bush/fallow. In the Northern parts of the District, land use becomes more intensive in the upper

agro-ecological zones.

Siaya District is composed of different agro-Ecological zones, which to some extent, influence the cropping patterns in different areas of the District. In the Um_1 Lm, and Lm_2, the rainfall is bimodal allowing two crop. Seasons while in the Lm_3 and L_4 zones, rainfall amount is low and mostly unreliable, therefore allowing only one crop season. The degree of land utilization in the district also varies from one area to another. It was observed during the study that there is alot of land lying unutilized (see footnote.[1]) Table 4:2 shows the extent of land underutilization by Division. The main reasons for the low utilization of agricultural land is lack of labour and the complementary factors to labour which makes farm activities difficult and slow. The low yields resulting from poor soils and unreliable (and low) rainfall also discourages farmers from putting much effort in agricultural activities.

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[1]-Land considered unutilized is that not left for grazing or any other agricultural activity. Land left for Livestock is under the utilized land.

Table 4:2 FREQUENCIES OF LAND UNDERUTILIZATION BY SIZE AND

DIVISION

Divis-ion	0-2	2.1-5	5.1-10	10.1-15	15.1-20	Total
Boro	11	-	-	1	1	13
Bondo	5	4	-	4	3	16
Yala	7	6	3	-	-	16
Ukwala	8	4	4	2	2	20
Rarieda	3	2	6	1	3	15
Total	34	16	13	8	9	80

From the table, all farmers surveyed had some land lying
idle.   The highest number of people with idle land was in
Ukwala, followed by Yala and Bondo. Yala and Ukwala lie in
the wet zones of Lm_1 Lm_1 and Lm_2, where the conditions
favour agricultural activity. With such underutilization of
agricultural land, alot of potential is lost especially for
increased maize production.   Even in the drier zones,
production could still be increased by getting more land
under agriculture.   Land underutilization is therefore
prevalent in all parts of Siaya.

Most of the land pieces covered by the study had been
registered. Over 75% of farmers had their land registered.
However, 52% of them had their title deeds. Reasons for not
having title deeds ranged from farmers not being aware of
title deeds to having no need for any at all.

4:1:2   The Cropping Pattern

Siaya is a district having a low degree of crop
diversity. The main crops grown are maize which is the

major foodcrop grown by almost all farmers(households). All farmers covered by the study grew maize. Other crops grown are sorghum, millet, beans,cassava, groundnuts, and simsim, while the major cashcrops are coffee, cotton and sugarcane. In the wetter zones of Um_1,Lm_1 and Lm_2 where the rainfall amount and reliability are favourable, maize is grown both during the long rains and the short rains seasons. Such areas fall in Yala, Ukwala and a small part of Boro. In the drier zones of Lm_3 and Lm_4, maize is only grown during the long rains season since the short rains are too unreliable to allow for a second crop. In both cases. maize is grown both in pure and mixed stands. The major crop intercropped with it was observed to be beans. In certain cases, it was also intercropped with crops like cowpea and groundnuts, but the latter case is rare. Maize as a staple is grown in all zones despite variations in yield which can be attributed to climatic differences. Both local and hybrid maize varieties are grown, but as is shown later, the local variety is more common.

The mean yield of maize per hectare in each of the divisions is given as follows:

TABLE 1:3-MEAN YIELD OF MAIZE BY DIVISION (90kg Bags per hectare)

Division	Yield
Boro	8.00
Bondo	8.50
Yala	18.00
Ukwala	13.00
Rarieda	11.00

The mean yield per hectare for each farm was found to be twelve bags.

From the study, Yala division had the highest average yield of maize followed by Ukwala. This can be explained by the fact that the two divisions lie in the wetter zones (Um_1 and Lm_1) compared to the other divisions lying in the drier zones. The two divisions also had the highest level of fertilizer use compared to the rest as is shown later in the chapter (see section 4:1:3).

The other crops grown in the district are grown in a smaller scale compared to maize in all zones. The highest acreage under maize from the sampled farms was found to be 3.2 hectares while the highest acreage under sorghum was found to be 0.7 hectares. This illustrates how important maize is and the level of land resource devoted to its production. Sorghum and millet are grown once a year in all the zones while the other crops like simsim, groundnuts, potatoes, green grams and cowpeas are grown in two seasons in most parts of the district. Cassava is a major drought resistant crop and is grown in all parts of the district throughout the year. Its cultivation is however more prevalent in the Lm_3 and Lm_4 zones. Along the Lakeshore in Rarieda Division vegetable cultivation is being undertaken for Commercial purposes. Acreage and yield of different crops is summarized in Table 4:4.

TABLE: 4:4.AVERAGE ACREAGE AND YIELD BY CROPS AND DIVISION 1987 LONG RAINS SEASON

| Division | Sorghum | | Millet | | Cassava |
	Acreage	Yield	Acreage	Yield	Acreage
Yala	0.32	0.5	0.16	1.4	0.02
Ukwala	0.48	1.5	0.12	1.2	0.28
Boro	0.32	0.7	0.08	0.4	0.36
Bondo	0.68	3.6	0.32	1.6	0.24
Rarieda	0.6	2.2	0.16	0.5	0.24

From the table, the highest average acreage under sorghum is in Bondo (LM$_3$ and LM$_4$) with 0.68 hectares. The highest average yield is also in Bondo (3.6 bags). This is explained by the fact the Division lies in LM3 and LM4 zones which are the driest zones in the district. As a result people grow sorghum more since it is likely to do better with less rainfall. Yala had the lowest average acreage under sorghum and the lowest average yield. This contrasts with the case of maize where the division has the highest average yield. Bondo also had the highest acreage under millet and the highest yield. The highest acreage under cassava is in Boro (0.36 hectares).

TABLE 4:5 THE FREQUENCY OF PEOPLE GROWING THE VARIOUS CROPS

Crop	Number of People	Percentage
Maize	80	100
Sorghum	42	52
Millet	49	61
Beans	74	93
Cassava	63	78
Groundnuts	13	16

The main reason for growing these crops was for subsistence purposes. However, some farmers grew them also to meet their cash requirements . An average of 2.2 bags of Maize is sold as, compared to an average output of 8.4 bags. It can therefore be concluded that agriculture is predominantly subsistence in nature. The Central Bureau of Statistics (1984) showed that Siaya agriculture is dominated by small-scale mixed farming, with crop production mainly being for subsistence. A large percentage (over 50%) of crops grown is consumed at home. The CBS report also showed high preference for maize production which is consistent with the present findings. This suggests that the cropping pattern exposes farmers to greater risk of food shortage especially in the drier zones where rainfall is more unreliable. This is consistent with other parts of Kenya where farmers have a high preference for maize although its yield is very low compared to other crops. Farmers should be encouraged to diversify their crop production.

