AN ANALYSIS OF TOBACCO LEAF PRODUCTION: A CASE STUDY OF KITUI 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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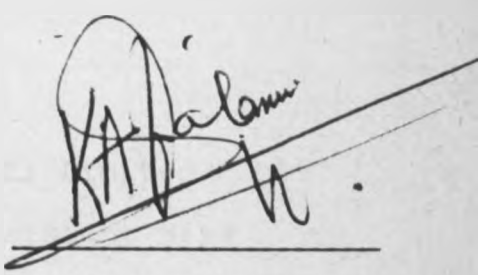
This Research Paper has been submitted for Examination with our approval as University Supervisors.



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DEDICATION

I dedicate this work to my father, Mr. John O. Kidiwa and to my Mother Mrs. Goretti M. Kidiwa.

ABSTRACT

The Kenya Government is concerned about the plight of the rural-households in the country. This is no doubt the reason why the Government has embarked on the "District-focus" for rural development. Developing the rural areas means that the inhabitants must participate in their own development according to the resource endowment.

Kitui District is a low-potential area when most of the land area is considered. Developing any economic activity that would suit the climatic conditions of the marginal area should be taken seriously as this will improve the rural welfare. Tobacco crop provides an opportunity to contribute towards the livelihood of the inhabitants of the area. The main aim of this study is therefore to identify the constraints on the production of tobacco crop in Kitui District. Solutions to the problem would help in increasing the productivity and output of the tobacco grown in the area.

Cross section data obtained from field survey and time-series data retrieved from the existing records were used in the analysis of the problem stated. Econometric and statistical techniques were used to test expected relationship and the results found can be summarized as:

1. There was knowledge of the use of better crop husbandry and yet they were not utilized to the maximum. The credit inputs were available but were not significant in the production of tobacco.

2. The mode of farming was still that of a subsistent economy. The technology used was rudimentary with predominant use of hoes. The physical capital was insignificant in increasing output.

3. Labour productivity was significant in the production of output. This conforms to the nature of the crop and would therefore increase output.

4. Land as a factor of production was significant at increasing output and therefore more land under the crop, and increased or same intensity in cropping would increase output.

5. Extension services results were just significant but not at a higher level and therefore improved and better agricultural trained personnel would aid in increasing output.

6. The farmers are responsive to the price incentive, basing our result on the output response. The long-run price supply elasticity conforms to economic theory and therefore agricultural price policy could be used to manipulate output.

Based on the foregoing results, we recommend that policies addressed towards the areas would increase tobacco output.

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CHAPTER ONE

INTRODUCTION

1.1 Background Information

1.1.1 An Overview Of Kenya Agriculture

The concern of every nation is how to achieve positive growth in economic development. Various strategies are pursued to develop the leading sectors in each nation. In most developing countries the dominant sector is Agriculture. This is the case with Kenya. Improving the sector lies mainly in raising the agricultural output level and improving on the quality of the products.

Developing agriculture means overcoming the constraints in the sector. The most prominent constraint is the scarcity of productive land. This is compounded by the rapidly rising population making the future to appear not promising. Kenya has 44.6 million hectares of land of which a meager 8.6 million hectares are medium-to-high potential agricultural land.[1] The preoccupation with the problem of land scarcity in agriculture has led to the promotion of small-scale farm holders in Kenya. Small-scale farming has proved to be a

source of productivity and employment which are the problems inherent in the sector.[2] This was also an indication of the government policy as regards the land tenure under the colonial set-up.

The role of agriculture in Kenya's economy can be viewed in several respects. Agricultural development will help solve problems as employment, balance of payments, income distribution, price and income stabilization. The dominance of the agricultural sector is visualized in its contribution to the Gross Domestic product which by far is the highest in the monetary economy.[3] In 1984, 1985 and 1986 for instance agriculture contributed 29.88, 28.63 and 27.98 percent respectively to GDP at factor cost. The foreign exchange derived from agricultural exports aids in the development effort. We may conclude that it probably is the most important sector in the economy contributing to the livelihood of 85 percent of the population.[4] For the purpose of planned development that will go along in improving the sector we need adequate and specific information on the activities of the sector.

Crop development as a subset of the activities of the agricultural sector has been a major attempt to improve the sector. The commodity programmes are taken to be central to

achieving the established goals of agricultural development. The crops namely coffee, tea, pyrethrum and sisal have been earmarked as the highly important crops contributing to agricultural development. The expansion of other high-value crops that could promote same objectives are also encouraged by the farmers and the Government. Among them is tobacco which is increasingly gaining importance. According to the value per hectare of selected commodities for the season 1983/84 it was highly ranked.[5] Tobacco is a high value cash crop such that its development will help alleviate some of the problems in the rural areas where tobacco growing is possible.

1.1.2 Historical Development of the Tobacco Industry in Kenya

The tobacco industry encompasses the growing of tobacco leaf, the auctioning of the leaf, tobacco products manufacturing and distribution of the tobacco products. In Kenya the products are mainly cigarettes and cigars. The tobacco industry dates back to 1907 when B.A.T. (British American Tobacco) group representative came to Kenya in search of new markets for the imported cigarettes and its distribution in the country. In the early 1920s there was some tobacco production under Department of Agriculture at Kitale in Trans-Nzoia. B.A.T. Kenya started tobacco leaf experiment stations in 1937 at Sagana in central province and a year later, another sprang up in Kitui.[6]

Tobacco did not grow into prominence in the country until the last decade. Prior to this it was a widely held belief that the country did not offer sound ecological conditions for the development of the crop.[7] Kenya used to import tobacco from Uganda and Tanzania for the manufacture of tobacco products. The importation of tobacco had several disadvantages. The world inflationary trends were reflected in the costs of acquiring tobacco from outside the country. The high costs of acquiring the raw materials would later be part of the production costs making the final product expensive. Secondly, it was argued that this was an outlet for the scarce foreign exchange. This foreign exchange was very much needed in the development effort if it could be conserved. Lastly, political hostilities within the region made it hard to acquire tobacco across the borders. In 1977, for instance, Tanzania closed her horders and Kenya had to import leaf from as far away as Korea and United States.[8] These problems led to the goal for self-sufficiency in internal leaf production in Kenya. The Government approached B.A.T to embark on leaf expansion programme to curtail the problems of leaf uncertainty and loss of foreign exchange.

1.1.3 The Structure of the Industry

The Kenyan tobacco industry is associated with B.A.T. Limited. The company has had monopsony power over tobacco activities prior to and after independence. A second cigarette manufacturing company, Mastermind, has just been established in the country.[9] Since it is still in its initial stages it has no impact as yet on the tobacco industry and therefore B.A.T. policies and structure will be assumed for the study.

The B.A.T. company's policy is that of promoting tobacco and not to grow tobacco itself. It contracts the farmers who grow tobacco in the suitable areas. The industry is composed of small-holder crop owners. The company's allotment policy is that tobacco be planted on a maximum of 0.5. ha so that the farmer has surplus land to undertake other food crop activities. This has not been strictly adhered to as we shall see in the case of Kitui. By the end of the crop year 1987/1988 there were a total of 10,000 registered farmers in the country.

Tobacco production in the country is in zones. These are Bungoma/Busia, Kuria, East and Central, Meru and lastly South Nyanza. Within the producing zones, leaf centres have been established. The leaf centres serve as focal points for

the provisions of services to the farmers. These services are extension services, farm inputs provision and they also act as the buying markets for all tobacco produced. For the zones mentioned above the leaf centres are at Malakisi; Suba Kuria and Taranganya; Kitui, Sagana and Ena; Mitunguu and Gaki; Oyani and Rongo respectively. The tobacco acreage that was cultivated in the country in the 1987/88 season was 5300 hectares.

To facilitate all the manufacturing phases of the Kenyan produced tobacco, the Green-leaf threshing plant was established at Thika in 1976. This stopped the shipping of tobacco to Uganda for threshing and drying. All the tobacco that is grown in the country is transported from the leaf centres to Thika for processing. The cigarette factory has been in Nairobi since 1956.

B.A.T. Limited buys the tobacco from the registered farmers. Ready market is therefore assured and there is no delay in payment. The tobacco is bought directly from the farmers apart from the central zone where growers co-operative societies exist.

The company is aware of the serious problems that has been encountered in the curing-process. There has been shortage of wood-fuel to cure the tobacco. The company has therefore embarked on an Afforestation Programme. There has also been an effort to adhere to the country's policy of the indigenous woodfuel that would otherwise be depleted to the detriment of the environment. Farmers who are contracted to grow tobacco are required to grow their own trees. There are about 13.5 million surviving trees planted by farmers in 1987 and there are about 11 tree nurseries in the country to provide seedlings for tree planting.

Domestic production of leaf has been expanding rapidly. The productivity of some producing district is indicated in Table 1.1. Kitui district which has one of the oldest history of tobacco production shows a lagging behand trend compared to the other producing areas. Bungoma which started leaf production much later in 1974 is among the leading districts.

Table 1.1. Yield of Tobacco Kg/Ha (Bungoma, Meru, Kitui)

Year	Bungoma	Meru	Kitui
1974-75	1,420	505	324
1975-76	1,000	430	412
1976-77	875	461	390
1977-78	1,000	809	761
1978-79	464	700	702
1979-80	632	755	905
1980-81	525	755	837
1981-82	805	750	713
1982-83	1,448	856	647
1983-84	1,623	920	1,803
1984-85	1,612	1,190	1,099
1985-86	1,570	1,190	661

Source: Ministry of Agriculture, Annual reports for Bungoma, Kitui and Meru. Various issues.
Notes: The productivity is derived from output and acreage. See Appendix 2.

1.1.4 Role of Tobacco in the Kenya Economy

The principal crops in the Kenya Economy have been coffee, tea, pyrethrum and sisal which have contributed immensely to the export sector. The horticultural crops have gained prominence in the 1980s.

Tobacco contribution to the export market has not been much. The first leaf export was in 1984 when 150,000 kg of fire-cured tobacco was destined for West Germany and Holland from the Mombasa port. Last year, 1988, a record 450 metric

tonnes of tobacco was exported. The contribution towards foreign exchange is that saved by the country indulging in import substitution. The foreign exchange earned on exports has been growing as shown in Table 1.2.

TABLE 1.2: Foreign Exchange Earned and Contribution to Government Revenue, 1983-1988

Year	Foreign Exchange earned in Exports US $000	Kshs 000	Contribution to Revenue Kshs 000
1983	3,936	51,996	964,520
1984	3,906	57,380	1,020,128
1985	4,151	67,172	1,175,129
1986	4,330	69,815	1,372,193
1987	4,669	76,448	1,627,641
1988	4,580	83,675	1,870,555

Source: B.A.T. Kenya Limited, Report and Accounts. 1988, 1987.

The export sales of the tobacco products have mainly been to Rwanda, Burundi and Southern Sudan. The export sales and the domestic sales portray an existing market for tobacco products. It has been a positive sales performance in the domestic market. The metric tonnes of the product consumed has been rising.[10]

The contribution of the industry to the economy is seen in respect of the contribution to the Government revenue. The industry through excise duties, profit and sales taxes have

yielded attractive revenue for the Government. Table 1.2 shows the trend exhibited by the growth in revenue as positive over the year. The role of the Government in the public sector cannot be over emphasized and its need for steady revenue sources.

The other role has been viewed in form of contribution of tobacco to the livelihood of the population. Tobacco being a high value-crop contributes as a source of income to the rural population. Being a labour-intensive crop it further provides employment in the areas where it is grown.

