

EVALUATION OF AN INTENSIVE DAIRY FARMING SYSTEM AMONG SMALL
SCALE FARMERS IN NAKURU DISTRICT

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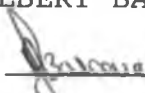
A THESIS SUBMITTED IN PARTIAL FULFILMENT OF REQUIREMENTS FOR
MASTERS OF SCIENCE IN APPLIED HUMAN NUTRITION, DEPARTMENT OF
FOOD SCIENCE TECHNOLOGY AND NUTRITION, COLLEGE OF AGRICULTURE
AND VETERINARY SCIENCE, UNIVERSITY OF NAIROBI

1996

DECLARATION

I hereby declare that this thesis is my original work and has not been presented for a degree in any other University.

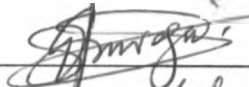
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HUMAN NUTRITION

DEDICATION

This work is dedicated to my parents, my wife Janet and our children.

ACKNOWLEDGEMENT

I'm indebted to all the staff at the unit of Applied Human Nutrition for their patient assistance both during my course work and my research period. I also acknowledge very sincerely the following Institutions and Agencies for providing me with the necessary funds and resources throughout the course. They are, the University of Nairobi, Hanns Seidal foundation of German, GTZ (German Technical Corporation) and IDRC (International Development Research Centre).

Special thanks go to my supervisors, Sandra Baldwin and Robert Mwadime whose encouragements and constant critical appraisals of my work saw me through successfully and to Dr. Abuid Omwega for guiding me through the corrections. I'm also particularly grateful to Prof. J Hoorweg of ASC (African Studies Centre, Netherlands) whose inputs right from the proposal stage were quite valuable. I cannot by all means forget the F.S.K (Farming Systems Kenya LTD) staff who offered very memorable assistance during my study. Thanks also go to Mr. Kennedy Andayi, Ms. Gladys Maina and Ms. Lucy Huri whose contributions as field assistants are treasured.

Finally I owe sincere gratitude to uncle Moses Webale and aunt Clara Shibutse for their encouragements and special concern without which I would not have come this far. All said and done, I owe it to God who gave me the strength and ability to accomplish this task.

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ACRONYMS AND DEFINITIONS

- F.S.K:** Farming Systems Kenya, a non-governmental organization undertaking income generating projects in rural areas of Nakuru District.
- IFPRI:** International Food Policy Research Institute.
- IGADD:** Inter-governmental Agency for Drought and Development.
- NCHS:** National Centre of Health Statistics.
- SPSS:** Statistical package for social scientists.
- EPI INFO:** Computer programmes developed for epidemiologic investigations.
- Household:** A family consisting of members that eat from the same cooking pot.
- Small-scale farmers:** Farmers with less than or equal to 10 acres of land.
- Food security:** Accessibility to adequate food, throughout the year, by means of production or purchase.
- Zero-grazing:** Method of rearing dairy cows under intensive husbandry practices where they are not allowed to graze around instead feed stuffs are brought for them in their feeding pens.
- Index child:** The youngest pre-school child in the household but who is at least 2 years of age.

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Mother: The person concerned with the decision making of household activities like cooking, fetching water, fetching firewood and child care.

Household work: This involved the following household duties,
cooking, washing utensils, washing, clothes, child care & feeding, fetching water and fetching firewood.

Personal Communication: This is the information that was derived by talking with F.S.K staff and some of the farmers in the study community, on a casual basis.

Malnutrition:

a) **stunting:** This is when the height of a child is less than 90 percent of the median height in the reference population (NCHS) for a child of the same age.

b) **wasting:** This is when the weight of a child is less than 80 percent of the median weight in the reference population for a child of the same height.

c) **underweight:** This is when the weight of a child is less than 80 percent of the median weight in the reference population for a child of the same age.

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ABSTRACT

This study was undertaken to identify differences in income, milk availability, labour involvement and the nutritional status of pre-school children among F.S.K (Farming Systems Kenya) households and non-F.S.K households in Nakuru district. The study involved collection of data using a cross-sectional survey which started in October 1992 and ended in February 1993. Data were collected from a comprehensively sampled F.S.K group and a comparative group of non-F.S.K farmers.