Among the cashcrops grown, sugarcane is only predominant in Yala and Ukwala division although the acreage under the crop did not exceed 1.8 hectares in any of the cases recorded. Cotton is grown on a small scale in the district. Its production is however almost a dying activity as only a few farmers in Ukwala and Rarieda reported being engaged in cotton production. The main reason was found to be' lack of incentives like low prices and delays in payment. Lack of chemicals leading to low yields. This corresponds to Aldington's finding (1971) that lack of producer

incentives is responsible for the poor performance of cotton in Kenya.

Coffee as a cash crop is still being introduced in the district, although it has taken up faster in Yala and Ukwala divisions. Among the farmers interviewed, ten had taken up coffee growing of which seven were in Ukwala and three were in Yala. A closer look at the characteristics of the farmers taking up coffee cultivation revealed that they had more resources at their disposal compared to the others. They also had more outside exposure in terms of agricultural practices to the extent that they had participated in coffee production and knew better practices. The average acreage under coffee in Yala was found to be 0.52 hectares while in Ukwala it was 0.8 hectares.

4:1:3   The Use Of Agricultural Inputs

The agricultural inputs considered here are fertilizers, improved seed varieties, and farm tools. The availability of inputs at low prices, short distance and at the right time would be seen as an incentive to induce farmers to increase their utilization and thus increase output.

4:1:3:1   Chemical Fertilizers and Manure

Most farmers covered by the study had not adopted to the use of improved inputs like chemical fertilizers, hybrid seeds pesticides and herbicides. Out of the 80 farmers interviewed, only 30% used chemical fertilizers in their

farms. The use of animal manure was however found to be more prevalent as 88% of the farmers used it. Only 16% had used protective chemicals for storing their produce. As a result most of them reported high losses in stored produce due to insect infestation and rotting due to poor storage methods. This is discussed in more detail later.

Table 4:6 shows the proportion of farmers using chemical fertilizers and manure.

TABLE 4:6 USE OF CHEMICAL FERTILIZERS AND MANURE BY DIVISION

Division	Fertilizer		Animal Manure	
	Number	%	Number	%
Boro	1	1.3	10	12.5
Bondo	2	2.6	9	11.3
Yala	10	12.5	21	26.3
Ukwala	10	12.5	22	27.5
Rarieda	1	1.3	9	11.3
Total	24	30	74	88

Ukwala and Yala once again had the highest number of people using both chemical fertilizers and animal manure.

Most farmers however expressed dissatisfaction with farm input supply arrangements due to reasons like late delivery of inputs, high cost of inputs long distance to supply source and the right kind of inputs not being available. These reasons therefore partly contributed to the low use of such improved inputs by the farmers. It was found that the main centres where such inputs are stocked in the district are Siaya District headquarters and Yala. The

few cooperative societies that are operational are mainly for sale of produce and do not sell inputs. These two sources are not able to adequately supply the whole district. Besides, the distance to these centres is far for some farmers who have to travel over 40 kms . This does not encourage farmers to use such facilities. The price of these inputs is also important. Given that these are mostly subsistence farmers, they would not be willing to invest highly in what they are not sure would give higher returns than the usual inputs. Farmers also responded that they are not able to afford the price of some inputs. This can lead to the conclusion that there are problems associated with the availability of agricultural inputs to farmers in the district.

Table 4:7 shows the use of certain agricultural inputs by division. The table shows the number of households out of the 500 interviewed that use the listed agricultural inputs. Although this is just a sample, the result show the trend of the use of inputs in the District.

Table 4:7 **NUMBER OF FARMERS REPORTING USE OF VARIOUS**
         AGRICULTURAL INPUTS BY DIVISIONS, (1985)

INPUT	YALA	BONDO	RARIEDA	UKWALA	BORO	TOTAL	PERCENT
Manure	18	15	4	22	–	59	32.2
Urea	25	–	–	11	12	48	26.2
Compounds	2	–	–	–	–	2	1.09
Other Fertilizers	–	–	–	–	1	2	1.09
Pesticides	–	–	2	–	–	1	0.55
Herbicides	1	–	–	–	–	1	0.55
Machinery	2	–	9	–	7	18	9.84
Labour	4	–	19	–	–	23	12.57
Others	–	4	25	–	–	9	15.85
Total	52	19	60	33	19	183	100

Source:- Farmers   Groups   and   Community
         Support Project - Siaya Baseline
         Survey 1985 First report page 45

     It can be seen that up to 58.46% of the farmers
interviewed used manure and urea, while less than 5% used
compounds, fertilizers, pesticides and herbicides. This is
consistent with the results of the present study.

4:1:3:2   The Use of Farm tools and Labour in Land
Preparation

     Simple traditional tools are predominantly in use
mostly hoes and pangas. In land preparation, it was found
that the hand hoe is very much in use. Ox-plough (both hired
and owned) is also in use. Other tools used are fork jembe,
shovels, and wheelbarrows. The fork-jembe however was found
to be used only by farmers engaged in coffee cultivation
(Table 4:8:).

TABLE 4:8: NUMBER OF PEOPLE OWNING DIFFERENT FARM IMPLEMENTS

Farm Implement	Number of people	Percentage
Ox-ploughs	27	34
Handhoes	80	100
Pangas	69	86
Wheelbarrows	31	38
Fork Jembe	6	8

From the table thirty one (31) farmers used hired ox-plough, 33 used hand-hoe and sixteen used own oxen. The hand hoe which is relatively inefficient is the most predominant tool used for land preparation. None of them reported ever having used a tractor for land preparation.

Weeding is done using handhoe in all cases recorded and where there is not enough labour to supplement the tools, the inevitable consequence is delayed weeding which may result in low yields. Hired labour is used by most farmers especially for land preparation and weeding. From the survey, farmers had hired labour during the period. Most farmers relied mainly in family labour with the subsequent labour shortage especially during the peak period.

4:1:3:3 - Use of Improved Seed varieties

It has been observed that Siaya Farmers have been slow to adopt agricultural innovations (Kenya, 1984 and 1985). The use of hybrid maize, fertilizers and agro-chemicals is less prevalent than in other districts in the region. Low demand by farmers discourage distributors from stocking

certain inputs, while difficulty in obtaining inputs locally discourages farmers from using them. Table 4:9 shows the adoption of improved maize in Siaya compared to other Districts.

TABLE 4:9: ADOPTION OF IMPROVED MAIZE 1983

DISTRICT	IMPROVED SEED USED % AREA
SIAYA	46.4%
BUSIA	64.1%
KISUMU	50.3%

Source: CBS Appraisal Report : Kenya Farmers Groups and
Community Support Project, Vol.II 1984, page 14

Most farmers use manure and urea on local maize and very little of artificial fertilizers and other crop protection chemicals. The 1985 Baseline Survey by the Central Bureau of Statistics (CBS) found out that most farmers do not use improved inputs due to lack of financial resources with which to purchase them or they were ignorant of source and application of such inputs. From the survey only 6% of the farmers used hybrid maize variety.