1.1.5 Tobacco in the World Economy

The major world tobacco producers are the United States, China, India, USSR and Brazil. The leading African states are Malawi and Zimbabwe. Before the mid 1970s, there was a steady increase in world tobacco output. Decline in output was experienced in the successive years till the 1980s. After the 1980s there have been fluctuations but the production can be described as fairly stable.[11] The decline in output has been more dominant in the developed countries as opposed to the developing countries which have shown more general rise in their output. Declines in tobacco production in the developed countries can be attributed to major campaigns against tobacco

on health grounds. Increases in taxes and prices, reduction in plantings in the leading countries and unfavorable weather.[12] Increases in developing countries output have mainly been due to the deliberate Government policy to increase output in the countries.

World trade in tobacco is seen from the imports and exports figures. The exports from developing countries in the 1930s were declining.[13] The possible reasons for this trend can be explained in terms of imports being affected by the import duties, the prefential treatment of leaf, the difficulty of entering some markets and countries which collude forming bilateral trade agreements and closing out others.

The world prices have been fluctuating with declines in the 1980s. A look at the exports and the value of exports ever in years indicate this in table 1.3.

TABLE 1.3: World Export Prices

Year	World Value of Export US$ Million	World Exports Tons 000	World Exports Price/Ton US$
73	1763	1226	1438
74	2292	1410	1626
75	2459	1245	1975
76	2906	1297	2241
77	3046	1264	2410
78	3809	1370	2780
79	3881	1391	2790
80	3753	1343	2794
81	4399	1507	2919
82	4616	1435	3218
83	4237	1360	3115
84	4144	1393	2974
85	4030	1342	3001
86	3987	1350	2953

Source: FAO, Commodity Review and Outlook, Various issues.

Notes: World export price flow derived from the World Export value and the world exports.

It can be argued that since Kenya's contribution to the world market has been minimal, therefore it will not affect much the development effort in Kenya.

1.1.6 Guide lines on Tobacco Policy

The broad agricultural development policy forms the basic guidelines for tobacco. Currently the country advocates firstly, internal self-sufficiency; secondly, maintaining

adequate levels of strategic reserves; and thirdly, generating additional supplies for the export policy.[14] It is through this policy guideline that simultaneous overall development goals as employment, income generation, foreign exchange earnings, rural-urban balance, food-security and overall-economic growth are based.

Tobacco development is mainly guided by the internal industrial demand. Leaf production is supposed to be sufficient to provide the necessary raw-materials for the agro-Industry B.A.T. Limited. Since independence there have been policy reforms towards the improvement of agricultural production. The reforms have centered on pricing system, storage, marketing and distribution systems. These have been channelled directly by the Government or through the bodies recognized by the Government to undertake these issues on their behalf such as parastatals or private companies. In Kenya the incentive structure has been primarily on prices. The pricing of commodities has been set to reflect the internal and external market situation. Price policies have been used to stimulate production and also to prevent over production for the market. Non-price incentives have also been used in the production process. Non-price incentives, though slower than the price incentive in raising production, also do influence the production level. Understanding how farmers adjust to these policies form the basis of the study.

1.2 Statement of the Problem

In the sixth development plan, the sectoral objectives remain the same as those outlined in the previous plans. Enumerated, these are; increased food production; growth in the agriculture employment; and poverty alleviation. With increasing population on land which is a scarce resource in the country there is dire need to increase productivity in the sector. The encouragement of small scale farms as the most relevant in the sector has been over emphasized. These have been found to be amenable to the labour intensive and land intensive methods of production.

The productivity of the small farmer has been affected by general problems such as finance to purchase the necessary inputs, high costs of inputs, inadequate technical knowledge from field services, fertilizer and pesticides to use and lack of improved agriculture implements. Weather unreliability could also pose as a natural hazard that could influence the productivity.

To alleviate these problems that surround the small farmer there is need for increased incomes in the rural settings. The development of high-value crops in the rural

areas has been over-emphasized.[15] Tobacco is a high-value crop and therefore its development will meet the farmers objectives.

Kitui district can be treated as a sub-sector of the producing districts. The other producing districts are Bungoma, Busia, Meru, Muranga and South Nyanza Districts. Tobacco is an important economic activity in the district given the adverse climatic conditions of the area: Tobacco leaf production provides an appropriate land use compared with the other producing areas that have high value croping opportunities. Tobacco is fairly drought resistant. Fluctuations in acreage and productivity have adverse implications on the farmer's household economic welfare.[16] Kitui tobacco also exhibits the lowest yield in the country. Further the acreage changes and the output changes over the years do not seem to change in the same proportion. This is seen by taking percentage changes of the previous year and current year of acreage and output. The acreage changes do not wholly explain he production output changes. This implies that there are other factors that cause the total variation in output. The low yeilds in the district are what causes problems reflected in the farmers welfare. Emphasis on rural incomes stabilization and development stem from the stability of the sources of earnings.

The historical development of the crop indicates that the country is already self sufficient in tobacco. On becoming self-sufficient, the objective is sustaining level of production of leaf for the domestic industrial purposes. This will help to save the foreign exchange that could be used for other development needs. It is with this objective in mind that we examine the Kitui sub-sector which has lagged behind in production despite being one of the earliest stations in the country.

1.3 Objectives of the Study

The broad objective of the study is to describe and analyze the structure, conduct and performance of the tobacco industry in Kenya. The specific objectives are:

(i) To identify the factors affecting the production of tobacco leaf in Kitui District.

(ii) To speficy and estimate model(s) that capture the effects of the factors in .i. above.

(iii) Following from the above objectives, suggest possible policy recommendations.

1.4 The Structure of the Study Area

1.4.1 Kitui Physiography

Kitui is a district in Eastern Province of Kenya. The total land area in the district is 29,388 square kilometers. The area lies between the longitudes 0^{o} 3.7' S and 3^{o} S and the latitudes 37^{o} 45' and 39^{o} East. For administration purposes it is divided into five divisions. These are Central, Kyuso (Far North), Eastern, Mwingi (Northern) and Southern divisions. Tobacco is grown in Central division. It is grown in the locations; Mulango, Zambeni and Changawithya. These three location constitute the area of study.

The district lies between 1,300 ft and 5,300 ft above sea level. The kind of vegetation found around the town is small patches of combretaeous savanna growth. Further away from the township there are dry bush thickets that characterize most of the district. Tobacco is grown in a radius of 8 km of the township.

In the district there are many semi-permanent or intermittent streams. They swell only in the rainly season. In Central division the rivers that are prominent are the Nzeu,

Kalundu, Mutendea, Ndiagu, Tiva and Mwitasyano. Most of the year round these are dry sand sources. The types of soil predominant in the area are the dark red and sandy loams that are from the basement complex and volcanic rocks. The soil texture contributes to the high erosion evidenced in the area.

The climate conditions of the district have resulted in the area being termed low potential in reference to most of the lands in the district. The land potential of the district is shown in Table 1.4.

TABLE 1.4: Land Potential in Kitui District

Land Category	Rainfall (mm)	Land area (ha)
High potential	> 857.5	67000
Medium potential	612.5 - 857.5	1137000
Low potential	< 612.5	1078000

Source: Central Bureau of Statistics (1987): Stastical Abstract, pp. 92.

Only 39.2 percent of land qualify as medium and high potential land according to the classification above. The study area, Mulango, Changwithya and Nzambani are among the areas that receive the high rainfall in the district. These areas receive an average of 762 - 1270 mm of rain per annum. The other areas that receive similar rainfall are Kisasi,

Miambani and Mutinyani also in the central division. The western parts of the district receive lower rainfall of about 508 - 762 mm while the Eastern receives about 508 - 1015 mm of rain per annum. There are two rainy seasons: one is the November/December season; and the other is the April/May season. The temperature are quite high with an average of 27^{o} C recorded at the central boma station as the maximum mean annual temperature. The high temperatures are responsible for the high rate of evaporation that is experienced in the area.

1.4.2 Demographic Characteristic

The 1979 population census had the population of the district as 464,283 on land area of 2,280,000 hectares. The Tsavo East National Park constitute 658000 hectares of the district land. The agricultural land of the remaining land suitable for use was 2,006,400 hectares.[17] Land is a fixed factor but the population changes over time.

The Central division and Mwingi division have the highest population density. The high density can be explained in terms of the high rainfall and the high agricultural potential of the divisions. The possible problems that will arise from the increasing density is that land division will

continue to smaller units that are uneconomic. The growth rate of the population was estimated at 3.42 making the future on land uncertain.[18]

1.4.3 Economic Activities of the Area

The district is basically a rural area and therefore has subsistence farming as the base. Activity for the market exists but at a much smaller proportion. Crops are grown in small farms and livestock are also kept. Farming is the major economic base of the district, 95 percent of the population are farmers. Within the small trading centres and the township meager 2 percent engage in trade and commerce. Industrial development and wage employment are low and would account for 2 percent of the population.[19]

Central and Mwingi divisions excel in cash-crop farming. The main cash-crops for both are cotton, tobacco, sunflower, sisal, pigeon peas and cowpeas. In the study area the major crops were tobacco, pigeon peas, cowpeas and little sorghum. Livestock as goats and cows are also kept. Maize is the major staple food crop and it is also taken to the market after the subsistence needs have been met. Opportunities for salaried earnings are just within the township.

1.4.4 Kitui Tobacco Development

The tobacco crop is grown within the locations Mulango, Changwithya and Zambani in the central division. It is mainly grown in a radius of 8 km off the township. It has been grown in the district since 1937. It is grown under the supervision of B.A.T (K) Limited and the Kitui tobacco grower's co-operative society limited. The co-operative society was formed in 1965. The role of the society is to act as the mediator between the farmers and the B.A.T company. The society manages the credit, provides the marketing representation of farmer and also keeps the farmer informed on the tobacco activities.

The farmers are assured of market for all the tobacco leaf they produce by the B.A.T (K) Limited. All the tobacco that is brought to the market is bought. The company buys the crop through the society. A farmer's tobacco is graded and weighed in his presence, the co-operative representative and the B.A.T leaf specialist. The farmers then later receive their sales value from the co-operative after their credit has been deducted. The grading is according to the specification given by the B.A.T company.

The credit facilities expand as the production requirements increase. It is the company policy to contract the farmers, therefore they provide all the credit in kind, that is, inputs. Transport is also availed to the farmers from the main feeder roads that lead from their homes. Transport is availed from the nearest assessable point to the farmers home. Tractor-hour is charged as the credit measurement.

The company (B.A.T.), provides extension services to the farmers. The company has employed a leaf technician and his assistant who should visit the farmer regularly to provide the advice on good tobacco husbandry. In the active periods of tobacco they are supposed to visit the farmers at least twice a month. The leaf technician commutes to the farmers by means of a motorcycle and the assistant covers the area on foot.

The Kenya Government has recognized that social stability is paramount for increased production in the agricultural sector. Land tenure is usually a thorny issue in many rural areas. The country has a land use policy whereby the systems of laws, rules, regulations and practices that govern the land owners are stipulated. Land adjudication in Kitui started in 1972 and has achieved tremendous progress. In the study area most of the land is registered with the farmers having title deeds for the land. This gives the farmers social stability and also a source of collateral.

The relative importance of tobacco in the district can be deduced from its value in the cash economy of the farm activity. Among the cash crops in the area tobacco ranks second to cotton, and first in the central division. But its value per hectare is much higher than cotton in the district. Table 1.5 shows the relative importance of the crop in the district.

