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## Some aspects of smallholder tea production in Belgut Division of Kericho District, Kenya

Alice Atieno Oluoko

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**Some Aspects of Small Holder Tea  
Production in Belgut Division of  
Kericho District, Kenya**

**1999**

SOME ASPECTS OF SMALLHOLDER TEA PRODUCTION IN BELGUT  
DIVISION OF KERICHO DISTRICT, KENYA.

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By

Oluoko Alice Atieno

A thesis submitted in partial fulfillment of the requirement of Master of Arts in  
Geography (Agricultural Geography) in the University of Nairobi.

1999

**Declaration**

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

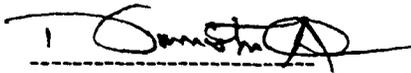
  
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Oluoko Alice Atieno

1<sup>st</sup> SEPT. 1999

Date

This thesis has been submitted for examination with my approval as University Supervisor.

  
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Prof. Dunstan A. Obara

1<sup>st</sup> SEPT 1999

Date

## **Dedication**

To my beloved husband Sam, in  
recognition of his constant support and care  
throughout the period of this study.

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**Abstract**

This study is about smallholder tea growing in Belgut Division of Kericho District, Kenya. The last thirty years in Kenya have witnessed rapid agricultural development contributed largely by the small-scale farm sector. In that context, smallholder tea growing has expanded to such an extent that it now accounts for 58.8 percent of all tea produced in the country, with Kenya being one of the leading tea producing countries in the World.

The major objective of this study is to investigate the various socio-economic factors influencing smallholder tea production in Belgut Division, and to test the significance of these socio-economic factors on smallholder tea growing. Using a farm-systems approach, various analytical tools were applied, especially in investigating the significance of the formulated hypotheses. A stratified random sample of 80 smallholder tea growers was selected from Belgut Division and, Analysis of Variance technique was used to investigate the differences in land allocations to tea production, food crop production and livestock farming among the smallholder tea farmers. The statistical analysis revealed that significant variations existed in land allocated to tea farming, food crops and pasture, resulting in rejection of formulated null hypothesis. Multiple Linear Regression Analysis was applied in trying to relate the variations in cash incomes and expenditures among smallholder tea farmers. The method allowed the researcher to examine the relationship between cash incomes and household and farm expenditures and, further to draw conclusions on sustainability of the tea industry,

relative to such incomes. The results of the Multiple Regression Analysis showed that, among the different expenditures, fertilizers were the most expensive, consuming most of the farmers incomes. Stepwise Multiple Regression Analysis was found useful in selecting most precise variables in predicting tea production among such different factors as age, education, labour, transport and hectarage for tea within the study area. The findings revealed that the relationship between tea production and these variables is significant, (all values of  $R^2 \Rightarrow 0.78$ ), thus prompting the rejection of the formulated null hypothesis.

According to the research findings, problems of land-use competition resulted in lack of labour, low incomes, and food shortages. These socio-economic factors were mainly found on farms less than 0.86 hectares, while larger farms obtained enough incomes from tea and, therefore, could afford to buy food and hire labour whenever there was need. Research findings on incomes and expenditures established that, many smallholder tea farmers spent more money on tea production than the incomes earned. It was established that many farmers obtained incomes which could not cater for all their required farm and household expenditures. Thus, contrary to expectation, at least one third of the farmers growing tea were found to be making losses rather than benefiting from the cash crop. These farmers, therefore, engage in other activities to earn additional income, for example, providing off-farm employment, planting vegetables, and practising dairy farming. The analysis using Stepwise Multiple Regression showed that age, education, labour, transport and hectarage for tea influence smallholder tea farming, with labour and hectarage of tea being the most precise

variables in predicting production, hence tea yields. Other problems facing small-scale tea farming are also discussed in this thesis, in particular, the role played by the Kenya Tea Development Authority (KTDA), the main institution charged with promoting smallholder tea development in Kenya over the last thirty years. It was found out that most smallholder tea growers are very dissatisfied with the operations of the Kenya Tea Development Authority. As a result, the institution was blamed for lack of extension services, low prices, poor tea roads, high fertilizer costs and delayed payment for tea delivered, which influence the success of smallholder tea development.

On the basis of the findings, it is concluded that socio-economic factors are very important in explaining the efficient functioning of smallholder tea farming. Smallholder tea farmers, therefore, do not always benefit sufficiently from such an important crop as tea, due to the high cost of inputs, for example fertilizers, and the unsatisfactory payments made to tea growers at the end of the process. Arising from the study, it is recommended that the Government, through the Kenya Tea Development Authority, should review some of its policies concerning smallholder tea in order to properly address the issues of (a) the tea payments to smallholder farmers, (b) improvement of transport services, (c) introduction of subsidies on fertilizer costs, and; (d) provision of extension services. The study recommends that further research is required to establish the spatial variations of incomes among other farm enterprises to demonstrate the greater profitability of these enterprises as compared to tea.

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## **CHAPTER ONE:**

### **1.0 INTRODUCTION**

#### **1.1 Statement of the research problem**

This is a geographical investigation of smallholder tea production in the new Belgut Division of Kericho District. The District is well known for large-scale plantations of tea which date back from the colonial past, and which are still largely foreign-owned and managed. The District also accounts for an important proportion (over 20 percent) of smallholder tea development in Kenya. A large number of smallholders grow tea as a primary cash crop in combination with maize and sugarcane as additional cash crops. Many of them also keep improved dairy cattle for milk production. Thus in discussing the tea crop, it will have to be seen in the context of "mixed small-scale farming".

Tea growing by smallholders was introduced as a result of deliberate Government policy in Kenya aimed at encouraging cash crops within the small-scale farm sector in the 1950s and early 1960s. This was in response to the Swynnerton Plan of 1954 by the Colonial Government to intensify the development of African Agriculture in Kenya. As the smallholder tea crop was deliberately developed independent of the large-scale tea plantations, its success in all the affected areas in Kenya was initially only made possible by the establishment of the Kenya Tea Development Authority (KTDA). The Kenya Tea Development Authority according to its mandate took care of:

- (a) construction of tea-processing factories,
- (b) collection of leaf from the small-scale farmers,

- (c) establishment and maintenance of "tea roads" throughout the small-scale tea growing areas of Kenya,
- (d) manufacture of tea in its own factories, and;
- (e) marketing of smallholder tea, which was also done independent of large-scale tea.

The study examines the problems experienced by the individual smallholder farmers at the farm level. The major observations are concentrated around the efforts to understand:

- (a) the competition between tea production and other farm enterprises,
- (b) monthly farm incomes;
- (c) changes in price as affecting tea yields over a period of time, and;
- (d) other socio-economic constraints (age, labour, education, and transport) on smallholder tea production.

Due to the significance of gender in agricultural production, a section of the study also discusses the role played by women in smallholding tea production within the study area.

## **1.2 Literature review**

In order to understand the subject of socio-economic factors influencing tea production, there is need to investigate the existing previous studies that have been carried out on tea production and the extent to which some of them have paid attention to these factors. The information is relevant in identifying the gaps that need to be filled by this current study, and hence the justification for this particular work.

The literature review has been organised into two major parts: section one deals with literature concerning Africa, and other parts of the World, where smallholder tea is found.

The second part specifically addresses the studies that have been carried out on Kenya, and the study area in Kericho District, and, hence Belgut. In each grouping, information concerning:

- (a) ecological aspects,
- (b) socio-economic issues and;
- (c) agronomic factors

are dealt with independently. The ecological issues are dealt with first because it is on them that the socio-economic factors impact. After the major contributions are discussed, the relevance of this current research is shown.

As far as Africa is concerned, comparisons have been made with other regions such as Sri-Lanka (former Ceylon), India, and China. The tea plant (*Camellia sinensis*) originated from China and later spread to India and the rest of the world. The tea grown in Kenya initially came from India and Sri-Lanka (Acland, 1971).

Gadd (1934) writing on drought conditions in relation to tea culture observed that in many of the tea growing districts of Ceylon, the major problem was how to rid the soil of excess water. Gadd also noted the severe effects of drought in the eastern side of Ceylon. During the Kericho study most farmers also identified drought as one of the problems affecting tea production. It was established that the impact of drought on tea farming is equally important as an aspect of production, but for the purposes of this thesis, a decision was made to leave it out. This is because it can be shown to affect all smallholder tea

producers and it also does not fall neatly into socio-economic factors.

Dutta and Shama (1967) working on cold weather yields from unpruned tea in India observed that cool seasons at high altitudes are periods of very slow growth for the tea plant. They also indicated that similar low temperatures do not inhibit tea growth in high altitude equatorial regions.

Palmer-Jones (1974) wrote on the economics of tea production and marketing in Malawi. While identifying the problems of tea production, he noted that low production in Kenya, Sri Lanka, South India, and Uganda, is associated with cold temperature, short day lengths and drought. Since the tea industry operates as a system comprising physical, human and biological factors, information on problems cannot be complete without investigating the human and biological factors. As a result, this research has contributed to the knowledge on problems of smallholder farmers through concentrating on the human factors that influence tea production.

Singh, de Vries, Hulley and Young (1977) carried out their study in Malawi and Kenya. Their major concern was the market prices and development lending. One of their findings was that tea could be grown under a wide range of climatic conditions, from Mediterranean to Tropical areas and the nearer the tea area to the equator, the higher the altitude necessary to achieve any given standard of quality. They also noted that rapid expansion of tea production, which is likely to accelerate the decline in International prices, would have more serious adverse effects on some growers than others. In East Africa, the production of tea on smallholdings is likely to remain stable despite the low International prices of recent years. Singh *et al* (1977) did not explain why the production

in smallholdings is likely to remain stable. Such a question can only be answered through an investigation of smallholder production.

Fordham (1970) reporting on factors affecting tea yields in Malawi attempted to explain the annual tea yield distribution in that country. He contended that yield is not necessarily a function of growth rate. He further postulated that plucking itself would bring about uneven crop distribution, and he also pointed out that since shoot elongation is more sensitive to physiological drought than the initiation of primordial buds, buds are produced at more constant rate than pluckable shoots. In Kenya, the Tea Research Foundation has sponsored many studies to establish the agronomic and other factors affecting tea yields both on the large estates and within the smallholder tea-growing sector.

Willat (1970) recorded that, in Malawi, consumptive use of water by mature tea remains constant ( $E_t = 0.856$ ) until a soil moisture deficit of 200 – 250 mm was reached, that is, when 40 percent of the total available moisture in the rooting zone was used. Further, Willat noted that, in spite of the effect of other environmental factors on tea yield for the hot dry season, the low yields in the months of September, October, and November had significant correlation with soil moisture deficits at the beginning of those months. Other effects of micro-relief and micro-climatic variations in smallholder tea production can be obtained in the work of Othieno (1983) as shown later in this literature review.

Hanna (1971) noted that tea is grown in East Africa within the bimodal pattern of rainfall, and that it is a dominant cash crop in the zone of high rainfall, equable temperatures and high humidity. Hanna also found out that, in the Kampala area of Uganda, high solar radiation is partly coincident with the wet seasons, when tea yields are also high. Dry

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seasons are, however, characterised by depressed yields. As tea yields affect a farmer's income which in turn determines the quality of life of the farmer, the present study has attempted to investigate the relationship that exists between tea yields and income since this kind of information was still lacking.

Brown and Cocheme (1969) reporting on the agro-climatology of the highlands of Eastern Africa argued that the continued viability of the tea industry owes much to the "hardiness" of the tea bush. Due to the frequent changes in the human sub-system of the environment, there is need to investigate in greater detail, the factors that are likely to interfere with productivity in this important industry.

On socio-economic issues, Acland (1971) in his book on East African crops recorded that tea was first planted in East Africa in 1900 at Entebbe Uganda. In 1903, small hectarages were also planted in Limuru (Kenya) and Amani (present day Tanzania). Acland further noted that, in 1925, the International tea companies brought large hectarages of land into tea production in the Kericho area of Kenya, and this marked the beginning of tea expansion in the country. By 1945, Kenya had only 6500 hectares (ha) of tea, and this figure had increased to 35000 hectares by 1969. In addition, between 1950s and 1960s, tea had become Kenya's second most valuable export crop, after coffee. Acland observed that smallholder tea was first initiated in Kenya in 1950 when a few hectares were planted in Nyeri division. However, he also noted that Kericho District was more suitable in his view and he observed that the yield and quality of Kenyan tea has been excellent. Acland's work thus provides useful information regarding the origin of smallholder tea production and the importance of Kericho District in tea production in Kenya.

Glaeser (1977) recognised two major crops in East Africa: maize as the most important staple crop, and tea which was, as increasingly becoming important as an export crop. Both maize and small-scale tea are traditionally raised in mixed cultivation. According to Glaeser, the gross margins obtained indicate the relative profitability of smallholder agriculture, since land, and family labour, are considered to be the fixed factor endowments of such farms. No detailed research has been carried out on cash incomes and expenditures of the smallholder tea farmers in the Belgut area of Kericho District as indicated in the objectives of the present study.

At the national level, there is need to provide a brief overview on the introduction of tea in the country, with special focus on the smallholder tea growers. This information is necessary for the better understanding of the smallholder tea industry, and, in that context, the importance of Belgut Division of Kericho District, which is the topic of the present study.

Most of the authors quoted have observed that tea growing in Kenya was as a result of favourable ecological conditions. The best quality tea is grown at high altitudes where extremes of temperatures are less marked and growth is slower. In Kenya most of the tea is found in the wetter districts to the west of Rift Valley and particularly in the Kericho – Sotik and Nandi Hills areas. To the east of Rift Valley, plantation tea is grown in the equally wet area around Limuru near Nairobi where there is acidic soils with a total of between 1250 – 2000 mm of rainfall, well distributed and falling in an average of 200 days a year. Kericho District satisfies the above conditions best compared to other areas, hence

its importance in tea production in Kenya.

The Tea Research Foundation based in Kericho has been responsible for a large number of studies concerning agronomic characteristics of tea production with special attention being paid on the improvement of tea clones used for vegetative propagation. Further, different researchers in Kenya have also tried to address both ecological and socio-economic factors. However, the present literature review has established that many gaps exist in dealing with socio-economic issues as compared to ecological ones. This, as will be stated later, is one of the justifications for the current study.

Maranga (1982) studying water balance in relation to tea yields in the Brooke Bond Liebig Estate in Kericho District of Kenya discussed the role of climate in the production of tea. He identified some agronomic aspects of tea cultivation (soil fertility, age of the tea bush, plucking aspects and pruning cycles) which interact with weather to determine the inter-relationships between tea yield and weather parameters. He reported that solar radiation has positive effect upon growth and about 37 percent of the yields may be attributed to solar radiation. Maranga based his sample on the tea estates rather than smallholder tea farmers as has been done in this research.

Ng'etich (1992) was interested in finding out the response of the tea crop to different environmental conditions. His research used dry matter and harvested yields as the basis for conclusions. Using regression analysis, he showed that the main climatic variables which affect yield were:

- (a) temperature,
- (b) saturation vapour pressure deficit of the air and soil water deficits,

- (c) rainfall,
- (d) evapo-transpiration, and;
- (e) hail.

However, out of his list, temperature and soil moisture were judged as being the most important. In addition, Ng'etich noted that drought in Kericho District has not received adequate attention in many previous studies, yet there has been crop losses ranging from 14 percent to over 20 percent due to mild cases of drought. Ng'etich's research did not cover the effects of the human environment on tea production. The drought of 1997 also needs evaluation in order to ascertain its impacts on tea production that year.

McCulloch, Pereira, Kerfoot and Goodchild (1964) studying the effects of shade trees on tea yields observed that planting of *Grevillea robusta* shade trees throughout tea gardens caused a considerable reduction in yield. The reduction in yield from increasing shade was found to be as great in rows near to the shade trees as in rows most distant from tea. Information on yield is quite relevant in the present research since yield determines the farmer's income.

Arvo (1968) studied the geography of the tea industry in Kenya. The major content of his work was based on the historical development of tea and its climatic and soil requirements. Arvo noted that tea was introduced in Kenya due to the promising World market that existed for the crop at the time. He also noted that competition for land in the already established tea countries outside Africa necessitated a search for suitable tea production areas in less developed areas. In his observations, Kericho and Limuru emerged as having favourable climatic conditions compared to those where tea was grown

in India and Ceylon (Sri Lanka). As a result, more tea was established in Kericho because, compared to Limuru and Kiambu, Kericho at the time had a relatively low population density and there was a sizeable portion of land which was alienated but not fully utilized. Arvo has, therefore, explained why tea was introduced in Kenya and further given the reasons why Kericho District became more important in the development of the tea industry in the country. He pointed out, however, that further research is still needed on transport network-connectivity, and economics of smallholder tea growing areas in Kericho and elsewhere in Kenya.

Stern (1969) helps in explaining the characteristics of small-scale tea farming in the first fifteen years of operation. Making an appraisal of tea production in smallholdings in Kenya, he noted that, among its many functions, the Kenya Tea Development Authority (KTDA) was charged with the following responsibilities:

- (a) supplying planting materials and fertilizers to the farmer on credit terms.
- (b) supervision of cultivation in the field and providing training facilities.
- (c) arranging for inspection, collection and transport of green leaf, and:
- (d) procuring proper arrangements for processing and marketing.

His analysis is useful, and provides a basis for the analysis of Kenya Tea Development Authority's performance. In this context, it will be useful to make a comparison between the Tea Authority when it was initially established, and thirty years later. This is because the smallholder farmers depend entirely on the Kenya Tea Development Authority for almost all their operations in tea production and processing and, therefore, it is important that the parastatal continues to provide all services efficiently for the success of the tea

industry, in general, and smallholder tea development in particular.

One of the early studies of the economics of the tea industry in Kenya was by Etherington (1970). His main concern was, on the basis of farm survey data, to put forward a relevant hypothesis explaining the role played by labour inputs with special reference to labour required for tea plucking on the farms, and for tea delivery to the various buying centres. The areas studied by Etherington in Kenya included Kericho, Kiambu, and Kisii districts. On analysing the weekly fluctuations of labour on the farms, Etherington found out that labour demand was determined by tea output. Four types of family labour were distinguished in that study:

- a) the farmer,
- b) other male adults,
- c) women, and;
- d) children.

Etherington's work was an important contribution to our understanding of the part played by labour in smallholder tea production. The current study will also consider the same issue for Belgut Division, by investigating any changes, which may have occurred with time with respect to labour supply, since labour requirements change with changes in technology and time. However, labour supply is considered to be only one of several variables, among the problems the smallholder farmer has to contend with.

In a later study, Etherington (1973) studying smallholder tea production in Kenya identified the agricultural sector as accounting for the largest share in export proceeds. Etherington noted the importance of the smallholder tea sector in contributing significantly

to agricultural growth in Kenya. This new work by Etherington focussed on an econometric approach to the study of smallholder tea production at the global level without defining a specific micro-scale for reference. The major aim of the new research was to estimate the yield parameters by estimating the parameters of the production function for smallholder tea in Kenya. He recommended that predictions of future output were required for the optimal phasing of road and factory construction, and the phasing of repayment of the International Loans which finance the tea industry, which in turn depends mainly on the level of tea yields actually achieved. The study was completed in 1973, and since then a lot of new developments have occurred and these need a fresh investigation. As a result, Belgut Division of Kericho District has been used in the present study in order to estimate the yields for the year 1997 and the general earnings of the smallholder farmers under new conditions. This information was considered necessary for judging their ability to pay the loans, and still live sustainably.

In a study of small-scale agriculture, Odingo (1973) recorded that, in 1973 the total cropped area in Kericho District covered 51500 hectares. Out of this, 78 percent was accounted by maize, while tea occupied 5.8 percent (3000 ha) only. He further noted that the area under tea rose rapidly between 1955 and 1963. The observed increase continued even after independence in 1963. A major question relevant in this study is to ask: "why this increase?" In order to answer this question, research is, therefore, necessary.

Gyllstrom (1977) while studying the organisation of production as a space modelling mechanism in underdeveloped countries used tea production in Kenya for his case study. He observed that, in 1974, smallholder tea hectarage comprised 34,647 hectares (Ha) or

58.9 percent of the national total for Kenya. This he attributed to continued extension of tea planting in Kericho and other areas after the two World wars. Gyllstrom's work was an important contribution as far as modelling is concerned within the tea industry.

Witucki (1979) working on agricultural development in Kenya since 1967 observed an increase in smallholder tea production in the period between 1967-1974. With the formation of the Kenya Tea Development Authority in 1964, the share of smallholder tea production had risen from 6 percent to 19 percent in 1967, and by 1974, smallholder production was now 59 percent of the total tea produced in the country, with an hectarage of 58,574 hectares. Witucki's research was mainly concerned with the growth of smallholder tea production within the stipulated period. Many changes have occurred in the tea industry since that time. It was on the basis of these observed trends in the industry that Kericho District was selected for a much more detailed analysis. Belgut Division served as an ideal location within Kericho for concentrated fieldwork.

The Kenya Sessional Paper No. 1 of 1986 which marked an important effort by the Government for overall improvement in economic production in the country stated that the farmers must continue to lead the country in economic development for the rest of the century. The policy issues in this paper emphasised the need for:

- (a) the adoption of more productive patterns of land-use,
- (b) price policy changes,
- (c) marketing, and;
- (d) extension services offered by institutions

to increase the farmers' income which can later be re-invested in off-farm activities.

Much research was necessary in agriculture and production patterns were to be diversified in favour of such crops like tea, coffee and vegetables, that produce much higher incomes and generate considerably more employment per hectare than other crops and livestock activities. Further, as far as tea was concerned, apart from the in-filling programme by the Kenya Tea Development Authority on smallholder tea farms, a separate measure was expected to increase average smallholder yields by 1.5 percent a year on existing farms. This measure was to be achieved by expanding the area planted at present by the smallholder farmers. Agriculture was, therefore, meant to:

- a) provide food security for the population,
- b) generate farm family incomes that grow by at least 5 percent a year for the next 15 years,
- c) absorb new farm workers at the rate of over 3 percent a year with rising productivity,
- d) supply export crops sufficient for a 150 percent increase in agricultural export earnings by the year 2000, and;
- e) stimulate growth of productive off-farm activities in the rural areas so that off-farm jobs can grow by at least 3.5 percent to 5.0 percent a year.

Although this Sessional Paper had listed various objectives to be achieved by agriculture, it was important to investigate whether in the field study area was any room left for the envisaged expansion of areas under food crops after the stipulated cash crop expansion. Therefore, this study also attempted to relate the areas under food crops versus those under the tea crop, to find out whether there is much land left for general crop expansion.

Information obtained by the researcher from a brochure by the Tea Board of Kenya indicates that by 1997 planted tea in Kenya now covers 120000 hectares and annual tea production is about 260 million kilograms (Kg) (Tea Board of Kenya, 1998). This brochure further noted that today Kenya is the third largest producer of black tea in the world, after India and Sri-Lanka. Further, tea production is carried out in rural areas, thereby contributing significantly to rural industrialisation and development. The above publication highlights the importance of the tea industry in Kenya, and it was relevant to investigate the part now played by smallholder farmers in the continued expansion of the tea industry in the country. In addition, it was found necessary to investigate the state of food production alongside tea production since Kenya plans to be self sufficient in food production by the year 2000 (National Food Policy Paper of 1981). This would naturally mean the existence of competition for land resources between tea and food crops. There was, therefore, need to investigate the effect of increased food production on tea production in key producing districts.

Osebe (1987) writing on the role of smallholder tea industry in the development of a rural area in Kisii district studied the linkages of the industry to other sectors of the rural economy in terms of creation of income and employment opportunities and other economic and social development activities. He examined the entire smallholder farming as an industry in a global sense, and he did not concentrate on individual households as has been carried out in this research. He did not also address the socio-economic factors affecting the linkages within the industry as suggested by the farmers themselves. This goes to explain why it was decided for the purposes of the present study to put more emphasis on socio-economic problems of smallholder tea growers.

Bülow and Sorenson (1989) observed that rather than neglecting food crop production, tea-growing households tend to neglect tea production whenever they encounter problems of labour shortage in peak seasons. Bülow and Sorenson were reporting on gender dynamics in contract farming. Their major concern was the role of women in smallholder tea production in Kericho District. Their work was intended to be a contribution towards the knowledge on gender and tea production. However, gender is viewed in the present research as only one of the many problems in smallholder tea production. Investigation was carried out to verify some of the ideas put forward by Bülow and Sorenson in respect of competition between the requirements for tea and food crops.

Most of the studies on the quality of tea have largely been carried out by the Tea Research Foundation of Kenya based at Kericho. In so far as they touch on tea yields, and hence individual tea growers incomes, a few of them are cited. But the majority of them are concerned with assessing the quality of planting materials, and are therefore considered to be outside the scope of the present study.

Othieno (1983) Studying the effects of nutrient uptake on the yield of tea found out that shading lowers light intensity, both air and soil temperatures, radiation, wind speed and other micro climatic factors within the shading area. He further noted that microclimate factors also influence one or many of the plant internal growth factors. He concluded that the uptake of nutrients was, therefore, reduced by shading. Nutrient uptake is necessary especially when considering the impact of fertilizers on tea crops.

Owuor and Odhiambo (1993) and (1994) noted that some black tea quality parameters responded to increasing nitrogen fertilizer rates and decreasing plucking frequencies by

increasing the caffeine content of black tea. They recorded that the tasters preferred tea from shorter plucking intervals and low rates of nitrogen application. However, yields increased with increasing rates of nitrogen, but were lowered by long harvesting intervals. Fertilizer application in tea production is a very important exercise, which all farmers must carry out since other forms of manure are not recommended in tea production. Smallholder farmers must spend their meagre income on these expensive fertilizers in order to increase their yields. However, information of the relevance on the increased fertilizer use on monthly incomes was still lacking. Hence the need for this particular study.

In a later study, Owuor (1994) recorded that yields and quality of black tea are known to be affected by the genetic make-up of the plant materials, the climatic condition under which the plant was grown, and the general environmental factors, such as soil conditions. In studying the clonal variations in response of black tea quality parameters to time of the year in Western Kenya highlands, he confirmed that, even with minimal variations in weather, measurable changes in quality are observed. So it is impossible to make tea of consistent quality throughout the year. However, these changes in black tea quality with season are lower closer to the equator. Owuor's work was an important contribution towards knowledge about the physical environmental factors affecting tea production. The results of the work by Tea Research Foundation are made available to all tea growers through extension officers, including the smallholder producers, and these may be reflected in Tea yields, which in turn depend on the effectiveness of extension services.

The above literature review has shown various studies that have been carried out in

Africa, East Africa and Kenya. In the East African region, the studies carried out on the physical factors of tea growing are more numerous compared with those on socio-economic issues. Since some of the physical factors were found useful in explaining the socio-economic factors dealt with in this study, it was necessary that they too be included in some parts of the report. However, the researcher identified a bigger gap to fill on the socio-economic factors as compared to physical factors. These studies carried out on socio-economic factors were done almost a decade ago with no particular emphasis on spatial temporal issues. It is also clear that no similar study has been carried out within the area of study before. Further, most mentioned researchers mentioned dealt with issues at the global level and not at the micro-level as mentioned here. In addition, there is no past research specifying 'by a geographer' that has been carried out on socio-economic factors influencing tea production as indicated in this study. The major reason for the review was to facilitate the choice of areas that needed further study. Through that process this study has attempted to contribute towards the areas discussed hereafter with emphasis on spatial considerations, wherever possible.

An attempt has been made to analyse the general earnings of smallholder farmers. Further, as Kenya is planning to industrialise in the year 2020 (Sessional Paper of 1986), the farmers should be able to raise capital for future investment into other non-agricultural activities. This was also in accordance with Etherington's suggestion that studies should be carried out on general earnings of smallholder farmers to establish their ability to pay for the loans for road and factory construction (Etherington, 1973).

Secondly, the current study has devoted some attention to an evaluation of the

performance of the Kenya Tea Development Authority since its creation in 1964. This was thought necessary because there have been several criticisms that have been levelled at the organisation, leading to its intended liberalisation by the year 2000.

Thirdly, it is clear that no research has attempted to investigate the relationship that exists between price and yield of tea as has been pointed out in this study. This contribution can be of great importance to policy-makers, especially when addressing issues concerning smallholder tea farmers. Other problems dealt with in detail include the effects of age, education, farm size, distance to the buying centre and labour in tea production, both jointly and individually. These are the kind of socio-economic issues which require better understanding to help appreciate the contribution of small-scale tea growers.

The next issue addressed is the relevance of increased fertilizer use, *vis a vis* the monthly incomes. This is because smallholder tea growers depend entirely on chemical fertilizers as other forms of manure are not recommended. The research has attempted to investigate whether increased fertilizer use has actually led to increased yield and, hence income, as most farmers were found to believe during fieldwork.

Lastly, this study has attempted to look at other socio-economic constraints (the effects of age, education, labour, transport and hectareage of planted tea, both jointly and individually) on smallholder farming which has been ignored by most researchers.

Surei (1997) attempted to deal with the above issues, but he did not give possible solutions to those constraints. This current study has tried to give solutions as suggested by the farmers themselves in trying to cope with such difficulties. Necessary amendments can, therefore, be made on the basis of ideas, some of which were obtained from

smallholder tea farmers themselves, and such exchanges truly justified the fieldwork on which, this study is based.

### **1.3 Research objectives**

The objectives of this study are:

- a : To study the competition between tea production and other farm enterprises on smallholder tea farms.
- b : To investigate the existence of a significant relationship between cash incomes from tea production and expenditures within the smallholder tea households.
- c : To establish the effects of labour, education, transport, hectarage of tea and age on smallholder tea production.

### **1.4 Hypotheses**

- a : H<sub>0</sub>: Differences in land allocation to other farm enterprises have no significant effect on smallholder tea production.  
H<sub>1</sub>: Alternative.
- b : H<sub>0</sub>: There is no significant relationship between cash incomes from tea and household expenditures in smallholder tea farming.  
H<sub>1</sub>: Alternative.
- c : H<sub>0</sub>: The effects of labour, education, transport, hectarage of tea and age on smallholder tea production are statistically insignificant.  
H<sub>1</sub>: Alternative.

### **1.5 Justification of the study**

The literature review together with some personal observations and experience provide justification for this study. Since land-use and agricultural systems change temporally and spatially, frequent studies are necessary to provide data which can be used in establishing the trends of such changes, especially when formulating policies which may affect farm output over time. Kenya depends on agriculture as a major source of foreign exchange earnings, hence any developments and constraints that may interfere with the tea industry need investigation.

In addition, the literature review above has shown the need for a further study of the socio-economic factors influencing smallholder tea production. The following issues have made this study relevant: the major cash crops contributing to the success in agricultural earnings in Kenya are tea, coffee, pyrethrum, and more recently, horticultural crops among others. Tea as an industry contributes a great deal to the foreign exchange earned and, therefore, it is important to examine in detail the factors that have contributed to the development of the tea industry. It is equally important to examine the factors affecting smallholder tea production, as the survival of tea will depend on the ability of the Government to promptly address such issues. For this reason, tea as a crop is very topical and smallholder tea is a natural subject for study.