4:1:3:4 Availability of Agricultural Credit

The availability of agricultural credit at favourable interest rates is an important component of an incentive package aimed at increasing production of farmers. Credit can be given to farmers either in cash or in kind whereby farmers are issued with necessary inputs on credit. Both

forms were considered here. From the field work it was observed that financial bodies with the responsibility of issuing agricultural credit exist in the district. These are the Agricultural Finance Corporation (AFC), Kenya Commercial Bank and Cooperatives in the district.

The availability of agricultural credit and farmers' access to it seem to be still very limited in the district. Out of eighty farmers, 16% received any credit at all. Twelve received agricultural credit, while one received credit for building purposes. The main sources were Agricultural Finance Corporation (AFC) and Cooperative Societies the break down is as follows:
From the thirteen people who received credit, 6% was from AFC while 10% received from the cooperative societies.

Another source of agricultural credit is in the process of being introduced in the District through the "Farmers' groups and community support projects". This is a pilot project under the Ministry of Planning and National Development, funded by international Fund for Agricultural Development (IFAD). Under this project, farmers are given agricultural loans as individuals belonging to a group, which acts as the collateral for the loan. The requirements for loan are that the individual belongs to the group which must be registered and has a bank account.

The main security required for the individual loans was land title deed and sale of produce for loans from the bank

and cooperative society respectively. Most farmers expressed dissatisfaction with agricultural credit arrangements especially because of the long approval process, too much security required, too high deductions and delays in payments. The breakdown of reasons is given in Table 4:10.

TABLE 4:10 REASONS FOR DISSATISFACTION WITH AGRICULTURAL CREDIT

Reason	Absolute Frequency	Percentage
pproval takes long	14	17.5
Requires much security	22	27.5
Delay in Payment	5	6.2
Too high deductions	13	16.3
ould not get loan required	5	6.2
Other Reasons	9	11.3
Total	68	85

Out of the farmers interviewed, 29% of them therefore did not need any credit because it was perceived to be too risky. The security required, especially land is felt by the farmers to be too much since it entails a possibility of losing one's land incase of defaulting. This seemed to be the major reason for dissatisfaction, followed by high deductions. As a result, the possibility that they are likely to need any agricultural credit in future was very limited. Twenty three (23) farmers responded that they are not likely to required any credit because it is too risky.

Riskiness as perceived by the farmer is therefore a major hindrance to the utilization of agricultural credit in the district. This is more so given that the farm production is unreliable and in case of crop failure, the

land would be subject to auctioning, thus risking the livelihood of the family. Interest rates were also seen to be very high.

The CBS survey found agricultural credit programmes are provided by the Kenya Commercial Bank, Co-operatives, and the Agricultural Finance Corporation in the District.

Seasonal Credit is hard to come by especially for the small farmers. This observation is not surprising since the main channel through which this credit is supposed to be provided is the cooperatives. However, cooperative societies in the district are almost dormant. Among the farmers interviewed, only 11% belonged to any cooperative society. The major function of these cooperatives was the sale of produce and not provision of loans. As a result, the availability of seasonal credit is limited in the district. Several credit schemes have ceased operation in Siaya because funds intended to revolve have dried up due to low recovery rates (CBS 1984). The main reason for defaulting by farmers is that they are not conversant with the repayment procedure therefore it accumulates to such a level that the farmers find it difficult to repay. There are also problems of late approval of the loans such that the farmer is unable to invest it as intended and thus poor repayment results. The CBS baseline Survey of 1985 found that farmers had different reasons for not receiving loans among which included, lack of required security, lack of knowledge about the existence of loaning schemes and their sources and dissatisfaction with the repayment arrangement.

The report concluded that lack of adequate information is a major obstacle hindering access to credit and therefore needs action. Lack of knowledge of source is the most frequently reported reason followed by no security. This is mainly because most farmers do not have title deeds for their land though it is registered. Even those who have title deeds do not use them as security due to risk averseness. The lack of an effective credit system means that even if inputs were available and farmers willing to buy them, the money with which to do so would be lacking. This study also found that an effective credit system is lacking in the district.

4:1:4   Availability of Market outlets and Storage facilities

The main channel through which surplus production is sold was found to be the local markets. All farmers who sold their produce did so through the local markets and unofficial parallel markets. The main reason for this was because most farmers sold in small quantities which could not be sold through official channels (NCPB). Prices in such markets was found to vary with the demand and supply situation in the market at the time of sale.

In terms of distance, a comparison of distance to the nearest NCPB depots and local markets is presented in Table 4:11.

TABLE 4:11   A   COMPARISON OF DISTANCE TO NEAREST NCPB DEPOT

AND LOCAL MARKETS

MARKETING CHANNEL	MINIMUM DISTANCE[1]	MAXIMUM DISTANCE
Local Market	0.02	10
Nearest NCPB Depot	0.5	46

1: Distance is measured here in kilometres.

Some of them (18%) did not even know about the operations of the NCPB.   Local markets were also preferred because their prices were higher,compared to the NCPB prices which are pan seasonal.

A comparison between local market prices and NCPB prices is presented below:-

TABLE 4:12 A COMPARISON OF NCPB AND LOCAL MARKET PRICES 1985

Commodity	NCPB Price(Per Bags (shs.)	Local Market Prices (shs.)
Maize	185.00	290.00
Sorghum	180.00	190.00
Beans	400.00	800.00
Groundnuts	580.00	1,200.00

Source: Republic of Kenya, Siaya District Annual Report 1986.

The   average   price   of   maize on the local markets was found to be Kshs. 234.00, while the maximum price was kshs.330.00 and the minimum was Kshs. 180.00.   The range is very high indicating high variations in the local price of maize in the district.   This compares very unfavourably with

the NCPB prices which are fixed throughout the year. Due to pressing cash needs most farmers sell their produce shortly after harvest when prices are relatively low and in some cases are impelled to buy back from the markets when prices have soared. However the few who manage to store up to the time when prices are high receive some positive pay off. Even the farmers who preferred NCPB as a marketing channel had not been able to sell through it due to the elaborate delivery arrangements which make it difficult for them. Such arrangements as minimum quantity required minimum moisture content and no cash payment discourage farmers from selling through NCPB.

Most of the sampled farmers stored their produce using traditional methods as mentioned in section (4:1). Only thirteen (16%) of the sample used any protective chemical. Lack of good storage methods and facilities resulted in wastage of produce. The CBS Survey (1985) found that a variety of traditional storage methods are in use by small holders in Siaya, resulting in crop loss through destruction by pests and diseases. There is therefore need for improved storage methods in order to reduce product loss. This is consistent with our finding in this study that inefficient storage methods and facilities are used by farmers with consequent crop loss.