Table 1.5: Relative Importance of Tobacco and Cotton in Kitui District

Year	Tobacco (KSh/ha	Cotton (Ksh/ha)
1980	8,580.34	217.41
1981	10,033.35	220.89
1982	10,681.85	122.52
1983	10,574.99	216.61
1984	8,961.71	133.97
1985	27,162.64	667.28
1986	16,260.89	473.88
1987	10,162.19	427.45

Source: Ministry of Agriculture, Annual Report, Kitui District Various issues.

In the division maize which is a staple food crop is the most important after tobacco in cash-earning. It is mainly grown for subsistence though. It is after the subsistence objective has been met that the surplus is offered for sale.

1.5 Justification of the Study

Tobacco has increasingly become important in the respective areas where it is grown. It has become an important source of cash income to the rural household. Its contribution to national development can be seen from its contribution as; source of Government revenue; foreign-exchange earning; employment creation; and linkages with other sectors. The labour-intensive nature of the crop and the opportunity it provides the farmers household to engage in economic activity helps curb the influx migration from the rural areas.

An analysis of the farmers production response to price will provide guidelines on how output can be varied under the existing pricing policy. The response is analyzed using the B.A.T. Kenya Limited price reviews. Price is among the most influential and easy-to-manipulate determinants of output. There is a wide range of literature on the subject of supply response in Kenya but none on tobacco. An attempt is made to provide coefficients of the supply response for the district using time series data. This will add to the existing knowledge on the subject. Further the production function of Kitui tobacco is hypothesized and analyzed. Emphasis here is on the non-price incentives in the crop production in this low potential area. Other factors also thought to affect

production are also included in the model. Agricultural production is influenced by both the price and non-price policies. A study of both is therefore thought necessary to understand the factors that have affected the development of the crop. It is hoped the empirical information generated will be useful for making decisions on the crop.

1.6 Organization of the Text

Chapter 1 provides the introduction of the study. The broad perspective of Kenyan agriculture and a background on tobacco are highlighted. The statement of the problem, objectives, background of study area and justification of the study are also presented. Chapter 2 concentrates on the review of the literature, and it is divided into three parts. Chapter 3 entails the research methodology used in the study, the specifications of the models and the procedure that will be used to analyze them. Chapter 4 will present the empirical analysis of the data. Finally Chapter 5 gives the summary of the results, the conclusions and the policy implications of the study.

FOOTNOTES

1. Republic of Kenya (1986: pp 63)
2. World Bank (1983: pp 51)
3. Republic of Kenya (1987: pp 35)
4. Sharma (1987: pp 223)
5. Op. Cit 1, See Appendix 1.
6. Murray (1948: pp 64); B.A.T (K) (1978: pp3).
7. Ibid 1, (pp 65)
8. B.A.T (K) (1977 pp 6)
9. The Weekly Review (1989, pp 54)
10. Op. cit 3, pp 128
11. See Appendix 3.
12. FAO (1988 pp. 93)
13. See Appendix 4 and 5
14. Republic of Kenya (1989: pp 103)
15. Op. cit 1, pp 65
16. See Table 1.1 and Appendix 2
17. Republic of Kenya (1983a: pp 220)
18. Republic of Kenya (1983b: pp 79-81)
19. Republic of Kenya (1979: pp 11).

CHAPTER TWO

LITERATURE REVIEW

Literature on agricultural development on agricultural development is broad in scope for the developing and developed Nations. This chapter therefore consists of three parts: the first part will be on theoretical aspects of agricultural development; the second part will be on selected empirical literature on agricultural production functions and on price incentives; the third part will be on selected literature specific to tobacco production.

2.1 Theoretical literature on Agricultural Development

Smith (1976) overviewed the agricultural development policy of Kenya. Today's agricultural development policy has its base in the colonial inheritance. Prior to independence despite the realization of the agricultural sector little was done to alleviate the situation. Incentives to motivate the African production started in mid 1950's. After independence it was realized that agricultural output could be increased through the participation of the larger african population. This required the alteration of the land tenure for the inclusion of the many small-holders. Government intervention was viewed

necessary in land registration, provision of credit, marketing facilities, administered prices and control in production to achieve increased agricultural output.

Levi and Havinden (1982), were of the view that to develop the Africa economies necessitates the development of the agricultural sector. They believed that reorganization of the factors of production and the introduction of new ones would bring about change. Innovation in the factor inputs like land, labour and capital was deemed necessary. To remove the constraints in these factors would eliminate lag in production. Further they were of the opinion that policies stimulating indigenous production would be appropriate as opposed to the suppressive colonial set-up that prior existed.

The world Bank report (1981) shows that agriculture is the mainstay of Africa economies. To achieve agricultural development, they argue, policies should focus on: small holder production; changing the incentive structures by hiking producer process, improving marketing facilities, increased farmers participation in the decisions that effect them, expanding agricultural research and promoting quick-yielding varieties. Improvement in the above areas would encourage agricultural development.

2.2 Selected empirical Literature on Production Function and Incentive studies

Hayami 1969 aimed at identifying the factors that determine differences in agricultural productivity and to asses the influence of those factors. The production elasticities were used to asses the influence of those factors across counties. The variables were labour, land fertilizer, machinery, education, research and extension services tested against the farm output. The contributions of the respective factors give guideline for allocating development efforts. The result show that the estimated equation fitted the data so well and for all the countries the coefficient of determination of above 0.9 was recorded.

Massel (1966) carried out a study on farm level production. He had a sample of 56 farms in the chiweshe reserve in Rhodesia (now known as Zimbabwe). He was interested in understanding the effect of skill on: the output of each crop, differences in input employed and output net of differences inputs. He used a cobb-Douglas function to relate to the variables: land, labour, chemical, fertilizer, organic fertelizer, fixed capital, soil-type and skills. He tested the objectives on three crops maize, millet and peanuts. All results were significant at one percent level. Less than half

the inter-farm output was explained by the observed inputs for Millet and Peanuts. At five percent level the significant results were: land, soil-type and both forms of fertilizer for maize, fixed capital and skilled management for peanuts and labour for millet. Further the results reveal that skilled farmers had better yields than unskilled for peanuts and that the semi-skilled attained more input in the millet production than other categories. Extensions services were discriminately awarded to corn and peanuts receiving more attention than Millet.

Hopper (1965) studied how well farmers allocate resources among several production alternatives in a village in central India. He used a production function to analyse the traditional technology output achieved using the inputs: land, bullock time, labour and irrigation water. Basing his study on 43 observations in the peak period of 1954 found that the farmers were efficient in the production process. He noted agricultural development required the information of new resources, skills and techniques.

Chennareddy (1967) used two separate samples : 67 for rice production and 37 for tobacco in South India. He derived the marginal value product from the estimated production functions and computed a ratio against the marginal factor cost

of each Inputs. He defined his input variables as land, human labour, capital and production expenses. He specified the value of the crops as the dependent variable. He was testing for resources efficiency. The fatal fitted well for the value and in both cases he found a coefficient of determination (R^{-2}) above 0.92.

Salami (1984) analyzed the impact of formal agricultural credit on small farm development. The study was carried out in the Ashanti region of Ghana in 1982. He carried out a farm survey of 200 farmers (100 each of credit and non-credit). His objective was to asses if credit increased resource productivity and if it led to adoption of improved farming technology. To facilitate the comparison he specified a Cobb-Douglas function on the independent variables: Value of farm materials (capital), farm tools (hoes, cutlasses, and the loan amount for the year)etc. The result of farm survey on both categories show that there was no statistically significant differences in the two regarding productivity.

Ongaro (1988) conducted studies in the Kisii and Nandi districts of Kenya. He was concerned with how production could be increased through the adoption of high-yielding varieties of maize technology. Using a Cobb-Douglas function in the log-linear form he found land as the most significant in

determining output. Most of the coefficients were significant at 0.01 level apart from Nitrogen fertilizer in the Kisii sample. Access to credit and extension were significantly related to maize yields.

Sahota (1968) evaluated the efficiencies of Indian farmers using the Cobb-Douglas production functions. Output of different farm sizes in different regions of India were studied. He concluded that there were no resource allocation inefficiencies in Indian agriculture.

Maitha (1973) studied the producer response to price of Kenya's maize and wheat industries. He used maize acreage data for the period 1954 to 1969 to calculate the short-run and long-run elasticities of price. He experimented with he partial adjustment lag and the fisher's lag to see which fitted the kenya data. He deflated the price of maize with that of wheat and vise-versa arguing that the two are close substitutes in the farm resource allocation decisions. The partial adjustment model yielded short-run elasticity of 0.94 and long-run elasticity of 1.897 for maize. Wheat had 0.31 and 0.36 for short-run and long-run elasticities respectively. The Fisher's lag yielded lower results in both cases. He concluded the kenyan farmers were responsive to price changes.

Odada (1976) used a partial adjustment model for the study on Kenyan pyrethrum. He dissagregated the data on regional basis to capture the disparities across regions. His conclusions was that producers were highly responsive to changes on price and would adjust pyrethrum output to changes in price.

Aldington (1971) performed a case study of cotton in Kenya. He argued that expanded production was a means by which incomes in the growing areas would be raised. He pointed out that there was a circle of poverty among the producers of cotton. The existing potential of the crop had not been fully exploited as the husbandry standards were low. To increase production farmers needed adequate motivation in returns by earning good prices and also having the costs of the inputs lowered. Further to improve the husbandry the farmers lack of knowledge should be eliminated through enlightment. He therefore advocated for the improvement of the incentive system for increase in production.

2.3 Selected Literature Specific on Tobacco Production

Oyugi (1984) was concerned with the effect of the introduction of tobacco on food production. The study was carried out in Migori, South Nyanza District. He wanted to

find out if there was conflict between the two in production and more specifically it if would effect maize production. His finding was that there was no conflict between the two and instead maize rotated with tobacco did well. The seasons of growth for the two crops differed in the region. Gross-margin analysis revealed that tobacco was the most profitable enterprise compared to maize, beans and dairy. Tobacco he found out further did not grow in importance with increase in farm size. Tobacco production is restricted by acreage allotment in the region. It is basically a small-farm crop in the country.

Ayako (1988) conducted studies on contract farming and outgrowers schemes in Kenya. He examined the production of sugarcane, tea, tobacco, oil seed and horticultural crops. His study on tobacco was in Siakago Division of Embu District. He found that due to acreage restriction and the average holding of farm size then tobacco does not effect the household food self-sufficiency. The twin objective of food self-sufficiency and sufficiency in raw-materials for the other agro-industries is achieved. He adds that family labour is prevalent in the enterprise and possible competition could arise in the labour utilization within the agricultural producing areas.

Adesimi (1970) developed an econometric model for the supply of air-cured tobacco for Western Nigeria. He was investigating the factors which could have contributed to the fluctuations and expansion in the size of the size of the air-cured tobacco. He specified an acreage-response supply function with acreage as the dependent variable. His independent variables were: lagged acreage of tobacco; alternative crop prices for yam, cassava and maize; price of tobacco and a trend variable representing the changes in population of growers. Using the adjustment lag he applied the ordinary least squares to estimate seven versions of the model. For the equation that best fitted the data he found a short-run price elasticity of 0.60 and a corresponding 0.82 for long-run supply. He concludes that the tobacco growers were responsive to price incentive.