The increasing problem of food security cannot be overlooked since there has been marked increase in population growth and this population depends on finite land for food. For a farmer to grow tea there is, first, the need for him to produce enough food for his

household. Where a household relies on tea only, it is important to investigate whether the income earned can provide for all food requirements sustainably. Further, there is need to know the influence of land-use competition between tea production and food crop production on smallholder tea production.

The three factors of production of land, labour, and capital are very important when determining the economic value of each enterprise. Farmers depend on farming as a source of employment. Tea production has shown an upward trend in foreign exchange earnings. But, has the farmer been able also to record this growth in terms of his earnings? There has not been any research carried out on this issue yet. It is through this study that the success of smallholder cash crop farming to each individual farmer can be judged.

Belgut Division of Kericho District has been chosen for this study because the author is familiar with the area for many years and it was natural to choose it for detailed study. Furthermore, Belgut Division is one of the leading areas for tea production in Kenya with smallholder tea recording a steady growth. In addition, the Division, among other divisions in Kericho District, has larger concentrations of smallholder tea with better accessibility in terms of road network.

### **1.6 Operational definitions**

The following definitions have been considered satisfactory and are adopted for use in this current research:

### **1.6.1 Agriculture and agronomy**

Agriculture is defined as the science of crop cultivation and livestock husbandry, while agronomy is a branch of agricultural economy dealing with the theory and practice of field crop production and soil science (Hurst, 1974; Sykes, 1976; and Obara, 1983).

### **1.6.2 Smallholding**

The term smallholding is defined as a farm ranging between 0.2 and 12 hectares (ha) of land (Kenya, 1983 and 1986). The term also refers to a small-scale farm in this research.

### **1.6.3 Environment**

Environment refers to the external physical, biological and socio-economic conditions influencing the growth and development of crops in an area. The concept defines the totality of immediate external conditions which impinge on the life and development of an organism, a community or an object (Obara, 1988).

### **1.6.4 Food crops and cash crops**

Food crops are crops grown primarily to meet the food needs of the farmer's household, although a small proportion of the produce may be offered for sale; cash crops refer to crops grown mainly for sale, and normally, they constitute a very limited part of the farmer's diet (Akech, 1990).

### **1.6.5 Production**

According to Obara (1983), Production is defined as area multiplied by yield. This definition is adopted in this research and Tea Production (Kg) refers to hectareage under tea (Ha) multiplied by yield (Kg/Ha).

### **1.7 Theoretical framework**

A farm-systems approach based on systems theory is adopted in this research since the study deals with smallholder agriculture involving differences in the socio-economic part of the system. This borrows from Ruthenberg (1980) who noted that the task of agricultural researchers is to concentrate on the analysis of existing crops' systems and their role in farming systems of different areas.

The systems theory assumes that a farm as a system consists of a set of related sub-systems which form a hierarchy of systems (Ruthenberg, 1980). A farm-system approach is useful, especially to Geographers, because it treats the farm household as a major decision-making point in agricultural development. The farm systems approach originated as a methodology developed by Asian cropping systems working group, in collaboration with the International Rice Research Institute (IRRI). It aims at establishing a manageable research process that is particularly suited for small farms, and that treats agricultural research as site-dependent. The method is based on visualising cropping systems as open, reactive systems. The research activities therefore focus on the description and classification of the environment, design of improved cropping systems, farm testing, and on the methods for the formulation of production programmes. In this theoretical

modelling of the system, the farm household unit is considered as a combination of productive and consumptive activities.

The farming system, therefore, addresses itself to each of the farm's enterprises and between the farm and its environment. The information about the farm environment (physical, institutional, social and economic), is employed in a farming system to increase the efficiency with which the farm utilises its resources.

The study of environmental factors as a system of inter-related sub-systems is not unique in this particular study. This can be evidenced in the work of Henshall (1967) who suggested that functional relationships should be best studied in their natural environment. Each individual farmer lives in an environment composed of the physical factors, human factors and biological factors. In the recent past, the systems approach was used by Obara (1983) to study the geographical investigation of the cotton yields in western part of Kenya.

A farm unit is the base for the provision of food for the household together with, goods for personal consumption. It is also the base for production aimed at the market using a cash crop such as tea in the case of Belgut area of Kericho District. Other important purposes for farming are safeguarding the future by the accumulation of wealth leading to special technical, social and economic achievements.

Symons (1968), Duckham and Masefield (1970, Morgan and Munton (1971) and Ruthenberg (1980) noted that, in a farm unit, the system embraces all workers and resources (elements of the system). The elements of the system are under the

management control of one decision-maker, the farmer, the family members working on the farm and the hired labourers who are supplied to the production unit by rural households.

The boundary of the farm unit and its economic environment are defined by purchase or procurement of inputs and disposal of outputs. The farm receives labour from the household and the labour market. It purchases production inputs and obtains capital from the markets and the household may supply capital to the farm and / or to the capital market.

The approach to environment as a set of related sub-systems can also be seen in the work of Laut (1968) who recorded that the forms of agricultural activities in any area of the world are responses to four groups of factors:

- (a) environment,
- (b) tradition,
- (c) economic dictates, and;
- (d) political dictates.

The environmental factors are summed up as the geomorphology, climate, the vegetation, and the soil, which combine to provide the ecological limits within which particular crops are grown. Traditional factors are related to the activities of the people through past ages and may condition acceptance of change in agricultural activities. Economic factors are related to the relative profitability of agricultural activities, while political factors are related to the role played by the government and the people's response, and may condition a change in agricultural activities.

The political factors also include aspects of religious and social organisation, which impinge upon agricultural activities.

Crop ecology, political factors, economic factors and traditional factors are seen to influence agricultural land use positively, while capital investments and education may also influence the way land is used. The above factors change temporally and spatially, hence requiring a continuous research at the farm level.

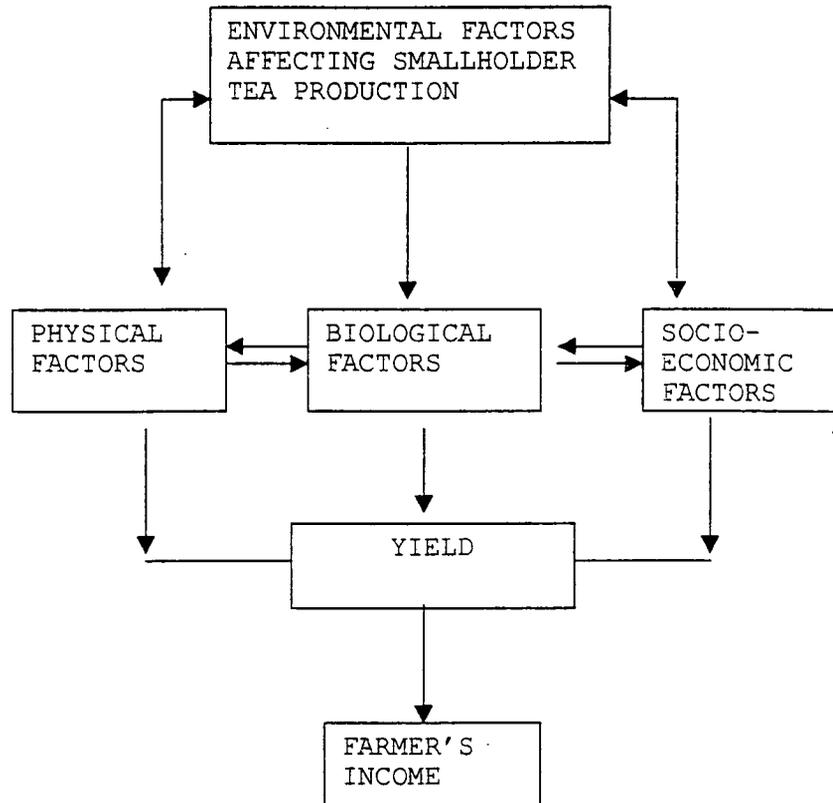
In order to succeed in tea production, a farmer needs inputs like fertilizers, seed, labour, pesticides /herbicides among others. The farmers later depend on the yield to finance the next farming expenses and household financial requirements. Yield should, therefore, be high enough to make the production exercise sustainable.

A farmer who chooses to grow a cash crop like tea alone should be able to make enough money to sustain him and his family in all food and other household needs, and to save enough to enable tea production to continue. Further, food security, as stated in the National Food Policy of 1981, can only be achieved if agricultural enterprises are sufficiently productive to pay for all food requirements within every tea household. This is because maximising food production would result in labour and land resources competition between different food crops and tea, resulting in low tea productivity and, hence, less income for smallholder tea growers.

It is these inter-relationships within the socio-economic environment that are examined in this study. The factors which interact to produce a farming system as a mode of

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production are summarised in a conceptual framework characterised in figure 1.1. In this conceptual framework, each farm is influenced by environmental factors (physical, biological and socio-economic factors). The environmental factors influence the crops, in this case tea, while on the other hand they are inter-related. Their effect is realised in the yield of a particular area.

**Fig. 1.1: CONCEPTUAL FRAMEWORK MODEL**

Source: Adapted from Laut, P. (1968)

The systems approach assumes that the proposed system is biologically suited to an important physical environmental complex of site. Therefore, yields in the pattern should be adequate and biological instability should not occur. However, this is not always the case since there are always continuous ecological changes which affect yield.

Further, the assumptions that the requirement of economic resources can be met and the existence of optimal management is not realistic in this study since most smallholder farmers are not well educated on issues concerning management and this may affect their management capabilities and decisions on resources. Finally, the system may not always satisfy the selected criteria for economic performance. It is these variations within the system that show the need for further research as is carried out in this study.

### **1.8 Scope and limitations of the study**

The socio-economic factors dealt with are:

- (a) the state of mixed farming,
- (b) cash incomes within the smallholder tea production,
- (c) temporal price changes,
- (d) age,
- (e) education, and;
- (f) transport.

The treatment of marketing is also limited to the prices offered to farmers and the Kenya Tea Development Authority or Middlemen. The problems of international markets and

other processes involved in tea marketing are considered beyond the scope of this study.

In addition, when addressing the problems of price changes, the period after independence was preferred since that was the period when African land development matured.

Other areas not attempted in the field by the researcher included soil testing, and detailed climatic investigations which are mainly concerned with the ecological factors of the environment, and which were considered to be beyond the scope of the study since the Tea Research Foundation has carried out many studies relating to these factors. It is, however, important to note that, if any of the above problems are mentioned by the farmer, the researcher also discusses them briefly and further studies are later recommended in those areas due to existing inter-relationships and inter-dependence of the environmental factors.

The issues left out may be quite relevant and important, but for the purposes of this study only the areas chosen for concentration are dealt with. The study is also limited to the administrative boundaries of the current Belgut Division of Kericho District.

## **CHAPTER TWO**

### **2.0 BACKGROUND TO THE STUDY AREA**

This chapter contains a brief geographical characterization of the study area, and includes an analysis of the physical and socio-economic environments. The information concerning location and extent is given as well as a summary of the development of tea industry in Kenya. In the case of smallholder tea production, the socio-economic aspects are of great importance since the physical factors are the same for all smallholder tea producers.

Socio-economic, physical and biological factors are inter-dependent and are inter-related within an existing ecosystem. Hence the choice of the systems approach as the theoretical framework in chapter one of the study. The physical environment consists of information related to topography and climate and the resulting agro-ecological zones within the study area, while biological factors refer to soil factors. The socio-economic background comprises of land-use, population characteristics, land-tenure, and organizations dealing with tea.

The analysis attempts to portray these inter-relationships and to show how they impact upon tea production in the study area. The historical perspectives are important in understanding the growth of the tea industry over the years and the factors, which favoured that development.

#### **2.1 Location and extent**

Belgut Division, which is the study area, is located in Kericho District of Rift-Valley

Province of Kenya as shown in figure 2.1.

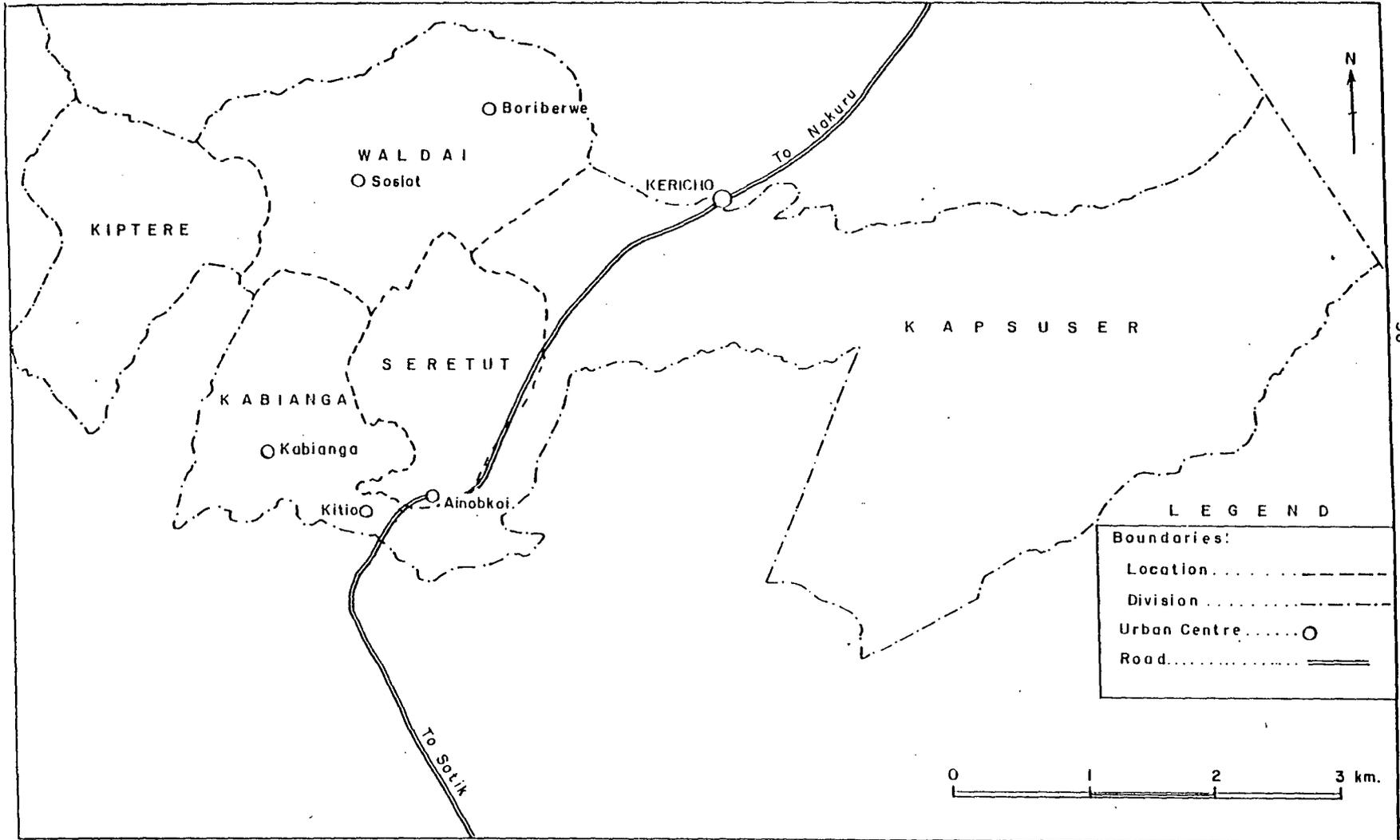
The area lies between longitudes  $35^{\circ}$  and  $35^{\circ}15'$  E and between latitude  $0^{\circ}25'$  and the Equator. Belgut Division occupies an area of 660.0 square kilometres and is bordered by Ainamoi Division to the north, Buret Division to the south, Kericho town-ship to the east and Kisumu District, Nyamira District and Kisii District to the west. It is important to note that Kericho District where the study area is located has faced continuous changes in its boundaries to the extent that, even during the fieldwork, more changes were taking place.

As a result, the researcher is restricted to the administrative boundaries during the period when the research was carried out as described in the location and extent.

There are five administrative locations in Belgut Division, namely: Waldai, Kiptere, Kapsuser, Kabianga and Seretut as indicated in figure 2.2. Within this study area, the sampling was limited to the areas with altitude not less than 1500m above sea level, where tea is grown.



Fig. 2.2: ADMINISTRATIVE BOUNDARIES OF BELGUT DIVISION



## **2.2 Biological environment**

According to the Jaetzold and Schmidt (1983) and District Development plan of Kericho (1996), the soils are mainly clay and loam. The soils on mountains, high-level structural plains and volcanic foot-ridges are well drained, shallow to very deep, dark reddish brown, friable, humic, rocky, and clay loams. The soils on piedmont plains, lacustrine plains, bottom lands, and flood plains are imperfectly drained, very deep, cracking, gravelly clay to clay, with calcarous deep sub-soils. These soils are variable in terms of their fertility, varying from moderately low to high fertility. Tea production is found in well-drained soils (volcanic foot-ridges) which are acidic in nature, with pH below 5.6, within the study area, and which are not susceptible to water logging.

On the mountains, the soils which are covered with mountain forest have an unstable fertility, while on the hills and minor scarps humic-top-soils with low fertility exist. The associated foot-slopes have variable fertility levels, but because of the associated high annual rainfall totals (1500 – 1800 mm), they are often covered by forest or high grass savanna where they have been disturbed by human settlement. The forest zones have contributed in a large extent towards tea development, especially considering the fact that most tea areas were initially forested lands.

Figure 2.3 shows the different types of soils in Belgut Division where the study is based. The following paragraphs also give a summary of the development of these soil types, as this is important in the understanding of the textural and structural properties of these soil groups.

The soils on mountains and major scarps were developed from major volcanic lava flows, chiefly Tertiary Phonolites and younger volcanics such as trachytes and aggregates, including recent volcanic ash, and tuffs (referred to as Cambisols). The minor scarps according to Jaetzold and Schmidt (1983) are characterised by soils developed on intermediate igneous rocks (Phaeozems and Lithosols). The plateaus and high level structural plains consist of soils developed on intermediate igneous rocks (Ferralsols), while on the plateaus and upland transitions, there are soils developed on other pyroclastic rocks from recent volcanic activity (Andosols)(Binge, (1962), Jaetzold *et al* (1983).

The soils on volcanic foot-ridges are those developed on tertiary basic igneous rocks (basalts, nepheline phonolites, including basic tuffs). The soils are an association of Humic Nitosols and Humic Cambisols. On the foot-slopes are found soils developed on colluvium from volcanic ashes and other pyroclastic rocks of recent volcanoes (Ando - Luvic Phaeozems).

The piedmont plains have soils developed on alluvium from undifferentiated basement system rocks (Verto-Entric Planosols). The upper level uplands have soils developed on acid igneous rocks (rhyolites) with volcanic ash admixture (Ando-Luvic Phaeozems). The upper middle-level uplands are characterised by soils developed on tertiary or older basic igneous rocks (basalts, nepheline phonolites, basic tuffs, among others) (Humic Nitosols).

On the lower middle-level uplands are soils developed on volcanic ash and other pyroclastic rocks from recent volcanic activity (Mollic Andosols), while those on the lower level are soils developed on basic igneous rocks (basalt)(Chromo-Luvic Phaeozems

with Gleyic Luvisols). The upland plain transitional lands have soils developed on basic igneous rocks with volcanic ash admixture (Entic Planosols and Chromic Vertisols).

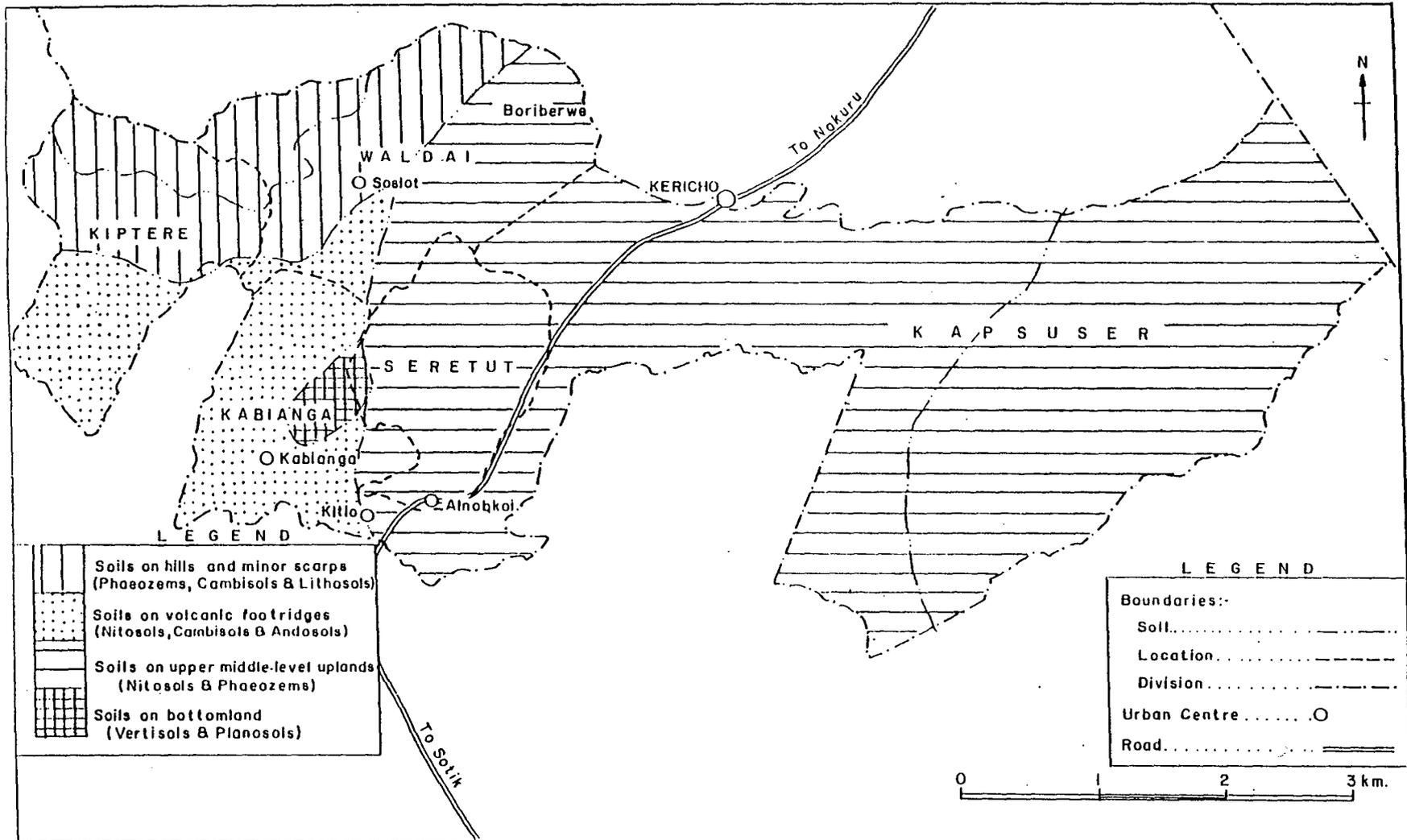
The non-dissected erosional plains are those developed on granites with volcanic ash admixture (Entic Planosols). The soils on the lacustrine plains are soils developed on sediments from lacustrine mudstones. The bottomlands have soils originating from undifferentiated volcanic rocks (Chromic and Pellic Vertisols, Saline Sodic phase). Finally, the soils on the floodplains are formed from sediments from various sources (recent floodplains) (Humic Gleysols).

### **2.3 Physical environment**

Belgut Division of Kericho District comprises the highlands and volcanic lava plateau west of the Great Rift Valley in Kenya, and falls within the high potential lands generally associated with the high rainfall districts of the Kenya Highlands. Jaetzold and Schmidt (1983) have written a lot on the physical and socio-economic characteristics of different parts of Kenya, including the study area.

As far as topography is concerned, Belgut Division which ranges in altitude from below 1400m to about 2350m is dominated by undulating to rolling topography with a flatter terrain in the south. The land slopes to the west, hence the drainage is in the same direction. Intermediate and basic volcanic rocks (phonolites) underlie most of the area, while undifferentiated basement system rocks (mainly granites) outcrop in the south. Tea is grown in the altitudes of 1500m and above which are volcanic and which possess the environmental conditions favouring tea production. Such areas are the main focus in this

Fig.2.3: SOIL MAP OF BELGUT DIVISION



study.

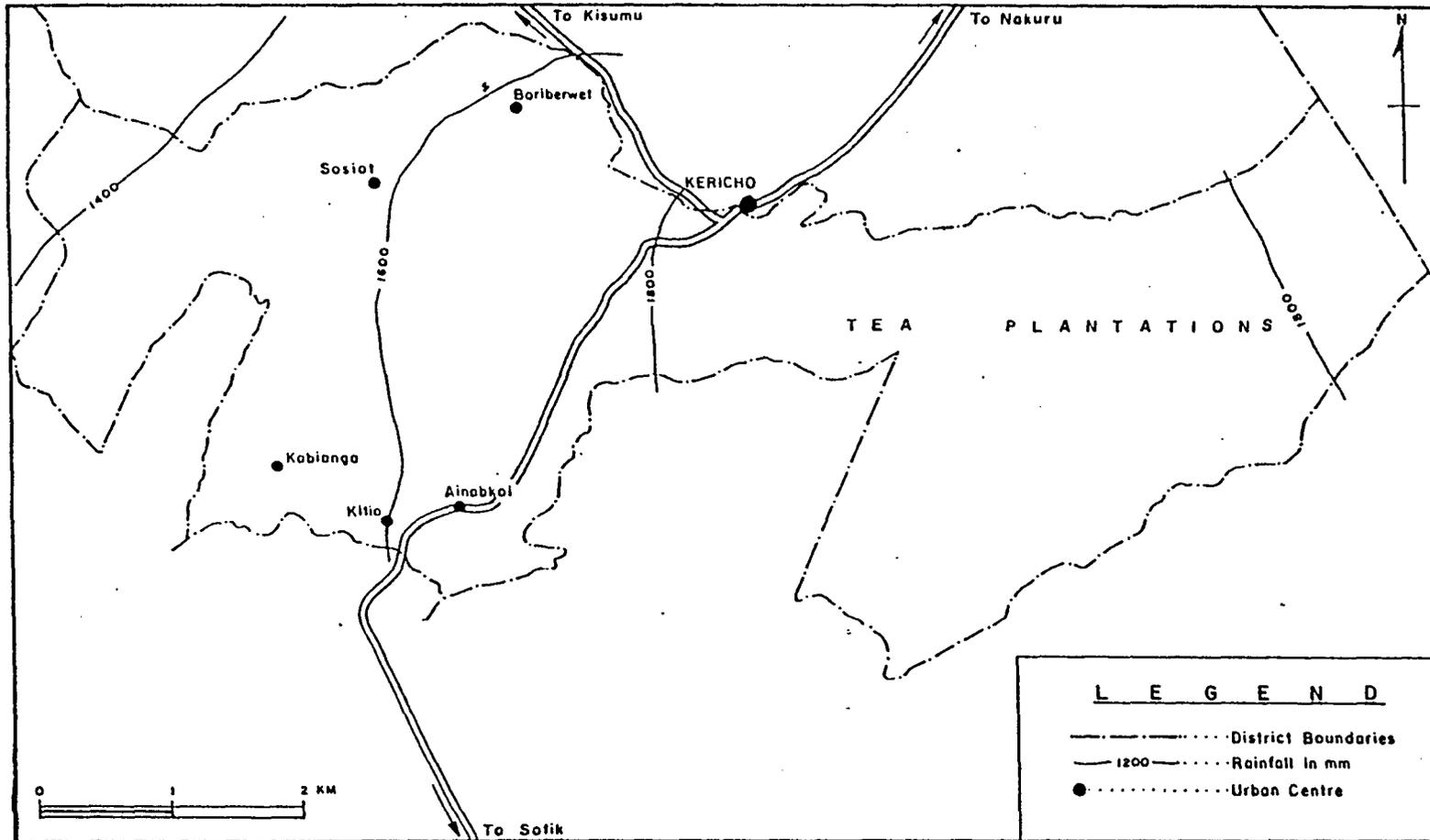
The study area receives high rainfall (more than 1400mm) as an annual average (see figure 2.4), except for the Nyando and Sondu valleys, the bordering Kano Plains and the southern part of Belgut, which are relatively dry with less than 1300mm average rainfall per annum. Lack of rainfall or low rainfall areas is as a result of rain shadow. The rainfall is well distributed except for the dry season, in January and February as indicated in figure 2.5 and table 2.1, and as was identified by most farmers during the field research. Figure 2.5 also shows the reliability of expected rainfall for the first rainfall period (February to July) and for the second rainfall period (July to February).