4:1:5   Availability of extension services

Extension services are provided to farmers through the technical assistants each of whom is in charge of a

sublocation. With the introduction of the training and
visit, each technical assistant is in charge of forty-eight
contact farmers. There is however a hierarchy in the
extension system starting with the junior technical
assistants, technical assistants, technical officer,
division extension officer and district agricultural officer
at the district level. The farmers are taught when to start
land preparation, planting time, spacing of seed, the number
of times weeding is required and the use of certain inputs
where applicable. It was however observed that in some
places[2] extension officers did not restrict their visits to
contact farmers only. Agricultural information was also
passed through chief's Barazas. Some farmers had also
visited field demonstrations, while others had attended
courses at the Farmers' Training Centre (Siaya). From the
farmers' response it could be concluded that extension
services are satisfactory compared to other services. Most
of them expressed satisfaction with the services. The
teachings however become ineffective since farmers fail to
implement them, due to reasons like inability to afford the
improved seeds and other recommended inputs.

4:1:6 Infrastructure

Infrastructure here was taken as roads, water
facilities, market and storage facilities. Different parts
of the District are served with roads at varying degrees.
The availability of roads both all weather and dry weather

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[2]. These places are Karapul, in Boro Division, Sigomere
and Siranga in Ukwala.

roads varies in extent between areas. The same is true of water facilities, and market areas. The mean distance from the nearest market centre was found to be 2.3 kilometres. The mean distance from the main road varied from place to place as is indicated shortly below:

TABLE 4:13- MEAN DISTANCE FROM MAIN ROAD BY DIVISION

Division	Mean Distance (in Kms)
Yala	3.0
Ukwala	6.2
Boro	3.2
Bondo	10.3
Rarieda	10.6

Bondo and Rarieda seem to be poorly served with roads resulting in transport problems. Water availability in these two divisions which lie within the LM_3 and LM_4 zones is also not very good. The major source of water are small streams, some of which are seasonal and therefore dry up during dry seasons. In Yala and Ukwala, piped water is available for domestic use and in few parts of Boro. In Bondo and Rarieda, piped water only exists at the divisional headquarters, markets are mostly open structures, thus exposing the products to the sun and rains.

The infrastructural development in the district is also a problem hindering agricultural production. The distribution of water for domestic and stock watering is inadequate and is a constraint of agricultural production.

The markets existing are not properly sheltered, thus exposing commodities to rain and sun. Perishables are therefore sold at give away prices while grain may rot or sprout.

4.2: A Summary of Constraints Hindering Increased Agricultural Production

In this section we consider the problems experienced by small-scale farmers as was recorded during the field work . How they interfere with agricultural practices of farmers is also important since they are related to the availability of incentives to farmers.

Poor soils and lack of reliable rainfall is a major problem experienced by farmers in some parts of the district. This problem is mostly prevalent in Bondo, Rarieda and Boro Division which lie within the LM_1 and LM_4 zones. Poor soils can be improved by the application of fertilizers and animal manure, while the problem of low and unreliable rainfall can be solved by encouraging the cultivation of fast maturing varieties of crops. Even within the LM_2 zone, problems of poor soils were experienced.

Most farmers are therefore faced with very low yields and consequent food shortages. To reduce the magnitude of such risks, farmers should diversify their crops, but the crop mostly grown for such purposes is cassava. Farmers

however still grow maize even though its performance is not as good as the other crops like millet and sorghum. It was shown earlier in this chapter that acreage under sorghum and millet is highest in Bondo while cassava acreage is highest in Boro. It was learnt that due to unreliable rains, farmers at certain times are forced to plant seeds twice because seeds fail to germinate during the first planting. Due to such problems, farmers do not opt for improved seeds (Hybrid) because it is more costly since it involves more cash outlays.

Due to low and unreliable rainfall, there is also another related problem of water shortage both for animals and domestic use Farmers rely on streams, some of which are seasonal for their water needs. This has got negative implications on agriculture especially with regard to labour. Farmers have to spend alot of time looking for water at the expenses of farm work. This then involves an opportunity cost for agriculture in terms of time.

Lack of agricultural inputs especially improved seeds and fertilizers is a problem facing farmers. The main reasons leading to these problems are long distance to the source of supply and high cost. Farmers are very far from the supply source while some do not even bother to know where such facilities can be obtained. Most farmers have to rely on public means which is very costly both in money and time. This is so because the long distance to be covered means high transport cost which greatly increases the cost

of the inputs. A related problem is the late delivery of
such inputs. This discourage farmers from the use of these
inputs more because they have to make many trips to the
source of supply of the seeds or fertilizers which is
costly. Farmers therefore resort to the use of local seeds
so as to avoid late planting.

Most farmers also rely mainly on the hand-hoe for farm
activities. Only a few farmers have ox-plough while those
who do not own have to hire. Due to the high cost (shs. 120
per acre) of hiring, some farmers can not afford it thus
resorting to use the handhoe. Lack of labour is also
experienced by farmers. Among the farmers interviewed.
43% were not able to get enough labour due to lack of
sufficient cash with which to hire. Labour shortage is
mostly experienced during weeding and land preparation. This
may result in late weeding or insufficient weeding resulting
in low yields.

Farmers also experience problems relating to credit
facilities. As is shown in section 4:1·3 most farmers do
not have access to agricultural credit. This partly
explains the problem of inputs since farmers lack the
financial ability with which to purchase them.

It has been mentioned that farmers mostly sold their
surplus through local markets. Long Distance to NCPB depots
and the delivery arrangements are the main reasons why they
are not used. In the local markets, farmers reported having

different problems like price fluctuations long distance and
lack of transport.   The breakdown is as in Table 4:15.

TABLE 4:14 MARKETING PROBLEMS FACED BY FARMERS

Problems	Number of People	Percentages
Price fluctuations	22	27.5
Long Distance	14	17.5
Lack of Transport	12	15
High Market cess	6	3.75

Farmers also experienced storage problems in the form
of lack of protective chemicals leading to stored produce
being infested by weevils.   There were also cases of lack of
storage space.   Due to these storage problems, sometimes
farmers are forced to sell their produce immediately after
harvest when   prices are still very low and buy back at high
prices during shortages.

Poor infrastructure is also another problem faced by
farmers in Siaya district. Lack of rural access roads is a
major hindrance to agricultural development since
transportation of produce to markets and inputs from the
supply source is made difficult.   Most farmers find it
difficult to transport their produce and also to buy some
fertilizers because of the long distances which they have to
cover, in addition to having to do with unreliable public
means of transport.   Lack of information about the

means of transport. Lack of information about the agriculture situation is also a major problem hindering agricultural progress in the District. It has been observed that most farmers lacked the knowledge about sources of agricultural credit and inputs and therefore were not able to use such inputs. There is also lack of knowledge about improved farming practices. Extension services, though available, are not adequate since most farmers are not able to implement the recommendations given by the extension staff. It can then be concluded that lack of a suitable incentive package is a major constraint hindering increased agricultural production in Siaya District.