Dean (1966) carried out studies on price elasticity of supply of Malawian Tobacco, conducting studies for the period 1946 to 1960 he transformed his variables to percentage changes. His dependent variable was sales. The independent variables were: money price of tobacco, the wage rate obtained abroad (South Africa and Zimbabwe), price index, and weather expressed as absolute changes. He tested variable forms of sales changes. He lumped the opportunity cost of alternative crops produced as that pertaining to cash-crops and omits

technical change in his model. He concludes that tobacco growers were responsive to price changes and would increase resources to tobacco production on price increases.

Cromarty (1959) estimated a master-model that incorporated the agricultural and non-agricultural sector of the United States. He analysed demand, supply and price relationships. He performed least squares single equations regressions analysis for the cured and burley tobacco among the sub-sectors. In Fluencured tobacco output was the dependent variable; the independent variable were; higher of announced support price or previous years market price, higher of acreage allotment or previous years acreage harvested and the June rainfall. For Barley all the variables were similar to the flue-cured case with the omission of rainfall and the inclusion of linear time trend. The time series covered the years 1929-1953. He obtained a coefficient of determination (R^2) of 0.80 for flue cured with a corresponding price elasticity of 0.516, Barley registered an R^2 of 0.83 and 0.31 as the supply price elasticity. He concludes that the price elasticity were reasonable compared to other studies.

Vernon et al (1971) developed a behavioral model for the American tobacco industry over an 18 year span from 1949. The model was in parts that explained leaf production, leaf price

and cigarette production. He estimated the model using seven behavioral relationship v. the least squares technique. Defining the free market acreage as his dependent variable and the lagged actual acreage and the lagged acre value as the independent variables, he obtained a response value of 0.48 and a coefficient of determination (R^{-2}) of 0.915. He further tested the hypothesis that underage was defined as the difference between actual acreage and acreage allotted. Regressing underage as the independent variable against Free market acreage less allotment, dummy variable for the poundage programme and dummy variable for the soil bank he found that they explained the underage well. R^{-2} = 0.83 was obtained.

2.4 Literature Overview

Kenyan tobacco industry has received little attention in academic circles. This could be possible attributed to B.A.T. (K) Limited being the most interested party in tobacco crop development. Outside B.A.T. (K) very little information can be generated on tobacco. Major contribution on tobacco dwells on the influence of tobacco on food production (Oyugi, 1984; Ayako, 1988). A survey of the literature reveals that economic analysis of tobacco and tobacco products is mostly prevalent in the advanced countries.

Supply response in the analysis of output or acreage can be performed using either programming (Normative supply) or through aggregative times series and cross-section studies. The literature reviewed was mainly on time series analysis whereby price is the main variable showing how output can be varied between alternative enterprises and influencing determinants. The models are lagged showing the cobweb characteristics of the agriculture commodities market. The adjustment, not instantaneous but exhibit some time lag. Further they exhibit that production decisions are made on the basis of past expenses and not current prices. The partial adjustment that exhibit these characteristics in the studies of Kenyan crops (Odada; 1976; Maitha 1973) will be a basis for this crop study to apply similar model.

Production analysis using time series limits as to the application of a few variables such as price. Data on price is readily available unlike data on non-price incentives. The specification of other input coefficients is not easy as data on farm-input are rare. Besides it is hard to find farmers maintaining records over a long span of time. Cross-section analysis provides a more revealing exercise on constraints and incentive structure. In the production process some of the responsible factors as extension services, provision, education and soil-types are also necessary to give a true form of

production. These in the models are captured through the dummy variables. The application of the Cobb-Douglas form of production is wide in agriculture production economics and this gives the basis for it to be used in this study (Massel, 1966; Ongaro, 1988; Salami 1984).

CHAPTER THREE

RESEARCH METHODOLOGY, MODEL SPECIFICATION AND ESTIMATION PROCEDURE

The nature of the data and its collection method of analysis are presented in the current chapter. The models to be used in the study are also examined. The models that capture the variations in sample farms and the overall production over the years are specified. Agricultural studies on farm production have used production functions of the Cobb-Douglas form to assess various aspects of the sector. Similarly time series analysis has been used in the acreage response models to understand the adjustment process that takes place in agriculture.

3.1 Data Collection Methodology

3.1.1 Data Type and Sources

Primary data is the source of data for the cross-section analysis. This was collected from the producing locations namely Changwithya, Zambani and Mulango. The information of the fieldwork was to generate information on the areas in relation to the farm characteristics, which included the area

under tobacco and the other competing crops for land use. Further it was to divulge information on the identified factors of production as fertilizers, labour, credit, soil-type, farm implements and extension services.

The time series data was collected from the archival records, and the time period related to the period from 1971/72 to 1987/88. The data to allow the description of the area was also obtained. The sources of the information were publications from the B.A.T. (K) Limited, Records of Kitui Tobacco growers Co-operative Society, Annual reports and Development Reports on the district and various relevant publications from the Central Bureau of Statistics.

3.1.2 Sampling Procedure

In the division there are only 3 tobacco growing locations. These are Changwithya, Mulango and Zambani. Farmers who planted tobacco in the 1987/88 were the target population. The number of farmers who grow tobacco every season is kept by the Kitui Tobacco Growers Co-operative Society and records of leaf technicians.

The total number of farmers in 1987/88 records were 279 with a break down of 21, 136 and 122 farms in Mulango, Zambani and Changwithya locations respectively. The sample size of 85 was drawn from the target population according to the location's ratio of the total number of farmers. Using the farmers list to draw the samples, 23 farmers were selected from Changwithya, 13 from Mulango and 49 from Zambani. Every farm in the population had an equal chance of being selected.

The respondents were very cooperative. The society officials and the B.A.T. officials in Kitui conveyed message on my presence and the need to be helpful as they could. The section on credit was not filled in the field but from the co-operative society records. This was because I noticed that the farmers were reluctant to divulge this information. Out of the 85 questionnaires filled in the field, 10 were considered spoilt in the sense that they did not have data for all the variables.

3.1.3 Data Collection Procedure

To obtain data on the primary sources a questionnaire was used.[1] The questionnaire was structured in such a way as to capture the production variables in the units required. One assistant was employed to undertake farmer interviewing.

Locating the farms was not a problem for I was taken round by the leaf technician on his motorcycle. The period for data collection was just before the long-rains. It was the tobacco marketing season. Most farmers were therefore at home curing, sorting and baling tobacco. The interview were conducted in the months of March and April 1989. The administration of each questionnaire took an average of between half an hour to one hour.

3.2 Production Function Model

A production function may be described as a purely technical relation which connects the factor inputs and outputs.[2] This functional relationship in general terms is expressed as:

$$Y = f(X) \qquad (1)$$

Where Y is the output of the various inputs used in the process of production. X is the vector of the physical inputs. In economic theory the major inputs used are land, labour and capital. In agriculture there are other factors which also affect output. They are referred to as the characteristic variables.[3] These are included in the function to constitute the form:

$$Y = f(X,E). \qquad (2)$$

The E refers to a vector for the characteristic inputs of the household and may also be referred to as the shift parameters. Before the inclusion of the characteristic variables the basic Cobb-Douglas function is given by linear representation:

$$Y = a \sum_{i=1}^{n} X_{ibi} \qquad (3)$$

with the log-linear form as:

$$\ln Y = a + \sum_{i=1}^{n} b_i \ln X_i \qquad (4)$$

The Xi's are the inputs. bi is the elasticity of Y. bi's and a are constants. The bi has two properties which make it useful in the analysis of farm production. The elasticity can be derived as shown above for the production function and secondly the assumption for the degree of homogeneity can be determined by d which is defined as:

$$\ln d = \sum_{i=1}^{n} b_i \qquad (5)$$

This will indicate the returns to scale as $d \lesseqgtr$ as diminishing, constant or increasing.[4] The characteristic variables are now incorporated into the production function. Given that they are shift parameters they do not affect the elasticities of the physical inputs (Xi's) in the model. The modified model will therefore take the form:

$$\ln Y = a \sum_{i=1}^{n} X_i^{bi} \sum_{i=i}^{n} e_i^{yiEi} \qquad (6)$$

The log-linear form of this model is:

$$\ln Y = \ln a + \sum_{i=1}^{n} b \ln X_i + \sum_{i=i}^{n} y_i E_i \qquad (7)$$

The characteristic variables represents shifts in the function. The yi's are percentage changes to a unit of the Ei's all the other inputs held constant. e is the base of

natural logarithms and i's denote the i^{th} variables. Given this background the model we estimate in the study has the following determinants.

$$Y = f(L, La, K, F, Cr, D_1, D_2, D_3) \qquad (8)$$

3.2.1 Definition of the Variables

3.2.1.1 Dependent Variable

Y is the output and is the dependent Variable. It is the output of the tobacco of the ith farm. It is measured in kilograms. This was the output of the farmer in the year 1987/1988 season.

3.2.1.2 Independent Variables

Land (L) is an input. It accounts for the area under the crop in the last season. It is measured in acres. The farmers in the district unlike other areas are not restricted in the acreage they can sow of the crop.

Labour (La). This was taken as that labour devoted to the production of the crop. Labour in the peak seasons are what might affect the crop output.[5] It was taken as an

aggregation of planting, weeding, harvesting and curing labour. It is measured in Man-hours. Both men and women were assumed to work equally hard on the farm activities. The children's contribution was taken as half the equivalent of an adult.

Fixed capital (K) was the farm implements the farmers used. In the area this included Hoes, Ox-ploughs, Wheelbarrow, Water-jugs, rakes and hired tractor. The value in ksh. was the measurement unit. It was assumed that since capital still performed the same services since it was acquired the value during the 1987/1988 was used.

Fertilizer is (F). The farmers used fertilizer as an input. This was acquired in 50 kilogram bags which was sold to the farmer at ksh. 315/= per bag. The fertilizer was 6:18:20: 4Mg 0. 0.1 Bo. This was made up of chemicals: Nitrate, Phosphates and Potassium in the ratios indicated. Fertilizer in the study was measured in kilograms used.

Credit (Cr). The farmer received the farm inputs as fertilizer, Orthene insecticide, Tree seedlings, F/pipes, Sisal twine, Hessians, transport of woodfuel, seedbed pack, baling box and iron sheets. They did not necessarily take all the inputs mentioned above but just what they needed in the

season. The value of credit was taken in monetary terms. It was secured from the Kitui Tobacco grower's co-operative society. This was dissaggregated in two forms. Credit of the production additives (fertilizer and pesticide) as Cr_1 and the total credit the farmer used in the season Cr_2.