**Table 2.1 Monthly rainfall and temperature during the period 1991-1992 in the study area**

Month	Long-term Monthly mean	1991		1992	
Jan	173.1	207.1	17.6	26.9	18.5
Feb	110.6	87.0	18.3	110.2	18.6
March	177.7	189.4	18.1	149.5	19.4
April	195.5	124.5	17.8	220.2	18.1
May	254.7	382.5	17.0	211.6	17.3
June	126.1	206.6	17.8	14.0	17.5
July	165.3	117.2	16.5	190.5	16.4
Aug	223.3	198.4	17.1	230.5	17.0
Sept	156.9	169.4	17.0	3.0	18.2
Oct	153.2	227.3	16.9	15.0	17.1
Nov	119.5	91.4	16.9	5.0	16.9
Dec	36.1	71.0	17.0	8.0	17.4
TOTAL		2027.7		1189.4	

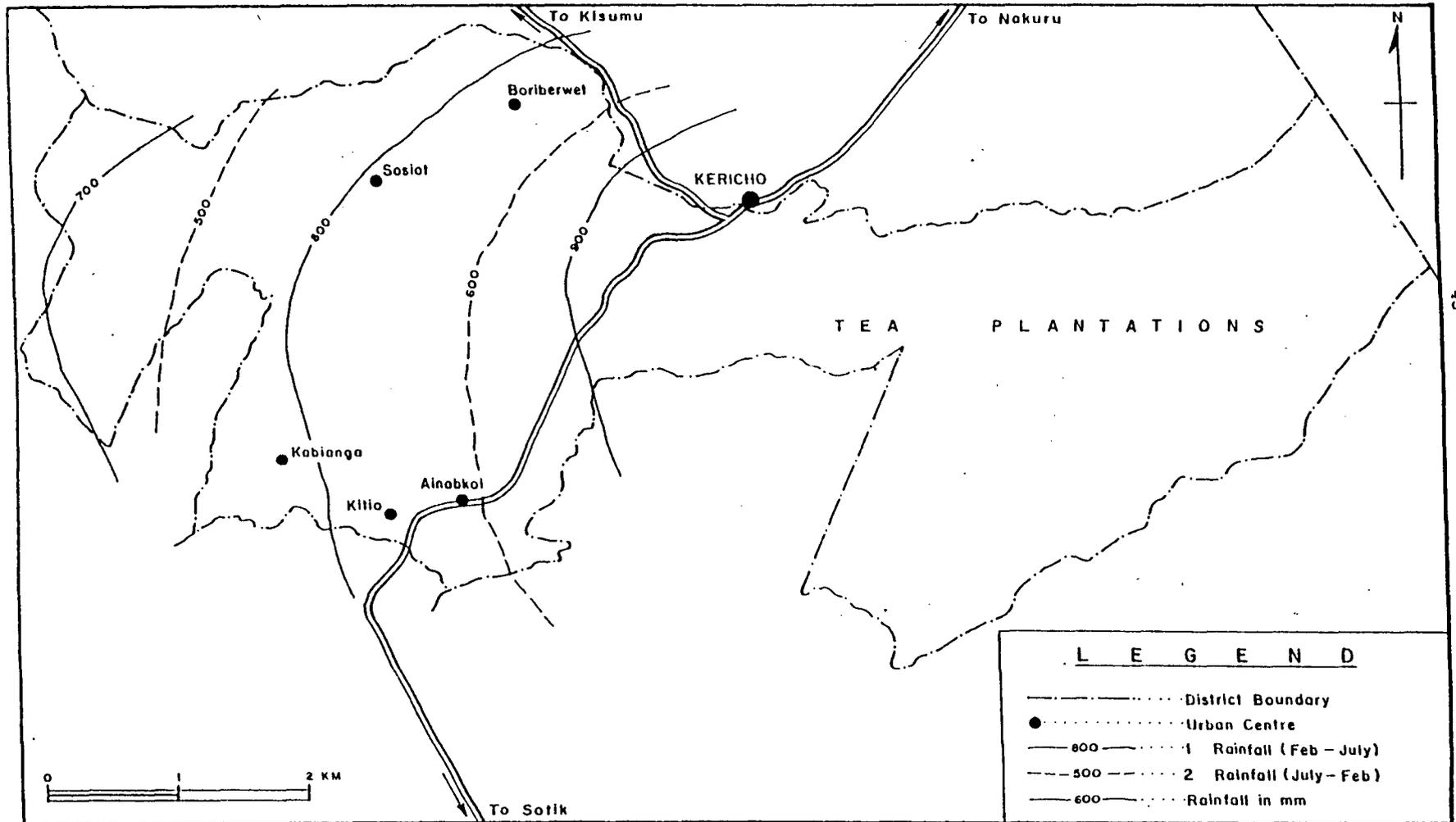
Source: Adapted from Kericho District Development Plan (1994-1996)

Fig.2.4 : MEAN ANNUAL RAINFALL MAP OF BELGUT DIVISION



Source : Adopted from Ralph Jaetzold and Helmut Schmidt (1983)

Fig. 2.5 : RAINFALL RELIABILITY MAP OF BELGUT DIVISION



Source: Adopted from Balah, Jaatzold and Helmut Schmidt (1987)

The amount of rainfall in each area closely influences the agro-ecological zones of the same region. The region is characterised by high evaporation, which may lead to water stress during the dry season, hence affecting the productivity. Much tea is grown in areas receiving an annual average rainfall of between 1400mm to 1800mm as indicated in the table of agro-ecological zones (table 2.2). Areas receiving low rainfall as in the western parts of the study area are unsuitable for tea growing.

Area UM3 is characterised by dry seasons, while in the south there is a problem of low temperatures caused by cold nights. There is also a weak rainy season in the UM4 (see figure 2.5) with soils susceptible to water logging. The UM5 has annual average rainfall of below 1,000mm.

According to Jaetzold and Schmidt (1983), the agro-ecological zones can be divided into four major categories with different sub-groups as follows:

- a) the Upper Highland Zones (UH) which can be divided into three sub-zones,
- b) the Lower Highland Zones (LH) grouped into four sub-zones,
- c) the Upper Midland Zones (UM) existing in five sub-zones, and;
- d) small portions of the Lower Midland Zones (LM).

The UH1 consist of very wet and steep slopes hence forestry emerges as the best land-use.

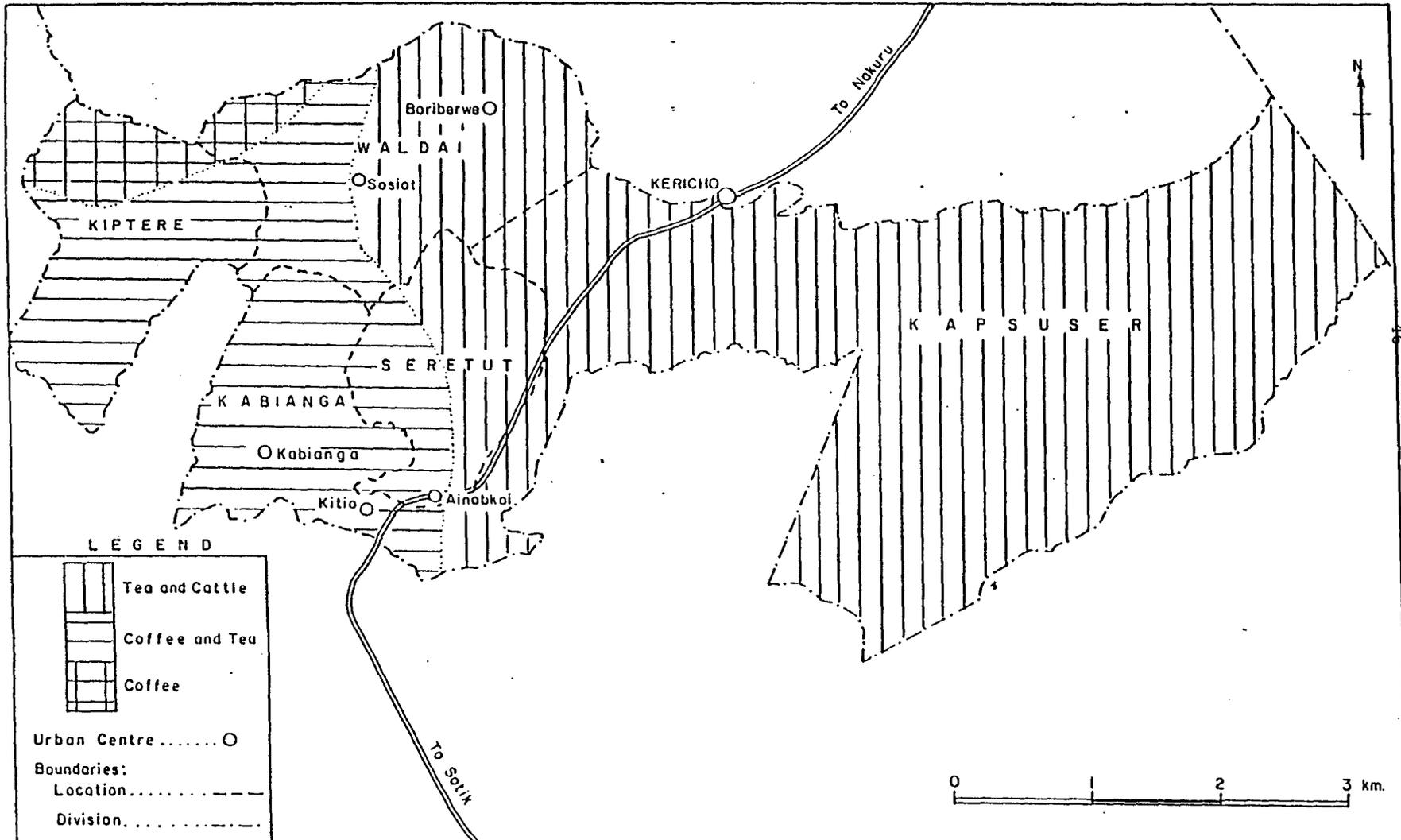
The zone has a long cropping season and intermediate rains, divisible into two variable cropping seasons. Some areas have good yield potential while other areas are mainly used for pasture and forage. Major crops grown are oats, peas, potatoes, strawberry and pyrethrum. The UH2 is a wheat/ pyrethrum zone. The region has a very long cropping season and intermediate rains, marked by variable cropping seasons. The yield potential

is similar to the UH1. Additional crops grown are kales, carrots and cabbage. The long rains start in March while the short rains start during the period of June-July. This is the zone that is always used for expansion of tea.

The LH1 is very wet in terms of rainfall and very steep in terms of morphology. Forestry is the best land-use. LH1 (the Tea -Dairy zone) has permanent cropping possibilities divisible in two variable cropping seasons (see figure 2.6). The yield potential is greater than 80 percent of the optimum as, opposed to 60 percent of the optimum of UH1. The yield, therefore, ranges from very good, to fair yield potential. The major crops are: peas, cabbage, carrots, spinach, maize, kales, cauliflower, beetroot, celery, lettuce, finger millet, beans, peas, sweet potatoes and passion fruit. This study examines the influence of these various crops on tea production as they compete for the finite land resources.

The wheat - maize pyrethrum zone is found in LH2. The area has a very long cropping season and intermediate rains divisible into two variable cropping seasons. The yield potential ranges from good, to fairly good with pasture and forage. Major crops grown in this area are wheat, potatoes, sunflower, peas, beans, carrots, kales, cauliflower, beetroot, spinach, celery, lettuce, artichokes, finger millet, tomatoes, onions, tea, pyrethrum, strawberry and passion fruit. The crops are divided between the two seasons. The area receives less rainfall and therefore is unsuitable for tea production.

Fig. 2.6: AGRO-ECOLOGICAL ZONES IN BELGUT DIVISION OF KERICHO DISTRICT



Source: Adapted from Ralph Jaetzold and Helmut Schmidt (1966)

The wheat/maize-barley zone (LH3) is characterised by a very long to long cropping season and intermediate rains divisible into two cropping seasons. The yield potential varies from good to fairly good. Crops are wheat, barley, peas, sunflower, cabbage, carrots, linseed, potatoes, kales, cauliflower, beetroot and tomatoes. The area also receives low rainfall amounts as the wheat/maize zone and, therefore, is unsuitable for tea production.

The UM1 is the tea-coffee zone (see figure 2.6). It has permanent cropping possibilities with two to three cropping seasons. Yield potential ranges from very good to good to fairly good with possibility for pasture and forage. The yield potential is about 80 percent of the optimum. Crops grown include: wheat, barley, peas, beans, linseed, sunflower, cabbage, carrots, rape seed, potatoes, kales, tomatoes, bananas, yams, pawpaws, avocado, loquats, sorghum and Arabica coffee. The UM2 is the coffee zone with a very long cropping season and intermediate rains, marked by two variable cropping seasons. The area has a very good yield potential of 70-80 percent of the optimum with other areas having good to fair potentials. The crops in this part of the study area are: maize, cabbage, kales finger millet, beans, sweet potatoes, sunflower, soya beans, onions, spinach, tomatoes, macadamia nuts, passion fruit, avocado, mountain pawpaws, bananas, guavas, wheat and barley, peas, English and sweet potatoes, Arabica coffee, yams and pineapples. Although UM2 is a tea-coffee zone, none of the farmers interviewed had coffee.

The UM3 is a marginal coffee zone or coffee-maize zone with a medium to long cropping season and intermediate rains marked by two variable cropping seasons. Major maize

hybrid- seed grown here are H612 and H511-12. The sunflower/maize zone (UM4) is an area with a medium cropping season and intermediate rains followed by a fully (weak) short cropping season. The yield potential is as the UM3. The UM5 is a livestock/sorghum zone with a very small potential. The Lower Midland zones are the marginal sugarcane zones. The area has a long to medium cropping season followed by a (weak) medium to short one. Major crops are sorghum, finger millet, beans, peas, groundnuts, soya beans, tomatoes, onions, green grams, sunflower, cassava, pawpaws, bananas, yams and beans. Other crops are cotton, sugarcane, pineapples, sisal, citrus, mangoes (though endangered by fungus diseases). The above agro-ecological zones are summarised in the table 2.2.

#### **2.4 Socio-economic environment**

As listed earlier, socio-economic issues are very important, especially when discussing the geographical characteristics of the study area. More important is the fact that it is these variables that greatly influence smallholder tea production since the physical factors are similar for all smallholder tea growing areas. They are the real effects of human intervention. This section, therefore, deals with the issues of land-use, population characteristics, land-tenure, tea organisations, and agronomic factors influencing tea production followed by chapter summary.

A large area of the study area can be categorised as high potential. There are also large areas where large-scale farming is practised. Since the colonial period in Kenya, the study area has remained one of the most important plantation and smallholder tea-growing area in Kenya.

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**Table 2.2 Major Agro-Ecological Zones in Kericho District**

Agro-ecological zone	Altitude (m)	Annual mean temperature (0°C)	Annual average rainfall (mm)
UH1-Sheep-Dairy zone	2350-2800	15.7-13.0	1300-1750
UH2-Pyrethrum-wheat zone	2350-2600	15.7-14.2	1100-1300
LH0-Forest zone	2100-2300	17.2-16.0	1800-1950
LH1-Tea-Dairy zone	1850-2350	18.7-15.7	1400-1800
LH2-Wheat/ maize Pyrethrum zone	1900-2350	18.4-15.7	1200-1500
LH3-Wheat/Maize Barley zone	1900-2350	18.4-15.7	1100-1300
UM1-Coffee-Tea zone	1800-1900	19.0-18.4	1400-1650
UM2-Coffee zone	1650-1950	19.9-18.1	1150-1500
UM3-Marginal Coffee zone	1550-2000	20.5-17.8	1200-1350 1150-1300
UM4-Sunflower maize zone	1650-1950	19.9-18.1	1000-1200

Source: Adopted from Jaetzold and Schmidt (1983)

By 1983, 13,000 hectares of tea producing approximately 10,000 Kg of green leaf per hectare, and roughly 10,000 ha of coffee yielding 250 Kg of clean coffee per hectare, were

cultivated in large enterprises in Kericho District where the study area occupies the largest portion. Tea was by far the most important cash crop. Smallholder farms cultivated 8,200 ha of tea, yielding about 2,400 Kg of green leaf per hectare (Jaetzold, 1983; Odingo 1985).

Odingo (1985) observed that even by 1985, the tea estates were still as intact as they were during the colonial period and that they continued to make a very important contribution to the country's export production. During the field study, it was clear that there had been changes in land-use as will be shown in chapter four.

It is noted that the current Belgut Division of Kericho District was just a location during the 1989 census. The locations then were Kiptere, Soin, Waldai, Kapsaos, Chaik, Ainamoi, and Kericho municipality with populations 46,676; 21,162; 48,556; 15,947; 31,604; 30,006 and 48,669 respectively. During the study period, the locations of Belgut Division with their respective populations were as follows: Kiptere (16,258); Waldai (18,937); Kabianga (11,241); Seretut (10, 557) and Kapsuser (10,906) using the same statistics. These statistics are summarised in table 2.3.

Population density by division is indicated in table 2.4. This table shows that Belgut Division has the largest area in square kilometres. However, not all the areas are suitable for tea, especially those bordering Kisumu District and South Nyanza Districts due to differences in altitude and mean annual rainfall as has been discussed earlier in the table of agro-ecological zones.

**Table 2.3 Population by sex in the study area**

Location	No. of Males	No. of Females	Totals
KIPTERE	7,949	8,309	16,258
WALDAI	9,349	9,588	18,937
SERETUT	5,329	5,228	10,557
KABIANGA	5,663	5,598	11,261
KAPSUSER	5,801	5,105	10,906
TOTAL	34,091	33,828	67,919

Source: 1989 Kenya Population Census

**Table 2.4 Population density by division**

Division	Area (sq.km)	1979	1993	1996
Buret	312.5	501	699	763
Londiani	523	58	81	88
Kipkelion	321.5	59	83	90
Belgut	660	121	169	185
Fort-Ternan	158	244	340	371
Ainamoi	540	184	256	280
TOTAL	2,515	168	235	256

Source: Kericho District Development Plan 1994-1996.

Considering population density by location in 1989, Kapsuser had the highest number of people. The high population density in Kapsuser location is explained by the fact that the

area has a very high concentration of large-scale farms which demand outside labour. Most of these people are, therefore, immigrants from the neighbouring districts whose main aim is to provide labour on tea farms as a source of income. Table 2.5 helps to illustrate this. Waldai location is the second in terms of population density.

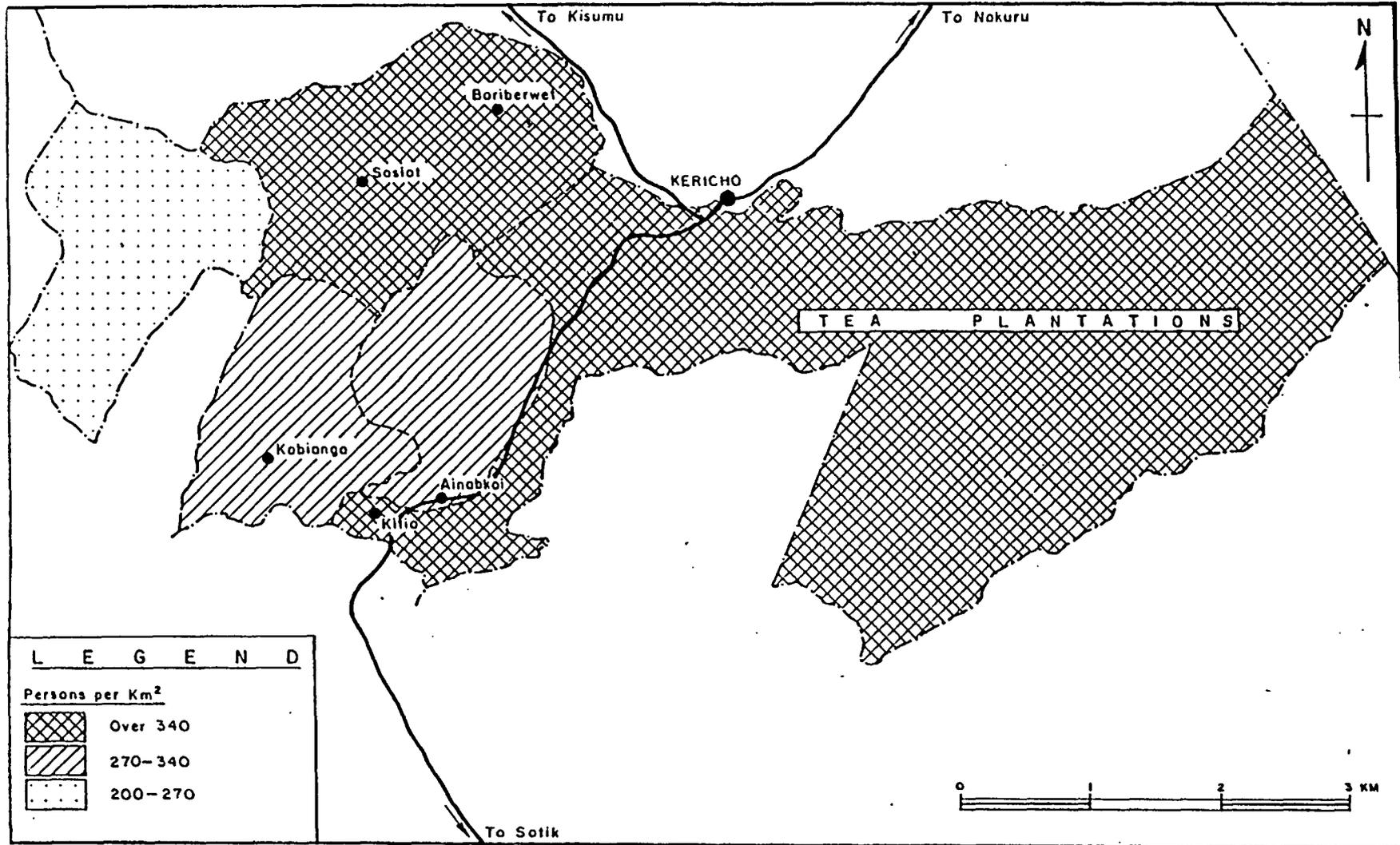
Figure 2.7 also shows the variations in population density using the data from 1989 census. During the fieldwork, it was noted that Waldai location had a greater number of smallholder tea farmers. More farmers were, therefore, interviewed in the region compared to other locations.

**Table 2.5 Population densities by location**

Location	Area (sq.Km)	Density
KIPTERE	62	262
WALDAI	55	344
SERETUT	37	285
KABIANGA	39	288
KAPSUSER	31	352

Source: Kenya Population Census 1989

Fig. 2. 7 : POPULATION DENSITY IN BELGUT DIVISION , 1989 .



Source : Adopted from Ralph Jaetzold and Helmut Schmidt (1983)

The District Development Plan (1996) available data does not indicate the number of health facilities, educational facilities, banking facilities, produce boards and status of roads in the study area, except for the existence of an electric grid. However, the Plan shows that average income ranges from Ksh. 400 to 3,500 per month, with agricultural sector having about Ksh. 430. Mortality rate was 42/1000 in 1992.

Land-tenure is also an important part of socio-economic background as it affects ownership, and use of each piece of land. Initially, African land in the area was communally owned. The most unsatisfactory feature of tenure under customary law was fragmentation. This came about owing to two factors: the practice of shifting cultivation and the system of inheritance whereby upon a man's death, his land was divided amongst the heirs (Blundell, 1962).

According to Odingo (1985), the evolution of land-tenure systems in Kenya can be divided into four phases as follows:

- a) the pre-colonial and early colonial phase when the African traditional systems were in full operation,
- b) the colonial period during which the impact of European settlement after land alienation started putting pressure on the traditional systems,
- c) the pre-independence period during which the colonial Government decided to introduce western concepts of land tenure involving the individualisation of tenure in the small-scale farm areas, and;
- d) the independence and post-independence phase which has been the consolidation of individualisation of tenure and the emergence of a significant

number of landless people.

During the pre-colonial phase, the majority of the systems were communal with the land being owned by various communities, though worked by different farm families. The evolution of land tenure systems during the colonial period arose from the fact that the limited good agricultural land in Kenya was all alienated to European settlement. The forced sedenterization thus introduced premature pressures on the land and made the communal systems unsuitable for the new circumstances.

The colonial period was marked by alien systems of land-tenure which were also introduced in Kenya, in particular the concepts of freehold and leasehold systems, which were directly borrowed from the English system. Land fragmentation set in and as the pressure increased, land deterioration began to be felt, thus creating a landless group of people.

The pre-independence era was characterised by the introduction of the Swynnerton Plan of 1954. It was a plan to intensify the development of African Agriculture. The plan was meant to:

- a) develop African agriculture on sound ecological lines,
- b) consolidate lands in the medium- and high-potential areas,
- c) introduce cash crops under scientific supervision,
- d) introduce improved livestock and mixed farming in all suitable areas,
- e) irrigate, reclaim swamps, or control floods in suitable areas, to extend agricultural land,
- f) manage livestock and improve pastoral areas,

- g) develop crops in difficult areas such as on coast, and;
- h) eradicate tsetse fly and reclaim the land.

The main outcome was the pushing of the concepts of individual land titles through the stages of land adjudication, consolidation (where necessary), and registration. As a result, individual land-tenure system (freehold) was created and the titles could be used to secure development loans from banks and lending institutions. The process of land registration went on even after independence period with the people then demanding the services rather than being forced due to the benefits realised by the Swynnerton Plan.

The landless community brought pressure on the Government in the 1960s and, therefore, land reform processes began (resettlement programmes). Apart from giving access of land to the landless group, there was also the need to re-distribute the land to give access to land to the African population on a more equitable basis. The result was three types of farms in the areas formally occupied by Europeans:

- a) smallholdings on settlement schemes,
- b) African owned large-scale farms (transferred intact), and;
- c) Co-operative farms.

Several districts in the highlands of Kenya were affected: Kericho, Kitale, Kisii, Nakuru, Nyandarua, Nyeri, and Laikipia. As far as Kericho is concerned, large-scale European settlement were established at Sotik and Chepsir. At Chepsir, about 2,000 hectares was sold and broken into some 35 medium size farms (Yeoman scheme) (Odingo, 1985). In all the farms tea, maize and dairy produce have taken the dominant agricultural enterprises yielding satisfactory incomes for the farming population, both in the settlement schemes

as well as in the small-scale farming sector. The importance of land-tenure in this study is to stress the fact that through the processes of land consolidation, adjudication and registration, Africans acquired ownership of land and, therefore, could grow cash crops like tea. One major disadvantage of this process is that there was no limit indicated upon which no further sub-divisions could be made. As a result, very small farms, uneconomical to tea production, emerged as will be discussed later in chapter four. All the same, it is important to mention the fact that, in Belgut Division, the average land holding per family is still relatively large (greater than 2 hectares) though sub-divisions are increasingly becoming common, thus reducing the land holding.

In discussing socio-economic background, it is also important to highlight the role played by different organisations that deal with tea. Such bodies include: Tea Board of Kenya (TBK), Kenya Tea Development Authority (KTDA), the Nyayo Tea Zones Development Corporation (NTZDC), Kenya Tea Growers Association (KTGA), and East African Tea Trade Association (EATTA). Among these bodies, the Kenya Tea Development Authority is the most important in terms of smallholder tea development. The Tea Board of Kenya through the Tea Research Foundation of Kenya benefits both the smallholder and large-scale tea plantations through research in both tea clones and fertilizers, among others. All other organisations are related to Kenya Tea Development Authority or Tea Board of Kenya in one way or another.

The Tea Board of Kenya is a body under the Ministry of Agriculture, charged with overall function of regulating the tea industry. The board licences the tea growing, manufacturing, and exports. The board also carries out research on tea through its

technical arm, the Tea Research Foundation of Kenya. The Tea Board of Kenya also gives advice to the Government on all policy matters relating to tea. The board is composed of members from the Government, Kenya Tea Development Authority, Nyayo Tea Zones Development Corporation and East Africa Tea Trade Association.

The Tea Growers Handbook of 1986 has shown that the Tea Board of Kenya through the Tea Research Foundation of Kenya assists Kenyan tea farmers in carrying out research. The Tea Research Foundation of Kenya is based in Kericho and carries out research on diseases, pests, improving planting material, husbandry, yields and quality. The officers also advise farmers on the best clone selection to suit the various ecological zones. These functions are explained further hereafter.

The research programmes at the Tea Research Foundation of Kenya are done through the Tea Advisory Board. The research programmes cover general problems confronting the Kenyan producers. The Tea Research Foundation of Kenya holds technical visits to most tea producers as well as carrying out sample soil analysis at a fee for pH test and soil analysis test. In addition, the Foundation carries out research on leaf analysis. The Foundation also operates a service on the tea plant nutritional and fertilizer use problems based on analysis of mature leaves. It is recommended that in order to diagnose the cause of a low yielding area, all fields must be tested once in a pruning cycle, preferably just before planting. All growers interested in this analysis send the uppermost mature leaf only, unless otherwise stated.

Further, the Foundation tests and calibrates simple instruments, such as pH meters and tea moisture meters used by the tea industry. Apart from giving advice on the purchase of

instruments and associated apparatus, the organisation analyses purchased fertilizers for growers wishing to verify their nutrient contents with that given by manufacturers.

The Tea Research Foundation of Kenya manufactures samples of green leaf and clones. The clones are released as soon as they have shown, in trial plots, to be superior to commercially available seedlings in both yield and crop quality characters. The release of the clones is restricted to 200 cuttings per clone per buyer per year. The fresh cuttings are released to purchasers who can plant the cuttings within 24 hours of removal from the mother bushes, and callused cuttings released to purchasers who will plant the cuttings more than 24 hours after removal from the mother bushes.

The Kenya Tea Development Authority (KTDA) is another important body dealing with tea production. In addition, the organisation is the most important as far as the smallholder farmers are concerned. The tea Authority is a corporation formed in 1964 and it spreads in all tea growing areas. Apart from receiving payment from the Kenya Tea Development Authority on monthly basis, the smallholders also receive total proceeds from their tea sales less transportation, processing, handling and marketing costs. There is also a scheme between the Authority and out-growers in tea production as identified by Bülow and Sorenson (1989). They noted that the study area is one of the most important tea-growing areas in the country. The system of out-grower schemes is a contracting system. The smallholders supply produce (green leaf) while the Tea Authority (parastatal) retains responsibility for technical assistance and marketing. While the Kenya Tea Development Authority is under the Government of Kenya, it relies on foreign agencies, this is to say the International Bank for Reconstruction and Development

(IBRD) and Commonwealth Development Corporation (CDC), for funding. The foreign agencies help in:

- a) technical inputs like fertilizer and machinery for transport,
- b) financial support for the construction of tea factories, and;
- c) International tea buying agents who buy tea directly or through auction in Mombasa and London.

While the smallholder farmers can own shares in the factory, the Kenya Tea Development Authority board presides over:

- a) tea committee representing the growers
- b) extension service,
- c) leaf inspection, and;
- d) factory operations.

The Authority's board includes members from Kenya Government, external financing sources and members from Kenya Tea Development Authority. This makes management difficult. The smallholders own the land and rely on family labour to grow the crop. The leaf officers control the quality of tea delivered at the buying centres through sorting to remove leaf considered to be of poor quality.

After sorting, the green leaf is weighed and then transported to the various manufacturing factories by lorry. The manufactured tea is transported to the auctions in Mombasa and London. A fixed percentage of all tea processed in the country goes to the Kenyan Tea Packers Company Limited (KETEPA).

KETEPA is charged with the responsibility for blending, packaging, and marketing of tea nationally. The tea Authority has shares and runs KETEPA. The growers are given a first payment at the end of each month and after the end of the year a second payment (bonus). It is evident from the above that the Kenya Tea Development Authority has contract over smallholder tea production. As a result, there has been conflicts between farmers and the officers of the Authority, leading to the formation of other competitive organisations, such as the Kenya Small-scale Tea Growers Association, Kenya Union of small-scale Tea Owners and 'Mang'ritu' as discussed in chapter four. Further, the mode of operation of the Kenya Tea Development Authority clearly supports the systems approach which, was adopted in this research.

The Nyayo Tea Zone Development Corporation is a state corporation established in 1985. The organisation was charged with responsibilities of managing Government tea projects around forest zones. Nyayo Tea Zone Development Corporation is spread in all tea growing Districts. The project creates a buffer zone between the settlement areas and the Government forests to avoid forest destruction. It is recorded that the organisation offers employment opportunities and generates foreign exchange from tea exports. However, none of these farms were sampled during the fieldwork, as they did not fit well within the sample frame.

The East African Tea Trade Association brings together tea producers, brokers and buyers of tea in East Africa. Its objective is to promote the best interest of tea trade and to collect and circulate statistical information as may be of assistance to members in the conduct of their business. Those wishing to trade in tea must take membership with the

Association.