CHAPTER FIVE

REGRESSION RESULTS

The selected analytical model to be used for analysis are specified in function 1 in Chapter 3. The function can be modified to take account of the stochastic nature of agricultural production by including the error term in the equations. The function is then written as follows:

(1) $Q = A X_1{}^{b_1} X_2{}^{b_2} \dots X_n{}^{b_n} e^u$

Where Q is the dependent variable, in this case maize output.

A is the constant term of the regression.

X_i is the ith independent variable in the function.

b_i is the elasticity of output with respect to the ith variable.

U_i is the error term in the estimation.

5.1 The Estimation Equations:

When the variables as defined in Chapter 3 are incorporated into the model, we get the estimating equations as follows:

(1) The log linear equation takes the form:-

$LnQ = LnA + b_1 LnN + b_2 LnLF + b_3 LnLH + b_4 LnK + b_5 LnP + b_6 LnE + b_7 LnEd$

The interpretation of individual regression

coefficients need further explanation. In this modified Cobb-Douglas function, the regression coefficients are the production elasticities of the relevant input. By fitting the data collected from the field work into the equation the following results presented in Table 5:1 were obtained for the output equation.

TABLE 5:1 REGRESSION RESULTS ON DETERMINANTS OF MAIZE OUTPUT

Variable	Estimated Coefficient	t-Statistic
Acreage (LnN)	0.919	12.817
Family Labour (LnLF)	0.027	1.370
Hired Labour (LnLH)	0.039	2.875
Capital (LnK)	0.103	1.543
Price (LnP)	0.022	0.714
Extension (LnE)	0.020	0.831
Education (LnEd)	0.005	0.226
Constant	0.625	

R^2 = .83
S.E.E. =.53
F ratio = 48.76(7,72)

Using the F - test, the whole regression model was found to be statistically significant. From the Value of R^2, 83% of the variation in output is explained by changes in the Specified independent variables. Using t-test it was found that acreage (N) is statistically significant at 5% and 1% levels of significance. It also had the expected sign (0.919). Hired labour (LH) was also found to be statistically significant both at 5% and 1% levels of significance. The other variables namely family labour, capital, price, Education and extension were not statistically significant using the t-test. The fact that the level of education is not significant in determining farm output can be explained by the fact that these are

subsistence farmers and more so, do not use improved methods
of production as is explained in chapter four. The
traditional production methods used do not require high
level of education. This finding is not surprising since
other studies (Rukadema 1977) have also found that the level
of education is not related to farm output. The fact that
the level of education is not significant in determine farm
out can be explained by the fact that these are subsistence
farmers and more so, do not use improved methods of
production as is explained in chapter four. The traditional
production methods used do not require high level of
education. This finding is not surprising since other
studies (Rukadema 1977) have also found that the level of
education is not related to farm output.

These results indicate that only acreage and hired
labour are important factors in determining total farm
output. The acreage variable had a positive regression
coefficient, meaning that if acreage is increased by a unit,
(like one acre) output would increase by 92% of the present
level. This is not an insignificant increase, given that
the district is a food deficit
area. The regression coefficient of hired labour is
positive, meaning that if hired labour is increased by one
unit (like 1 Man day),output would increase by about 3.9%
from the present level. From the F-test and the R^2, we see
that all the specified explanatory variables are significant
in determining the level of output. However, taken
individually, some variables are not significant. This can

be explained by the fact that the need to increase
agricultural output requires a package of measures taken
simultaneously to supplement each other in realizing the
desired objective. Therefore only one factor taken in
isolation without considering others can not be effective in
increasing output. In this particular case, we can conclude
that an incentive package embodying availability of capital,
favourable output prices, marketing outlets and extension
services would be effective in increasing maize output and
that of the other crops.

A separate regression was run for the twenty four
farmers who had used fertilizer in their farming. The
results are presented in Table 5.2.

TABLE 5:2: REGRESSION RESULTS ON THE EFFECT OF FERTILIZER ON
MAIZE OUTPUT.

Variable	Estimated Coefficient	T-Statistic
Acreage(LnN)	1.211	4.574
Family labour(Ln.LF	0.030	0.950
Hired Labour(Ln.LH)	0.056	2.054
Capital (LnK)	0.077	0.578
Price (LnP)	0.068	1.813
Extension (LnE)	0.203	2.351
Fertilizer (LnF)	0.237	1.190
Constant	0.633	

R^2 =.69
S.E.E. = 0.48
F-ratio = 4.19 (8.15)

From the value of R^2, we see that 69% of the variation in
output is explained by the changes in the specified
explanatory variables. Using the F-test, at the 5% level of
significance, the whole regression model was found to be

statistically significant. Using the t-test, it was found that Acreage, hired labour and Extension services were statistically significant in determining the level of output both at 5% and 1% levels of significance. Family labour, capital, price and fertilizer were not statistically significant. These results show that when fertilizer is applied, then extension services are necessary in order to realize an increase in output. The fact that fertilizer is not significant can be explained by the way it is applied by the farmers, that is in small insufficient quantities and not at the right time.

5:2 Testing of the Hypotheses

In this section we make an effort to test the hypotheses specified in chapter 3 and to explain the results. These hypotheses were tested using the regression results. The hypotheses to be tested are as follows:

Hypothesis 1: That yield is a positive function of both family and hired labour. As labour is increased, yield would increase.

From the regression results, the coefficients of both family labour (0.027) and hired labour (0.039) were found to be positive. However, only hired Labour was found to be statistically significant both at the 5% and 1% levels of significance. We therefore conclude that both family and hired labour are positively related to the level of yield but only hired labour significantly determines the level of yield positively.

Hypothesis 2:   That yield is positively related to the price
                level.   The higher the anticipated price of
                the product, the more a farmer would be
                motivated to increase production.

The regression coefficient of price   was found to be
positive (0.022), showing a positive relationship between
yield and price.   However, the coefficient was not
statistically significant at the 5% and 1% levels of
significance.   We can therefore conclude that yield is
positively related to price but price taken alone is not
significant in determining yield.   It needs the existence of
other factors for it to be effective. The insignificance of
price may be attributed to the fact that production is not
for commercial purposes, and there fore farmers decisions
are not very significantly influenced by price expectations.
The main objective is to meet subsistence needs of the
family.

Hypothesis 3:   That yield is positively related to the
                      extension services.   The farmer who
                      receives extension services is more
                      likely to undertake farming practices
                      which can increase his yield than those
                      who do not receive any extension
                      services.

The coefficient of extension services was found to be
positive (0.020). It was also found to be statistically
significant both at 5% level of significance when fertilizer
use is considered. Therefore yield is positively related to

extension services and we do not reject the hypothesis.

Hypothesis 4:   That output is positively related to acreage

under production. The more the area under

production, the higher the output would be.