Soil-type (D_1) was by observation of the soil-type. Dummy variable is used to assess the effect of it on output. Land as input in acres affects production but it is necessary to classify it further to assess the characteristic effects. The observations were based on the possible classification of loam, sandy, clay soils.

$$D_1 = \begin{cases} 1 \text{ if loam soil} \\ 0 \text{ otherwise} \end{cases}$$

Extension services (D_2). Also a dummy variable is used. Extension services are provided by the B.A.T. personnel. It is assumed that the personnel would provide equal services to the farmers but this in the practical sense was not so. Had this been so then the variable would be a constant and not worth estimating. Included in the extension services are the field demonstrations, and visits to any formal meetings where tobacco information is provided. It was recorded as the number of visits.

$$D_2 = \begin{cases} 1 \text{ if it is above mean number of visits} \\ 0 \text{ otherwise} \end{cases}$$

Education (D_3). A dummy variable is used. The number of years for which one has been to school was used as an indication of skill-level. If the person had any farm training courses in his life time then he was considered skilled.

$$D_3 = \begin{cases} 1 \text{ if had above 7 years of school or had any FTC courses} \\ 0 \text{ otherwise} \end{cases}$$

3.2.2 Expected Relationships

For the model the possible relationships that we expect are:

a) We expect a positive relationship between land acres planted and the output.

b) Labour availability in peak seasons should increase output. Labour scarcity at crucial peak seasons could lower output as in weeding time when lack of labour would lead to destruction of the crop.

c) Capital implements availability is expected to increase output.

d) Fertilizer is expected to increase output until the level of diminishing returns sets in. There is a healthy maximum and above it, will be destructive.

e) Credit relationship with output cannot be stated a priori. More so when the credit is lumped in the various farm requirements. Previous study by Salami[6] shows that it may not be significant. The disaggregated form for fertilizer and insecticide may show a positive relationship.

f) We expect the loam soil to have a positive relationship with output. Given that it has greater fertility level and is less prone to erosión than the sandy soil then it should indicate a greater percentage change in output of the two.

g) Output is positively related to the availability of the extension services. We expec. those who receive above mean sample average to achieve greater output changes.

h) Education as skill variable is expected to have a greater positive effect on output. Massel[7] shows that they may use more land and inputs in the production.

3.3 The Acreage Response Model

Crops supply tend to relate to the prices of the commodities, the input cost factors, the level of technology and environmental factors. Time series data on most of these factors and specification problems led to most studies relying on the price factor as the most influential and also readily available in data form. Most supply analyses derive from the works of Nerlove. He built the model on the hypothesis of price expectations as important in influencing farmers decision to plant. The work is summarized in three equations.[8]

$$x^*_t = a + bP^*_t \qquad (1)$$

$$P^*_t - P^*_{t-1} = b(P^*_{t-1} - P^*_{t-1}) \qquad (2)$$

$0 \quad b \quad 1$

$$x_t - x_{t-1} = y(x^*_t - xt-1) \qquad (3)$$

$0 \quad y \quad 1$

where P^*_t is the price expected this year

P^*_{t-1} is the price expected last year

P_{t-1} is the actual price last year

x^*_t is the acreage expected this year

x_{t-1} is the acreage last year

x_t is this years acreage

b is the constant for farmers price revision expectations

y is the supply adjustment constant

The long-run equilibrium supply is indicated by the acreage expected this year x^*_t and the price this year P^*_t. x^*_t is assumed to be a linear function of P^*_t. In the movement towards long-run supply equilibrium the expected price is adjusted by b as shown in equation 2 and supply adjusted by y. x^*_t and P^*_t are unobservable future expectations and they are manipulated to give equations of the current supply with respect to current price and current supplies.[9] The derivations end in a simple model of current acreage being explained by last years price and last years acreage written as:

$$X_t = d + eP_{t-1} + f_{t-1} \qquad (4)$$

a,b,d,e and f are constants in the model explaining the factors. The basic model is what has been modified in the acreage response studies with the inclusion of more variables. We therefore specify our model as being composed of the determinants.

$$A_t = f(A_t, P_{t-1}, P_{m-1}, E, G) \qquad (5)$$

3.3.1 Definition of the Variables

3.3.1.1 Dependent Variable

A_t is the acreage under the crop in the year t. We use acreage in the model as the dependent variable. Planted acreage is assumed to be the planned portion of the total supply and also to represent the farmers non-control of the environmental conditions as weather. Seasonal variations in weather may effect the use of output as a reliable dependent variable in the time series analysis.[10]

3.3.1.2 Independent Variables

Price of tobacco is measured in shillings per kilogram. The average price is the one that is used in the model. It was derived from the total value of the crop that is produced and the total production in kilograms. It is denoted P_t.

Price of maize is (P_m). Maize is the most dominant crop grown in the whole district. All the samples taken also showed considerable land area devoted to it from the farm area. It is the staple food of the area. It was used to try and capture the effect of an alternative crop. It is grown in two seasons and may have competing effects in the labour required in the farm practices. The price were obtained from the maize and cereals board.

Environmental factors (E) were captured by the precipitation over the months the crop was in season. The rainfall was measured in mm.

The population of growers (G) was used as the number of registered tobacco farmers in the area. This was obtained from the co-operative society records over the years.

3.3.2 The Expected Relationships

For the model the possible relationships we expect are:

a) That acreage is positively related to the price of the product. Farmers are likely to respond to the price incentives.

b) A positive relationship is also expected in the acreage that was sown in the previous year on the acreage planted this season.

c) We expect a negative relationship for the price of maize on the tobacco output. Maize is used as an alternative crop.

d) We expect a positive relationship between the rainfall figures in mm and the output. A good years rain should increase output.

e) We expect a positive relationship in the output induced by a greater population of growers.

3.4 The Production Response Model

This model is built on the same principles as that of the acreage response. The only difference is that now we will use the output produced as the dependent variable. The variable is measured in kilograms. The independent variables are: lagged acreage, lagged price of tobacco, lagged price of maize, the rainfall and population of growers. We previously indicated in section 3.3.1.1 why acreage response has been preferred to output response. But given the nature of data in most developing countries. Kenya being no exception, the data on acreage may not always be precise. Data on large farm acreage may be much informative compared to the data on small farm acreage. Output quantity is often well recorded compared to acreage measurements.

The model will therefore test similar relationship as outlined in 3.3.2 except that acreage is substituted with output in the dependent variable. The estimated equations take the form shown in the next section with similar substitution of the dependent variable.

3.5 The Estimated Equations

3.5.1 The Production Function

Economic phenomena have a stochastic nature and therefore the random error term will be included in the model. We will assume that the errors fulfill the assumptions of the linear stochastic model to allow for estimation.[11] Both linear and log-linear forms are employed in the estimation.

3.5.1.1 Production Function Determinants

$$Y = b_o + b_1L + b_2La + b_3K + b_4F + b_5Cr_1 + y_1D_1 + y_2D_2 + y_3D_3 + e \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$Y = b_o + b_1L + b_2La + b_3K + b_4F + b_5Cr_2 + y_1D_1 + y_2D_2 + y_3D_3 + e \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$\ln Y = b_o + b_1\ln L + b_2\ln La + b_3\ln K + b_4\ln F + b_5\ln Cr_1 + y_1D_1 + y_2D_2 + y_3D_3 + e \quad \ldots\ldots (3)$$

$$\ln Y = b_o + b_1\ln L + b_2\ln La + b_3\ln K + b_4\ln F + b_5\ln Cr_1 + y_1D_1 + y_2D_2 + y_3D_3 + e \quad \ldots\ldots (4)$$

3.5.2 The acreage Response

Various versions of the model are estimated to see which combinations of the independent variables fit the data. Both linear and log-linear and log-linear forms are taken to see if one is an improvement on the other fit. The versions in linear and log-linear forms are:

$$A_t = b_o + b_1 P_{t-1} + b_2 P_{m-1} + b_3 A_{t-1} + b_4 E + b_5 G + e \quad \ldots\ldots(5)$$

$$A_t = b_o + b_1 (P_{t-1})/(P_{m-1}) + b_2 A_{t-1} + b_3 E + b_4 G + e \quad \ldots\ldots(6)$$

$$A_t = b_o + b_1 P_{t-1} + b_2 A_{t-1} + b_3 E + b_4 G + e \quad \ldots\ldots(7)$$

$$\ln A_t = b_o + b_1 \ln P_{t-1} + b_2 \ln P_{m-1} + b_3 \ln A_{t-1} + b_4 \ln E + b_5 \ln G + e \quad \ldots\ldots(8)$$

$$\ln A_t = b_o + b_1 \ln (P_{t-1})/(P_{m-1}) + b_2 \ln A_{t-1} + b_3 \ln E + b_4 \ln G + e \quad \ldots\ldots(9)$$

$$\ln A_t = b_o + b_1 \ln P_{t-1} + b_2 \ln A_{t-1} + b_3 \ln E + b_4 \ln G + e \quad \ldots\ldots(10)$$

FOOTNOTES

1. See Appendix 7

2. Koutsoyiannis (1979: pp. 67)

3. Ongaro (1988: pp 116)

4. Rukandema (1977: pp. 81) ; Moock (1973 pp 69)

5. Massel (1966: pp 3)

6. Salami (1984: Conclusions)

7. Op at 5: pp 10

8. Hill (1971: pp 287)

9. Nerlove (1956: pp. 497-509), Behrman (1968: Chapter 5), Op. cit 8, pp for mathematical derivations of Nerlovian model.

10. Maitha. (1973: pp 184)

11. Koutsoyiannis (1977: pp 55)

CHAPTER FOUR

DATA ANALYSIS AND REGRESSION RESULTS

This chapter is concerned with the analysis of the data in the area of study and an examination of the results of the regression equations specified in chapter 3.

4.1 Description of Farm Production

Tobacco season starts in July and ends between the months of March and April the following year. The leaf grown in Kitui is Virginia type and it is fire-cured. The work on tobacco starts at the seed-bed. The seedlings are raised in the nursery and later transplanted. Various operations to sustain the seedlings life are undertaken at the nursery stage. These are fumication, watering, thinning and mulching, removing the mulch and hardening of the seedling. The seedlings are transplanted into the prepared fields when the rains start. This takes place between Mid-October and November. The planting should take a maximum of 3 days. Field preparation takes place between the nursery and transplanting stages. Ridges are made for planting the tobacco field during the nursery stage he is expected to cut-woodfuel and store in the barn in the homestead. Fertilizer is applied to the crop

within the first seven days after transplanting. The farmer is expected to apply the first spraying of insecticide after the first two weeks of transplanting. About this time the first weeding takes place. Weeding is done at least three times before the plant matures. Topping which is the removal of the flower is done between one and half months to two months after transplanting. Harvesting of the first leaves takes place after this procedure. Curing tobacco is the last season work to be performed on tobacco. Thereafter tobacco is ready for market.

TABLE 4.1: Sample Means and Standard Deviation of Input, Output and Farm Characteris ics

Variable/Characteristics	Means	S.D	Maximum	Minimum
1 total farm area	6.62	5.17	30	2
2 Total area cultivated	3.82	2.65	15	1.20
3 land on tobacco	1.48	0.98	7	0.50
4 3/1	0.28	0.14	0.63	0.03
5 3/2	0.45	0.20	1.17	0.04
6 output	395.12	309.49	2200	67
7 Capital	810.83	467.04	2645	225
8 Credit (1)	1215.48	758.82	5374	315
9 Credit (2)	2127.39	1539.08	9535	540
10 labour	1985.50	875.93	5924	696
11 Fertilizer	179.33	115.11	800	50
12 Education	0.27	0.45	1	0
13 Soil-type	0.53	0.50	1	0
14 Extension Services	0.76	0.43	1	0

Source: Computed from Farm survey data.

Table 4.1 reveals the nature and characteristics of the farm activity in the Kitui tobacco production zone. The farms varied in size with the average holding in the sample area being 6.62 acres. The largest farm in the study area was 30 acres while the smallest farm was a poor 2 acres. The tobacco farms constituted 27.7% of the total farm area and 44.7% of the total area cultivated. Though it is not the concern of this paper to assess whether tobacco production conflicts with the national food policy objectives it is worth mentioning that since land allocated to tobacco constitutes only a minor part of the total farm area there should be no conflict with food

production. Out of the cultivated land tobacco takes almost half of the area showing its relative importance as a cash-crop in the area. There is land lying idle which can be deduced from the difference in the means of the farm area and that of the area cultivated. This reveals that there is possibility of expanding output if more of the idle land can be put to useful farm practices. The acreage under tobacco in this producing area is not restricted as in other producing zones of maximum being 0.5 Ha. In Kitui tobacco production acreage is left to the farmer's decision and this is seen from the largest farm size under tobacco being 7 acres. The average farm size is 1.48 acres with a standard deviation of 0.98 acres.