The above bodies are very important in understanding the processes involved in tea production, marketing and processing.

There are certain agronomic factors influencing tea production. Their understanding is useful in analysing the labour requirements in smallholder tea production. The tea garden sites must be sheltered from the prevailing wind and must be on sunny exposure. The soil should be fertile and two meters deep or more and have a pH of no more than 6.0. The area should be cleared of all weeds, especially couch grass before the seed bearers are planted. In Kenya, a spacing of 6 meters is adopted (Eden (1976) and Tea Growers Handbook (1986)).

When planting, holes of one meter in diameter and one meter deep are dug and the excavated soil then replaced in the holes. Single, double and triple super phosphate fertilizer is mixed with soil before spreading it round the tea plant. Planting is done when the soil is damp rather than wet, and on a cloudy weather.

The economically important part of the tea bush consists of the terminal tender shoot, made of the succulent stem and one to three leaves and a bud which protrude above the plucking table or surface. The objective of plucking is to provide the factory with leaf suitable for processing. There are different types of plucking: fine, coarse, light, and hard. These can be combined to produce fine and light, fine and hard, coarse and light and coarse and hard. Light plucking ensures that adequate depth of maintenance foliage is present on the bush. Too light plucking raises the plucking table. In hard plucking, the shoots are plucked right to the previous plucking level so that the foliage can hardly

develop. It has been established in the Kenya highlands that a normal leaf on a pluckable shoot takes 8 to 9 days to expand fully from the growing bud. Good quality tea cannot be manufactured unless the plucked leaf arrives in the factory in perfect condition. Bruised leaf starts to ferment immediately so that it is recommended that leaf is plucked into baskets with adequate size so that it does not have to be compressed.

Under normal plucking, the table rises gradually with time at the rate of about 20cm annually. After 3 to 4 years from pruning, the table reaches an unmanageable height (120-150 cm) and plucking is considered cumbersome, leading to reduction in plucker productivity. At this stage, the bushes are pruned. The Kenya Tea Development Authority keeps records for smallholder farmers on the daily basis and hence records for a whole month.

As far as the fertilizers are concerned, experience in Kenya has shown that it is not generally safe to expect the soil to provide sufficient nutrients for more than a short period to support high yields of tea. Lack of nutrient supplements may lead to uneconomic yields. The only way of adding these nutrients is by adding fertilizers since organic manures cannot play appreciable part in tea production. Fertilizers in current use in tea in Kenya contain all or almost all of their phosphorous in a water-soluble form. Other types of fertilizers are nitrogenous fertilizers, phosphorous and potassium. Different fertilizers are used at different stages of growth of the tea plant. Organic materials, especially the mulches, are known to have certain effects on soil condition. The Tea Research Foundation of Kenya does not recommend that a fertilizer programme should be influenced by the use of organic materials.

Tea is also prone to diseases, pests, weed and other abnormalities, which must be controlled. For example *Armillaria mellea* (armillaria root rot) is known to be endemic in Kenya. The researches done by the Tea Foundation try to address all problems related to pests and diseases.

## **2.5 Historical development**

The historical perspectives are necessary in understanding the factors that led to the creation and growth of the tea industry not only in the study area, but also in other areas of Kenya.

Stern (1969), Odingo (1971) and (1973), Gyllstrom (1977) and Ghai and Radwan (1983) recorded that tea was first planted in Kenya in 1903. There is, however, considerable variation on the exact dates when tea was introduced. Studies by Odingo (1971) and (1973) showed that from 1925 – 1933 tea production expanded rapidly and by 1933 there were already 4300 ha in Kericho, 454 ha – Limuru, 40 ha – Nandi and 80 ha – out of the main area. During this period, Africans only provided labour and were prohibited from growing tea. Between 1933 – 1947, the International Tea Restriction Scheme brought expansion to a halt. Expansion resumed after removing those restrictions. Plantations in Kericho were introduced in 1954 and by 1973, 50 percent of total plantation tea was found in Kericho.

The introduction of smallholder tea development in Kenya would not have been possible without well-structured Government support in the early stages of the development of the

industry as a response to the Swynnerton Plan of 1954. This came in the form of the establishment of appropriate infrastructure in the suitable areas, assistance with procuring of planting materials, land preparation, and with the establishment of the Kenya Tea Development Authority (KTDA). The organisation was supposed to oversee some of these issues, as well as establishing factories to process tea produced by the smallholder farmers. The Kenya Tea Development Authority was formed in 1964 and it has been the subject of many comments and analysis by various authors writing about smallholder tea production in Kenya.

Further, the farmers interviewed during the research gave many different reasons as to why tea was planted. The farmers who planted their tea in 1950s noted that agricultural officers advised them at that time to plant tea. This can be linked to the implementation of the Swynnerton Plan of 1954. Other farmers planted tea because they wanted to increase their monthly income, and be self employed, while others just planted because they saw others planting.

It was in the recent years that farmers with a certain level of education gave the following reasons: while some wanted an insurance for the future which their children could inherit, others wanted to be able to pay school fees and increase their family income. Further, apart from just stopping to provide labour in the tea estates and becoming self employed, other farmers had no reasons at all for planting their tea. About 34.5 percent of the farmers wanted to increase their monthly income, 4.6 percent wanted to be self employed, 2.3 percent were told to plant by extension officers, and 1.1 percent gave other reasons. The present tea farmers have therefore recognised the influence of tea as an economical

crop and not just as a way of life.

Within the study area, 6.8 percent of the tea was planted in 1950s, 7.6 percent in 1960s, 27.0 percent in 1970s, 44.6 percent in 1980s, and 20.8 percent in 1990s. The above data show tremendous increases in the smallholder tea hectares, with most development on smallholder tea hectares taking place during the 1980s (see Appendix 2 for more details).

## **2.6 Summary**

The above chapter has highlighted different environmental factors affecting smallholder tea production and the relevance of the theoretical framework adopted in the study. As far as the physical environmental factors are concerned, geology, topography, climate, and vegetation of the study area have been discussed while the biological factors (soil factors) dealt with soil types and their formation. Although these factors influence the environmental conditions within which tea is grown, they are not investigated and are assumed to be uniform within the smallholder tea sector.

The socio-economic factors of infrastructure, population and land-tenure are of great importance in this research since their absence in an area can greatly hinder the development of tea. For example, tea requires good accessibility, and as well as good infrastructure. Both of these will determine profit margins of a farmer. The relevance of the organisations dealing with tea can be seen in controlling production, processing and marketing of tea in the country. Farmers, therefore, depend on them greatly for the above

services. It is these socio-economic factors that are of particular importance to this study since they vary greatly among the smallholder tea growers. A brief history of the tea industry is also given to help in understanding how the industry has grown over the years.

## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

The importance of statistical techniques in data acquisition, analysis and presentation has been emphasised by many authors in different statistical literature. Though techniques are not an end in themselves, they have served well as a means of achieving quality and lack of bias in analysis. The choice of different methods of data acquisition and processing is normally determined by the nature of data collected and the hypotheses to be tested. In this particular study, an attempt has been made to select those techniques which bring out the best in the data collected.

There are three objectives, which were listed earlier in chapter one which this research aims to achieve. The relevant null hypotheses have also been formulated for testing. Their rejection would lead to acceptance of alternative hypotheses. Chapter three, therefore, deals with data acquisition techniques, data analysis and presentation. Both qualitative and quantitative methods of data analysis have been used. The chapter begins by showing the sources of both primary and secondary data and the means of acquiring them. Later, different analytical techniques are given with their respective advantages and disadvantages, including the reasons for their choice and use in this thesis.

#### **3.1 Sources of primary data**

Primary data was obtained from the field by using questionnaires and interviews, general observations and recording. Among those who have used questionnaires, Gregor (1970) suggested that they be used as a supplement to sampled studies. Both structured and

unstructured questionnaires were applied. The structured questionnaires were made open-ended to ensure that no relevant information was left out. Informal interviews were conducted with the Kenya Tea Development Authority, District Agricultural staff and extension officers of Kericho and the staff of the Tea Board of Kenya in Nairobi, Tea Research Foundation at Kericho and the farmers, to ascertain that no vital relevant information was omitted in this study.

The questionnaires were used to collect data for both qualitative and quantitative analyses. The enumerator filled the questionnaire in order to aid the understanding of the questions and ensure accuracy.

The major limitation to the use of questionnaires is the continuous recording of information from the unstructured interviews. Other problems are language barriers and demand for literate and well trained research assistants when need be. Problems of language barriers were overcome by using Kiswahili which most people understood, and where the interviewee could not understand Kiswahili, a suitable interpreter was asked to translate. The questions were kept at a minimum to reduce the amount of recording.

In this study, the primary data required were those relating to crop hectares, which could be used to investigate the distribution and allocation of land parcels in a household to cash crops and food crops. Other types of primary data acquired through using questionnaires were those relating to household incomes, education, age, transport and labour among other socio-economic parameters. The questionnaire used for the sample farms is given as Appendix 1 at the end of this thesis.

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### **3.2 Sources of secondary data**

Secondary data were obtained from different libraries. These libraries were: the University libraries, the Ministry of Agriculture library, the Tea Research Foundation, Tegat Factory, the Tea Board of Kenya, and the Kenya Tea Development Authority offices both in Nairobi and Kericho. Other additional sources of secondary data include topographical maps, aerial photographs, and satellite imagery. A major concern was literature regarding the previous studies that had been done in the area of study, and the relevant methods of data analysis and presentation.

The data on changes in price over time were obtained from the Tea Board of Kenya, the regulatory organisation responsible for keeping all data on tea in the country. Different types of maps and aerial photographs were also used to provide information on the location of the study area, and agro-ecological conditions that could be expected in such areas.

The secondary data obtained on prices was global and did not specifically address the study area. Due to lack of any other data, the information was used, taking into account the fact that prices of tea do not vary significantly in the country. A major limitation pointed out in the data was that other factors which affect tea delivery to the Kenya Tea Development Authority buying centres were not considered. Such issues include considering the effect of middlemen and failure of means of transport, leading to tea wastage.

Secondary data that were acquired in this research were the physical and socio-economic

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characteristics of Belgut Division, temporal price changes of tea, and different types of maps, satellite imagery, and aerial photographs which provided information on geographical location of the study area.

### **3.3 Sampling frame and Sampling design**

The study area was stratified according to the locational administrative boundaries. In stratified sampling, individuals were first divided into groups or categories and then independent samples were selected within each group or stratum. A disproportional stratified sampling is employed due to the variation in smallholdings of tea from one location to the other. Major access routes were, therefore, used in choosing the first sample in each location.

After stratification, a simple random sampling technique was adopted. The technique assumes that each individual has equal chance of being selected and all combinations are equally probable. The technique has been used by Obara (1976) to study the environmental problems of smallholder sugarcane production. In order to avoid the tendency of being biased, printed papers of numbers (1 to 9) were picked so as to choose the next farmer to be interviewed. For example, if 3 was picked then the third farmer from the previous one is selected. Should one farmer be picked twice, the next immediate farmer is interviewed to avoid repetitions. A table of random numbers was not used because the tea farms are scattered and this meant that the researcher would be forced to cover long distances between the sample farms. The large differences found in the table of random numbers could have made the research very cumbersome. Since simple

random sampling is always associated with some bias, a sampling frame as indicated later is specified and decisions made by picking the numbers.

During the fieldwork, the records from the Kenya Tea Development Authority offices revealed that there were 12,505 growers in Belgut Division with 11,132 delivering their tea to Togat Factory. The figure 11,132 was taken as the population represented by the sample size in this study since all farmers interviewed were delivering their tea to Togat Factory. The difference between these two figures is due to the fact that some tea had not matured for plucking. A purposive sample of 80 smallholders was selected and this was thought to be representative of the whole group of smallholder tea growers with a proportion of 100/13915. This information is illustrated in figure 3.1, which shows the distribution of the sample farms in the study area. In this figure, there is variation in the concentration of smallholder tea relative to the locations with Kiptere having the lowest number. The smallholder tea household farms were interviewed to obtain information on the status of mixed farming, labour supply, capital generation, education, age, and temporal price changes. Information on yield in 1997 was also included. This was useful in illustrating the spatial differences on yield within the study area.

A sample size of 80 was considered adequate, especially after considering the time available for this research and the financial constraints the researcher faced. In addition, depending on the method of analysis, a sample size lying between 30 to 100 may be large enough to assume normalcy when other statistical conditions are observed. It is important to point out that Kiptere area is marginal for tea, hence the small number of farms studied in that area. In each of the locations, the sampling proportions in each area represented

the populations as follows: Waldai - 5,983; Kapsuser - 2,922; Kabianga – 835; Kiptere – 557, and Seretut – 835.

The researcher carried out a pilot survey in order to test the questionnaires before proper research was done. A modification was made on the questions which could not be easily understood by farmers and those which the farmers were reluctant to answer. This was done to improve the accuracy of the results while saving time in administering the questionnaires. An intensive fieldwork lasted a period of three months.

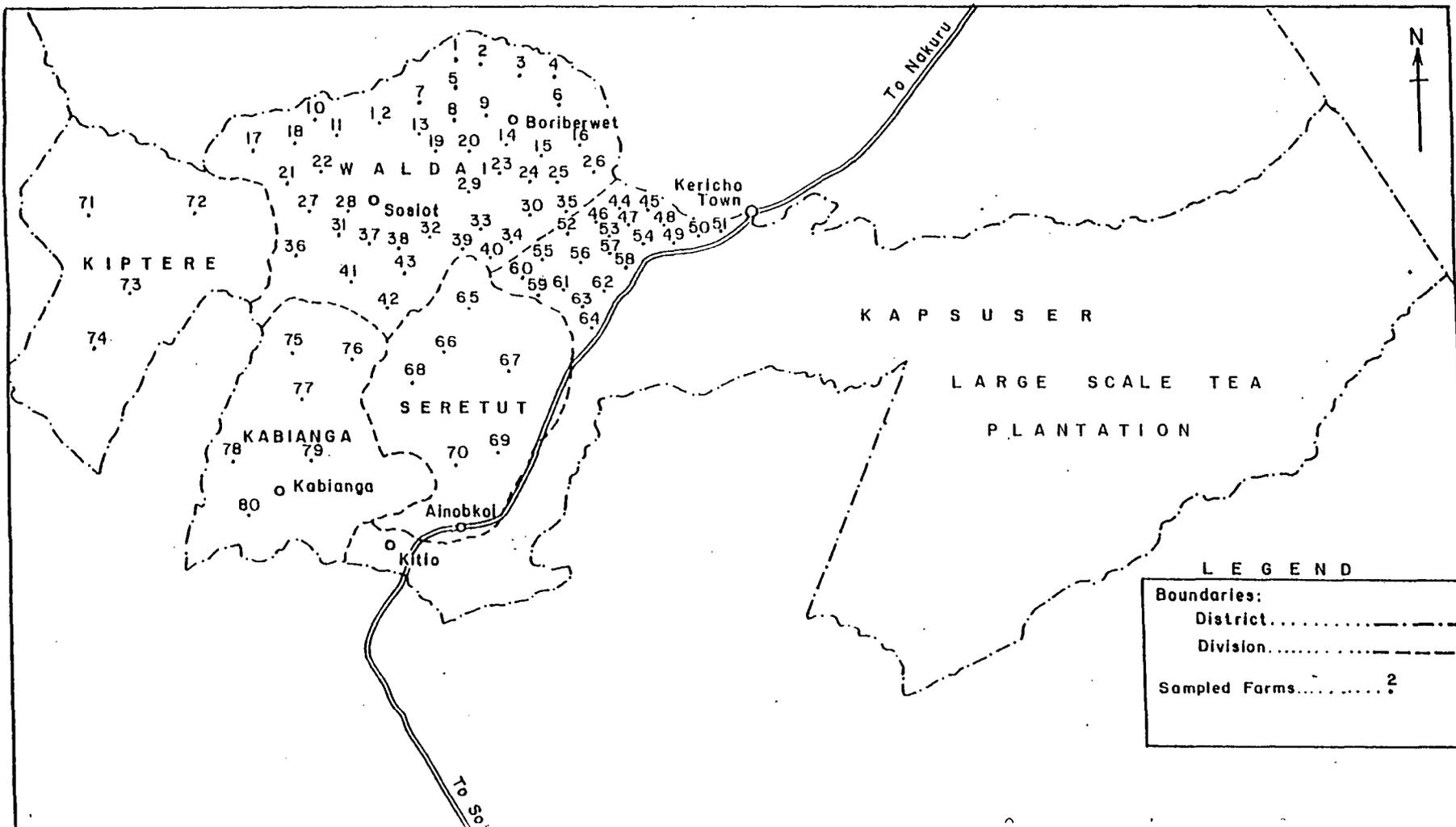
### **3.4 Analytical techniques**

Different analytical techniques have been used: Analysis of Variance test, Multiple Regression Analysis, and Stepwise Multiple Regression. The issues concerning the choice, limitations, and success of the above methods are discussed below.

#### **3.4.1 Analysis of Variance (ANOVA)**

Many studies have used Analysis of Variance tests. For example, Cruickshank and Armstrong (1970) applied Analysis of Variance technique in determining the amount of difference among average values recorded on soil properties. Blalock (1979) also noted that the advantage of analysis of variance is that a single test may be used in the place of many.

Fig. 3.1 : SAMPLED FARMS IN THE STUDY AREA



Analysis of variance is useful in situations where we have more than two samples. It is a relationship between a nominal scale of three or more classes and a metric scale. Although it is viewed as an extension of the difference of means test, it is also possible to view it as a model in which the variance in the metric variable is related to, or explained by, the categories of the nominal scaled variable. For purposes of this work, one – way analysis of variance has been used.

The following assumptions are, therefore, made: The sample means of categories should only differ due to sampling error and the distribution of these differences should be normal. If the population means are actually different, the sample means will differ by more than expected by the normal distribution. The null hypothesis tested is that there is no difference in the population that underlies the samples being analysed, and if it is incorrect, the variation will be due to the differences between the samples rather than the differences within the sample themselves. The method requires independent random samples, normal population distributions and equal standard deviations. According to the model, the total sum of squares (SST) equals to within class sum of squares (SSW) plus between class sum of squares (SSB).

The Analysis of Variance technique was used to analyse the state of mixed farming in the area of study. The analysis enabled the researcher to identify different combinations of farming enterprises. Discussions are based upon the sustainability of food crop production within this high potential area. There are three categories in this report: hectareage for food crops, hectareage for tea and hectareage for pasture. Comparisons are made of the size of land allocated to the food crops and pasture in each sample unit.

However, the assumption that the means of the categories and distribution of errors should be normal is a limitation. But the Analysis of Variance method is a better technique compared to difference of means test. Chi-squared distribution could not be used because, apart from having more than two categories, the data did not satisfy all the assumptions prompting the use of Chi-squared.

### **3.4.2 Multiple Regression Analysis**

Multiple Regression Analysis is an extension of simple Linear Regression Analysis (SLRA) where more than one independent variable is used against a single dependent variable. According to Johnston (1978), Blalock (1979), and Clark and Hosking (1986), regression analysis attempts to predict the value of one variable from the other. Shan and Wheeler (1985) have described the technique as a useful method in measuring multivariate relationships since geographical problems involve complex interacting variables. Large sets of observations can therefore be summarised by only a few parameters. Etherington (1966) used the method estimated by least squares to analyse labour using time spent on farm and non-farm activities. Similarly, Palmer-Jones (1974) has also used Multiple Regression Analysis to analyse the economics of the tea industry.

A similar approach was adopted in this research to test the ability of smallholder farmers to raise capital for future investment into other non-agricultural activities in accordance with the Sessional Paper No.1 of 1986. The independent variables are total cost of inputs (pesticides, fertilizer, labour and seed), and cost of household expenditures (education, food, loan payment, medical services, and other social activities).

It should be noted that there are many ways of carrying out Multiple Regression Analysis, for example, the Enter method and Stepwise method. In this study both methods are used.

The Multiple Regression Model, is expressed as:

$$E(Y_j) = \alpha + \sum(\beta_i X_{ij}) + \epsilon_i$$

where,

$E(Y_j)$  = Expected value (E) of Y at the  $j^{\text{th}}$  position,

$\alpha, \beta_i$  = Population parameters,

$\Sigma$  = Summation sign,

$X_i$  = Independent variable  $\forall i = 1, 2, \dots, k$ , and;

$\epsilon_j$  = Error term at the  $j^{\text{th}}$  position.

The above model is estimated by the equation:

$$Y_j \text{ (estimated value of Y at } j^{\text{th}} \text{ point)} = a + \sum(b_i X_{ij}) + e_j.$$

The model assumes that the dependent variable  $Y$  is a function of  $k$  independent variables ( $X_{1j} \dots X_{kj}$ ) in a population. It is further assumed that for each set of values for the  $k$  independent variables  $x_{1j}, x_{2j}, \dots, x_{kj}$  there is a distribution of  $Y_j$  values such that the mean of the distribution is on the surface represented by the equation:

$$\Sigma(Y_j) = \alpha + \beta_1 X_{1j} + \beta_2 X_{2j} + \dots + \beta_k X_{kj},$$

where,

$\alpha, \beta_1, \dots, \beta_k$  are population parameters,

$\beta_k$  is the  $k^{\text{th}}$  partial slope coefficient of the relationship between independent variable  $x_k$  and the dependent variable  $Y$ , all other independent variables constant.  $\alpha$  is the intercept.

Each individual observation of  $Y_i$  is assumed to be determined by an equation containing the error term and the relationship between  $x_i$  and  $E(Y)$  is assumed to be linear while the effects of  $k$  independent variables are additive. The error term may be conceived as representing the effects on  $Y$  of variables not exclusively included in the equation, and it could be a residual random element in the independent variable. Other assumptions are made in order to carry out statistical analysis such as: all variables being measured at interval scale without error, and for each  $X_i$  and  $e_j$ ,  $E(e_j) = 0$ ,  $\text{Var}(e_j) = \sigma^2$ ,  $\text{Cov}(e_j, e_h) = 0$ ,  $\text{Cov}(X_i, e_j) = 0$ , and  $e_j \sim \text{Nor}(0, \sigma^2)$ .

The goodness of fit is assessed by the coefficient of determination ( $R^2$ ).  $R^2$  varies between 0 and 1 ( $0 \leq R^2 \leq 1$ ). Due to the limitation of  $R^2$  an adjusted  $R^2$  is used in this research represented by the equation:

Adjusted  $R^2$  ( $A.R^2$ ) =  $(R^2 - (k/n-1))((n-1)/(n-k-1))$  and;

the null hypothesis tested is that:

$\beta_1 = \beta_2 = \dots = \beta_k = 0$  ( $\beta_i = 0$ ). F – test is used where:

$F = (R^2/k)/((1-R^2)/(n-k-1))$  with  $k$  degrees of freedom in the numerator and  $n-k-1$  degrees of freedom in the denominator. If computed  $F$  is greater than critical  $F$ , then the null hypothesis is rejected or if calculated  $F$  is greater than significant  $F$  then the null hypothesis is rejected. But when computed  $F$  is less than critical  $F$ , then there is not enough evidence to reject the null hypothesis.

Multiple Regression Analysis has limitations of multicollinearity, heteroscedacity and

autocorrelation. Multicollinearity exists when the independent variables are linearly dependent or when they act together with another variable (not included in data) to cause an effect on the dependent variable being measured. Its existence is known by examining the matrix of bivariate correlations in order to see the correlations between pairs of independent variables. If no correlation exceeds 0.8 then multicollinearity is not a problem. Multicollinearity is not be a problem in this research since the number of independent variables are far less than the sample size. However, should the problem exist, only the data with time effects shall be used with respective means.

Heteroscedacity refers to a situation in which the error term in a regression model does not have a constant variance. In other words, the error term is correlated with the independent variables. Heteroscedacity exists when the independent variable was measured with error, a dependent variable relates to meaningful situation with the independent variable, or whenever there is an interaction between the dependent variable and another variable that has been left out. In this report, it is fortunate that there was no measurement of individual variables involved which could be influenced by adjacent environmental conditions, neither was there an omitted variable. This is because the questionnaire covered all the areas of expenditure without leaving any relevant area without investigation.

Autocorrelation is a situation whereby the observations appear to have a sequential order. It exists when adjacent errors tend to be similar in both temporal and spatial dimensions or large positive errors are followed by large negative errors and vice versa. In addition, observations from adjacent experiments may have autocorrelated residuals. However

should autocorrelation be detected anywhere, the means or percentages are used instead of actual variables.

### 3.4.3 Stepwise Multiple Regression Analysis

As has been said earlier, this is another form of Multiple Regression Analysis where the analysis is carried out in steps in order to eliminate multicollinearity that may exist among the independent variables. Among many other studies, Stepwise Multiple Regression method has been applied on a study of the relationships between soil and crop (Cruickshank and Armstrong, 1970). Cruickshank and Armstrong carried out five stepwise multiple regression on farm enterprises' data. In all cases, the relationships were assumed to be linear and of the following general form:

$$\hat{Y}_j = a + \sum b_i X_i + e, \forall i = 1, \dots, k,$$

where,

$a$  = regression constant,

$b_i$  = regression coefficients,

$X_i$  = independent variables  $X$  at  $i^{\text{th}}$  point, and;

$Y_i$  = dependent variable  $Y$  at  $j^{\text{th}}$  point.

Recently, Obara (1983) applied Stepwise Multiple Regression analysis technique in the study of geographical investigations of cotton yields. Obara noted that the method is useful in geographical investigations as a predictive tool for yield. It is a powerful variation of Multiple Linear Regression analysis which provides a means of choosing independent variable which will provide the best prediction possible with fewest

explanatory variables.

The technique is used in this study to help in describing the greatest problem on yield among the listed ones. The socio-economic problems dealt with are: labour, education, distance, tea hectarage and age. Other problems are also discussed in relation to the above listed ones. The resulting information is necessary in framing policy issues which are geared towards assisting these farmers.

### **3.5 Research problems and their solutions**

A number of research limitations were identified during the period of data collection. These limitations were related to finance, time, poor weather conditions, and the social set up of the sample population. However, despite the above limitations, the researcher still managed to carry out the research. As a result, this section discusses the various problems experienced and the remedies taken in overcoming such difficulties.

Due to financial constraints, a sample size of 80 was regarded as being adequate, considering the time it would take to finish the fieldwork. Much difficulty was also evidenced on the cost incurred during transportation from one area to the other. Such problems were overcome by staying within the area of study. Further, many farmers could only speak well in their mother-tongue. As a result, there was need to look for appropriate interpreter whenever such a problem was realized. This led to time wasting and slow – down of the process of administering questionnaires. Fortunately, there was always someone to assist whenever problems of language arose. In addition, most farmers in the study area were very kind and therefore they always felt inclined to socialize and

prepare food for the researcher. Such incidents caused delays whenever the farmers insisted on that condition. Many times the researcher was therefore forced to persevere.

High rainfall occurrence also caused inconveniences at the time of administering the questionnaires since no work could be done in the afternoons during rainfall. The problem was overcome by maximising the work in the mornings by leaving the house very early in the morning to make sure that enough people were interviewed before it started raining.

The above problem can also be linked to the fact that smallholder farmers go to pluck tea in the morning and in the afternoon they disperse to the buying centres for weighing of green leaf. The questionnaires, therefore, had to be administered in the mornings to get farmers in their respective farms.

Most farmers do not keep records of their expenditures and incomes and so they could not respond to related questions effectively. As a result, they only provided estimated values for incomes and expenditures. In certain cases, some smallholder tea growers could not even approximate the above figures and, therefore, failed completely to answer the question. Such farmers were left out and the next sample established. One major inconvenience caused by those farmers was that whenever sampling was repeated it meant walking very long distances to reach the next farm.

It was quite clear during the fieldwork that most women were semi-literate or illiterate. Among the community members, it was the men who owned land and therefore kept all documents. In cases where the male household head could not be found or was engaged in off – farm employment, the next farm had to be approached since most women could not answer any or most of the questions. Further, many smallholder tea growers did not

know the administrative boundaries. It was therefore difficult to establish which farmer belonged to what location and sub – location. This is a problem resulting from frequent changes in administrative boundaries. Other farmers in the same area were then used in helping to identify such locations.

Although suspicion was not a major problem, some farmers were still very nervous and unwilling to respond to questions. This problem was caused by the crisis that had existed between smallholder tea growers and Kenya Tea Development Authority. To minimise this problem, the researcher had to attend a chief's *baraza* for introduction. However, some farmers still insisted that the researcher be accompanied by the chief before they could be interviewed. Such people were left out and the next farm visited instead. In some cases it was not uncommon that hostile dogs sent the researcher fleeing for her life. Nothing could help in such situations, except to hope for some good luck in the next farm.

### **3.6 Summary**

This chapter has given the various processes undergone during data acquisition, and the different techniques which are used in the next chapter for analysis. Such techniques are Analysis of Variance, Multiple Regression Analysis and Stepwise Multiple Regression Analysis. It is also important to note that both qualitative and quantitative methods are used in the study, with price analysis, among other variables, being qualitatively. Further, the major problems experienced during the field research have been stated and the possible remedies that were used to make the research a success discussed.

## **CHAPTER FOUR**

### **4: RESULTS AND DISCUSSIONS OF SOME SOCIO-ECONOMIC ASPECTS OF SMALLHOLDER TEA PRODUCTION**

This chapter contains a summary of the findings from the fieldwork, followed by detailed discussions about their implications. The data has been presented in maps, tables, charts and graphs, which form the basis for the analysis and discussions. The discussions are made on the basis of the chosen methods of analysis as earlier indicated in the previous chapter. The chapter is intended to enable the researcher to test the validity of the selected null hypotheses, which were set out to be tested, and appropriate conclusions drawn.

The socio-economic problems that were used in formulating the null hypotheses were referred to as, the major problems to be focussed upon. Other problems also identified by the researcher as a result of field discussions with the smallholder farmers and which did not form part of hypothesis testing are also discussed in this chapter. As pointed out in the theoretical framework, these factors are inter-related and inter-dependent, and, therefore, it is important to analyse them appropriately in an effort to show the complexity of socio-economic considerations in small-scale agriculture.