From the regression results, the coefficient of acreage

was positive (0.919). It was also found to be statistically

significant at 5% and 1% levels of significance. The sign

is as expected and therefore we do not reject the hypothesis

that output is positively related to acreage.

Hypothesis 5:   That output is positively related to both

family and hired labour. As labour is

increased, output will increase.

The regression results showed that both hired and family

labour had positive coefficient. However, only hired labour

was found to be statistically significant at 5% and 1%

levels of significance. We therefore do not reject the

hypothesis that labour is positively related to output. It

should however be noted that family labour is not important

in determining output.

Hypothesis 6:   That output is positively related to price.

The higher the price, the more a farmer would

be induced to increase production.

The regression coefficient of price was found to be positive

as expected. It was however found not to be statistically

significant.   We   therefore conclude that   output is

positively related to prices, but taken alone it is not

important in influencing the level of output.

Hypothesis 7: That output is positively related to
Extension services. The farmer who receives
more extension services is likely to have
higher output than that who doe not.

From the regression results, the extension services had
the expected positive sign.   But it was only statistically
significant when fertilizer use is considered. We therefore
conclude that output is positively related to extension
services, but if taken alone, it is not important in
determining the level of output.

5:3 Conclusions

From the foregoing analysis, some observations can be
made.   Agriculture in Siaya is mainly of small scale
subsistence nature and only a few cash crops are grown.
Over 50% of the production is consumed at home with only a
small percentage sold to meet cash obligations. A number of
food crops are grown in the district, though some are not
grown in some parts. Maize is the main staple and was found
to be grown by all households in the survey.

Farmers face a number of problems in their farm
activities which hinder their progress.   As concerns
incentives, adequate incentives do not exist in the district
to induce farmers to increase their production. Farmers do
not have access to credit facilities due to security
arrangements and high interest rates charged. Improved
seeds, fertilizers, and other inputs are not available at

short distance and affordable prices and therefore are not used by most farmers. Official market outlets are not adequately available, while local markets are characterized by price fluctuations. leaving farmers with no reliable outlet for any surplus production. Most farmers have no title deeds because either they are not bothered to get one or they do not know its use. Even those who have it do not use it for acquisition of any agricultural credit. Good storage facilities are lacking leading to wastage of stored produce. This together with other factors forces farmers to sell their produce immediately after harvest at low prices, thus giving them no incentive to produce above the subsistence requirements.

Extension services are provided to farmers through Ministry of Agriculture officials. Efforts are being made to educate farmers about the use of improved agricultural practices. However, most farmers lack the ability to implement these teachings, thus making them ineffective. Infrastructural facilities are lacking thus hampering alot of activities. There is idle agricultural land in the district due to lack of complementary inputs to labour and suitable incentives.

A concerted effort is needed to improve agriculture in the district. A package of measures and incentives are needed, instead of giving isolated assistance without considering how effective it would be in the absence of other factors. It has been observed earlier in the paper that there is idle agricultural land in Siaya District. Farmers should be given incentives to induce them increase

output through increased acreage under crop cultivation. Specifically farmers should be given agricultural credit at reasonable interest rates, to enable them purchase the necessary farm inputs in addition to hiring labour and the complementary factors to labour which hinder increased cultivation. Extension services are needed to enable the farmers use the credit facilities efficiently so that they can benefit from it. With increased production, there will be surplus production. An outlet is needed to make the production meaningful. In addition producer prices should be such that it encourages surplus production by giving a positive pay off to the investment made in farming. A related requirement is good storage facilities and methods to enable farmers store their produce longer and therefore be able to sell at reasonable prices.

There should be good infrastructure especially access roads to enable easy movement of produce, inputs and the extension officers. If these incentives are considered as a package an improvement in the agricultural performance in the district can be realized. Some policy implications of these findings are presented in the next chapter. It should however be recognized that these farmers are small scale subsistence farmer whose major objective is to meet subsistence requirements. In order to increase food production. An effort should be made to enable them produce the amount adequate for subsistence before they can produce any surpluses. The main objective should be to aim at self-sufficiency in food availability, before any surpluses can be realized.

CHAPTER SIX

SUMMARY,POLICY IMPLICATIONS AND AREAS FOR FURTHER RESEARCH

6:1 Summary

The study was aimed at finding the incentives which can be used to increase the production of food crops in Siaya district. More specifically, the study was geared towards giving a description of the nature of agriculture in Siaya, and the problems experienced by farmers. It also aimed at finding out which agricultural incentives exist in the District and their impact on food production.

A field survey was conducted in Siaya District to collect the data necessary for the study. Cross-section data was collect with the help of a designed questionnaire which was administered to the sampled farmers. Both multistage and stratified random sampling procedures were used.

The collected data was analysed using both statistical and econometric methods. The specified model was estimated using Ordinary Least Squares(OLS) technique. In hypothesis testing and carrying out tests of significance, the students-t-statistic was used. The overall significance of the whole regression was also tested using the F-statistic. Two output equations were estimated, one for all farmers without fertilizers use and the other for those farmers using fertilizers in their farm activities..

Agriculture was found to be mainly of small-scale

subsistence nature with over 50% of the produce being consumed at home. Only a few cashcrops (Cotton, sugarcane and coffee) are grown. The major food crops grown are maize which is the main staple, sorghum, millet, beans, cassava, groundnuts, simsim, potatoes and vegetables. Maize and beans are grown by all farmers either in pure stands or mixed stands. The other crops are grown in some parts and not others depending on rainfall availability.

Few farmers have access to agricultural credit. It was found that only 16% of the sample received any credit. The main channels through which agricultural credit was received is AFC and cooperative societies. The use of chemical fertilizers is also low. Only 30% of the sample farmers used had fertilizers. Animal manure is used by most farmers. The low usage of chemical fertilizers was found to be mainly because of long distance to source of supply and high cost, hence inability to purchase them. Farmers mainly use simple farm implements for their farm activities. Both family and hired labour are used. However, labour shortage is a problem experienced mostly during peak periods.

The main channel through which agricultural produce is sold was found to be the local markets. The prices in these markets fluctuate seasonally, being low during harvest and very high during planting seasons. Farmers prefer the local markets to the NCPB because of the high prices. They are also near and convenient for farmers selling small quantities to meet their cash needs. There was found to be

a big price differentials between local markets and NCPB. Different traditional storage methods in use, with consequent problems of crop wastage.

Farmers experience different problems in their activities. The problem of poor soils and unreliable rainfall, leading to crop failure is experienced. Lack of improved seeds fertilizers and other inputs at the right time and place and at affordable prices is a major hindrance to their use by farmers. Lack of access to facilities due to security arrangements and high interest rates is a problem experienced by farmers. Long distance to local market centres and lack of transport together with storage problems and poor infrastructure discourage increased surplus production. Official Markets are also not adequately available to farmers, thus leaving them with no sure outlet for their surplus production.