Tobacco is grown in pure stand as is advised by the B.A.T. (K) Limited. For the given sample, the average output obtained was 395.12 Kg and this varied with a standard deviation of 309.48 Kg. The maximum output in the sample size was 2200 Kg and the minimum output record was 67 Kg.

Labour is extremely important in the tobacco activity. Labour was aggregated for the peak seasons for it is in these periods that the final output ready for market would be affected. The peak seasons that constitute the labour were the planting, weeding, harvesting and curing which revealed an average of 1982.5 man-hours in the season with a standard deviation of 875.93 man-hours.

Assessing the capital in the production process is relatively not straight forward in the sense of capturing the real value of the farm-tools used in the farm activity. The values of the ox-ploughs, the wheelbarrows, the fork Jembe, the watering-jugs and hoes were approximated to give a value in Ksh. Farmers do not replace items as Jembes yearly, nor do they buy wheelbarrows very often. The value at the time they were bought was appreciated to the current market price if the implements was still in good condition to render services. The value of hired implements was also included in this capital and it was found that on average the amount of Ksh. 810.83 was spent in production process.

Credit was available from the society and this was in form of input. The farmer obtained the inputs he needed and this was valued in monetary terms to be deducted when he harvested his crop. The society lent the farmers credit worth on average Ksh. 2127.39 and the highest amount available to a farmer in that season was Ksh 9535.00. Farmers who used the fertilizers showed an average application of 179.33 Kg of fertilizer. The highest amount of fertilizer used was 800 Kg while the lowest used was 50 Kg.

4.2 The Production Function Regression Results

The results of the equations in (3.5.1.1) are indicated in table 4.2. The table shows the variables estimated with credit 1. This is the disaggregated credit consisting of fertilizer and insecticide.

Table 4.2: Regressions of Tobacco Production Function Version 1

Variables	Linear Form Est. Coeff		T-stat.	Log-linear Form Est. coeff.		T-Stat
Constant	-164.902	(28.508)	-5.784	0.242	(0.860)	0.282
Capital	0.058	(0.035)	1.664	0.065	(0.092)	0.718
Credit(1)	0.023	(0.023)	1.020	0.046	(0.075)	0.618
Labour	0.070	(0.021)	3.401	0.508	(0.101)*	5.038
Land	182.408	(22.765)	8.013	0.598	(0.098)*	6.122
Fertilizer	0.070	(0.216)	1.399	0.134	(0.092)	1.464
Education	-29.382	(23.071)	-1.273	0.011	(0.067)	0.172
Soil-type	34.711	(17.898)	1.939	0.079	(0.053)	1.458
Extension	13.121	(21.209)	0.619	0.119	(0.064)**	1.866
R^2	0.947			0.874		
R-2	0.940			0.859		
S.E.E	75.640			0.224		
F-ratio	146.595			57.451		
n	75			75		

Note: ()* Significant at 0.01 level; ()** Significant at 0.05 level. In parentheses are the standard errors.

Est. = Estimated
Coeff = Coefficient

The estimated coefficients of both the linear and log-linear forms, their standard errors and t-statistics are shown. The results are based on the ordinary least squares. For the log-linear equations which are discussed in the study the estimated coefficients represents the production elasticities. For the variables Education, soil-type and extension services the values are not elasticities but multiplicative factors.

The interpretation of the results in the linear form are as follows: Based on the F.test which gives a value of 146.595, we may suggest that the whole model is statistically significant. The model explains 94.7% of the variation in output. To assess the influence of the various independent variables on output produced a t-test is used. Both the 1% and 5% level of significance are used. At 5% level of significance the capital used in the production and the soil-type are significant. They also possess the expected positive signs. At 1% level land and labour show high level of significance and also exhibit the expected signs.

To assess the influence of the various independent variables on output produced, a t-test was used at 5% and 1% level of significance. At 5% level the capital used in the production and the soil-type are significant, which seem to conform with the expected positive signs. At 1% level land and labour show high level of significance and also exhibit the expected signs.

Credit, Fertilizer, Education and Extension were found not to have significantly affected output. Education was found to have a negative sign contrary to what was expected. The possible explanation for this is that farmers through experience in farm production could have acquired the skills

necessary to produce the output. But then since the negative relationship was not statistically significant, we cannot make any strong inference about the relationship.

The log-linear results of this version of the equation using credit (1), as one of the independent variables shows that the model is statistically significant using the F-test. The variation in output explained by the variables is lower than the linear-form. It shows that the log-linear form explains 87.4% of the variation.

The t-statistic revealed that labour and land were statistically significant at 1% level. This was found to be the case in the linear functional form indicating the strength of the two in explaining the output achieved. Extension services was significant at 5% level. All the other variables were found to be statistically insignificant. They all had the expected positive signs, which imply that they are factors of production that need to supplement each other in the production process.

The other version of the model that lumped credit used as an independent variable, shows the results presented in table 4.3. This is the total credit allocated to the farmer for the whole season.

Table 4.3: Regressions of Tobacco Production Function Version 2

Variables	Linear Form Est. Coeff		T-stat.	Log-linear Form Est. coeff.		T-Stat
Constant	-154.184	(27.853)	-5.536	0.676	(0.443)	1.527
Capital	0.047	(0.035)	1.363	0.078	(0.062)	1.269
Credit(2)	-0.020	(0.010)**	-1.987	-0.077	(0.060)	-1.283
Labour	0.065	(0.020)*	3.190	0.521	(0.049)*	10.729
Land	198.199	(23.450)*	8.452	0.614	(0.053)*	11.518
Fertilizer	0.594	(0.187)*	3.171	0.188	(0.062)*	3.040
Education	-32.318	(22.629)	-1.428	0.005	(0.047)	0.111
Soil-type	34.948	(17.477)**	2.000	0.081	(0.037)**	2.164
Extension	19.320	(20.702)	0.933	0.133	(0.062)**	2.142
R^2	0.949			0.877		
R^{-2}	0.943			0.862		
S.E.E	74.050			0.222		
F-ratio	153.315			58.585		
n	75			75		

Note: ()* Significant at 0.01; ()** Significant at 0.05 level. In parentheses are the standard errors.

The model in both the linear and log-linear forms was statistically significant using the F-test criteria. The variation in output that was explained in the model is much higher in this version of the model than in the first case. The variation in output that was explained by the independent variables 94.9% and 87.7% respectively.

The total credit and soil-type were significant at 5% level for the linear functional from. Credit (2) had a negative sign. Labour, fertilizer and land were statistically

significant at the 1% level. The same variables were statistically significant at the same level in the log-linear regressed equation. In the log-linear form at 5% level soil-type and extension were significant variables.

4.2.1 Testing the Expected Relationship

The results obtained from the log-linear form in section 4.2. of the first version of credit are used to explain the results. The expected relationship were put down section 3.3.2 of chapter 3. The expected relationship can be interpreted as the hypothesis of the model.

Hypothesis 1: The regression results show there is a positive relationship between land acres planted and the output that was achieved. Further the regressions revealed that the factor is significant at 1% level of significance.

Hypothesis 2: The expected positive relationship was confirmed between the output and labour used in the peak seasons o the crop. At 1% level of significance the estimated coefficient obtained 0.508 was significant. The revelation is that labour in the peak seasons is very important in determining the final output that will be achieved.

Hypothesis 3: Output is positively related to the availability of physical farm implements. These are various implements, used in the production process. They hasten the pace of work done, but on their own, they are not important factors of production. At both 5% and 1% level of significance capital was not important.

Hypothesis 4: Effect of fertilizer application on output had the expected positive sign. The factor was not significant at either of the two levels used in the study. This shows that even though it positively increases output, the amount of fertilizer that the farmer's applied was not adequate to significantly affect output.

Hypothesis 5: Tested the significance of credit on output. The disaggregated credit that consisted of fertilizer and insecticide valued in monetary terms had the expected positive sign. It was thought not very important in determining output and therefore needs the influence of other factors to aid in increasing output.

Hypothesis 6: There was no significant difference between the soil-type in the production of tobacco. The fertility of the loam type indicates that it has a 5.3%

incremental effect on output. The effect though positive as expected is not significant statistically in determining the output that is achieved.

Hypothesis 7: The advice administered by the extension officers show a positive relationship with output as expected. The factor was significant at 5% level. We would expect it to have the positive sign as shown because contact with extension advice provides better husbandry methods for the development of the crop. Tobacco by its nature needs great care and poor husbandry would affect the final output achieved. The positive effect of extension reveals that they are responsible for 6.4% change in output.

Hypothesis 8: The level of education a farmer has attained is positively related to output but as a factor by itself in the production process it is not significant at either 5% or 1% level of significance. What this confirms is that it is possible to achieve output without much education standards. The subsistence farmer through the routine farm-work has gained experience in the farming methods and are therefore still able to produce a good quantity of the crop.

4.3 The Acreage - Response Regression Results

The acreage response data did not particularly fit well to the data. Several equations of the acreage response were tried in both the linear and log-linear forms. The one that was best of the equations is presented in table 4.4. The summarized results are of the log-linear functional form. Acreage is the dependent variable.

Table 4.4: Regression Results of the Acreage - Response

Variable	Coefficient		T- Statistic
Constant	3.615	(2.004)	1.804
Tobacco Price	-0.306	(0.265)	-1.153
Maize Price	-0.073	(0.183)	-0.401
Lagged acreage	0.243	(0.300)	-0.810
Farmers Population	0.105	(0.227)	0.463
Rainfall	-0.047	(0.116)	0.408
R^2	0.564		
R^{-2}	0.365		
S.E.E.	0.174		
F	2.843		
n	17		

Note: In parentheses are the standard errors.

The F-test indicates that the acreage model is not wholly significant in explaining the variation in acreage. The acreage variation that is explained by the independent variables was low. It showed that only 56.4% of the variation

in output was explained by the independent variables. Based on the t-statistic none of the variables used was statistically significant. All variables had the expected signs except the price of the tobacco which had a negative sign instead of the expected positive sign. The implication was that if the price of tobacco increased then the acreage that is planted decreases. Though it was not statistically significant we may argue that on the basis of the results the farmers possibly could be target workers who are only interested in acquisition of a certain level of income after which further price increase would not induce or motivate them to increase acreage.

Given that the acreage model did seem to wholly explain the situation of the Kitui tobacco farmer a model of production response built on the same principles was also tested.

4.4 The Production Response Regression Results

The same variables used in the acreage model in an earlier section are used in this section. In the previous section, it was revealed that the acreage response was not statistically significant. Various versions are again tried using both the linear and log-linear forms as indicated section 3.5.2 of chapter 3. The log-linear results indicate that their function form fit the data better than the linear functional form. Table 4.5 shows two equations that fitted the data well.