#### **4.1 Land-use competition**

The importance of the tea crop for smallholder tea farmers can be seen in the comparison of land allocations for tea in comparison with other crops including pasture. One of the objectives of this study was the analysis of the characteristics of mixed farming in the study area. The objective can be achieved by a detailed analysis of land allocations for the

**Table: 4.1 Land allocation for different farm enterprises in Belgut Division**

Sample No.	Hectarage of Tea	Hectarage of food crops	Hectarage of Pasture
5	0.43	0.26	0.26
11	0.43	0.43	0.64
13	0.21	0.30	2.68
14	0.26	0.85	0.43
16	1.23	2.13	0.85
18	0.85	0.85	1.91
24	1.06	1.49	5.53
28	0.43	0.43	1.06
32	0.64	0.43	0.43
33	0.17	0.43	0.43
34	0.30	0.43	0.77
35	1.06	0.55	2.30
36	0.13	0.13	0.17
37	1.06	0.43	1.74
38	0.21	0.43	1.49
39	1.23	0.85	0.00
41	0.43	0.10	1.74
42	0.64	0.85	1.06
43	0.64	0.43	0.32
52	0.85	0.64	0.40
57	0.43	0.43	0.00
58	1.06	0.64	0.64
65	0.32	0.85	1.23
66	1.19	0.43	0.82
68	1.49	0.43	0.43
70	1.49	0.96	0.05
73	1.06	0.21	2.98
75	0.64	0.26	0.51
77	0.85	1.23	2.02
79	0.34	0.26	0.55
<b>TOTAL</b>	<b>19.94</b>	<b>18.14</b>	<b>33.44</b>

Source: Fieldwork (1998)

**Plate 4.1**

Plate 4.1 shows smallholder tea, livestock, and maize production in the study area.

Table 4.1 was summarised into table 4.2 in terms of frequencies in order to simplify table 4.1, and to show the range of land allocation for tea in comparison with food crops, and land set aside for pasture. Table 4.2 shows the variation of farm size with different farm enterprises. The table further indicates that tea occupies larger parcels of land as compared to food crops and pasture, with most of the tea being grown in parcels smaller than 0.82 hectares.

**Table 4.2 Frequency table for the land allocation between the farming enterprises**

Farm size (Hectares)	FREQUENCY		
	Hectarage of Food crop	Hectarage of Tea	Hectarage of Pasture
0.0 – 0.39	10	9	7
0.43 – 0.82	15	8	13
0.86 – 1.13	2	11	3
1.33 – 1.72	3	2	2
1.78 - >3.23	1	1	6

Source: Fieldwork (1998)

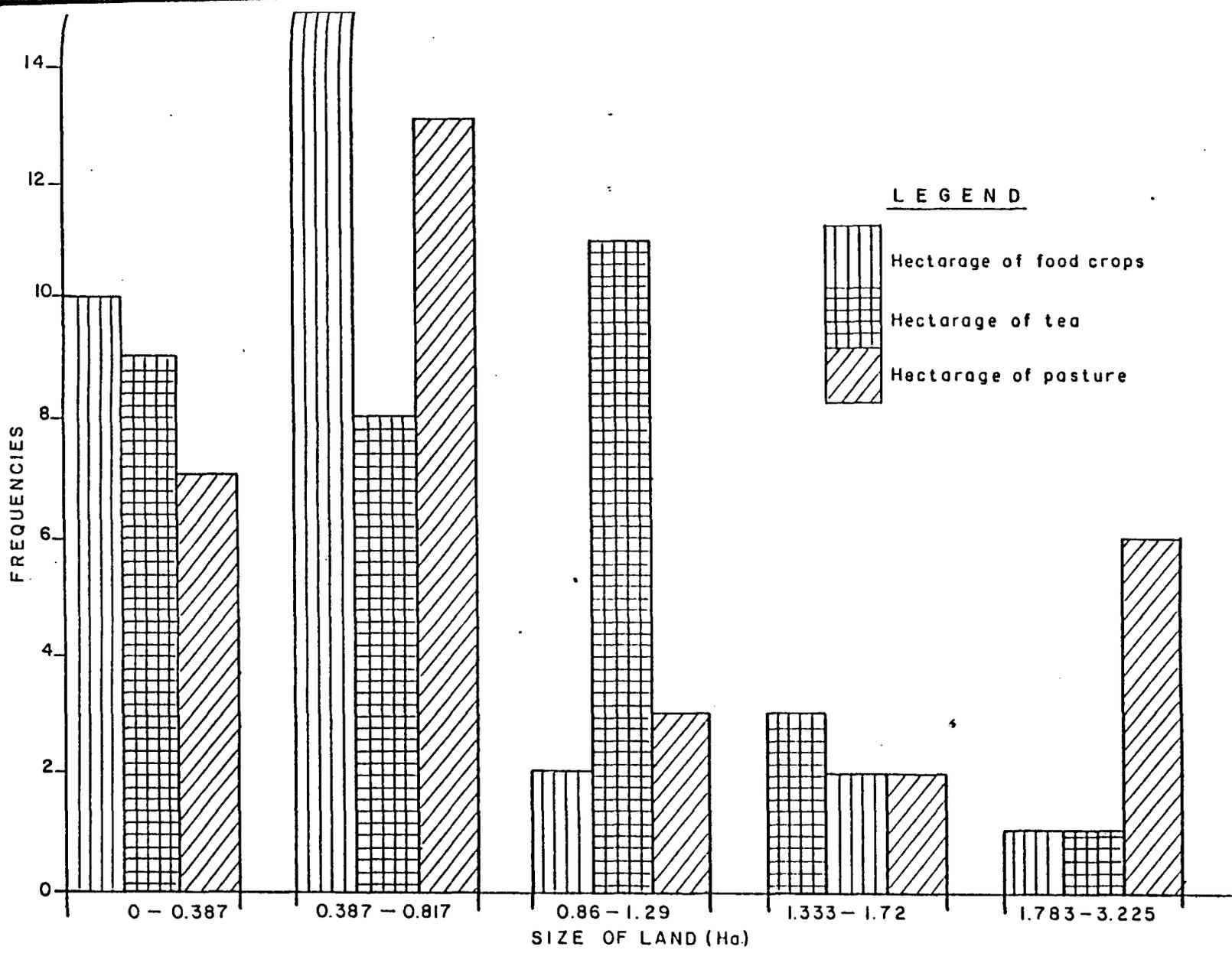
The results on frequencies showed that 62.7 percent of the farm sizes for tea were greater than 0.43 hectares, while only 36 percent were less than 0.43 hectares. The mean hectarage was 1.97 hectares with Standard Deviation of 2.74. The smallest farm among those studied was 0.02 hectares, barely enough for a serious tea crop in terms of expected returns for an average family. The largest farm was 8.6 hectares, showing a marked variation in the sizes of smallholder tea farms. A hectarage between 0.33 and 0.86 hectares was the most common (the modal class).

Table 4.1 was later subjected to statistical analysis using Analysis of Variance technique. The null hypothesis tested was that there was no significant difference in the allocation of land for the various farming activities in Belgut Division. A graph showing the

distributions of these variables is given in figure 4.1.

According to the Analysis of Variance results using the F statistic, the calculated value of F was greater than the tabulated value ( $F_{(4,26)}$  was equal to 2.74, while calculated F was 3.94). The null hypothesis of no difference was, in this particular instance, therefore, rejected resulting in a conclusion that there was a significant difference in the allocation of land resources for tea and food crops, as well as pasture.

These results further imply that most farmers allocated more land resources to pasture and then to tea as compared to other crops within the study area. The formulation of the above null hypothesis was prompted by the fact that the Government policy is for the country to be self-sufficient in food production (according to Sessional Paper No. 4 of 1981 on National food policy). The Sessional Paper noted that there was very limited land area left for expansion of food crop production, and the only alternative was to increase yields per unit area. Since the study area (Belgut Division) is typical of lands lying within the high potential areas, it enables one to see to what extent the drier districts can hope to be fed by surpluses from the better-favoured districts in the country.



Source: Fieldwork (1998)

#### **4.1.1 Smallholder tea and livestock farming**

Although the land left for livestock production was not equal to that used for tea production, the influence of livestock production as a competitive enterprise to tea cannot be ignored. Most farmers kept a few heads of cattle; while some of them practised dairy farming. The mean hectarage for pasture was 2.54 hectares with Standard Deviation of 2.95. The minimum pasture size was similar to that for tea and the largest pasture size was 5.59 hectares (greater than that for maize).

The above results showed that there was significant variation in land allocated for tea farming and pasture. Most farmers kept only one animal irrespective of the farm size. As these cattle require equal attention of the smallholder farmer, the farmer is forced to decide upon and meet the labour requirements for the two competing farming enterprises without concentrating on tea only. This action can be a disincentive to the growth of smallholder tea, as by inclination the farmers are traditionally inclined to pay greater attention to livestock than to tea.

Most farmers that were interviewed kept different types of livestock (75 out of 80 farmers). About 70.1 percent of the farmers kept dairy animals, 1.1 percent of the farmers kept goats, while 10.3 percent had donkeys and sheep. The majority of the farms had improved dairy cattle.

One of the two farmers who did not keep livestock had rented the land where he planted tea, while the other did not have any land that he could use for livestock production. It should be noted that the farmers who planted tea on rented land risked eviction by the

owner of the land in case of any disagreements thus leading to loss of the tea farm with all the developments that had been done on it. As a result, the practice should be discouraged to avoid any disappointment of the smallholder tea farmers. Alternatively, there is need for legal provisions to protect those renting land in order to develop tea.

#### **4.1.2 Smallholder tea and food crop production**

During this study, it was observed that most smallholder farmers, in this high potential area were also on some occasions faced with severe food shortages. Among the food crops, maize was the staple and occupied approximately 90 percent of the cultivated land. Maize and other cereals were stored in stores similar to the one shown in plate 4.2. Other food crops were sorghum, millet, cassava and vegetables. Most farmers sold vegetables to buy more maize whenever there was a food crisis in the family. Table 4.2 suggests that 61.3 percent of the hectarage sampled had more than 0.43 hectares for maize. This was slightly less than the hectarage used for tea production. The modal class was similar to that of tea with a minimum of 0.01 hectares, smaller than the minimum as shown in the operational definitions, and a maximum hectarage of 4.73 hectares. The above figures were all less than those on tea. The mean was 1.41 hectares and Standard Deviation was equal to 1.53, showing a less variation in land allocation for maize crop farming. Although there was less variation observed in hectarage set aside for maize, the farms were in most cases much smaller than for tea.

Land allocation for other food crops was found to be too insignificant to measure.

Plate 4.2



Plate 4.2 illustrates a store for maize and other food crops in the study area

These results indicate that the smallholder tea farmers still value the tea crop much more as compared to other crops, especially when comparing the hectarages allocated for the various crops. However, the definition of a smallholding as defined by the Central Bureau of Statistics does not fit well in this area since many farms are less than 0.2 in terms of hectarage for all the farming enterprises. This would seem to indicate that farm fragmentation is beginning in some case to fall below the economic unit. It is therefore recommended at the end of this thesis that a study be carried out to establish the economic unit of a farm in the area.

The statistics obtained showed that 61.9 percent of the farmers stated that often they

experienced food shortages within their various households. On running the frequencies based on field results, it was established that such farmers solve their problems through:

- (a) borrowing food or money from friends or banks respectively (11.3 percent),
- (b) saving food during the harvesting period (13.7 percent),
- (c) using money from off-farm employment (21.7 percent), and;
- (d) planting vegetables for sale (14.8 percent) to supplement family incomes.

A major issue arising from these observations is that tea is grown in combination with other crops in order to cope with family food requirements. Further, a large number of smallholder farmers were found to require much larger resources than their monthly income. As a result, they engage in off-farm employment as a source of additional income to enable them to buy food. This means that these farmers must divide their resources (such as labour, capital and land) among other enterprises to enable them to allocate adequate time for crops other than tea, a condition quite detrimental to smallholder tea production.

Most farmers interviewed did not mention maize as a complementary cash crop to tea as earlier suggested by Odingo (1973) in a previous study, but rather It was mentioned as a food crop. In contrast, vegetables were seen as quick money earner, especially before the planted tea was mature, and are increasingly becoming popular. In addition, it is probably possible that the researcher did not select the farmers interviewed by Odingo (1973). This study is also conducted about three decades after which implies that there are likely to be changes beyond the farmers control, particularly farm fragmentation as reported in this study.

Further, farmers with smaller farms sold vegetables for money since they received less pay from tea, which always proved to be inadequate for the monthly farm cash requirements.

Vegetables were, therefore, seen as attempting to take over the position of maize, by playing the dual role of being cash crop as well as food crop. A major explanation for this was that, as farm land allocated to maize decreased in response to the extension of tea, most farmers found themselves only able to grow enough for food, and not for sale. However, vegetables have higher returns per unit area and end up being profitable even on small farms.

Among the other crops, coffee is grown on land which is unsuitable for tea as shown by Jaetzold and Schmidt (1983). But, on the whole, much of the land in Belgut Division was earlier shown to be suitable for tea, which is the favoured crop.

#### **4.1.3 Importance of tea production among the different farming enterprises**

In considering the hectarages to each of the above farming enterprises, it was established that both within and between class variation existed. For the purposes of this study, the between class variation was found to have greater importance than the former since it enabled the researcher to evaluate the importance of tea production among these smallholder tea farmers.

On analysing of the farmers' opinion on the importance of increasing the land allocated to tea showed that, 57.5 percent of the smallholder tea farmers were willing to increase the tea hectareage in their farms, while 25.3 percent were either not interested or in a

position to expand their tea hectareage. The major reasons for unwillingness was found to be that there was no room for expansion, or tea was uneconomical in a small area. This implied that this group of farmers would soon be forced to abandon tea production since they have experienced the economic difficulties arising from competition of land resources among the various farming enterprises. Other farmers responded by saying that the size of land planted was enough.

The group of farmers who felt that tea was uneconomical in smaller farms and could soon abandon smallholder tea production could be interpreted as suggesting that under present conditions the family earnings from the tea crop are too marginal to meet all the family cash requirements. However, since the percentage of farmers willing to expand tea hectareage was greater, tea production still stands as the most rewarding enterprise among these different farming enterprises.

Among other problems identified, insufficient land resources overall, could be seen as one of the most important factor influencing smallholder tea farming. To support this observation, it has already been reported that some tea growers planted their tea on rented land, though this result appeared insignificant. Such farmers cannot afford to put more development on their tea production because the land they are using does not ultimately belong to them.

#### **4.2 Household incomes and expenditures within smallholder tea farms**

The results of the data relating to the variables on household incomes are shown in table

4.3. The figures are in thousands of Kenya Shillings (Ksh.). The table is a summarised version of a more detailed table given in Appendix 3.

**Table 4.3 Household incomes and expenditures among smallholder tea farmers**  
**(in thousands of Ksh.)**

Sample No.	Annual Inputs( $X_1$ )	Fertilizer ( $X_2$ )	Household Use ( $X_3$ )	Annual Income (Y)
1	14.00	1.40	48.00	25.99
4	97.28	8.00	168.00	259.2
5	43.80	7.80	38.40	23.14
6	63.00	1.50	312.00	57.60
7	6.35	6.35	57.60	14.98
8	4.55	4.55	24.00	6.75
9	5.04	5.04	2.76	7.20
10	29.85	11.20	48.00	3.60
11	2.80	2.80	3.84	2.02
12	3.50	3.50	4.80	2.16
13	7.50	7.00	21.60	5.40
14	2.80	2.80	4.80	9.00
15	96.20	4.20	27.12	57.60
16	17.60	1.40	4.80	15.60
17	2.75	5.60	36.00	1.44
18	38.36	1.40	9.60	2.35
19	6.65	5.60	48.00	24.00
20	1.40	1.40	78.00	7.20
21	12.80	5.60	1.44	25.20
22	16.70	7.70	6.00	27.00
23	0.00	0.00	12.00	4.00
24	30.66	18.90	44.16	48.00
25	12.80	0.80	24.00	25.20
26	19.76	5.60	18.24	43.20
27	43.40	1.40	4.80	6.00

Table 4.3 continued

28	59.60	5.60	38.40	57.60
29	104.62	3.94	24.00	23.04
30	2.71	2.71	8.40	36.00
31	4.22	4.22	21.60	14.40
32	18.60	18.20	6.72	5.60
33	32.83	8.73	48.00	17.00
34	41.00	9.80	48.00	28.80
35	64.10	19.90	15.36	46.40
36	1.40	1.40	8.64	3.76
37	24.20	18.20	13.44	57.60
38	166.20	4.20	8.64	10.08
39	23.50	9.10	19.20	9.60
41	14.70	2.80	18.00	18.00
42	73.00	15.40	14.40	40.50
43	21.56	9.80	8.64	8.64
51	5.11	5.11	96.00	14.40
53	388.00	1.40	11.86	8.64
54	12.15	2.80	7.32	14.40
55	11.10	112.00	41.88	864.00
59	37.40	1.40	48.00	69.12
60	4.80	4.80	28.8	43.20
61	2.40	2.40	14.4	21.89
62	5.71	5.71	55.248	74.88
71	18.60	4.20	6.00	14.40
75	4.20	4.20	24.00	57.60
76	1.40	1.40	28.00	12.24
77	62.20	15.40	24.00	57.60
78	11.40	4.20	14.40	17.28
79	17.50	7.00	18.00	19.44
80	4.20	4.200	12.00	21.60

Source: Fieldwork (1998)

Table 4.3 will be discussed together in a joint analysis. Table 4.4 is an indication of factors

affecting incomes and the various categories of expenditures based on frequencies, which helps in understanding of table 4.3 above. It contains an analysis of the distribution of farm expenditures among the various enterprises, including fertilizers, all other farm inputs, and household requirements. The table also shows the frequency distribution of household incomes according to the various income groups.

**Table 4.4: Frequency table for household incomes and expenditures**

COST OF EXPENDITURE IN ('000'KSH.)	FREQUENCY			
	Farm inputs	Fertilizer	Household use	Annual Income
0 – 10	21	45	16	7
11 – 20	12	6	11	16
21 – 30	4	1	11	11
31 – 40	3	0	4	1
41 – 50	3	0	7	2
51 – 60	1	0	1	4
OVER 60	8	1	4	11

Source: Fieldwork (1998)

Table 4.4 was prepared after studying the results obtained during the field study. Most of the smallholder tea farmers tried to limit their expenditure on fertilizer at below Ksh. 20,000. Farmers receiving both high and low incomes did the same. The farmers who

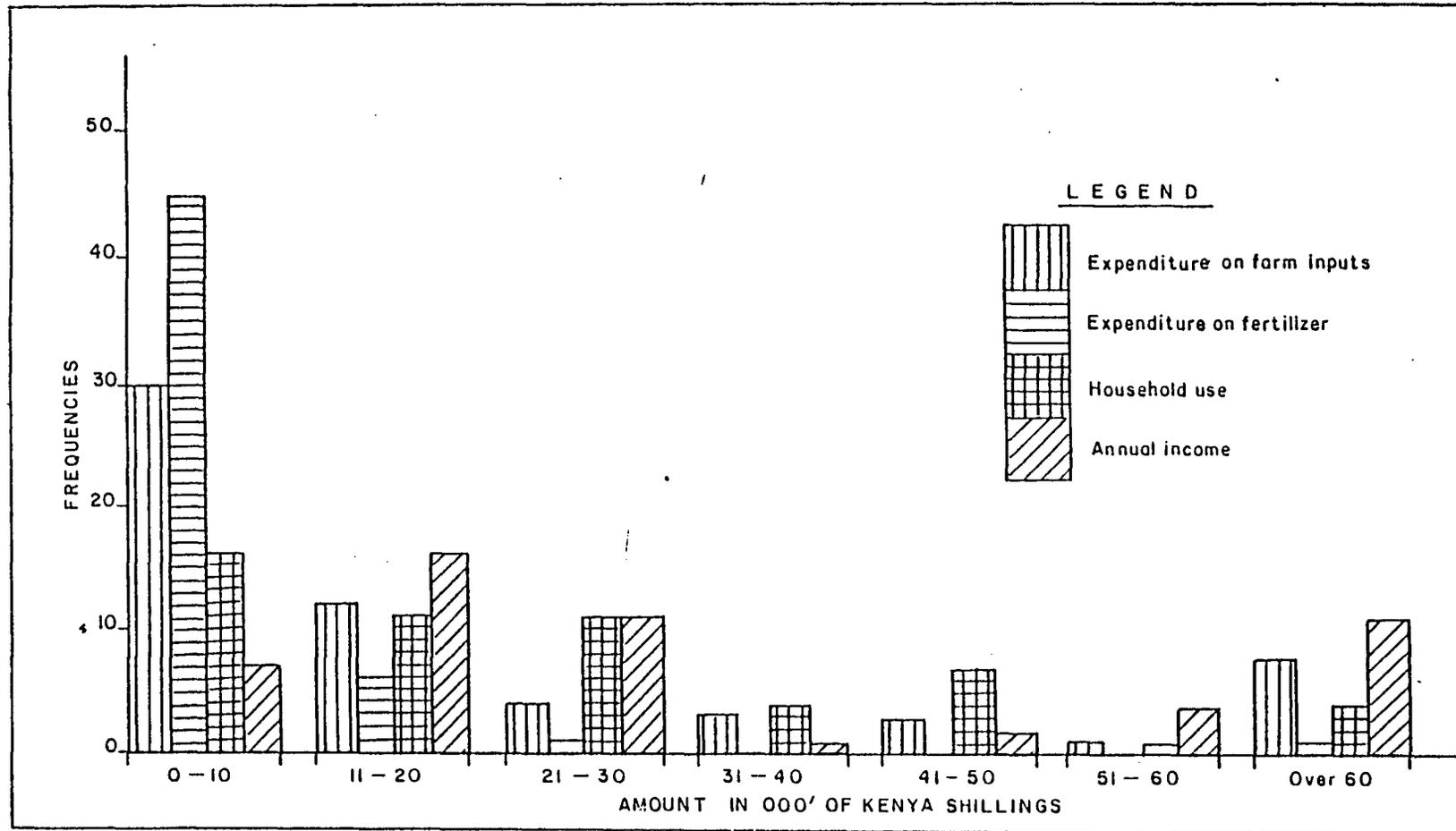
earned less income felt the difficulty most, as was evidenced in the field where some farmers did not even use fertilizers but, instead, used compost manure contrary to the recommendations of the Tea Research Foundation of Kenya. The majority of the farmers spent below Ksh. 11,000 on fertilizers irrespective of their tea holding. These expenditures on fertilizer were not related to household income from tea. The items are illustrated in graphic form contained in figure 4.2.

On farm inputs, the analysis of the results shows that farmers limited the cost of inputs to below Ksh. 30,000 irrespective of the size of their holding. The cost of farm inputs was therefore not a major problem to farmers earning higher incomes from larger tea hectarages as compared to those farmers earning less income. Most farmers spent less than Ksh. 11,000 on farm inputs. This meant that expensive farm inputs could not be bought easily by these smallholder farmers.

The null hypothesis tested is that there was no significant linear relationship between cash incomes and expenditure in smallholder tea farming ( $\beta_1 = 0$ ). Using Multiple Regression Analysis with F distribution, and  $n = 55$ , the equation  $Y = 34.18 - 0.89X_2 + 0.05X_3$  was obtained.

Since  $\beta_2 = -0.89$  and  $\beta_3 = 0.05$ , with only  $\beta_1 = 0$ , there is a linear relationship between incomes and expenditures on fertilizer and household expenditures, with no relationship between income and cost of inputs. The null hypothesis of no relationship is therefore rejected in the case of fertilizer and household expenditures.

Fig. 4.2 : HOUSEHOLD INCOMES AND EXPENDITURES



Source: Fieldwork (1998)

However, there does not exist a relationship between the expenditures on other farm inputs and incomes from tea production. According to the results obtained, the relationship was not significant and the value of  $R^2$  was equal to -0.04.

In examining the relationship between income, fertilizer and household expenditures, there was found to be a very strong relationship between fertilizer and income. The effect of other farm inputs and household expenditures was found to be insignificant on annual income of smallholder tea households.

Other results showed that the farmers having limited farm sizes (less than 0.43 to 0.86 hectares) had very little monthly income compared to those who grew tea in larger areas (more than 0.86 hectares). Some of these farmers spent much more money than their monthly income. Smallholder farmers growing tea in larger areas earned more income compared to the expenditures on their tea production and household needs. This was because large hectarages of tea could easily pay for all the necessary inputs, including hired labour, which small farm sizes could not manage.

In order to discuss incomes properly, attention was paid to the expenditures, both household and farm maintenance expenditures. Among the smallholder tea farmers, the major sources of income apart from off – farm employment were sales of tea and vegetables. As most farmers were not able to separate their time allocation accurately enough to account for all these, concentration was paid on those incomes from tea, which could easily be obtained during fieldwork. About 29.8 percent of farmers sold milk, while all those interviewed farmers sold tea. Vegetable was sold both at home and at the nearest

market centre.

Farmers who sell milk took it to the nearest road for the middlemen who in turn would take them to the nearest market centre, and eventually all the milk would find its way to the Kenya Co-operative Creameries closest to Belgut. Other middlemen took their milk as far as Kisumu, Muhoroni, and other hotels both in the village market centres or Kericho town.

Tea was sold at the buying centre or to middlemen (*Mang'rito*) as is discussed later. There were different buying centres established at different positions along the tea roads as shown in plate 4.3.

**Plate 4.3**



Plate 4.3 shows a tea buying centre in the study area.

The tea vehicles collected tea from 10.00 o'clock in the morning everyday. Before the tea was collected, the farmers were required first to take the newly picked tea leaves to the buying centre, sort them, and weigh them. In sorting, the Kenya Tea Development Authority standard of two leaves and a bud was followed. Other spoilt leaves were also removed and after weighing, the green leaf tea was packed into sacks and hooked onto the tea lorry, without squeezing them together. This was done to avoid fermentation of the green leaf. Each farmer was expected to take the green leaf tea to the buying centre.

Transportation of green leaf to the factory was done using the tea lorries belonging to Kenya Tea Development Authority. But deductions were made on the monthly earnings of farmers to pay for the costs incurred. The farmers also paid for the Kenya Tea Development Authority loans, which were used in repairing and maintaining the "tea roads" as well as for factory constructions.

The statistical analysis revealed that 74.7 percent of the farmers interviewed sold their tea to the Kenya Tea Development Authority buying centres, while 4.6 percent sold their tea to both the Authority buying centre and middlemen. Some farmers repossessed the tea thrown by the Authority officers at the buying centre and sold it to the middlemen as shown in plate 4.4.

It should be noted that the sale of spoilt green leaf tea to the middlemen results in the processing of that tea by the tea estates where it is eventually sold. As a result, the quality of tea in estate factories is lower compared to that of the Kenya Tea Development

Authority.

**Plate 4.4**

Plate 4.4 shows middlemen buying tea from smallholder tea farmers.

This is explained by the fact that the Kenya Tea Development Authority has less tea in terms of hectares compared to the tea estates. In this respect, the Tea Authority has less tea to pluck and can maintain the standard of two leaves and a bud. Due to the high quality of the tea made by the Kenya Tea Development Authority, higher prices were obtained compared to the tea processed by estate owners. The Tea Authority paid the farmer both monthly payment, and a bonus payment given per Kilogram of tea harvested and delivered to the Authority. Bonus payments are made at the end of the year.

About 49.4 percent of the farmers had accessibility to credit facilities, while 37.9 percent had none. Among those who had this borrowing facility, 10.3 percent had not used the facility, 31.0 percent borrowed money once each year and 11.4 percent borrowed money twice a year. Farmers used this income to buy fertilizer or in expansion of and maintenance of tea. Others spent money on medical services, farm tools, and other personal expenditures. The statistical analysis showed that 28.5 percent of the farmers used loan money to purchase farm-related goods or functions, while 12.5 percent engaged in other household expenditures. They were required to start payment of the loan after a month or two in most cases.

A marked variation was observed concerning the monthly income earned by each individual farmer:

- (a) 19.0 percent of the farmers earned below Ksh. 1,000 a month,
- (b) 27.8 percent got between Ksh. 1,000 and Ksh. 2,000 a month, and;
- (c) 17.8 percent fell in the range of Ksh. 2,000 to Ksh. 4,000 a month.

Most farmers earned between Ksh. 1,000 and Ksh. 2,000 per month (modal class). The mean monthly income was Ksh. 5,482.50 with a Standard Deviation of 10,776.90, showing a marked difference in the figures. The minimum earning was Ksh. 168 and the maximum income Ksh. 78,120 a month.

On cross-tabling hectareage versus incomes of the smallholder tea growers, the statistics revealed that 16.2 percent of the farmers earned about Ksh. 168 to Ksh. 160 and they had not more than 0.43 hectares each. About 13.5 percent of the farmers had over 0.43

hectares to 0.86 hectares of land and were earning Ksh. 540. The monthly earning increased with increases in farm allocated to tea, especially, in hectares greater than 0.86.

It was noted that although some smallholder tea farmers keep dairy cattle, not everyone of them sold milk. This is because depending on the family size, a family with one to two dairy cows does not normally have surplus milk to sell since most of it was used for family consumption. In cases where farmers decided to sell all the milk produced, they would be left without milk for their households. The problem of milk was very real in the area of study since every morning farmers took their milk to the Kenya Co-operative Creameries and at the same time less milk was distributed in the area. As a result, local milk was lacking in the shops during most days, especially in Sosiot market centre where the researcher lived. The people who live in the market centres, therefore, had to purchase tetra pack milk brought into the area from Kericho, or even from as far as Nakuru.

The approximated monthly expenditures were given in the corresponding column of table 4.3 together with incomes. The modal class was between Ksh. 1,000 and Ksh. 2,000. On examining the results, the minimum expenditure was Ksh. 120 and the maximum was Ksh. 40,000 a month, with a mean monthly expenditure of Ksh. 4,206. Minimal differences in the expenditures meant that there was a certain amount of money that every farmer had to pay for farm inputs in smallholder tea production. Farmers with small pieces of land on tea were most hit. It is in this connection that there is need to set a limit as to a minimum piece of land beyond which no further sub-divisions should be allowed to enable

each smallholder tea farmer to obtain a small but sustainable family income from the land.

The balances between individual household income, and expenditures also varied from one household to the other. Forty three percent of the farmers interviewed had less than Ksh. 1,000 a month. They further said that the balance was always used in buying additional maize for household consumption. Even this was inadequate and most farmers had to borrow further funds for the purchase of food. Among the farmers interviewed, three farmers spent more money than their monthly income. Such farmers depended on their kin for support and temporary loans until they received the next payment for their tea. This would result in a vicious circle, which these smallholder tea farmers could not break. Twenty percent of the farmers had a balance of between Ksh. 1,000 and Ksh. 2,000, while 20 percent had between Ksh. 2,000 and Ksh. 4,000 after expenditures. Approximately 4.7 percent of the farmers fell in the range of Ksh. 4,000 to Ksh. 6,000 a month. The modal class was the group of farmers remaining with less than Ksh. 1,000 a month. The mean monthly balance was Ksh. 3,301.90 with Standard Deviation of 6,960.70. The minimum was zero and maximum Ksh. 43,220. These figures imply that household income within the smallholder tea households increases with the increasing teahectarages. This means that, for a farmer to earn more money, he needs to have a larger area in tea production.

#### **4.3 Other major socio-economic factors**

The third hypothesis to be tested in this study was to establish the existence of a relationship between each individual item of age, education, labour, transport and

hectarage for tea and production. After the relationship is determined, Stepwise Multiple Regression Analysis enables the researcher further to identify the variables with the best prediction from a list of selected socio-economic factors and to determine the inter-relationships between the variables in accordance with the theoretical framework adopted.