The results from this study show that the total cash income among F.S.K households per year is, on average, significantly higher than that among non-F.S.K households although almost half (45.0 percent) of the cash income among F.S.K households is from milk sales. F.S.K households have more milk available for home consumption as a result of the fact that, 63.5 percent of the milk produced by these households is reserved for home use. The introduction of the dairy project by F.S.K in the area served to increase the involvement of women in on-farm activities. Contrary to expectations, the project has not shifted labour involvement of mothers from crop production activities. However, mothers within F.S.K households are less involved in household work as was anticipated. Households with high cash incomes and high available calories from own production, include children with higher levels of nutritional status relative to the rest of the study population.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The alleviation of world hunger has been of great concern to biological and social scientists since the end of the second world war (Smith, 1986). Agricultural scientists have made great strides in improving both the yield and nutrient content of staple foods. Increased production is assumed to provide farmers with income with which to purchase food and goods that will improve their well-being. Income is considered an important determinant of household food security, and is among the underlying factors that influence the nutritional status of individuals (UNICEF,1991; FAO/WHO secretariat,1991).

In the last two decades, the rate of growth in food production has lagged behind that of food demand in 32 out of 41 sub-Saharan countries (Dey,1984). This is because production has been adversely affected by persistent droughts, unreliable rainfall, desertification, severe crop infestations, serious outbreaks of livestock diseases, civil strife and refugee problems, shortage of production inputs and inadequate socio-economic policies. The latest special report from the FAO suggests that the food situation and crop prospects in sub-Saharan Africa are, to say the least, grim due to the impending droughts (Daily Nation Newspaper, April,1992).

1.2 Statement of the problem

Kenya is facing the problem of securing an adequate food supply for its rapidly increasing population (FNSP,1988). There is high pressure on arable land, and future increases in agricultural production will depend on the possibilities of increasing the yields per hectare of crop land, as well as bringing the remaining often marginal areas under cultivation (FNSP,1988). According to the five-year development plan of Nakuru District (Republic of Kenya,1989), the level of production particularly of staple foods is considerably below the potential. This is particularly so among the small scale farmers who do not have enough resources in terms of capital and financial assets. Consequently their income levels are also low. The low purchasing power coupled with low food production leads to families with inadequate food supply at household level, endangering their nutritional status. Therefore, alternative ways of tackling household food security problems i.e by increasing household income need to be identified and strengthened or implemented.

1.3 Justification

The F.S.K in pursuing its main objective of increasing income levels, is one of the development agencies (governmental and non-governmental) offering alternative ways of tackling household food security problem. The F.S.K project offers credit facilities to small scale farmers to acquire dairy animal. Not many studies have been conducted in Kenya to evaluate the outcome of such projects with respect to income and the

nutritional status. Therefore information on the success of dairy farming among the rural small scale farmers especially with respect to the nutritional status is virtually lacking.

The study is therefore intended to provide information that will be useful to the F.S.K, its beneficiaries and policy makers in general, in formulating dairy related interventions for income enhancement in rural areas.

1.4 Objectives

1. To determine the sources of income and their relative contributions to the total household income among F.S.K and non F.S.K households
2. To determine milk availability within households of the two communities.
3. To assess the labour distribution among household members and hired labour in the two communities (F.S.K and non F.S.K households) with respect to their involvement in different farm activities.
4. To assess the nutritional status of pre-school children amidst the two farming groups.

1.4.1 Sub-objectives

1. To determine the contribution of milk sales to the total household income among F.S.K farmers in a year.
2. To estimate the annual income from crop sales per year in the two communities.

3. To assess milk utilization within the F.S.K households.

1.5 Study hypotheses

1. F.S.K households have different income levels compared to those of non F.S.K households.
2. The level of involvement in crop production and household work activities by mothers on their own farms is different between F.S.K and non F.S.K households.
3. The nutritional status of pre-school children among F.S.K households is different from that of pre-school children among non F.S.K households.