Table 4.5: Regression Results of the Production Response

Variables	Equation 9 Est	Coeff	T-Stat	Equation 10 Est.	Coeff	T-Stat
Constant	5.460	(4.168)	1.310	5.706	(3.805)	1.500
Tobacco Price				0.532	(0.341)	1.562
Tob. Price/ Mai. Price	-0.254	(0.380)	-0.669			
Lagged acreage	-0.114	(0.616)	-0.186	-0.168	(0.480)	-0.349
Pop. of Growers	1.344	(0.398)*	3.377	1.022	(0.435)**	2.349
Rainfall	-0.071	(0.240)	-0.297	-0.080	(0.216)	-0.371
R^2	0.669			0.715		
R^{-2}	0.559			0.620		
S.E.E.	0.362			0.336		
F-ratio	6.064			7.516		
n	17			17		

()* Significant at 0.01; ()** Significant at 0.05 level
In parentheses are the standard errors.
Note: Tob = Tobacco; Mai = Maize.

We use these two equations to explain the behaviour of the output variation. Equation 9 is the one used to test the expected relationship in the next section. This we base on the argument that it captures maize as an alternative crop because of the possible competition in their growth period for the farmers attention. They are grown in the same season so we expect competition in labour during the season. Further it was already noted that in the sample study it took up considerable portion of the cultivated land. The two are grown separately. Tobacco is grown in pure stand. Maize is the staple crop and also is taken to market.

Equation 9 shows that the model based on the F-test is significant at both the 0.01 and 0.05 level of significance. We can therefore use the model to explain the output over the years. The variation in output that is explained by the model is 66.9%. The correlation matrix of the model is shown.[1] It shows that multicollinearity was not a serious problem. The model can therefore be used on the above qualifications to assess the explanatory powers of the independent variables on output.

Only the population of tobacco growers was significant at the 1% level of significance. The rest of the variables in the equation 9 were not significant in explaining output variation. In equation 10 population of growers was significant at the 5% level only and the rest were not statistically significant.

4.4.1 Testing the Expected Relationship

The results of the equation 9 are used to explain the explain the expected relationships. Referring to the expected relationship put down in section 3.3.2 of chapter with modification explained in section 3.4 of chapter 3 and interpreting the expected relationship as the hypothesis of the model then:

Hypothesis 1 The results we obtained show that the price of tobacco is positively related with the output that is achieved. The coefficient of the relative price of tobacco and that of maize is negative. If we look at the coefficient of price of tobacco in equation 10, it is positive therefore suggesting that in the relative prices the positive sign is attributed to the price of tobacco while negative is attributed to the price of maize. The price of tobacco was not significant at either of the two levels of significance. Cromarty[2] using an almost similar model established similar results. Our long-run price supply elasticity was 0.532.

Hypothesis 2 The results revealed that the coefficient of last years acreage on output had a negative sign. This was not expected but can be explained in terms of the small sized-farms being more intensely cultivated. The relationship shows that for a decrease in acreage output increases. We may argue that the small scale farmers are more effective in land-use than the large-holding but we use the scale to refer to the sizes of the farms. The value of the coefficient was not significant at the 0.01 and 0.05 levels of significance.

Hypothesis 3 The expected negative relationship between alternative crops is exhibited based on th explanation in hypothesis 1, then we can confirm the source of the negative relationship. The price of maize was not significant at any of the two levels.

Hypothesis 4 The results of the rainfall had a negative sign in the regressed coefficient, with implication that as rainfall increases, output tends to decrease. This was not expected given that the area is not adequately supplied by rain. However we may still explain this by regarding the nature of the crop. Akehurst[3] argues that the distribution of the rain is more important than rainfall insufficiency for suitable growth. When we regard the rainfall pattern of Kitui during the crop season we see that it is not well distributed and perhaps high rainfall was more detrimental than useful and so resulted in the decreased output. Cromarty[4] also found a negative relationship in his analysis of rainfall on tobacco production. In our case the rainfall was not significant at either the 1% or 5% level of signficance.

Hypothesis 5 The population of the growers had the expected positive sign. It was further significant at the 0.01 level of significance. it shows that the factor contributes strongly to the production of the tobacco crop. Tobacco is a

labour intensive crop and therefore the significance of man-hours as shown in the cross section analysis will increase output. More growers of the crop means there will be more participants and if they apply intensive farming then more output would be expected.

FOOTNOTES

1. See Appendix 6.

2. Cromarty (1950: pp 573)

3. Akehurst (1981: pp 195)

4. Op.cit 2, pp 567

CHAPTER FIVE

SUMMARY, POLICY IMPLICATIONS AND AREAS FOR FURTHER RESEARCH

Introduction

This chapter covers the summary of the study and conclusions of what has been discussed so far. The policy implications of the study and its limitations are also elucidated. Lastly an examination of the area for further study are outlined.

5.1 Summary

In chapter 1 we outlined the aim of the study. This was to examine the feasibility of effective development of the tobacco industry in the Kitui district. Specific objectives included identifying the constraints to the production of tobacco in the Kitui district. Among the producing districts, Kitui has the lowest productivity in terms of kilograms per hectare. Total output from the district is also the lowest. The position of the crop within the Kenyan Economy and its position to world trade is also discussed. Within the Kenyan Economy tobacco is recognized to be increasing in importance in the areas where it is grown. Over-time Kenya has grown from a

net-importer of tobacco to become self-sufficient in the production of tobacco. This has been achieved through an aggressive leaf expansion-programme upon the request of the Government to B.A.T (K) limited, for self-sufficiency in the leaf supply. Notwithstanding the overall success, Kitui has had its pitfalls in the tobacco leaf production.

The importance of the crop can be summerized as the benefits that accrue to the small-holder in the rural areas. Tobacco is a high-value crop and therefore provides a rewarding package to the small-holder farmer. Secondly, at the national level it contributes to the exchquer. The public revenue derived from tobacco and its products was also outlined. The role of Kenyan tobacco in the world trade is almost insignificant. The output the country produces on a world ranking is minimal. The main objective of the Kenyan tobacco is therefore sustaining self-sufficiency in leaf supply. This is in the line with the policy of import substitution in any raw materials that could feasibly be produced at home. Nevertheless we may add that the role it plays in foreign exchange sector is that of saving the scarce foreign exchange that would otherwise be used to import the tobacco.

Literature review in the development of the agricultural sector and those pertaining to tobacco are provided in Chapter 2. Agricultural sector development and hence development of tobacco as one of the activities of the sector requires the implementation of incentives. Previous studies reveal that tobacco farmers are responsive to incentives. The incentives in this case can be the price-factor or subsidized inputs and improved technological modes of production. The literature reviewed provide the backbone of the chapter on research methodology.

In chapter 3 we discussed the research methodology. To answer to our needs about the study fieldwork was undertaken in central division of Kitui district. This was to generate data required for the cross-section analysis. Further we retrieved data on the relevant variables from relevant records on the incentive structure of tobacco. These provided the sources of data for the study.

The specified models were a modified Cobb-Douglas production function. This was used in the cross-section data analysis. The acreage and output response were built on the Nerlovian principles. All the model forms were then regressed using the ordinary least squares technique. The expected relationship that served as the hypotheses were put to test

using the student t- statistic for the level of significance. The overall plausibility of the model was gauged using the F-test.

In the analysis chapter, 4, statistical methods were used to provide the description of the factors from the means obtained. It was also used to reveal the maximum and minimum of the various factors for comparison within the sample size.

The Cobb-Douglas production function was put to test on two versions of the farm data. One version had the disaggregated credit and the other the total credit available to the farmer. The former consisted of the value of credit assigned to fertilizer and insecticide. The results of this version confirmed the expected priori relationship in the log-linear form. This was by implication that the factors positively increase output as they are increased. The linear form yielded expected results part from the variable, education, which had a negative sign. The latter version of the model did not have much difference in the explanatory power. It yielded a negative coefficient in the lumped credit and in education in the linear form while in the log-linear form credit still remained with a negative sign. The log-linear form provided a better fit of the two modes of analysis. The version of the disaggregated credit was chosen

to explain the constraints on tobacco. This was because it revealed most of the priori expectations and also a good fit to the data. It showed that only labour and land were very significant factors affecting output. Extension services was significant but at a lower level. The rest of the factors explained the output but were insignificant on their own. This provided the basis for the policy recommendations, discussed in chapter 5.

The time-series results showed that for Kitui tobacco, the output response is much informative than the acreage response. The production response was supportive of the held belief that farmers are responsive to price incentive. The long-run price elasticity of supply confirms this and compares well with previous studies. Though it has been advocated that acreage response is preferred to output response it was not the case in this study. Possible sources of this non-conformity could have been due to inappropriate data on acreage over the years for the small-holder tobacco production.

5.2 Conclusions and Policy Implications

The production response was positive and the long-run price elasticity of supply showed that the farmers behaviour in the region conform to economic theory. Empirical results indicate that the Kitui tobacco farmers are responsive to price changes and will increase output with positive changes in price.

Further, we come to the conclusion that the farmers, though are aware of the existence of the input incentives, do not exploit them to the maximum. This was probably due to the fact that they bear the full risk of utilizing the credit allocated to them. Credit was given to the farmers in the form of inputs and the corresponding amount deducted at the end of the tobacco season after the tobacco has been sold in the market. The policy implication of this is that in as much as the farmers tend to be risk averse, a policy could devised to help farmers so that the potential burdened could be lessened. In this regard B.A.T. (K) Limited, the company responsible for the tobacco industry, and the Government, should come to the farmers aid in cases of crop failure. In the course of the analysis of data it was revealed that credit was not statistically significant. It could also argued be that this could have been due to the smallness of the credit amount or the effect of credit might be hidden in other forms. But in

view of the fact that credit was in kind, mostly in form of fertilizer and insecticides, we could conclude that the latter was the case.

Concerning the factor input land, it was revealed that there was idle land that could be cultivated to increase tobacco output. The implication of this is that a policy of expansion in the acreage cultivation be instituted to achieve increase in tobacco output.

Regarding the physical implements it was found that simple tools like the hoe were predominantly in use. The application of hoes mainly to till the land is not adequate. The study revealed that physical capital was statistically insignificant, indicating that there was need to improve on this factor. A device such as the ox-plough could be made popular in the area with the view to breaking the apparent constraint posed by the physical capital input. This policy could help bring about the relevant technical progress needed by the sector.

In this regard over-production should not be a problem since a new cigarette manufacturing by name "Mastermind" is now in operation and is likely to be in competition with rival B.A.T. (Kenya) Limited for tobacco crop.

5.3 Limitation of the Study

This study does not make any claim to have answers to all probelms of tobacco production in Kitui District. The study has been made narrow due to time and financial constraints.

One of the limitations of the study is the problem of data recall in respect of data for the cross-section study which relied mostly upon the memory of the farmer about his previous seasons activities. Most farmers do not keep recorded data on all the information generated. Therefore such problems should always be taken into account. It was interesting to find that our data fitted well implying our data can be regarded quite reliable. Further we should note that when dealing with cross section analysis as was the case in this study, the trend exhibited may vary over the years, because the real world is ever changing.

The time series analysis on the acreage did not reveal the expected results showing that the data used was not very precise. This interferes with reliance on the data for making any future predictions. Therefore there is need for all relevant authorities to be more keen on efficient storage of

reliable data for future use. Good and reliable data helps in providing much more information for effective planning.

5.4 Recommendations for Further Research

The scope of this study allows us to include only one district. A study covering all leaf production areas would determine better and enable more conclusive remarks about the factors affecting the tobacco output. This production area is for instance co-operative based production area so an analysis with other areas that farmers deal directly with overseer company would provide far more reliable comparisons of the constraints to increased production.