The data concerning these socio-economic factors are shown in table 4.5 with a more detailed table in Appendix 4 at the end of this thesis. The data on age and education are in years (Yrs), labour in man-hours per day, distance in kilometres (Km) and Hectarage of tea (farm size for tea) in hectares.

Table 4.5 was summarized into frequencies resulting in table 4.6 in order to allow further discussions.

Table 4.5 Age, Education, Labour, Transport and Hectarage of Tea

Sample No.	$X_1$ Age (Yrs)	$X_2$ Education (Yrs in School)	$X_3$ Labour (Months/day)	$X_4$ Distance (Km)	$X_5$ Hectarage for Tea (Ha)	Production (Kg) -y
2	30.50	7.00	10.00	2.50	0.85	10800
4	55.00	7.00	24.00	4.50	5.1	28800
5	30.50	7.00	3.00	0.50	0.43	3856
6	55.00	12.00	6.00	0.50	0.85	9600
7	30.50	7.00	7.00	2.50	1.06	2496
9	55.00	7.00	6.00	2.50	0.34	1200
10	55.00	16.00	6.00	0.50	1.7	336
12	55.00	7.00	6.00	0.50	0.43	360
20	30.50	7.00	6.00	2.50	0.13	1200
22	55.00	0.00	9.00	2.50	0.6	3000
23	48.00	7.00	6.00	2.50	0.31	444
24	55.00	0.00	5.00	0.50	1.06	5400
25	48.00	7.00	12.00	0.50	0.21	4200
30	30.50	7.00	4.00	2.50	0.43	6000
31	48.00	7.00	5.00	4.50	0.21	2400
33	30.50	7.00	6.00	1.50	0.17	2500
36	48.00	0.00	12.00	0.50	1.06	960
37	55.00	7.00	6.00	0.50	0.64	9600
43	48.00	7.00	6.00	0.50	1.7	1440
45	55.00	0.00	6.00	0.50	1.7	20160
47	48.00	7.00	5.01	0.50	0.85	10080
48	55.00	0.00	6.00	0.50	2.13	24816
50	48.00	7.00	14.00	0.50	0.85	11184
51	55.00	7.00	8.00	0.50	0.11	2400
52	48.00	12.00	14.00	0.50	0.85	2340
54	30.50	12.00	6.00	0.50	0.11	2400
55	48.00	7.00	7.50	0.50	8.5	144000
56	48.00	7.00	6.00	0.50	0.85	9600
57	48.00	7.00	6.00	0.50	0.43	31200
58	30.50	7.00	6.00	0.50	1.06	1200
59	55.00	12.00	24.00	0.50	0.64	115530
61	48.00	12.00	6.00	0.50	0.32	3648
62	55.00	0.00	6.00	2.50	0.96	12480
63	55.00	0.00	6.00	0.50	0.17	3996
66	30.50	7.00	16.00	2.50	1.19	13440
70	48.00	7.00	6.00	0.50	0.21	17280
73	55.00	0.00	12.00	2.50	1.06	1600
74	30.50	0.00	1.00	0.50	0.85	1200
75	30.50	7.00	6.00	2.50	0.64	9600
76	48.00	7.00	12.00	0.50	0.10	2040
78	55.00	12.00	2.00	0.50	0.43	2880
79	30.50	7.00	7.00	2.50	0.34	3240

Source:

Field data (1998)

**Table 4.6 Frequency table for labour, education, distance and hectarage of tea**

Range	Education	Labour	Distance	Hectarage of Tea
0 – 0.5	9	0	27	18
0.6 – 2.5	-	2	12	22
2.6 – 8.9	25	28	2	4
9.0 – 20	7	9	0	2
Over 20	0	2	0	0

Source: Fieldwork (1998)

Table 4.6 shows that majority of the farmers spent less than 8 years in school. The range from 0 to 0.5 applies to those who never went to school, while the illiterate farmers exceeded those who attained secondary school education.

As far as labour was concerned, most farmers spent from 2.6 – 8 hours on their tea farms daily. A few stayed for nine to twenty hours daily while very few stayed for over twenty hours. This meant that the farmers spent more than half a day on their tea farms. But, this was only time used in plucking, weeding, and pruning. It was important to note that after plucking, the green leaf tea was taken to the buying centres where the farmers still took time in sorting and weighing their tea. They further waited for the tea lorry, sometimes as late as 8.00 o'clock in the evening. Tea production, therefore, occupied most of their time and very little time remained for other farm enterprises.

Table 4.6 also illustrates that most farmers lived within a distance of 0 to 0.5 kilometres from the buying centres. Such farmers had more time for work as is shown in the later pages. Many farmers had very small farms in terms of hectarage. It was such farms that proved to be unproductive relative to the required inputs.

Age could not fit well in table 4.6, thus making it impossible to include the data. About 33.9 percent of the smallholder tea farmers studied were between 21 to 40 years (youth), 30 percent are over 55 years of age, 26.1 percent are aged between 41 to 55 years (adults) and the remaining 10 percent did not give their ages. Age is an important factor in smallholder tea production since it determines the land ownership. It was evidenced during the fieldwork that many of the larger smallholder tea hectarages were owned by farmers in the age range over 55 years.

In carrying out Stepwise Multiple Regression Analysis, four different equations were obtained. These equations together with the values of F and correlation are given in form of tables (Table 4.7, 4.8, and 4.9). Two variables (labour and hectarage for tea) remained as the best prediction factors. First, the variables in the equation are summarized in Table 4.7.

**Table 4.7 Variables in the equations of Stepwise Multiple Regression**

Equation No.	Constant (a)	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>	b <sub>5</sub>
1	11455.2	-184.4	56.1	-664.6	-1077.9	14335.2
2	11971.1	-187.6	—	-661.5	-1096	14328.6
3	9521.9	-144.1	—	-815.7	—	14382.6
4	2926.5	—	—	-791.2	—	14201.9

From table 4.7, equation 1 and 4, for example, can be formed as follows:

$$Y = 11455.2 - 184.4X_1 + 56.1X_2 - 664.6X_3 - 1077.9X_4 + 14335.2X_5 \dots\dots\dots 1$$

$$Y = 2926.5 - 791.2X_3 + 14201.9X_5 \dots\dots\dots 4$$

In the first equation, all the five variables are included (regression equation of the five variables) with the value of adjusted  $R^2$  equals to 0.77 and F equals to 28.27. The fourth equation is the prediction equation with only two variables remaining (labour and hectareage of tea) after eliminating the other three (age, education and transport). Adjusted  $R^2$  in the fourth equation is 0.78 with F equals 73.27. Both values of F were significant at 0.00 significance level as is indicated in table 4.8. It should be noted that the values of  $R^2$  are also given to allow comparison with the results that could be obtained using the t-statistic.

In order to ascertain that multicollinearity did not exist among the independent variables,

the researcher used the table of correlation (Table 4.9).

**Table 4.8 Values of F, significant F and adjusted R<sup>2</sup>**

Equation No.	Value of F	Significant F	Adjusted R <sup>2</sup>
1	28.28	0.00	0.77
2	36.31	0.00	0.78
3	48.81	0.00	0.78
4	73.27	0.00	0.78

**Table 4.9 Correlation, 1 – tailed significance**

	Y	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>
Y	1.00	0.09	-0.03	0.09	0.07	0.87
X <sub>1</sub>	0.09	1.00	-1.12	0.03	-0.32	0.16
X <sub>2</sub>	-0.03	-0.12	1.00	0.01	-0.04	-0.05
X <sub>3</sub>	0.09	-0.04	0.01	1.00	0.49	0.28
X <sub>4</sub>	-0.07	0.32	-0.04	0.49	1.00	0.04
X <sub>5</sub>	0.87	0.16	-0.05	0.28	0.04	1.00

The null hypothesis tested in all cases above was  $\beta_i = 0$ . According to the results, all cases of  $\beta_i$  in table 4.7 are greater than zero. This showed that there was a linear relationship between the variables, and hence the null hypothesis of no relationship was rejected.

The significance of the relationships was tested using the F statistic. The calculations further showed that all values of F are significant as indicated in table 4.8. The value of F calculated was greater than F significant in all cases. In addition, the value of  $R^2$  obtained for each of the equations was in each case greater than 0.7, which means that all the relationships were significant. The null hypothesis of no significant relationship between the above variables and production is, therefore, rejected.

Table 4.9 (table of correlation) indicates that there is no correlation between the independent variables. The highest correlation is evidenced between hectarage for tea and production. In addition, table 4.7 illustrates that hectarage of tea and labour, are the most important variables influencing smallholder tea production. These factors are further discussed independently to show their importance in tea production.

On enumerating some of the socio-economic problems, 77.0 percent of the farmers complained of labour problems (too much labour requirements and unavailability of sufficient labour). About 48.3 percent of the farmers complained of lack of extension services and lack of motivation to farmers by the Kenya Tea Development Authority. Close to 51.7 percent of the smallholder farmers later recommended that these services be provided. The smallholder farmers coped with these problems by weeding during the dry season, when there is reduced demand for casual labour.

The problems of age, education, labour, transport, and farm size for tea could not be ignored if the tea industry was to survive. From the results obtained, the effects of these variables cannot be ignored as they greatly impact upon different stages of smallholder tea

production. For that reason, each will be analysed in turn briefly.

#### 4.3.1 Age

Table 4.10 illustrates the distribution of males and females within the different age categories of smallholder tea households studied. Among these households, there were 16.2 percent families with 1 to 3 people, 29.7 percent of 4 – 6 people, 36.9 percent of 7 to 9 persons and 16.2 percent and 1.4 percent of 10 to 15 people and over 15 persons respectively.

**Table 4.10 Age categories and percentage of males and females**

Age (years)	Percentage	Percentage of males	Percentage of females
21 – 40	25.3	27.6	27.6
41 – 55	33.3	37.5	37.5
Over 55	28.6	31.9	22.4

Source: Fieldwork (1998)

Most of the farmers in the age group 21 – 40 (youth) did not have title deeds since the land ownership was still with their father. They also have no access to credit facilities.

In areas where two sons were interviewed or a son and his father, the number of the plot remained the same. This took place where a father sub-divided his land among his sons without changing the title deed. The farm sizes were independent of age. About 27.9 percent of the farmers were aged between 21 and 40 years but there were important

differences in land sizes allocated for tea within the farms studied, ranging from 0.32 to 8.6 hectares.

#### **4.3.2 Education**

Education is discussed in four levels: primary school (those who completed or left without finishing), secondary school (those who spent nine to twelve years in school), higher or A-level (those who spent 13 to 14 years in school), and University education (more than 14 years in school):

- (a) 57.7 percent of the farmers spent seven or less years in school (primary education),
- (b) 13.8 percent of the farmers reached secondary school, and;
- (c) 17.2 percent did not have any education at all.

Among the smallholder tea farmers interviewed, only one farmer had an A-Level qualification.

During the field study, a number of smallholder tea farmers interviewed, indicated that they stopped working in towns because they felt that those types of jobs were not sustainable compared to tea growing. Tea production was sustainable since one could own the tea holding throughout his life and later leave it for children to inherit. One major shortcoming of this type of reasoning is the failure to recognise that every time the land was sub-divided amongst the family sons, it became smaller and less economical for farming.

More educated farmers (those who attained at least secondary school of education) were able to point out more problems as they responded to the questions as compared to those who did not have any education at all. This category of farmers knew at least some of the functions of the Kenya Tea Development Authority which were not fulfilled as per their expectations. They suggested various solutions to their problems and they understood more the concepts of agronomic aspects of tea production when compared to those with limited education. A section of the farmers also engaged in smallholder tea production while on the other hand engaging in other off-farm employment. Such farmers had better standards of living since they earned income from two different sources and could also employ additional labourers in their tea farms to meet all the labour requirements.

In examining their wealth status by comparing the type of goods owned by these smallholder farmers, many of the farmers were found to have built permanent houses because they could obtain loans from various sources. Fourteen percent had bicycles, 2.3 percent had shops, 1.1 percent had posho mills, and a similar percentage had a restaurant, a car and tractor. Approximately 18.4 percent of the farmers had combinations of bicycles, shops, motor cars, wheelbarrow, and even garages. However, 20.7 percent (the highest percentage) of these farmers had nothing among the wealth indices listed above.

Tea production was, therefore, undertaken by a combination of very wealthy farmers with very poor ones. Smallholder tea farmers engaging in other non-farm jobs with better pay, when compared to their colleagues in the tea estates, had much wealth.

An analysis of the sample of farms which had 0.43 hectare piece of land (16.7 percent) revealed the following:

- (a) 66.7 percent attained primary school education,
- (b) 6.3 percent attained secondary education,
- (c) 25 percent had no education at all.

Considering the whole group of farmers in the sample, 63.9 percent, 15.3 percent, and 19.4 percent attained primary education, secondary education and no education respectively. Farmers with the largest pieces of land for tea production had either no education or attained primary school education. According to these farmers there is no recommended standard on the amount of fertilizer that should be applied per hectare in different farms. This shows lack of awareness on the side of the farmers. However, a section of the farmers believed that when more fertilizer was used, yield increased and hence, more income was realised. Increased fertilizer use also meant that more money was to be deducted by the Kenya Tea Development Authority. As a result, the farmers tried to reduce the number of fertilizer bags given by the tea Authority and where necessary farmers would buy additional bags of fertilizer from the Kenya Farmers Association (KFA) stores. This was because the farmers felt that the prices were lower when fertilizer was purchased directly from the Association than when delivered by the Kenya Tea Development Authority and later deductions made from their tea money. Other farmers decided to use less fertilizer to reduce the cost of inputs.

Due to high frequency in growth, demand in labour for plucking increased beyond what the farmer could provide, rendering some leaves to waste. In order for a farmer to cope with the increased demand in plucking labour, some farmers hired casual labourers to help them. This had a disadvantage in that it increased the cost of inputs, which could not

necessarily lead to increased output.

All farmers, both literate and illiterate, kept records of their monthly earnings. These records were kept through the help of Kenya Tea Development Authority where each farmer was given a card to take home and each time tea was delivered, the quantity was noted in the card. Every farmer was able to bring the list of his green leaf tea deliveries showing the total number of kilograms of green leaf weighed and, therefore, income could easily be obtained. There were only three women who attained secondary school of education. These women could easily understand the questions and respond where necessary whenever the husband was away. However, they still did not know the earnings from the yields since it was the husband's right to keep these monthly earnings. Women were expected to benefit from their husbands' earnings mainly through food, clothing and shelter.

#### **4.3.3 Labour**

Labour was a major factor of production as indicated earlier by the findings of Stepwise Multiple Regression Analysis. As a result, labour supply in smallholder tea production is discussed in three different categories in this study in terms of labour for:

- (a) establishment of the tea crop,
- (b) maintenance, and;
- (c) plucking.

Labour for establishment is necessary for clearing, digging, and planting of the crop. At the time of maintenance, weeding is carried out, including fertilizer application. Later,

plucking takes place after crop maturity. These activities prompt the use of hired labour in cases where the farmer cannot provide all the necessary labour himself.

This study has revealed that most men provided labour in their own tea farms. Women and children assisted the men but were not compensated. Of the farmers interviewed, 36.6 percent attempted to answer this question. From the answers, 11.5 percent of the labour was provided by women, and only 14.9 percent of the respondents were women household heads. In weeding, 6.9 percent and 18.4 percent of the labour was supplied through women and men respectively. As far as clearing and digging was concerned, 4.6 percent and 17.2 percent of the labour was contributed by women and men respectively. Only those who used hired labour paid their workers. The mean man-hours a day for household labour supply in smallholder tea farms sampled was 6.31 hours with a Standard Deviation of 2.78. The minimum time was two hours and maximum twelve:

Tea plucking and weeding consumed most of the hired labour. Among 36 people that were hired for labour,

- (a) 25 percent out of 58 percent was hired for weeding and plucking,
- (b) 4.6 percent were hired to provide all the necessary labour in the respective tea farms, and;
- (c) 3.4 percent provided labour for clearing, digging, weeding, and plucking.

Those employed for the purposes of weeding and pruning, were only 10.3 percent. These figures show that most families provided their own labour for most work in the tea farms.

It is important to point out that the same family labour would be used for other crops, chiefly the food crops.

According to the records, most permanent hired workers provided labour for 8 hours a day. The mean time was 6.82 hours with a Standard Deviation of 2.34. The minimum time spent on work per day was 2 hours (which was mainly for pruning) and the maximum was 12 hours per day. The temporary workers provided labour for a minimum of 6.54 hours and maximum of 12 hours per day. The majority of the temporary hired workers provided labour for 6 hours a day.

Most farmers hired only one permanent male worker. The percentage of those farmers hiring only one permanent male worker was 14.9 percent out of 36 percent. The mean was about one person, minimum of zero and maximum of 8 people. Only five farmers employed one permanent female worker each.

The statistical analysis further showed that 17.2 percent of these farmers employed only one temporary male worker while 10.3 percent employed two male workers. A similar percentage did not hire any. The maximum number for temporary hired labour in a farm was 20 people. On the side of the temporary hired women labourers, out of 38 percent, 4.6 percent and 6.9 percent employed one female worker and two female workers respectively. The maximum hired number of female workers was three.

Just as the types of labour employed varied, compensation also was different. The payment was done on monthly basis as follows:

- (a) 42.4 percent of the farmers paid between zero and less than Ksh. 1000 per unit of hired labour,
- (b) 24.3 percent of the farmers paid from Ksh. 1000 to less than Ksh. 2000 per

unit, and;

- (c) 21.1 percent of the farmers paid between Ksh. 2000 and Ksh. 5000 per unit.

Only four farmers paid over Ksh. 6000 per unit (where a unit refers to each worker) to both temporary and permanent labourers.

The use of oxen for ploughing and land preparation was not common because in the main tea growing areas, traditional livestock no longer exists. The hand labour was mostly used. A few of the smallholder farmers engaged in provision of labour required at the tea farms, among the smallholder farms and in the tea estates. In such cases, the running of the daily work was left to the women. That was the group of smallholder farmers who relied on hired labour in fulfilling most of their labour requirements. The findings of Bülow and Sorenson (1989) in Mosop area also hold in Belgut that the farming activities in the area represent an association of women labourers and male farmers.

It was also clear that smallholder farms with less than 0.43 hectares to 1.29 hectares relied upon family labour since their income could not support the payment of hired labour. As a result, the farmer wholly relied on himself, his wife and children for the provision of labour. As tea hectareage expanded, monthly income increased and, therefore, the farmer was able to pay for the expenses on hired labour as well as making enough profit which, could be transferred to savings. The children mostly provide labour during the weekends while during the school days they go to school. This result in a major problem in that there was too much tea for weighing during weekends leading to too much work at the

factory, while, the people at the buying centre were few and the factories were less busy during weekdays.

The smallholder tea farmers, just like other farmers, underwent a period of too much work due to labour competitions from different farming enterprises. Apart from tea, as mentioned earlier, some farmers grow Maize as a staple food crop in addition to other crops. These crops also compete for the same labour that is needed for Smallholder tea production. In households where no hired labour was used in tea farming, the tea farms were neglected, thus reducing the monthly income. The factories also had less green leaf tea to process. However, not all farmers neglected their tea as they felt that it was more important than any other crop. The action could be explained by the fact that some smallholder tea farmers decided to grow tea only and leave the other crops – a condition that is quite detrimental for the attainment of food security policy in the country. The demand for additional labour by different farming enterprises was also found to be a problem for the farmers who use hired labour. During the rainy season, most labourers attend to their own crops at home and, therefore, are not available for hiring. As a result, there was shortage of workers in the tea farms during this season. This led to reduced plucking and hence less green tea leaves for the factory for processing. The factory, therefore, faced irregularities as far as the maximum load capacity was concerned.

#### **4.3.4 Transport**

Transport is the other important factor in tea production. Transport is discussed in two different parts: transport of green leaf to factories, and transport between farms and the buying centre. Of great importance was the transport between farms and the buying

centre. Transport between farms and buying centres was related to the distance travelled by the farmer in order to deliver the green leaf tea to the buying centre. Transportation of green leaf to the factory is under the Kenya Tea Development Authority. The expenses were later deducted on the monthly earnings of the farmer. The farmers were not sure whether the deductions were honest, but they complained that too much money was taken away from their pay.

After plucking, each farmer had to take the green leaf tea to the buying centre. There were different modes of transport identified during the field study: walking, use of bicycle, wheelbarrow, tea lorry, private vehicle, and a combination of the above. According to the statistics obtained, 42.7 percent of the farmers walked to the buying centre, and 13.8 percent used wheelbarrows. The above modes of transport suggest that the farms are located close to the buying centres. Only 2.3 percent, 4.6 percent, 1.1 percent, and 2.3 percent respectively used donkey, private vehicle, tea lorry, and bicycle transport. In this study, distance was used as a measure of transport since there was no monetary figures available from the respondents.

The distance between farms to the buying centres varied. As far as distance was concerned, four different ranges are used: 0 – 1 Km (Kilometres), 2 – 3 Km, 4 - 5 Km, and 6 and above Kilometres.

The results showed that 41.4 percent of the farmers were found at 0 – 1 Km distance to the buying centre. Approximately 5.7 percent and 1.1 percent were located at 4 – 5 Km and 6 and above Km respectively from the buying centre. Most farms were, therefore, reasonably close to the buying centres (33.3 percent). This further explains why walking

was the most common mode of transport. Between most farms and the buying centres were also small footpaths, which vehicles could not go through. The only possible means of transport on such routes was the bicycle, wheelbarrow, or human transport. Only farmers who had good roads could transport their tea by vehicles to the buying centre. The farmers who used private vehicles not only delivered their tea to the buying centres, but they also got permission to take their tea directly to the factory. They, therefore, escaped deductions on transport by Kenya Tea Development Authority and instead they were paid for the service which they thus rendered. These farmers had an advantage in that there was no day when they failed to sell their tea.

During the field study, it could be easily observed that, the buying centres were more concentrated in areas with the greatest concentration of tea. Farmers in such areas had easier time of taking their tea to the buying centres and further could pluck for longer hours compared to those farmers located in the marginal tea areas. Plucking long hours was made possible by the fact that the farmers would wait until they saw the lorry arriving. They would then go for sorting and weighing as the tea lorry waits.

The farmers who had to walk long distances to the buying centres had to leave plucking early enough so that they could walk to the buying centre and wait for the tea lorry, lest they miss the transport. Further, such farmers risked missing the tea lorry due to bad roads making them not sell their produce. These farmers also complained of the delay of the tea lorry due to bad roads, sometimes until evening and, occasionally, not appearing at all. In some days, there could be many farmers waiting to weigh their tea, and if there was only one lorry that day, some green leaf tea would be left for one to two days. The

farmers pointed out that on many occasions, tea got spoilt by the next day and became rejected by the Kenya Tea Development Authority officers while the deductions for transport for these occasions were still made. This was observed to be one of the major problems in smallholder tea production which resulted in the emergence of middlemen (*mang'rito*) as discussed later in this study.

The farmers in marginal tea areas with buying centres far apart often had to undergo the problem mentioned above. As a result, these farmers plucked very little tea, earned very little, and their tea farming appeared unproductive. The same category of farmers had more problems of food shortages as they did not have excess money to buy grains. Further, due to the meagre incomes earned by these farmers, they did not have enough money to pay for hired labour. They, therefore, faced severe competition problems in terms of labour supply between tea production and other farming enterprises.

#### **4.3.5 Hectarage (farm size) of tea**

A comparison was made between the farm sizes used for tea production and those allocated to other crops. A major reason for this was to enable the researcher to identify some of the influences these crops imposed upon tea production.

Table 4.2 showing the distribution of land allocation to the various farming enterprises shown earlier illustrates that smallholder farmers owning larger farms mainly concentrated on tea crop farming. Small-sized farms were left for food crop farming, while some farmers did not attempt to grow any food crop.

Hectarage of tea was the most important factor determining tea production of each individual farmer as is shown in the results of Stepwise Multiple Regression. Hectarage of tea also influences the earnings of each individual farmer as income is determined by production. Those farms that were less than 0.86 hectares did not produce enough income to enable farmers to pay all their expenses.

As was shown earlier, the largest group of smallholder tea farmers had less than 0.43 to 0.86 hectares piece of land. Such small-sized farms could be uneconomical in terms of tea production. The farmers with these small-sized farms needed to be advised to choose between tea production and other crops for farming since the land could not sustain more than one crop. Tea farms which were greater than 0.86 hectares and above paid well as far as the inputs invested upon them were concerned. Since smaller farms are not suitable in tea production, due to divisions of labour and other services, concerned farmers need to be advised to grow crops which could be more profitable in such farms. Although removal of tea in such farms will reduce the smallholder tea hectarages, the concerned farmers would have the freedom to choose other crops which could be more beneficial to them.

In addition to those aspects of the study that were used in hypothesis testing, there are certain problems facing the tea growers in Belgut Division, which are subject to discussion in order to give the proper context within which tea is grown in the study area. These issues will now be dealt with in the subsequent paragraphs.

#### **4.4 Producer price**

According to the data collected and responses from farmers during the field study, price paid to growers for produce, in this case tea, is perceived to be not only important, but central to the success of smallholder tea farming. Although the researcher would have liked price to be one of the objectives tested, the data available from the Tea Board of Kenya was found to have certain limitations, thus, making it impossible to formulate an appropriate hypothesis (see table 4.12 on page 141 of this thesis). The information obtained on prices was global and did not specifically address the area of study. Further, the data did not take into account the effect of other factors which affect recorded amounts of production, such as the role of middlemen, and green leaf tea thrown during sorting and errors that could have occurred when recording the data. However, the information was useful in that it included temporal variations in production. It was established that tea prices are uniform throughout the country and, therefore, the information obtained was still relevant to the area of study. It is important to note that final prices are only known after the crop has been processed in the factories and presented at the Tea Auctions in Mombasa. Plate 4.5 shows Tegat tea factory where all tea from Belgut Division is taken for processing. All the same, the most sensitive aspect is the initial price paid to growers for tea delivered at the end of each month.

In theory, a rise in producer prices should act as an incentive to increased production. However, observation reveals that at times there has been a decrease in price, while production has been increasing. Increases in production from 1980s to the present can thus imply that there are other factors which also influence production. It could also mean

that there were errors on the recorded amounts of tea produced.

At the farm level, price determines the profitability of the farmers labour invested, farm inputs purchased, and the general maintenance of farming enterprises. It dictates whether a smallholder tea farmer would continue to produce the commodity in future.

**Plate 4.5**



Plate 4.5 shows Tegat Tea Factory where the smallholder tea is processed in Belgut.

Appropriate price ought to cover the cost of producing a single unit of the commodity in question (in this case, tea) at a profit.

Among those interviewed, 40.0 percent of the farmers mentioned price as a major socio-

economic problem experienced by smallholder tea producers. Most farmers felt that they were not being paid a "good price" for their tea. This explains why during the fieldwork, one of the problems most cited by farmers was the low prices paid for their tea crop. The farmers preferred that, if possible, the cost of one kilogram of green leaf tea should be doubled or tripled to pay for all the capital invested. About 50.3 percent of the farmers interviewed complained of low prices. This percentage shows the seriousness of the problem in smallholder tea production. Unfortunately, it also shows the inability of the individual farmer in the rural area to comprehend how crop prices are determined in the market place.

According to the farmers, tea is a labour intensive crop, requiring several inputs which had to be purchased. During planting, there is need to have labour to clear the land, plant the seedlings at the required specifications, and start to maintain them. Fertilizers are also to be applied and continuous weeding carried out. As the tea grows, the farmer has to wait for three and a half to four years before starting to harvest (pluck)(the economic part of tea production) the crop. Plucking equally is a labour consuming exercise and has to be carried out at the right time. Pruning is done after every three to four years when the plucking table has to be raised. All these processes require cash money, and the operations can only be carried out efficiently where farmers have access to cash.

The link between prices paid to growers by the Kenya Tea Development Authority at various intervals brings them into close touch, and often leads into conflict with the Tea Authority (KTDA). The Kenya Tea Development Authority acts on behalf of the farmers to transport tea from the buying centres to the factory and from factories to tea auctions

after processing. The expenses incurred by the Authority on behalf of the farmers are deducted from their dues before they are finally paid. While most farmers felt that the Tea Authority should raise the prices for green leaf tea, the Kenya Tea Development Authority officers felt that it was not the Authority that was responsible for price decisions. Rather, they emphasised, tea prices are determined at the Tea Auctions by International Considerations. Farmers must, therefore, be made to understand the above facts, especially for the good of the tea industry as well as the survival of the Authority.

Price determines the savings of the farmers and hence the standard of living. Good prices ought to have enabled the farmers to make enough profit to pay for all the expenses incurred and save some for future use. Appropriate prices would mean that other household needs, such as food, clothing and shelter, could also be met at some minimum in order to improve the standard of living of these farmers.

Since Kenya is planning to industrialise by the year 2020, farmers need to be encouraged to reinvest their capital into other non-agricultural activities. This is due to the increasing population pressure on the finite land resources. A farmer who cannot save is faced with indefinite low standards of living and is not able to pay for even the basic family cash requirements. Smallholder tea industry can only be considered successful if prices paid can guarantee the average farmer a decent minimum income.

#### **4.5 Assessment of the functions of Kenya Tea Development Authority**

In assessing the services rendered by the Kenya Tea Development Authority, farmers were asked questions relating to the awareness of services rendered to them by the Authority.

Among the answers given:

- (a) 20.0 percent of the respondents were dissatisfied with transport services,
- (b) Approximately 26.3 percent were related to marketing,
- (c) 52.8 percent concerned dissatisfaction with processing and provision of loans,
- (d) About 33.3 percent of the farmers were aware that the Authority is responsible for the provision of extension services, and;
- (e) 6.9 percent did not know anything concerning the responsibilities of the Authority.

This shows that farmers need to be educated about the role of the Kenya Tea Development Authority in their farming operations. It should also be noted that some of the farmers who claimed that the Authority was like a 'hyena' came from Kabianga location where the effects of 1992 "tribal clashes" were concentrated. During the clashes people from other tribes who were working in the tea farms, and did not belong to the community of Kipsigis, were all chased away leading to labour shortages. As a result, the tea in the Kabianga region looked very dilapidated compared to other areas of Belgut despite the fact that tea hectarages in the area were larger than for other areas. Farmers should, therefore, learn or be advised not to engage in activities which, tend to destroy their source of income since they wholly depend on agriculture as a source of livelihood (means of life). Destroying the success of their crops was equivalent to destroying them individually. Unfortunately, such farmers find it easy to blame their problems on the inefficiency of the Kenya Tea Development Authority.

As far as the unfulfilled promises are concerned, responses to questions put to farmers concerning the irresponsibility of Kenya Tea Development Authority were as follows:

- (a) 28.7 percent of the farmers complained of poor transport,
- (b) 23.0 percent were dissatisfied with extension services, and;
- (c) 32.9 percent identified problems relating to processing and marketing of tea.