From the regression analysis, Acreage and hired labour were found to be statistically significant in determining the level of output. When fertilizer use was considered hired labour, acreage and extension services were found to be significant in determine the level of output. From the F-test, all variables were significant in both cases.

It was concluded that adequate incentives to improve agriculture in Siaya District are lacking. The incentives should be given as a package, taking into account the effect of one in the absence of other incentives. The present

situation of agriculture exists because of lack of a good incentive package to farmers.

6:2 Policy implications

From this case study, two policy issues can be drawn. These are: (1) Policies to increase maize production by increasing acreage under cultivation.

(2) Policies to increase maize production by increasing yield per acre.

From the results of the study, there is evidence that there is idle agricultural land in the district. Food production can therefore be increased by putting more land under cultivation. Such a policy should however take into account why such land is presently left idle. It was found that farmers mostly use simple tools for farm preparation therefore not being able to cultivate big pieces. Lack of complementary factors to labour is therefore a problem. Availing appropriate farm implements to the farmers could be one solution to the problem. Farm implements like ploughs, could be sold to farmers at subsidized rates so as to enable them purchase such facilities. They could also be given on credit terms which is paid through the sale of produce. To ensure the productivity of such implements, farmers should be taught how to use such implements, like ploughing courses and competitions. This calls for the provision of extension services to the farmers to enable them adopt better farming practices.

In the zones where there is low and unreliable-rainfall, then alternative crops with faster maturity should be encouraged. Such areas are the LM₃ and LM₄ zones. Drought resistant crops like cassava, millet should be encouraged. The availability of such appropriate and more efficient farm implements can also solve the problem of labour shortage .

With increased production, there will be need to sell the surplus production. There should therefore be reliable market outlets at short distance since farmers sell their produce in small quantities and at short interval. Farmers should also be exposed to better storage methods so that they can be able to store their produce as long as they want instead of being forced to sell immediately after harvest at low prices. This may encourage surplus production since there is proper storage.

Food production can also be increased by increasing yield per acre of land under cultivation. Emphasis here should be on better agronomic practices which include among others timely planting and weeding. optimum plant population the number of times weeding is done and proper use of a chemical fertilizers. Use of improved seeds is also important. The provision of extension services is therefore necessary in this case. Farmers may not be able to implement such recommendations if improved seed varieties are not sold close to them and at low prices. Farmers ability to purchase the inputs and therefore implement the

recommendable practices should be emphasized. There should be local stockists of such inputs to reduce transport costs. They should be available at low cost or they can be given on credit.

In case of credit, there should be follow-up activities to ensure proper utilization of the inputs and the credit.

In general, policies aimed at increasing food production should consider encouraging farmers to produce above their subsistence requirements. Whether production is increased through increased acreage or increasing yield per acre, it is important to consider that these incentives are given as a package so that they supplement each other. If farmers are given credit to enable them improve their production, they need extension services to enable them follow better agricultural recommendations and therefore get higher returns from their credit. With increased production, there will be surplus output. There should be an outlet for the surplus if the farmers are to continue with the same effort in agriculture. The prices should also be such farmers are rewarded for the investments they have put in agriculture. Farmers should also be encouraged to commercialize their agricultural activities. This would help to reduce regional shortages which may result in very high price fluctuations.

6:3 <u>Limitations of the Study and Areas for Further Research</u>

Cross-section data was used to determine which incentives are important in determining the level of output. This does not show what the trend has been in the past and therefore recommendations made on this basis only refer to a point in time. Further research could be done using a supply response analysis to show the behaviour of acreage with respect to the variables overtime.

The study used production function analysis to determine factors important in influencing the level of output. It should be noted that the results from the production function are only valid for the period covered by the study and no long term recommendations can be made from the results.

Siaya district has the potential for producing a variety of food crops. It is not however known which crops would optimize food availability. More work need to be done using Linear programming technique to determine which farm activities should be undertaken by farmers in order to maximize their production. This would also help planners to know which food crops should be encouraged and therefore the kind of incentives that should be given to different farmers.

The study mainly emphasized maize. Other food crops grown in the district should also be studied. This could

resources and time. This is an area for further research into the agriculture of Siaya .The study considered all the Agro-Ecological zones (AEZs) in Siaya district. More work can be done to determine the agricultural situation in each specific AEZ.

In estimating the variables used in the study, some problems were encountered. It was not easy to get detailed data for amount of resources like labour and capital devoted to specific farm activities. The approximation procedure used was based on the significance of the different agricultural activities in the district. More work can be done in this area. With more resources, and time, data can be collected relating to specific Labour inputs to various activities. This could improve the viability of recommendations made on that basis.

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APPENDIX

Q U E S T I O N N A I R E

INCENTIVES FOR INCREASING THE

PRODUCTION OF FOODCROPS AMONG SMALL -SCALE FARMERS:

A CASE STUDY OF SIAYA DISTRICT

QUESTIONNAIRE No._____

_____

DATE_____

ENUMERATOR_____

SURVEY AREA_____ DISTRICT_____

DIVISON_____ LOCATION_____

HOUSEHOLD CHARACTERISTICS

1. Respondent's relation to head of Household

      Head of household - man   1

      Head of household - woman   2

      Wife   3

      Son   4

      Daughter   5

      Other(specify)

2. How old are you (PROBE)_____

3. What is your religion_____

4.   What level of formal schooling did you attain?

None _____

Some Primary _____

Completed Primary _____

Some Secondary _____

Completed Secondary _____

University/Polytechnic/College _____

Other (SPECIFY) _____

(b)   Any other informal training if at all_____

_____

5. Where were you born?_____Place

_____District

6. Have you always lived in this place(here)?

Yes _____

No _____

7. If "NO" what made you move from the previous place?

Drought   1

Lack of grazing   2

Lack of Water   3

Land adjudication   4

Livestock disease   5

Land shortage   6

Infertile land   7

Other (SPECIFY)_____

8.   How many people altogether live in your Household at
the   moment.

_____

_____

9. How many members of your family help you in farm preparation.

_____

How many help in weeding and harvesting times?

_____

10. (a)   Are there members of your Household who presently
           live somewhere else   Yes   1

                                  No   2

    (b)   If "Yes" who is presently absent and why is he/she
           away?

                                          Reason

           1. Husband_____

           2. Wife_____

           3. Daughter_____

           4. Son_____

           5. Other (SPECIFY)_____

Codes for (10b. as follows:

    00 No reason   05 Employment

    01 Education   06 With relative

    02 Other training   07 Herding cattle

    03 Job seeking   08 Farming

    04 Military   09 Other Specify_____

OCCUPATION

12. (a) What is your main occupation?