It was pointed to earlier that the bearing of risk wholly by the farmer made him over cautious in relation to use of credit input. In this connection, an analysis of farmers risk-response would provide further understanding of the behaviour of the small-holder tobacco producer in his production plans.

Further analysis of resource efficiency use was not conducted in this study. This area can be looked at in the wider context to enable far more comprehensive recommendations to be made.

We may also suggest that given the dynamic nature of the tobacco industry, a more comprehensive study should be taken to establish the demand-side of tobacco trade, for our study has been mainly concerned with the supply side, that is tobacco leaf (crop) production.

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A P P E N D I C E S

APPENDIX 1

ESTIMATED AREAS, VALUE AND VALUE PER HECTARE FOR SELECTED COMMODITIES, 1983/84

Commodity	Area		Value(d)		Value Per ha	
	% of Total	(Rank)	% of Total	(Rank)	K£/Ha	(Rank)
Milk	46.6	(1)	16.3	(3)	70	(16)
Maize & Beans(a)	27.6	(2)	16.6	(2)	153	(12)
Root Crops (b)	7.9	(3)	8.1	(5)	205	(9)
Sorghum & Millet	6.7	(4)	1.5	(11)	48	(17)
Coffee	2.9	(5)	21.6	(1)	1,489	(1)
Wheat	2.2	(6)	2.7	(10)	191	(10)
Cotton	2.1	(7)	0.4	(18)	32	(18)
Fruits	2.1	(8)	3.1	(9)	296	(7)
Sugar	1.7	(9)	-3.6	(21)	-432	(19)
Tea	1.6	(10)	11.9	(4)	1,325	(2)
Sisal	1.1	(11)	1.1	(12)	137	(14)
Vegetables	0.7	(12)	3.4	(8)	913	(3)
Cashewnuts	0.5	(13)	0.4	(15)	162	(11)
Groundnuts	0.4	(14)	0.2	(20)	84	(15)
Barley	0.3	(15)	0.4	(17)	249	(8)
Sunflower	0.2	(16)	0.2	(19)	141	(13)
Pyrethrum	0.2	(17)	0.4	(16)	419	(6)
Rice	0.2	(13)*	0.5	(13)	519	(5)
Tobacco	0.1	(19)	0.5	(13)	885	(4)
Beef	(c)	-	6.8	(6)	(c)	-
Sheep & Goats	(c)	-	4.9	(7)	(c)	-
Others	(c)	-	3.1	-	(c)	-
	100.0(e)		100.0(e)		170(f)	

SOURCE: Republic of Kenya, Economic Management for renewed growth. Sessional Paper No. 1 of 1986, pp. 64.

NOTES:(a) Because beans are typically interplanted with maize, the two crops are considered together; maize alone accounts for 13.3 percent of total value.

(b) Includes potatoes which account for 5.3 percent of total value.

(c) No. estimates available.

(d) Value at farm gate.

(e) The total areas is 5.17 million hectares and total value is K£ 1,035 million.

(f) Excludes Beef, Sheep and Goats, and "others"

APPENDIX 2

TOBACCO PRODUCTION OF 3 DISTRICTS

	BUNGOMA		MERU		KITUI	
	Area HA	Production KG	Area HA	Production KG	Area HA	Production KG
1975-76	80	80,000	334	146,083	133.5	55,008
1976-77	230	220,000	758	350,000	163.5	98,573
1977-78	400	420,000	350	283,000	202.3	78,992
1978-79	443	228,800	500	350,000	130	99,020
1979-80	647	409,000	530	400,000	130	91,325
1980-81	708	372,000	795	600,000	159	143,924
1981-82	708	570,000	840	630,000	158.5	132,817
1982-83	784	701,000	900	772,900	164.91	117,611
1983-84	711	1,175,251	1,284	1,181,500	119.51	77,357
1984-85	437	704,375	1,300	1,546,600	100	180,313
1985-86	460	722,200	1,039	1,236,330	100	109,928

SOURCE: Ministry of Agriculture, Annual Reports, Bungoma, Kitui, Meru; Various Issues.

APPENDIX 3

WORLD TOBACCO PRODUCTION OUTLOOK (TONNES)

Year	World Output	Developed Countries	Developing Countries
1970	4,625	1,474	1,781
1971	4,559	1,369	1,790
1972	4,779	1,398	1,873
1973	5,016	1,468	1,922
1974	5,160	1,551	1,978
1975	5,426	1,709	2,062
1976	5,648	2,392	3,256
1977	5,612	2,224	3,388
1978	5,506	2,203	3,303
1979	5,381	1,986	3,395
1980	5,141	2,115	3,026
1981	5,688	2,237	3,451
1982	5,756	2,180	3,576
1983	5,706	2,112	3,594
1984	6,456	2,207	4,249
1985	6,939	2,114	4,825
1986	6,587	2,028	4,559
1987	6,484	1,941	4,543

SOURCES: FAO, Commodity Review and outlook, various Issues.

NOTES: Production is farm sales weight basis.

APPENDIX 4

WORLD EXPORTS '000 tons

Year	World Output	Developed Countries	Developing Countries
1970	943	392	437
1971	1,003	378	497
1972	1,188	467	602
1973	1,226	458	636
1974	1,410	525	740
1975	1,245	473	635
1976	1,297	581	716
1977	1,264	577	684
1978	1,370	670	700
1979	1,391	623	768
1980	1,343	570	773
1981	1,507	620	887
1982	1,435	615	820
1983	1,360	750	610
1984	1,393	627	767
1985	1,342	599	743
1986	1,350	535	715
1987	1,311	600	711

SOURCES: FAO, Commodity Review and Outlook, Various Issues.

NOTES: Exports is given on dry weight basis.

WORLD IMPORTS '000 tons

Year	rld Total Countries	Developed Countries	Developing Countries
1970	943	392	437
1971	1,003	378	497
1972	1,188	467	602
1973	1,226	458	636
1974	1,410	525	740
1975	1,245	473	635
1976	1,297	581	716
1977	1,264	577	684
1978	1,370	670	700
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1984	1,393	627	767
1985	1,342	599	743
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1987	1,311	600	711

SOURCES: FAO, Commodity Review and Outlook, Various Issues.

NOTES: Exports is given on dry weight basis.

APPENDIX 6

CORRELATION MATRIX FOR EQUATION 9

Price of Tobacco	Tobacco & Maize Prices	Lagged Acreage	Population of growers	Rain
Price of Maize	1	0.688	-0.474	-0.108
Lagged Acreage	0.688	1	-0.546	-0.065
Population of growers	-0.474	-0.546	1	0.239
Rain	-0.108	-0.065	0.239	1

Source: Computed from the time series, data.

QUESTIONNAIRE FOR FACTORS INFLUENCING TOBACCO PRODUCTION IN KITUI DISTRICT

1. Farmers Background

1.1 Farmer's Name _____ Form No._____

1.2 Sub-Location_____

1.3 Age_____ Sex_____ Marital Status _____

1.4 Highest Level of education obtained _____

2. Land and Crops Planted

2.1 What is the total area of your land? _____acres.

2.2 What area of your farm is under each of the following activities:

(a) Tobacco _____ acres.
(b) Cotton _____ acres.
(c) Maize _____ acres.
(d) Sorghum _____ acres.
(e) Trees for fuel wood _____ acres.
(f) Others specify _____ acres.

2.3 How do you grow the crops? Pure stand or Mixed stand (Tick appropriate)

Name of crop	Pure Stand	Mixed Stand
Tobacco		
Cotton		
Maize		
Sorghum		
Other (Specify)		

2.4 What makes you grow tobacco in form (2.3) above?

Give reasons_____ _____ _____

_____ _____

2.5 What reasons makes you allocate land to crop?

(a) Matures faster
(b) Drought resistant
(c) Sources of cash income
(d) Stores well
(e) Others (Specify)

Name of crop	Reason for land allocation
Tobacco	
Cotton	
Maize	
Sorghum	
Other (Specify)	

3. Market Facilities

3.1 Do you belong to any cooperative society? YES _____ No_____

3.2 If Yes in 3.1, what is it's name _____

3.3 Can you numerate it's purpose.

(a) Selling of produce
(b) Provision of inputs
(c) Provision of loans
(d) Provision of information on tobacco production
(e) Others specify

3.4 How many cropping seasons do you have? _____

For the crops below indicate the appropriate practices.

	Tobacco	Cotton	Maize	Sorghum	Others Specify
Season when grown					
How long it takes to be harvested					
Total Production in 1988 (kg) (bag)					
How much was sold (kg) (bag)					
Price paid per (kg) (bag)					
Distance to place of sale (Km)					

3.5 Was there any other marketing arrangement to facilitate selling of crop?
Yes _____ No _____

3.6 If yes, give it's nature _____

_____

4. Fertilizer

4.1 Did you use any chemical fertilizer in your production last season?
Yes _____ No _____

If yes, please provide the following about it.

Name of Crop	Amount of fertilizer (kg) (bag)	Where obtained (Distance)	How was it financed (Cash/Credit)
Tobacco			
Cotton			
Maize			
Sorghum			

4.2 Did you use any manure to increase your product last season?
Yes _____ No _____

If yes, provide the following information.

Name of Crop	Amount of Manure (kg) (bag)	Where obtained (Distance)	How was it financed (Cash/Credit)
Tobacco			
Cotton			
Maize			
Sorghum			

5. Labour

5.1 Do you use family labour entirely or some hired labour in your tobacco production? Family Labour _____ Hired Labour _____

5.2 If family labour entirely provide the following information

Activity	No of Grown ups	Hours (days) worked per man	No. of Children	Hours (days) worked per child
Land pre-paration				
Planting				
Weeding				
Harvesting				
Others (Specify)				

5.3 If hired labour provide the following information.

Activity	No of Grown ups	Hours (days) worked per man	No. of Children	Hours (days) worked per child
Land pre-paration				
Planting				
Weeding				
Harvesting				
Others (Specify)				

5.4 Do you experience any labour shortages in the farm activities?
Yes _____ No _____

5.5 If yes in 5.4 specify which activity _____

_____

6. Services

6.1 Do you receive any extension services? Yes _____ No _____

6.2 Which of the listed below did you receive in the past season (1988)?

Nature of Service	Number of Times
1. Visits by extension officer	
2. Field Demonstrations	
3. Visits to any formal meetings where tobacco production information is given	
4. Others (specify)	

6.3 What is your opinion about the provision of extension services on tobacco? _____

_____

7. Farm Implements

7.1 Which of the following did you use in the tobacco farming.

Farm Implement	year when bought	Price at that time
Hoes		
Ox-ploughs		
Tractors		
Wheel barrow		
Others (Specify)		

7.2 Did you hire any of the farm-implements Yes _____ No _____

If yes provide the following information.

Farm Implement	No. of times hired	Cost per hiring (Shs).
Hoes		
Ox-ploughs		
Tractors		
Wheel barrow		
Others (Specify)		

8. Credit

8.1 Did you receive any credit to help improve your tobacco farming last season? Yes _____ No _____.

8.2 If yes in 8.2 provide the following information.

Source	Year	Purpose	Amount	Payment Period.
B.A.T.				
Co-operatives				
Others (Specify)				

8.3 Are you satisfied with the availability of credit? Yes _____ No _____

8.4 Give reasons for your position in 8.3 _____

_____

8.5 What other problems do you face in the development of your crop?

_____

_____

9 Farm Soil-type

9.1 By observation, tick appropriate (one only)

Clay soil _____, Loam soil _____, Sandy soil _____.

THANK RESPONDENT: END INTERVIEW