The farmers complained of poor roads and inadequate tea lorries needed to transport their tea. Further, extension services were perceived to be lacking, and farmers also complained about inadequate factory capacity. Other complaints concerned low prices and late payments. The reaction of the interviewed tea growers to perceived failures of the Kenya Tea Development Authority were observed and recorded as follows:

- (a) 5.7 percent of the farmers responded by neglecting their tea and concentrating on other crops,
- (b) 6.9 percent resorted to selling their tea to middlemen,
- (c) 15.7 percent opted to discuss the matter with Kenya Tea Development Authority officers in their offices, and;
- (d) 17.1 percent of the farmers felt that it was good to ignore the setbacks and continue working while at the same time counting their losses.

It was also observed that 17.2 percent of the farmers resorted to purchasing their own fertilizer requirements independent of the Tea Authority or to opting to reduce the amount of fertilizers used. The farmers who decided to neglect the tea altogether were reacting towards the failure of the parastatal to deal with their problems. It should also be

remembered that those who chose to ignore the Authority and continue working perpetuated the existence of irresponsibility in the society. The farmers who opted for discussions with Kenya Tea Development Authority officers chose a more constructive course, but arising from the divisions that existed among the farmers, their chosen response was not particularly effective. There was, therefore, need for farmers to discuss their problems first among themselves and demand for solution with one voice without succumbing to the “divide and rule strategies” of the Kenya Tea Development Authority.

Farmers were also asked in the questionnaire to suggest ways to find lasting solutions to the problems and their responses were recorded as follows:

- (a) 19.4 percent of the farmers preferred supervision of the work of the Tea Authority by Government, and that the Authority be forced to fulfil all its obligations to the farmers,
- (b) About 11.5 percent appealed to the Kenya Tea Development Authority to increase the number of vehicles used for transportation of tea leaves and to build more buying centres, and;
- (c) 13.6 percent of the respondents recommended that loans be availed to farmers, and that fertilizers be delivered in time, and their prices be reduced.

Urgent action on the improvement of roads was in the view of most farmers interviewed very crucial. Other farmers requested that the tea Authority should allow them to transport their tea to the factory in cases where the Kenya Tea Development Authority the tea lorries failed completely to appear. This was because, under normal

circumstances, the Tea Authority does not allow farmers into the factory premises unless with some specific reasons as that given to farmers with private vehicles as indicated earlier. A few of the smallholder tea growers interviewed also decided to use green manure, while others used none, to find their own solutions to the high cost of fertilizers. However, the Tea Research Foundation based at Kericho recommends that only chemical fertilizers should be used in tea production due to the dangers that may be posed by other forms of organic manure. Farmers who resorted to using green manure risked low yields and which may lead to the collapse of their tea farms.

In responding to the above issues, discussions with the Kenya Tea Development Authority officers at Kericho established that extension services had been adversely affected by problems of staff retrenchment, while others retired or died and were not replaced, leading to inefficiency in service provision. Further, the officials interviewed lamented that liberalisation of the tea industry had now made it possible for farmers to sell their tea to the estates, hence giving Kenya Tea Development Authority tight competition. However, an interview with one of the staff at the Tea Research Foundation of Kenya revealed that there is already a genuine misunderstanding between the tea farmers and the Tea Authority which needs to be sorted out. He pointed out that there was need to establish whether the Authority belonged to these smallholder tea growers or to the management of the Authority. It is only when this point is properly addressed that the solution to the various disagreements between the two parties could be solved. The crisis of confidence among the tea growers has led to the formation of the current Kenya Union of Small-Scale Tea Owners, the Kenya Small-Scale Tea Growers Association, and also to the emergence of middlemen (*Mang'rito*) in smallholder tea production.

The role of middlemen and their relationship with the tea growers also needs to be examined since they now have an important influence on tea production in Kericho, and particularly in Belgut Division, the study area. The emergence of middlemen is a result of the failure of the Authority to efficiently deliver its services to the farmers. As a result, this group of entrepreneurs decided to fill the gap by getting tea from desperate smallholder farmers and selling it to the estates or plantations. The problem has emerged from:

- (a) the frequent congestion at the buying centres, and because of the long hours of waiting,
- (b) rejection of some green leaf by the Tea Authority, and;
- (c) the fact that the Kenya Tea Development Authority's factories are already receiving tea above the maximum load capacity.

This means that not all green leaf tea delivered per day can be processed. This problem, however, is more linked to factory capacity, and the only solution is to be found in the construction of an additional factory.

The popularity of the middlemen lies in the fact that they pay the farmers in cash immediately after buying tea from them. The poor farmers who need to buy food on a day to day basis find this convenient. Further, the middlemen take all the leaf (whether poor quality or not). No tea is, therefore, wasted on the basis of quality.

Finally, the prices per kilogram of tea leaves offered by the middlemen were found to be slightly higher than those offered by Kenya Tea Development Authority: this is to say,

seven shillings as compared to six shillings respectively. The slightly higher prices offered to farmers by these middlemen acted as incentives to divert green leaf from the Kenya Tea Development Authority to the large tea estates. This explains why it was observed that the middlemen were spread throughout the locations within the study area.

A critical review of the role of the middlemen in the tea industry in Belgut Division is very revealing. Smallholder tea farmers rely upon the first payment, and later receive a second payment (bonus). In contrast, when the middlemen buy tea from the farmers, they only pay them the first payment and not the second one. They later get and keep the bonus for themselves. Most smallholder farmers rely on this second payment to perform most of their activities. Failure to get that money means the perpetuation of low standards of living within smallholder tea industry.

Further, as the estates emphasise quantity for their profits, when the middlemen sold their tea to them, they can be accused of promoting the development of large-scale tea at the expense of smallholder tea. This action is contrary to the mandate of the Swynnerton Plan of 1954 which set out to promote the development of African small-scale cash crop production, in this case tea. Bonus payments enable farmers to purchase the required farm inputs like fertilizer, which are normally made available on loan from the Kenya Tea Development Authority. Farmers who sell his tea to the middlemen who do not give bonus payments risk forfeiting the chance of obtaining loans through the Authority, which they need for developing the tea farms.

The issues which were observed among the small-scale tea growers in Belgut are not confined to Kericho District alone, and they may be observed in all the small-scale tea

growing areas of Kenya. The dissatisfaction has led to the call for a review of the constitution of Kenya Tea Development Authority, which has to date been rather insensitive to the complaints of smallholder tea farmers.

The demand for changes has now been accepted by the Government, and a new management structure defining the relationship between the Authority and the tea growers is likely to come into place in the near future. This thesis is not the place for that more involved discussion or analysis and some of these issues must be left for future researchers.

#### **4.6 Tea yields**

Tea yield is also a major concern in this study. As already indicated, tea yield determines the income of every individual farmer. In this study, average yield was calculated on the basis of the total hectareage in each location and total green leaf production. The spatial distribution of the results is shown in figure 4.3 and also in table 4.11. The table contains a summary of the 1996/1997 tea yields within the sampled farms. It was quite clear that the year 1996/97 was characterised by an unusual drought that surprised most farmers, leading to reduced yields on tea.

Table 4.11 shows that Seretut was leading followed by Kabianga in terms of yield, while Figure 4.3 illustrates these spatial differences of the yields from sampled farms. Yield figures were obtained from the total hectareage of planted tea in each location and total production within the sampled farms. The lowest yields are evident in Waldai location with less than 7000Kg per hectare.

**Table 4.11 Tea yields in sampled farms by location**

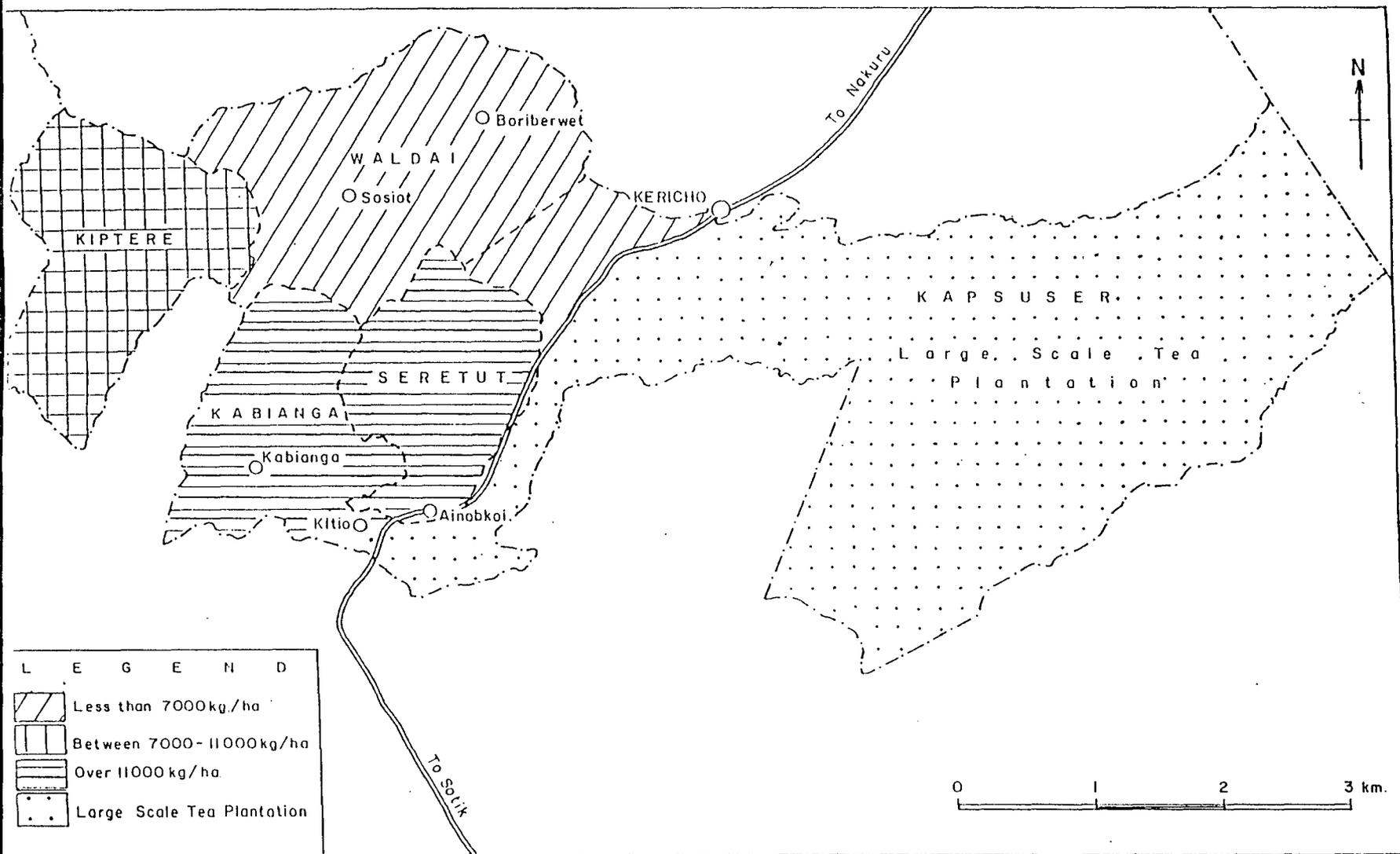
LOCATION	TOTAL AREA UNDER TEA	TOTAL KG. HARVESTED IN 1996\97	YIELD IN KG/HECTARE
WALDAI	29.83	186,004	6,235.47
KIPTERE	2.47	18,000	7,287.74
KAPSUSER	56.40	378,132	6,704.47
KABIANGA	2.64	30,960	11,727.27
SERETUT	5.74	103,836	18,089.90

Source: Fieldwork (1998)

As far as temporal variation in tea yields is concerned, table 4.12, adapted from the Tea Board of Kenya, has been used for illustration. Table 4.12 is useful for providing an overview of the expansion of smallholder tea growing in Kenya between 1963 and 1997. This period has seen the very rapid expansion in area under tea and the rise to prominence of small-scale tea growers as opposed to plantation grown tea. The yield variations are not easy to explain because of variation in hectareage planted, hence of immature tea and other factors such as variation in annual rainfall received in the different tea growing areas in the country.

Smallholder tea production now accounts for nearly 60 percent of the total tea grown in the country. The apparent drop in yield per hectare may also be an indication of the management problems the smallholders are experiencing with the Kenya Tea Development Authority.

Fig. 4.3 : VARIATION IN TEA YIELDS DURING 1996/97 PERIOD IN Kg/Ha



Source: Fieldwork (1998)

**Table 4.12 Temporal variation in tea yields**

YEAR	PRODUCTION (KG)	HECTARES PLANTED	YIELD (KG/HA)	PRICE PER KG (K )
1963	311980	3527	88.45	0.33
1964	824853	4471	184.49	0.34
1965	796011	5429	146.62	0.36
1966	1572481	7238	217.25	0.37
1967	2248059	9269	242.54	0.41
1968	3402760	12233	278.16	0.37
1969	5777160	14685	393.41	0.34
1970	7976425	17985	443.50	0.38
1971	3068220	20528	149.47	0.36
1972	13129006	26493	495.57	0.33
1973	15072903	31161	483.71	0.34
1974	16180350	34648	466.99	0.39
1975	17915222	37205	481.53	0.44
1976	21462626	41412	518.27	0.54
1977	30737048	43641	704.32	0.95
1978	34821260	46910	742.30	0.78
1979	37633936	48876	769.99	0.71
1980	33980009	50691	670.34	0.78
1981	35803706	52748	678.83	0.81
1982	39946051	54698	730.30	0.97
1983	50964190	54969	927.14	1.23
1984	52708241	56499	932.91	2.21
1985	71339025	56505	1262.53	1.52
1986	68124740	56546	1204.77	1.48
1987	76932597	56891	1352.28	1.21
1988	84692559	57693	1467.99	1.34
1989	100567147	57934	174.31	1.67
1990	109996712	67041	164.07	1.86
1991	112741963	69609	161.96	2.17
1992	99811409	72162	1383.16	2.85
1993	112534790	73109	153.92	4.96
1994	119084498	78183	152.15	4.97
1995	138945451	80355	172.91	3.96
1996	144070653	81159	177.52	4.43
1997	129707792	85057	152.50	6.27

Source: Adapted from Tea Board of Kenya (1998)

Price of tea has been increasing over the years with major increases between 1980s and 1990s and a peak period in 1992/3 when prices rose from Kenya pounds 2.85 to 4.96.

This could be linked to reduction in yield during the same period from 1383.16 Kilograms per hectare to 153.92 Kilograms per hectare (Kg/Ha). The reduction in yield in the period 1996/7 from 177.52 to 152.50 Kg/Ha was accompanied by price increases from Kenya pounds 4.43 to 6.27. On these occasions, price appeared as being determined by yield fluctuations. However, these fluctuations on yield cannot solely be attributed to price since, in a number of years there were yield reductions without similar price increases. This could be explained by the fact that increased tea production, resulting in increases in yields, has been also due to increases in hectarage planted over the years as is indicated in Appendix 2 of this thesis. In an earlier study already quoted, Etherington (1973) had also noticed the continued expansion of tea hectarage despite apparently declining tea yields.

#### **4.7 Technology used**

Almost all smallholder tea farmers use sickle, jembe and panga in carrying out their day to day activities. The panga is used for clearing, the jembe for land preparation and weeding, and sickle (pruning knife) for pruning. Only one farmer who had 8.6 hectares of tea used a tractor on his farm for ploughing and general land preparation. Other activities are carried out by hand. This is a slow process, but in Kenyan smallholder tea production, mechanisation has not really picked up.

It was indicated in another section of this study that smallholder tea farmers studied used different amounts of fertilizer in their farms. Each farmer decides upon the amount to use irrespective of the recommended levels. This could be attributed to problem relating to the lack of extension officers to give farmers advice on the agronomic requirements of the

tea crop.

According to the Kenya Tea Development Authority (Kericho), it is recommended that one bag (50 Kg each) should be used for every 500 bushes. About 3637 bushes make 0.43 hectares, demanding 7.3 bags. The officer also cautioned that use of more fertilizer led to waste due to high costs of inputs incurred and less output. There are several compounds of fertilizers used in tea production, but as far Kenya is concerned, Nitrogenous, Phosphorus, and Potassium containing fertilizers have been mostly used. For example, Sulphate of ammonia (S/A), Ammonium sulphate-nitrate (ASN), Single and Concentrated Super-phosphate, Sulphate of Potash, and Di-ammonium phosphate. Farmers however, believe that the more fertilizer used the higher the resulting yield. Due to this ignorance, it was found difficult to gauge the extent to which farmers in Belgut were spending too much or too little on fertilizer application. The Kenya Tea Development Authority tries to give fertilizer to each farmer depending on the size of the tea hectare, but it is difficult to judge whether this is being applied correctly.

As far as the timeliness of fertilizer delivery is concerned, 50.3 percent of the farmers studied held the view that there was always a delay in delivery of fertilizers. In addition, the Authority was also alleged to have provided inadequate fertilizers compared to the demanded quantity. A few farmers held the view that fertilizers provided by the Tea Authority were too expensive. The farmers are, therefore, demanding that the costs of fertilizer be reduced, and the Authority be made to supply farmers with fertilizers two times a year as this would reduce the effect of delays in fertilizer delivery. Only 1.1 percent of the farmers interviewed used green manure on their tea. All others preferred

fertilizer.

#### **4.8 Gender in smallholder tea production**

As far as gender is concerned, the findings of Bülow and Sorenson (1989) in Mosop area also hold for Belgut Division. In the sample farms, it was found that the husband was as a rule the head of household and he commanded labour from his wife and children. Among the farmers interviewed, 89.5 percent heads of households were men, and only 6 percent were women. The household head, therefore, owned or controlled the production of tea on his/her farm. The women who were heads of households were widows.

In terms of labour supply, great inequality exists between jobs done by women and those done by men. More male employees are employed compared to female labourers. Many farms also did not employ any woman. The time spent on the farms daily is equal for both men and women. Most women employed carried out mostly plucking activities and minimum weeding. Their male counterparts carry out weeding, plucking and pruning.

The women who were heads of households had no education at all, with the exception of one woman who attained part of primary school education. One major explanation for this was that they tended to be aged and even the men in the similar age category lacked education. Those who attained secondary school education were mostly youth.

When the men went to acquire off-farm employment, the women remained at home. The women took care of all the responsibilities in their houses as well as those on the tea farm.

When payment is due, the men usually go back home to receive the money. Women are

considered to be mere labourers to men, and had no authority over any of their properties.

As a result, women in Belgut Division had inferior roles compared to men in smallholder tea production.

#### **4.9 Summary**

In summary, three null hypotheses were tested in this chapter. The first one aimed to establish the differences in land allocation between different farming enterprises and to evaluate their effects on smallholder tea production. According to the results, tea is grown in competition with maize, vegetables, and millet among others. It was shown that there is competition for labour between tea and livestock and food production enterprises, especially during the peak period.

The hypothesis on incomes and expenditures revealed that among the various farm inputs, fertilizer is very crucial. Fertilizer is costly, yet all farmers need to apply it for higher yields. It, therefore, reduces the amount of earning of each individual household. Smallholder tea farmers occupying the smaller farms were shown to be the worst hit.

Lastly, the effects of age, education, labour, transport and farm size on production were shown to be statistically significant using the F statistic on page 113 (Table 4.8). They greatly influenced tea production as was shown using other findings. Hectarage of tea and labour emerged as two important prediction factors in the equation after carrying out Stepwise Multiple Regression Analysis.

This chapter, therefore, has shown the various socio-economic problems influencing

smallholder tea production and the types of effects they have upon tea production. The next chapter will be used to highlight some of the findings of this research and to make recommendations, which are appropriate to the study findings.

## **CHAPTER FIVE**

### **5: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Summary of findings and conclusions**

This chapter contains a summary of the findings of the study and these will form the basis upon which relevant conclusion are made. The major objective of this study was to investigate the various socio-economic problems experienced by smallholder tea farmers in Belgut Division of Kericho District which have made it difficult to exploit to the full the high potential agricultural land on which they work. This research has established that the problems of smallholder tea farmers can be classified into two major categories:

- (a) those resulting from poor management decisions made by the farmer and concerning the related resources required for successful agriculture and other external forces, and;
- (b) Socio-economic factors, which could be attributed to problems of land-use and the choice of the right crops and livestock combinations.

In circumstances where many types of crops were grown in combination with tea within small hectarages of land, it was revealed in the study that such farmers face severe problems of food shortages, low incomes from tea, and lack of labour. The external forces refer to the decisions made by other people and not the farmer, especially the Kenya Tea Development Authority concerning the provision of transport facilities, fertilizer, and producer prices offered to farmers. The intensity of the above problems varied spatially and temporally.

In studying the competition between tea and other farming enterprises, Analysis of Variance technique was used. Comparison was made between land allocated to tea production with that allocated to food production and to pasture. The results established that there was a significant difference in land allocation, with tea coming first, followed by food crops, and pasture.

The importance of tea production in Belgut Division could be seen from the fact that tea occupied more land than any other crop. It was established that the higher the land given to the tea crop, the more stable was the allocation for the other crops. For example, it was shown that farmers having less than 0.86 hectares of tea were the ones experiencing various socio-economic difficulties such as frequent food shortages, inadequate labour, and generally low incomes. They were thus forced to resort to certain short-term measures to cope with these problems. For example, many of the farmers planted vegetables for sale, which had higher returns per unit area (hectare); others resorted to looking for, and taking, off-farm employment, while others were even forced to borrow food from their friends in difficult times. A few farmers who had access to credit facilities obtained loans from banks to meet their short-term income requirements, but the end result is that most of them were persistently in debt. In this case, it is concluded that smallholdings of tea (less than 0.86 hectares) are not economical in tea production.

The Multiple Regression Analysis technique was used to compare the incomes and expenditures within the smallholder tea households. The aim was to examine the viability of the tea industry among this group of farmers. This is because in order for Kenya to industrialise by the year 2020 as now commonly postulated in Government policy, farmers

must save enough money, which they could re-invest into other non-agricultural activities. The results established that a definite relationship existed between the incomes and expenditures, with a significant relationship between incomes and expenditures on fertilizers.

The study further revealed that, among other farm inputs, fertilizer was too expensive in the context of the average earnings of farmers, especially those with smaller tea hectarages (less than 0.86 hectares farms). The study also showed that some farmers were buying fertilizers directly from Kenya Farmers Association (KFA) stores in order to avoid too exorbitant deductions on fertilizer delivered by the Kenya Tea Development Authority.

In any case, most farmers were unhappy about the frequent delays in the arrival of the subsidised fertilizer from the Kenya Tea Development Authority. It is, therefore, concluded that the smallholder tea farmers were dissatisfied with the services rendered by the Tea Authority and thus, the Kenya Tea Development Authority has contributed to some of the problems experienced by the smallholder tea farmers in Belgut Division of Kericho District.

Further analysis established that the farmers with larger hectares of land for tea production (greater than 0.86 hectares) obtained higher incomes compared to those who had their tea on smaller parcels of land (say, less than 0.86 hectares). Most of the farmers having the smaller tea hectarages earned very little income, while many of them had too little food from their land to sustain them throughout the month. According to the research findings, it is this group of farmers who also experienced the problems of food shortages since their average farm incomes frequently could not enable them to buy enough food to feed the

entire family. It is thus concluded that smallholder tea production is more profitable in farms greater than 0.86 hectares.

The existence of a relationship between tea production and age, education, transport, labour and hectarage for tea was determined using the Stepwise Multiple Regression Analysis technique. The relationship between production and the above variables was found to be very significant, thus resulting in rejection of the formulated null hypothesis. The best prediction variables for smallholder tea production were shown to be labour and farm size (hectarage). The effects of hectarage on tea production can be linked to those already discussed in respect of land allocations to different farming enterprises.

The results obtained established that age of the farmer was linked to land ownership. Many of those aged between 21 and 41 years and also still had their parents did not own any land and, therefore, did not have access to credit facilities where land title had to be used as security. This was found to be a limiting factor, since as already pointed out, education was necessary for establishing the profitability of each individual farm enterprise. It was found that more educated farmers understood their problems better, and could point them out whenever they were asked during fieldwork as opposed to farmers with no education, who at times were unaware of their problems. It is, therefore, concluded that education is one of the factors influencing tea production but to a smaller extent. Further, sub-division of tea land between a father and his children is responsible for the existence of small tea farms which proved to be uneconomical due to low incomes earned. It is concluded that farm fragmentation is beginning to take place below economic unit in the study area.

Transport problems in smallholder tea farming were linked to the distance covered by each individual farmer,

- (a) from his farm to the nearest buying centre,
- (b) from buying centre to the factory, and;
- (c) from the factory to the tea auctions at Mombasa,

for which, they are charged by the Kenya Tea Development Authority.

Furthermore, farmers located near the buying centres were found to have more advantages as compared to their colleagues located away from buying centres. Those located near buying centres were, for example, able to pluck for longer periods each day and rarely missed the tea lorries, were compared to growers located far away. The smallholder tea farmers located far from the buying centres had to walk very long distances to the buying centres, thus reducing considerably the time available to them for plucking tea. It is concluded that transport problems contributed to low production recorded by the Tea Board of Kenya since farmers had to stop plucking early and wait for the tea lorry. Further, transport problems have also contributed to the low earnings of the tea farmers since low productivity results in low incomes. In addition, deductions on the farmers' earnings when no service is rendered is an indication of the farmers' exploitation by the Tea Authority.

Qualitative methods of analysis were applied to the issues concerning the functions of Kenya Tea Development Authority, spatial variation in tea yields, producer prices, fertilizer application and gender. These were based on observations in the field, as well

as from the secondary data obtained from the Kenya Tea Development Authority and the Tea Board of Kenya.

The research findings indicated that most farmers felt that the above Tea Authority has failed to deliver the required services to them. The problems of the Kenya Tea Development Authority are linked to the fact that its board is made up of officials who do not deal directly with the farmers. Further, the Authority relies on the Ministry of Agriculture for extension service provision to farmers. Due to retrenchment, some of the extension officers have lost their jobs; others have retired, while others died without being replaced.

The emergence of the middlemen within smallholder tea production has contributed to the lowering of standards of living among the farmers. This emergence has been due to the failure of the Tea Authority to address farmers' problems of low prices, high cost of deductions on transport and fertilizer, and poor schedules of payment in time. If the Tea Development Authority is to survive, the management officials must recognise the role of the farmers in its management, or be ready to face the competition from the newly formed organisations, such as the Kenya Union of Small-scale tea Owners, and the Kenya Small-scale tea Growers Association. The Kenya Tea Development Authority is thus responsible for low productivity of the smallholder tea farmers due to lack of extension services and the lowering of standards of living as a result of the emergence of the middlemen.

The study of the role played by tea yields was shown to be an important aspect of this study. It was shown that the distribution of tea yields in the studied locations varies from

one location to the next, with Seretut location leading and being followed by Kabianga.

Temporal data on yield further established that, in general, tea yields have been increasing over the years, except for the 1990s, with minimum fluctuations despite apparent overall price decreases. Theoretically, price should be an incentive towards the increases in yields. However, tea yields were found to have increased without similar increases in price.

According to this study, tea yields have continued to fluctuate over the years, whereas overall production has continued to increase with minimal fluctuations. This has been true in Belgut Division as well as other tea growing areas in Kericho and Kenya. It is concluded that increases in yield cannot solely be attributed to favourable prices, but also to other factors such as the increases in the hectares of tea planted

The above findings could greatly enable the Kenya Tea Development Authority to remove the current inefficiencies that have characterised its operations for the development of the smallholder tea industry. The importance of socio-economic aspects of smallholder tea production cannot be ignored if the sector is to develop.

### **5.3 Recommendations**

Recommendations were made both to the Government as a policy-maker, and for future research.

#### **5.3.1 Policy-makers**

The marginal areas within the land ordinarily gazetted for tea expansion ought to have

been used for more appropriate crops instead of using them for tea. They add to the current problems of low productivity and low standards of living among the tea farmers due to low returns. Since tea is a very specialised crop in terms of soil and water requirements, farmers with limited land within the high potential land areas should be encouraged, in addition to their tea to keep improved dairy cattle, which could even be fed using zero grazing within the homesteads. This is a possible alternative to the current situation where tea is obviously uneconomical.

According to the findings, the problems of land-use competition in smallholder farming (lack of food, low incomes earned, and labour competition problems) require that the farmers be advised to choose between tea production, and other farm enterprises. This would allow them to grow other crops that are more suitable for the small farm sizes, which are becoming the rule rather than exception. They could, for example, concentrate on dairy farming so that they would be in a position to use the little land they have to its fullest capacity. Although this suggestion would reduce tea hectares all round, the smallholder tea industry would thus be made more sustainable.

The process of land acquisition and ownership in these areas should be modified. A limit needs to be set on the smallest land size allowed for tea farming. No further sub-division should be allowed on such farms, but, instead, joint ownership should be encouraged. In addition, no tea should be grown on hired land due to the problem of insecurity of tenure should there be any disagreements between the tea farmer and the owner of the land.

As far as the running of Kenya Tea Development Authority is concerned, the Authority

should make second payment after six months instead of one year, immediately after knowing the prices of tea in international market.

In addition, as the Authority depends on international prices of tea, the officers of the Authority need to inform the farmers on issues concerning changes in prices so that there is no misunderstanding about the payments made. The cost of fertilizer should also be reduced and the farmers should be left with the choice to buy either their own fertilizer or rely on the Tea Authority for provision in order to allow the processes of liberalisation within the tea industry. The problem of the high cost of fertilizer input is real, and can be properly addressed by allowing the farmers to buy their fertilizer directly without going through the Kenya Tea Development Authority. As of now, there is very little trust of the Kenya Tea Development Authority and the farmers should be encouraged to find new management approaches which would work satisfactorily for them.

Further, due to the existing problems of labour, education, and transport, the Tea Authority should source funds to enable them to carry out different activities as discussed below

- (a) improvement of roads, and the increment of the number of tea lorries, as well as allowing the farmers to deliver their tea directly to factory wherever possible,
- (b) employment of enough extension officers to educate farmers on the required economic practices to improve production instead of relying on the Ministry of Agriculture, and;
- (c) second payments for the tea delivered be done within six months rather than a year and the Tea Authority should also keep records of smallholder farmers by

location.

The above procedures could greatly enable the Kenya Tea Development Authority to remove the current inefficiencies that have characterised its operations for the development of the smallholder tea industry. The importance of socio-economic aspects of smallholder tea production cannot be ignored if the sector is to develop. These attempts would further enable the Authority to identify and understand the farmers' problems better and to address the issues at the right time.

### **5.3.2 Further research**

Due to lack of data on prices of tea and hectarages in Belgut Division, no hypothesis could be formulated to test the effects of prices on yield. A study by other researchers on the spatial-temporal analysis relating price data to that of yield would therefore be necessary especially when discussing the influences of price on yield. In order to carry out the study, a larger area would be required so as to investigate the spatial variations of producer prices relative to different factories in the respective areas.