    Farmer   1   Butcher   8

    Pastoralist   2   Driver   9

    Fisherman 3   Mechanic   10

    Graftsman 4   Tailor   11

Shopkeeper	5	Carpenter	12
Teacher	6	Govt.Employee	13
Preacher	7	Medicineman	14
		Other (specify)	_____

(b)   About how much money did you earn from this activity   last year? Kshs._____

(c)   Do you have any other source of income?_____

13. (If YES) What is it?_____

14. Are there any member of your household who work elsewhere and send you money.

Yes   1

No   2

LAND OWNERSHIP

15. What is the approximate area of land you own in this area?___

Acres or Hectares

16. (a)   Do you have a title deed for it   Yes   1

No   2

(b)   If No" why don't you have one?_____

17. What is the approximate area of land you cultivated Last Crop Year? Actual Hectares_____

18. Are you cultivating this land as

Owner   1

Tenant   2

Share dropper   3

Squatter   4

Other (SPECIFY)_____

19.   (a)   How long have you been cultivating this land"

Actual years_____

(b)   Which farm implements do you own?

(List all of them)

Farm Implement	Cost	When Acquired	Number	Source of Money
Hoes				
Ox-ploughs				
Tractors				
Wheel barrow				
Oxen				
Others(Specify)				

(c)   Do you hire any people to work on your Farm?

Yes

No

(If "Yes" fill the following)

	Number of people hired		Time taken
Name of Activity.	Adults	Children	
1. Land Preparation			
2. Planting			
3. Weeding			
4. Harvesting			

(d)   Did you get as much labour as you needed in 1987?

Yes   1
No   2

(e)   Why not
Expensive Labour   1

Not sufficient Cash   2

No Labourers   3

Others (Specify)_____

20. Have you ever bought land in this area_____

Yes   1

No   2

21. How much land did you buy_____acres/hect.

22. How much did you pay for it_____kshs.

23. What is (are) Your Main agricultural activity(ies)?

Crop cultivation   1

Livestock husbandry   2

Fishing   3

Other (specify)   _____

24. Indicate whether grown on pure or mixed stands:

	Crop	Food or cash	pure stands	Mixed stands
1	Maize			
2.	Soghum			
3.	Millet			
4.	Beans			
5.	Cassava			

Code - Mainly food   1

Mainly cash   2

Both cash/food   3

Pure   4

Mixed   5

25. For the main five crops, what type of cultivation do you practice?

Permanent agriculture	1
Shifting cultivation	2
rainfend(upland	3
Irrigated	4
Food agriculture	5
Crop rotation	6
Inter-cropping	7

(Use the following codes for each crop)

26. For each of the five main crops, specify the area cultivated last year and the total yield.

	Crop	Area	Yield
1			
2			
3			
4			
5			

27. Why do you grow them (Tick where relevant)

Have higher yield	1
Are more drought resistant	2
A source of cash income	3
Mature faster	4
Other reasons_____	

(Give only two answers?)

28. How many cropping season, do you have?

   (fill in as follow)

	Maize	Sorghum	Millet	Beans	Cassava	Cowpea
Total Production in 1987(bags)						
How much sold						
price paid per bag						
where sold						
distance to place of sale						
Season when grown						

29. What do you use to prepare your land?

Tractor	1
Oxen	2
Hand	3
Own-Oxen	4
Other-(specify(_____	

30. How do you store your produce

Product	Store
1	
2	
3	
4	

31. Name most important marketing and storage problems that you face.

MARKETING   STORAGE

32. What time during last year were there too few labourers available when you needed them?

(Tick where appropirate)

1. During land preparation

2. During planting

3. During weeding

4. During harvesting

5. All times

6. Never a shortage

33. Are you a member of any co-operative?

    Yes   1

    No   2

34. What is its Name?_____

35. What are its functions?

    Provision of loans

    Provision of Inputs

    Selling of Produce

    Provision of Informats

    Farming Practices

    Other (specify)_____

INCENTIVES

36. (a) Have you ever received any credit in cash or kind from any of the following sources?

> Yes   1
>
> No   2

(b) If "Yes" fill the following

Name of Source	Nature	Amount	Year	Purpose	Payment period	Amount out- stand ing
Commercial Bank						
AFC						
Cooperative Society						
Local Stockist						
Other						

37. If you get the credit, what was the collateral required?

> - Land title deed
> - Other property
> - Sale from.Produce
> - Other (specify)_____

38. (a) Did you have any difficulties in re-paying the Credit?

> Yes   1
>
> No   2

(b) If "Yes" please explain_____

(c) Explain how you used the credit_____

39. Are you satisfied with availability of agriculture Credit.

      Yes   1

      No   2

40. If "No" why not?

      (a)   Approval takes too long

      (b)   Requires too much security

      (c)   Delay in Payment

      (d)   Deductions are too much

      (e)   Could not get loan amount needed

      (f)   Other (specify)_____

41. Are you likely to need any credit in the future?

      Yes   1

      No   2

42. (If "Yes") what kind of Credit will you need?

      Specify?_____

43. (If "No") why will you not need any credit?_____

      (a)   Have enough cash

      (b)   Present depts too high

      (c)   Its too risky

      (d)   Application will not be approved

      (e)   Other (specify)_____

44. For your farming do you use fertilizer?

      Yes   1

      No   2

If "Yes" Give the following information

Name of the activity	Amount of Fertilizer used (bags)	Where bought	Distance source	How it was financ -ed

45. Are you satisfied with farm input supply arrangements?

        Yes   1

        No   2

    (b)   If "No" why not?

        a

        b

        c

        d

        e

a)   Late delivery of inputs

b)   Right kind not available

c)   too much cost

d)   long distance to supply source

e)   Other (specify)_____

46. Do you receive any extenstion services?

    (Yes _____ No _____(skip to 15).

47.   14. Which of the following did you receive last year?

Name of service	Number of times received
Visit by agricultural officer	
Training and Visit (T&U)	
Field Demonstration	
Visit to a contact farmer	
Attendance of a chief's baraza where agricultural information was given	
Visit to Farmer's Training Centre	
Other (specify)	

48.   15. Are you satisfied with the extension services?

Yes_____ No _____(skip to 16)

Give reasons_____

_____

49.   16. What do you feel about the agricultural extension

officers) _____

_____

50.   17. Do you understand the message they give?_____

51.   18. What is your opinion about the prices prevailing in the

local markets and at the NCPB?

Explain

GENERAL

52. What means do you use to transport your produce to the place of sale?

    a. walking

    b. bicycle

    c. public transport

    d. Other (specify)

53. How far are you from the main road?_____

_____

What improvements would you like to see incorporated to imporve credit and input supply schemes and infrastructure.

    (a) Credit_____

_____

    (b) Inputs_____

_____

    (c) Infrastructure_____

_____

54. Of these, which is the most important?_____

_____

55. In your opinion, what are the most important problems hindering increased agricultural production in this area?

    1._____

    2. _____

    3._____

56. In your opinion, what should be done in this area to improve agriculture production in this area?

1. _____

2. _____

3. _____

Thank the Respondent, End Interview.