Another area that requires further research is the spatial variation and comparison of the cash incomes between tea farming, other cash crops (sugarcane and pyrethrum) and also improved dairy cattle production. This information would be useful when advising farmers with smaller pieces of land.

Other topics requiring detailed research by other researchers include the role of women in more meaningful rural development of the study area. This is because the present study

identified women as mere labourers in tea production, and yet they should be an integral part of the economy of each farm in the study area. Further, a study is necessary to help in establishing economic unit of a farm within this high potential area.

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**APPENDICES****APPENDIX 1:****QUESTIONNAIRE****CONFIDENTIAL****QUESTIONNAIRE FOR SMALLHOLDER TEA PRODUCTION IN BELGUT DIVISION OF KERICHO DISTRICT, KENYA.****A: PERSONAL DATA**

- 1: a) Name of household head.....  
 b) Male or Female .....  
 c) Location .....  
 d) Farm number.....  
 e) Age.....  
 f) Respondent.....  
 g) Date of interview.....  
 h) Respondent.....

**B: HOUSEHOLD INFORMATION**

- 2: a) Total number of household members.....  
 b) Number of males.....  
 c) Number of females.....  
 d) Level of education of the farmer.....

**C: LAND ALLOCATION FOR FARM ENTERPRISES**

- 3: a) No. of parcels.....  
 b) Location of parcels .....  
 c) Cash crops grown.....  
 d) Food crops grown.....  
 e) Cost of fertilizer used in Ksh.....  
 f) Hectarage for (i) Tea....., (ii) Food crops....., (iii) Pasture.....

**Coding**

**A: Age: 1-10 years-1; 11-20 years -2; 21-30 years-3; 41-55 years-4; 55 –over 55 years-5.**

**Household head : Male-1; Female-2.**

**Location: Waldai-1; Kiptere-2; Kapsuser-3; Kabianga-4; Seretut-5.**

**B: Education**

**None-1; Primary-2; Secondary-3; Higher-4; University-5.**

**D: SOURCES OF LABOUR**

4: Do you use any hired labour?,

5: If yes, please answer the following:

- a) For what type of activities do you use hired labour?.....
- b) How many males have you hired and for how long?.....
- c) How many females have you hired and for how long?.....
- d) How much money do you pay them per day?.....

6: If no, please answer the following:

- a) What is the source of labour for –
  - 1) Planting
  - 2) Weeding
  - 3) Plucking
  - 4) Pruning
  - 5) Other labour and sources of supply. ....
  - 6) For how long do you stay on your tea farm each day.....

7: How do you compensate yourself.....

---

**Coding****C: Parcels**

In village area-1; Outside village area-2.

**D: Time per day**

1-2 hours-1; 3-4 hours-2; 5-8 hours-3; 8 and above-4.

---

**E: SOURCES OF CAPITAL**

8: Where did you get money for investment into tea production .....

9: Do you have any access to credit facilities?.....

10: If yes, from what sources? .....

11: How many times a year do you take loans?.....

12: For what purposes were the above loan(s) taken?.....  
 .....

13: What was the duration for payment for each loan?.....  
 .....

**F: INCOMES AND EXPENDITURES**

14: How much tea do you sell daily?.....

15: How much tea do you sell weekly? .....

16: Please fill the table below for expenditures,

Items weekly purchased	Items monthly or annually purchased	Cost of each Item in Ksh.

**G: TECHNOLOGY**

17: Which farming tools do you use for the following:

a) Clearing and digging?.....

b) Weeding?.....

c) Pruning?.....

d) Plucking?.....

18: How do you store your:

a) Food crops?.....

b) Tea? .....

19: How do you transport your green leaf from farm to the buying centre?.....  
 .....

**H: CROP INFORMATION**

20: Please fill in the table below:

Crop	Hectarage planted in 1997	Total Kg. harvested in 1997	Price paid to farmer

**I: MARKETING**

21: To whom do you sell your tea?.....

22: Where is the tea sold?.....

23: What is the distance from your farm to the place of sale?.....

24: Do you sometimes fail to sell some of your products?.....

25: What happens to the remaining?.....

**Coding**

**G:19: Self carriage-1; Bicycle-2; Wheelbarrow-3; Co-operative vehicle-4  
Private vehicle-5; Others-6.**

**Yes-1 and No-2 throughout the work.**

**I:22: On the farm-1; At the buying centre-2; Any place of middleman-3**

**I: 23: 0-1Km-1; 2-3Km-2; 4-5Km-3; 6Km and above-4**

**I: 25: They are thrown away-1; I sell them the next day-2;  
I sell to the middleman-3; Others (specify)-4**

**J: LIVESTOCK INFORMATION**

26: Do you keep any livestock in the farm?.....

27: If yes, please answer the questions below:

a) What type of livestock? .....

b) How many of the above do you keep?.....

- c) How do the livestock above help you in your tea farm?.....
- 28: Who attends the flock?.....
- 29: What type of activities are carried out in this process?.....
- 30: How much time is spent on carrying out the above activities per day?.....  
.....
- 31: How many people are involved?.....

**Coding**

**J:27:c**

**Manure-1; Ploughing-2; Transport-3; Others-4**

**J:28: Household members-1; Hired labour-2; Other relatives-3; others-4**

**J:29: Grazing/Feeding-1; Milking-2; Spraying-3; Others-4**

**J:30:**

**1-2 hours-1; 3-4 hours-2; 5-6 hours-3; 7-8 hours-4; 9-10 hours-5;  
11-12 hours-6; 12 hours and above-7.**

**K:42: Personal will-1; Friends-2; By birth-3; Extension officers-4;  
Government officers (chiefs)-5**

**K: OTHER SOCIO-ECONOMIC PROBLEMS**

32: What problems do you experience in smallholder tea production?.....  
.....

33: How do you solve such problems?.....  
.....

34: Have you experienced any problems of food shortages in the family?, If so when  
.....

35: How do you solve such problems of insufficient food?  
.....

36: When did you start to grow tea and for what reason?.....  
.....

37: Do you wish to continue growing tea, if yes, why? or if no, why?.....  
.....

38: What services does the Kenya Tea Development Authority render to  
you?.....

39: Which one(s) does it not render and yet it is suppose to provide.....  
.....

40: What do you do when no service is rendered?.....  
.....

41: What would you like to be done in order to solve such problems .....  
.....

42: How did you decide on crops grown?.....

43: Do you own any of the following (please tick appropriately):

- a) Bicycle
- b) Motor car
- c) Motor cycle
- d) Matatu
- e) Bus(s)
- f) Shops
- g) Others

## APPENDIX 2

## Analysis of Variance Table

Sample No.	Farm Code/Name of Farmer	Location	Year of Planting Tea	Hectarage (Ha) of Tea	Food Crops	Pasture	Tea Production (Kg)	Tea Yield (Kg/Ha)
1	Arap Cheres	Waldai	1954	0.85	0.85	-	-	-
2	Joseph Cheruyot	"	-	0.85	-	-	10800	12705.9
3	Samuel Rotich	"	1978	0.32	0.32	-	-	-
4	1334	"	1972	5.10	0.85	-	28800	5647.1
5	0082	"	1985	0.43	0.43	0.26	3856	8967.4
6	0006	"	1976	0.85	-	-	9600	11294.1
7	0261	"	1987	1.06	-	-	2496	2354.7
8	3145	"	1980	0.32	0.11	-	3000	9375
9	0109	"	1981	0.34	0.21	-	1200	3529.4
10	3012	"	1974	1.7	0.85	-	6000	3529.4
11	0205	"	1956	0.43	0.43	0.64	336	781.4
12	0045	"	1972	0.43	0.44	-	360	837.2
13	1350	"	1950's	0.21	0.30	2.68	900	4285.7
14	0369	"	1992	0.26	0.85	0.43	1500	5769.2
15	Andrew Koech	"	1982	1.91	-	-	9600	5026.1
16	Lydia Cheruyot	"	1983	1.23	2.13	0.85	2600	2113.8
17	0308	"	1980	0.21	-	-	240	1142.9
18	0320	"	1961	0.85	0.85	1.91	392	461.2
19	0300	"	1983	1.70	4.68	-	4000	2352.9
20	1000	"	1989	0.13	0.17	-	1200	9230.8
21	Musa Tanui	"	1988	0.43	-	-	2400	5581.4
22	1120	"	1993	0.60	0.64	-	3000	5000
23	David Maritim	"	-	0.13	0.13	-	444	3415.3
24	0050	"	1969	1.06	1.49	5.53	5400	5094.3
25	David Tanui	"	1986	0.21	0.13	-	4200	20000
26	0118	"	1966	0.43	0.85	-	4800	11162.8
27	0099	"	-	0.21	0.43	-	1000	476.2
28	0041	"	1973	0.43	0.43	1.06	9600	22325.6
29	1043	"	1972	-	-	-	3840	-
30	2905	"	1988	0.43	-	-	6000	13953.5
31	0164	"	1986	0.21	-	-	2400	11428.6
32	0027	"	1967	0.64	0.43	0.43	960	1500
33	1861	"	1983	0.17	0.43	0.43	2500	14705.9
34	0078	"	1978	0.30	0.43	0.77	4800	16000
35	0939	"	1971	1.06	0.55	2.30	14400	13584.9
36	Robert Kosgei	"	1997	0.13	0.13	0.17	960	7384.6
37	Bones Ng'eny	"	1952	1.06	0.43	1.74	9600	9056.6
38	0021	"	1983	0.21	0.43	1.49	1680	8000
39	0048	"	-	0.23	0.85	0	9600	7804.9
40	1001	"	1992	-	-	-	-	-

41	0302	"	1980	0.43	0.10	1.74	3000	6976.7
42	0027	"	1966	0.64	0.85	1.06	7000	10937.5
43	0030	"	1969	0.64	0.43	0.32	1440	2250
44	0071	Kapuser	1994	0.43	0.85	-	300	697.7
45	0177	"	1987	1.70	0.85	-	20160	11858.8
46	0024	"	1974	1.70	0.43	-	20400	12000
47	0188	"	1993	0.85	0.64	-	10080	11858.8
48	0001	"	1978	2.13	0.85	-	24816	11650.7
49	0157	"	1983	2.55	0.64	-	30888	12112.9
50	0077	"	1979	0.85	1.28	-	11184	13157.6
51	0078	"	1980	0.11	0.21	-	2400	21818.2
52	0098	"	1990	0.85	0.64	0.40	2340	2752.9
53	0024	"	-	0.43	-	0.43	1440	3348.8
54	0114	"	1991	0.11	-	-	2400	21818.2
55	0191	"	1986	8.5	-	-	144000	16941.2
56	1534	"	1985	0.85	0.43	-	9600	1124.1
57	0141	"	1983	0.43	0.43	0	31200	72558.1
58	0951	"	1984	1.06	0.43	0.64	12000	11320.8
59	James Bor	"	1978	0.64	-	-	11520	18000
60	0927	"	1988	0.32	-	0.32	7200	22500
61	0162	"	1964	0.32	-	-	3648	11400
62	0026	"	1956	0.96	-	-	12480	13000
63	1515	"	1989	0.17	0.32	-	3996	23505.9
64	0054	"	-	0.11	-	0.21	6300	57272.7
65	0173	Secretut	1987	0.32	0.85	1.23	11196	34987.5
66	2255	"	1983	1.19	0.43	0.82	13440	11294.1
67	0063	"	1978	-	0.48	-	33600	-
68	2133	"	1982	1.49	0.43	0.43	17280	11597.3
69	1948	"	1976	1.06	0.43	-	11040	10415.1
70	0041	"	1978	1.49	0.96	0.05	17280	11597.3
71	1277	Kiptere	1986	0.21	-	-	2400	11428.6
72	0706	"	1979	0.34	0.11	-	4800	14117.6
73	0003	"	1960	1.06	0.21	2.98	1600	1509.4
74	0103	"	1970	0.85	0.21	-	1200	1411.8
75	0036	Kabianga	1996	0.64	0.26	0.51	9600	15000
76	1001	"	1979	0.1	-	-	2040	20400
77	0978	"	1984	0.85	1.23	2.02	9600	11294.1
78	0037	"	1981	0.43	0.64	-	2880	66977.7
79	0166	"	1978	0.34	0.26	0.55	3240	9529.4
80	0152	"	1989	0.30	-	-	3600	12000

## APPENDIX 3

Table of Multiple Regression Analysis (Cash incomes and expenses (Kshs))

Sample	Annual Cost of inputs (Kshs)	Monthly Income from Tea	Approximate monthly expenditure	Cost of fertilizer	Total Amount Income
1	14000	7000	4000	14000	25990
2	-	5200	2000	-	94800
3	1800	-	3200	-	-
4	97280	144000	14000	8000	259200
5	43800	984	3200	7800	23136
6	63000	46800	26000	1500	57600
7	6350	2496	4800	6350	14976
8	4550	1500	2000	4550	6750
9	5040	600	230	5040	7200
10	29850	34500	4000	11200	3600
11	2800	168	320	2800	2016
12	3500	180	400	3500	2160
13	7500	1350	1800	7000	5400
14	2800	1200	400	2800	9000
15	96200	16800	2260	4200	57600
16	17600	600	400	1400	15600
17	2750	2700	300	5600	1440
18	38360	2332	800	1400	2353
19	6650	6300	4000	5600	224000
20	1400	600	6500	1400	7200
21	12800	1200	120	5600	25200
22	16700	1500	500	7700	27000
23	0	720	10000	0	3996
24	30660	1680	3680	18900	48000
25	12800	2400	2000	800	25200
26	19760	2400	1520	5600	43200
27	43400	6000	400	5600	6000
28	59600	6000	3200	1400	57600
29	104620	1920	2000	5600	23040
30	2710	1600	700	3940	36000
31	4220	1200	1800	2710	1440
32	18600	960	560	4220	5760
33	32830	1420	4000	18200	17000
34	41000	2400	4000	8730	28800
35	64100	6000	1280	9800	46400
36	1400	460	720	19900	3760
37	24200	2480	420	1400	57600
38	166200	840	720	18200	10080
39	23500	2400	1600	4200	9600
40	2800	600	-	9100	-
41	14700	1800	1500	2800	18000
42	73000	3600	1200	2100	40500
43	21560	720	720	15400	8640
44	-	5040	4000	9800	60480
45	-	10080	6000	-	120960
46	-	5040	3000	-	122400
47	-	10080	8000	-	60480
48	-	12400	5200	-	185328
49	-	6160	3000	-	67104

50	-	5600	-	-	7500
51	5110	1170	8000	5110	14400
52	17020	1170	-	6020	14040
53	5000	720	988	1400	8640
54	2800	1200	610	2800	14400
55	388000	78120	34900	112000	864000
56	12150	4800	-	11200	57600
57	11100	5000	-	1500	87200
58	-	6000	-	-	72000
59	37400	5760	4000	1400	69120
60	4800	3600	2400	4800	43200
61	2400	1824	1200	2400	21888
62	5710	6240	4604	5710	74880
63	-	200	4100	-	23976
64	43200	3150	-	-	37800
65	-	5600	-	-	67176
66	1400	6720	5000	-	80640
67	16800	1200	15600	-	201600
68	-	1440	-	-	103680
69	-	5520	-	-	66240
70	-	8640	7000	-	103680
71	18600	1200	500	4200	14400
72	31400	2400	-	9800	28800
73	41500	6200	-	17500	57600
74	10600	600	-	7000	7200
75	4200	4800	2000	4200	57600
76	1400	1020	2400	1400	12240
77	62200	4800	2000	15400	57600
78	11400	1440	1200	4200	17280
79	17500	1620	1500	7000	19440
80	4200	1800	1000	4200	21600

## APPENDIX 4

Table of Stepwise Multiple Regression Analysis

Sample No.	Age (Yrs)	Education (No. of years spent in school)	Labour (Hours/Day)	Distance (Kms)	Hectarage of Tea (Ha)
1	>55	0	12	-	0.85
2	21-40	<=7	10	2-3	0.85
3	41-55	<=7	10	2-3	0.32
4	>55	<=7	21	4-5	5.10
5	21-40	<=7	3	0-1	0.43
6	>55	8-<=12	6	0-1	0.85
7	21-40	<=7	7	2-3	1.06
8	41-55	<=7	6	0-1	0.32
9	>55	<=7	6	2-3	0.34
10	>55	>13	-	0-1	1.70
11	>55	<=7	6	0-1	0.43
12	21-40	<=7	6	0-1	0.43
13	>55	8-<=12	6	-	0.21
14	41-55	<=7	6	-	0.26
15	41-55	0	12	-	1.91
16	>55	0	10	-	1.23
17	>55	<=7	12	-	0.21
18	>55	<=7	16	-	0.85
19	41-55	8-<=12	13	-	1.70
20	21-40	<=7	6	2-3	0.13
21	-	-	4	4-5	0.43
22	>55	0	9	2-5	0.60
23	41-55	<=7	6	2-3	0.13
24	>55	0	5	0-1	1.06
25	41-55	<=7	12	0-1	0.21
26	-	<=7	12	-	0.43
27	21-40	<=7	8	-	0.21
28	41-55	<=7	6	-	0.43
29	21-40	<=7	13	4-5	-
30	21-40	<=7	4	2-3	0.13
31	41-55	<=7	5	4-5	0.21
32	>55	<=7	6	-	0.64
33	41-55	<=7	16	0-1	0.17
34	-	<=7	12	0-1	0.30
35	-	0	6	2-3	1.06
36	41-55	<=7	6	2-3	0.13
37	41-55	0	12	0-1	1.06
38	21-40	8-<=12	6	-	0.21
39	>55	<=7	-	0-1	1.23
40	21-40	8-<=12	6	0-1	-
41	-	<=7	113	-	0.43
42	41-55	<=7	11	-	0.64
43	>55	<=7	6	0-1	0.64
44	21-40	<=7	6	-	0.43
45	41-55	<=7	6	-	1.70
46	>55	0	6	0-1	1.70
47	41-55	<=7	5.01	0-1	0.85
48	>55	0	6	0-1	2.13
49	41-55	<=7	6	-	2.55

50	41-55	< = 7	14	0-1	0.85
51	>55	< = 7	8	0-1	0.11
52	41-55	8 < = 12	14	0-1	0.85
53	-	0	8	0-1	0.43
54	21-40	8 < = 12	6	0-1	0.11
55	41-55	< = 7	7.5	0-1	8.5
56	41-55	< = 7	6	0-1	0.85
57	41-55	< = 7	6	0-1	0.43
58	21-40	< = 7	24	6+	1.06
59	>55	8 < = 12	6	2-3	0.64
60	21-40	-	6	0-1	0.32
61	41-55	8 < = 12	6	0-1	0.32
62	>55	0	6	2-3	0.96
63	>55	0	6	0-1	0.17
64	41-55	-	16	0-1	0.11
65	21-40	< = 7	14	-	0.32
66	21-40	< = 7	16	2-3	1.19
67	41-55	< = 7	6	0-1	-
68	41-55	-	6	2-3	1.49
69	41-55	-	6	-	1.06
70	41-55	< = 7	6	0-1	1.49
71	21-40	< = 7	12	-	0.21
72	41-55	8 < = 12	11	-	0.34
73	>55	0	12	2-3	1.06
74	21-40	0	1	0-1	0.85
75	21-40	< = 7	6	2-3	0.64
76	41-55	< = 7	12	0-1	0.1
77	21-40	8 < = 12	-	0-1	0.85
78	>55	8 < = 12	2	0-1	0.43
79	21-40	< = 7	7	2-3	0.34
80	41-55	< = 7	6	0-1	0.30

THE TEA BOARD OF KENYA  
KENYA TEA INDUSTRY - 1963 - 1997

January to December	ESTATES		SMALLHOLDERS (KTDA)		Total Estate/ smallholders Hectares	Total Production Estate/smallholders Kgs.	Exports Kgs.	Value of Exports Kf	Local Consumption Kgs
	Planted Hectares	Production Kgs.	Planted Hectares	Production Kgs.					
1963	17,921	17,770,383	3,527	311,980	21,448	18,082,363	15,353,636	5,013,000	2,728,727
1964	18,591	19,615,777	4,471	624,853	23,062	20,240,630	16,422,313	5,665,409	3,820,217
1965	19,327	19,027,163	5,429	796,011	24,756	19,823,174	16,823,174	6,055,514	3,766,235
1966	20,102	23,846,177	7,238	1,572,481	27,340	25,418,658	23,283,084	8,714,000	2,135,574
1967	20,809	20,563,555	9,269	2,248,059	30,078	22,811,614	18,115,977	7,395,846	4,965,637
1968	21,329	26,359,730	12,233	3,402,760	33,362	29,762,490	27,329,247	10,041,063	1,924,243
1969	21,840	30,333,367	14,685	5,777,160	36,525	36,060,527	32,951,963	11,271,130	3,108,564
1970	22,289	33,101,169	17,985	7,976,425	40,274	41,077,594	33,851,055	12,704,544	5,659,318
1971	22,838	28,221,634	20,528	3,068,220	43,366	36,289,854	30,072,656	10,843,926	6,691,416
1972	23,268	40,193,463	26,493	13,129,006	49,763	53,322,469	49,483,857	16,442,180	5,838,612
1973	23,635	41,505,197	31,161	15,072,903	54,796	56,578,100	50,528,200	16,975,480	6,049,900
1974	24,087	37,259,318	34,648	16,180,350	58,735	58,439,668	49,646,800	19,402,521	7,075,987
1975	24,337	38,814,557	37,205	17,915,222	61,542	56,729,779	52,682,600	22,969,766	7,472,129
1976	24,539	40,521,833	41,412	21,462,626	65,951	61,984,459	59,154,300	31,769,020	8,068,210
1977	24,859	55,554,370	43,641	30,737,048	68,500	86,291,418	75,257,865	71,779,926	9,578,493
1978	25,159	58,552,159	46,910	34,821,260	72,069	93,373,419	80,791,032	63,193,033	11,004,360
1979	25,424	61,641,351	48,876	37,633,936	74,300	99,275,287	88,984,528	62,844,957	12,462,391
1980	25,850	55,913,349	50,691	33,980,009	76,541	89,893,358	74,799,000	58,003,496	13,648,788
1981	26,153	55,137,699	52,743	35,803,706	78,869	90,941,405	75,500,671	61,092,660	14,491,671
1982	26,384	56,037,026	54,698	39,946,051	81,082	96,033,077	80,371,415	77,882,331	13,979,833
1983	26,567	68,774,249	54,969	50,964,190	81,836	119,738,439	100,644,735	123,420,077	15,171,708
1984	26,873	63,463,679	56,466	52,708,241	83,372	116,171,920	91,198,110	189,477,628	14,390,275
1985	27,322	75,764,529	56,505	71,339,025	83,827	147,093,554	126,086,264	191,409,638	17,013,894
1986	27,854	75,192,023	56,546	68,124,740	84,400	143,316,763	116,455,862	172,789,445	17,701,737
1987	23,529	78,875,203	56,891	76,932,597	85,420	155,807,800	134,778,631	163,353,527	17,322,439
1988	29,109	79,337,869	57,693	84,692,556	86,802	164,030,428	138,201,002	185,262,701	17,712,225
1989	29,539	80,033,333	57,934	100,567,147	87,473	180,600,480	163,188,149	271,834,827	17,569,279
1990	29,979	87,011,557	67,041	109,996,712	97,020	197,008,289	169,585,818	314,981,238	17,883,218
1991	31,017	90,846,756	69,609	112,741,963	100,626	203,588,719	175,555,295	381,625,486	17,538,306
1992	31,340	88,260,870	72,162	99,811,904	103,502	188,072,279	166,506,564	474,883,277	15,465,008
1993	31,754	98,633,570	73,109	112,534,790	104,863	211,168,360	188,390,150	933,533,362	13,719,730
1994	32,038	90,338,363	78,183	119,084,498	110,221	209,422,861	183,739,627	912,279,678	12,638,029
1995	32,201	105,579,709	80,355*	138,945,451	112,556	244,525,160	237,497,459	940,415,966	14,343,509
1996	32,523	113,091,277	81,159	144,070,653	113,682	257,161,930	244,237,162	1,080,924,897	13,638,927
1997	33,180	91,014,357	85,057	129,707,792	118,237	220,722,149	208,968,555	1,310,305,233	13,211,449

APPENDIX

NB: The Figure for KTDA includes NTZDC



\*\*\*\*\* MULTIPLE REGRESSION \*\*\*\*\*

Equation Number 1    Dependent Variable..    Y    Production (Kg)

----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
X1	-184.421221	180.255651	-.083538	-1.023	.3131
X2	56.050071	425.253760	.010015	.132	.8959
X3	-664.636934	422.265438	-.142823	-1.574	.1242
X4	-1077.878218	1508.061832	-.065976	-.715	.4794
X5	14335.196678	1227.066167	.929489	11.682	.0000
(Constant)	11455.212710	9827.694638		1.166	.2514

End Block Number 1    All requested variables entered.

\*\*\*\*\*

Block Number 2.    Method:    Backward    Criterion    POUT    .1000  
 X1            X2            X3            X4            X5

Variable(s) Removed on Step Number  
 6.. → X2            Education (years in school)

Multiple R            .89272  
 R Square              .79696  
 Adjusted R Square    .77501  
 Standard Error    10636.72376

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	4	16430889667.77535	4107722416.94384
Residual	37	4186176014.51037	113139892.28406

F = 36.30658            Signif F = .0000

## \* \* \* \* MULTIPLE REGRESSION \* \* \* \*

Equation Number 1    Dependent Variable..    Y    Production (Kg)

Var-Covar Matrix of Regression Coefficients (B)

Below Diagonal: Covariance    Above: Correlation

	X5	X4	X1	X3
X5	1463299.21	.06022	-.14220	-.27768
X4	107911.198	2194325.81	.33392	-.50100
X1	-30311.747	87166.5970	31053.9049	-.10326
X3	-139721.28	-308695.01	-7569.1004	173016.927

## ----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
X1	-187.625384	176.221182	-.084990	-1.065	.2939
X3	-661.487632	415.953035	-.142147	-1.590	.1203
X4	-1096.545555	1481.325692	-.067119	-.740	.4638
X5	14328.645667	1209.669052	.929065	11.845	.0000
(Constant)	11971.094325	8894.151310		1.346	.1865

## ----- Variables not in the Equation -----

Variable	Beta In	Partial	Min Toler	T	Sig T
X2	.010015	.021962	.661610	.132	.8959

## \* \* \* \* MULTIPLE REGRESSION \* \* \* \*

Equation Number 1    Dependent Variable..    Y    Production (Kg)

Variable(s) Removed on Step Number

7..    X4            Distance (Km)

Multiple R            .89104  
R Square              .79395  
Adjusted R Square    .77768  
Standard Error    10573.26897

## Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	3	16368893048.45830	5456297682.81943
Residual	38	4248172633.82742	111794016.67967

F =            48.80671            Signif F =    .0000

Var-Covar Matrix of Regression Coefficients (B)

Below Diagonal: Covariance    Above: Correlation

	X5	X1	X3
X5	1440648.62	-.17250	-.28651
X1	-34186.801	27263.1132	.07849
X3	-123058.97	4637.55623	128048.539

## ----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
X1	-144.066609	165.115454	-.065259	-.873	.3884
X3	-815.748287	357.838705	-.175296	-2.280	.0283
X5	14382.570906	1200.270227	.932561	11.983	.0000
(Constant)	9521.866748	8206.574136		1.160	.2532

## ----- Variables not in the Equation -----

Variable	Beta In	Partial	Min Toler	T	Sig T
X2	.015116	.033050	.894185	.201	.8417
X4	-.067119	-.120804	.667497	-.740	.4638

\* \* \* \* \* M U L T I P L E R E G R E S S I O N \* \* \* \* \*

Equation Number 1      Dependent Variable..      Y      Production (Kg)

Variable(s) Removed on Step Number

8..      X1      Age (years)

Multiple R                      .88872  
 R Square                        .78982  
 Adjusted R Square              .77904  
 Standard Error      10540.86129

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	16283785166.72755	8141892583.36377
Residual	39	4333280515.55816	111109756.80918

F =            73.27793            Signif F =    .0000

Var-Covar Matrix of Regression Coefficients (B)

Below Diagonal: Covariance      Above: Correlation

	X5	X3
X5	1389224.38	-.27799
X3	-116526.05	126480.752

----- Variables in the Equation -----

Variable	B	SE B	Beta	T	Sig T
X3	-791.242025	355.641325	-.170029	-2.225	.0319
X5	14201.917420	1178.653632	.920848	12.049	.0000
(Constant)	2926.515494	3185.501387		.919	.3639

----- Variables not in the Equation -----

Variable	Beta In	Partial	Min Toler	T	Sig T
X1	-.065259	-.140145	.895266	-.873	.3884
X2	.022000	.047917	.920009	.296	.7691
X4	-.034883	-.065950	.694267	-.407	.6860

End Block Number    2    POUT =    .100 Limits reached.

## \* \* \* \* MULTIPLE REGRESSION \* \* \* \*

Equation Number 1      Dependent Variable..    Y    Production (Kg)

## Residuals Statistics:

	Min	Max	Mean	Std Dev	N
*PRED	-5148.1973	117708.5000	10659.4286	19929.0113	42
*RESID	-27566.4863	26914.1113	.0000	10280.5529	42
*ZPRED	-.7932	5.3715	.0000	1.0000	42
*ZRESID	-2.6152	2.5533	.0000	.9753	42

Total Cases =            42

Durbin-Watson Test =    1.75985

Hi-Res Chart # 1: Partial residual plot of y with x3

Hi-Res Chart # 2: Partial residual plot of y with x5

## \* \* \* \* \* M U L T I P L E R E G R E S S I O N \* \* \* \* \*

## Listwise Deletion of Missing Data

	Mean	Std Devia	Label
Y	10659.429	22424.434	Production (Kg)
X1	45.667	10.158	Age (years)
X2	6.429	4.007	Education (years in school)
X3	7.941	4.819	Labour (Manhours/day)
X4	1.488	1.373	Distance (Km)
X5	.987	1.454	Hecterage for tea (ha)

N of Cases = 42

## Correlation, 1-tailed Sig:

	Y	X1	X2	X3	X4	X5
Y	1.000	.087	-.026	.086	-.073	.874
		.293	.436	.294	.322	.000
X1	.087	1.000	-.117	-.031	-.317	.157
	.293		.229	.423	.020	.160
X2	-.026	-.117	1.000	.005	-.037	-.051
	.436	.229		.489	.409	.375
X3	.086	-.031	.005	1.000	.488	.278
	.294	.423	.489		.001	.037
X4	-.073	-.317	-.037	.488	1.000	.039
	.322	.020	.409	.001		.403
X5	.874	.157	-.051	.278	.039	1.000
	.000	.160	.375	.037	.403	