CHAPTER TWO

LITERATURE REVIEW

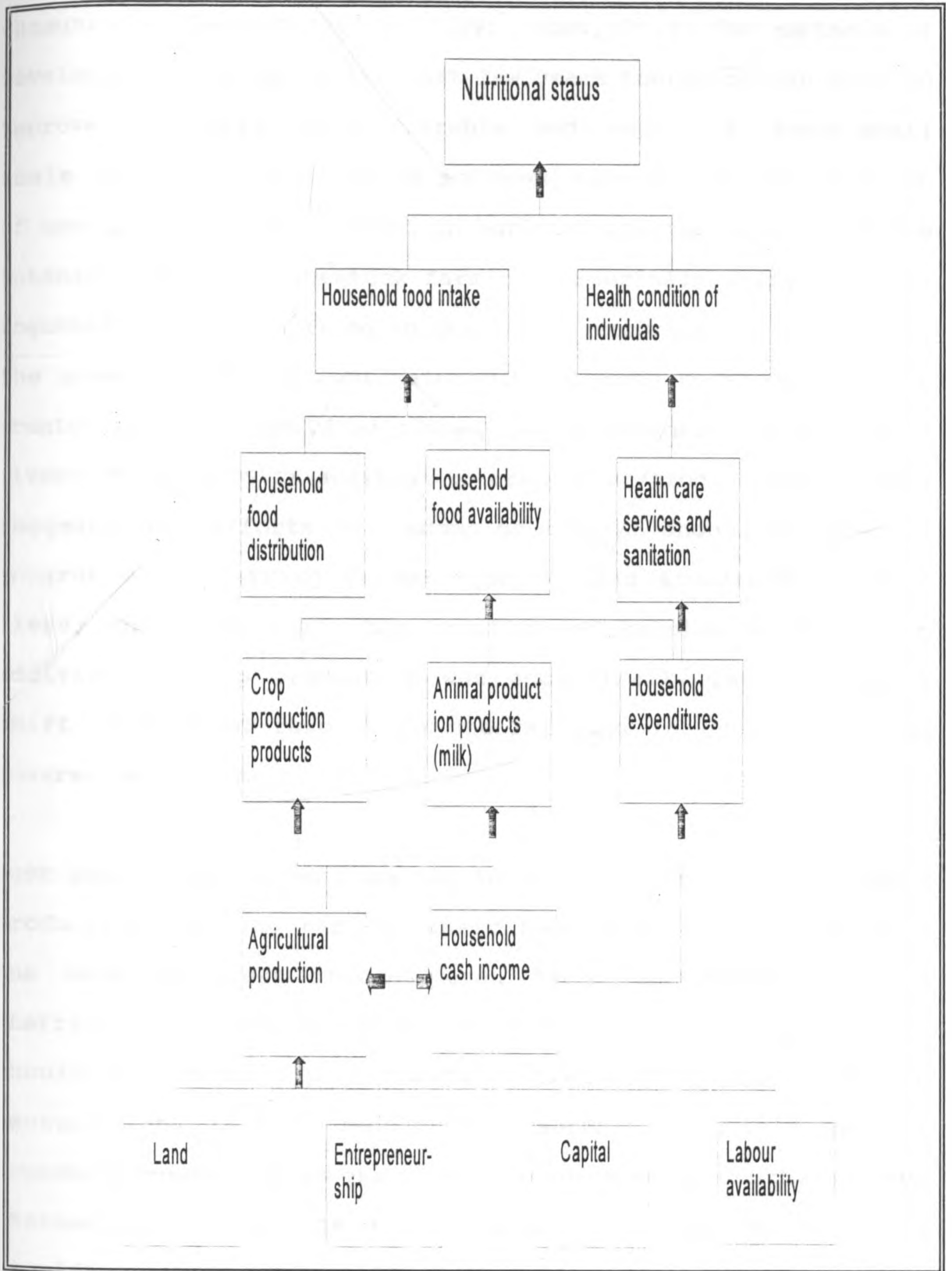
2.1 Introduction

The underlying determinants of nutrition are access to nutritious food, care of individuals, health and health care services (see also Figure 1). Adequate access to food at household level is necessary for an adequate dietary intake, which in turn is one of the immediate requirements for preventing malnutrition, along with the prevention of infection (Young,1991). Household food and economic security do not necessarily imply good nutrition for all family members. Factors such as intra-household food distribution, feeding practices and illness substantially govern an individual's food intake and its utilization by the body (Quinn et al,1990), consequently influencing the nutritional status.

2.2 Household food security and income

It was realized in the 1970s' that malnutrition generally resulted from a lack of food rather than a deficiency per se of nutrients such as protein. This led to the premise that malnutrition would be eliminated by overall increases in food production (Young,1991). Increased food production is critically important considering that according to World Bank estimates, 33 million people are food insecure in IGADD countries (IGGAD,1990).

Figure 1: A conceptual framework of selected important factors influencing nutritional status



Higher outputs may result in increased food availability which can in turn improve the food security of rural farming communities (Leegwater et al.,1991; Huss,1992). The emphasis of developing countries in the past few years therefore has been to improve the productivity of arable land, especially among small scale farmers. This is being achieved through the introduction of new crops, the improvement in agricultural technology and the intensification of livestock farming, especially dairy farming. Bogahawatte (1984) working in Sri Lanka, recommended that due to the present high level of malnutrition among rural children, a greater emphasis should be placed on the expansion of the rural livestock industry in addition to crop production. Bendly (1988) suggests that efforts for income generation should be directed towards mixed farming (mixed cropping and livestock). Sisler (1988) indicated that, the practice of keeping livestock in addition to crop production was economically rational and a shift from mixed farming to specializing in crop production lowered net income.

Most small scale farmers are not totally involved in subsistence production. Selling part of their food crops clearly indicate the need for cash incomes even among subsistence farmers (LeFranc,1981). Young (1991) argues that income generation should be a central policy within strategies to reduce hunger because long term household food security requires greater household purchasing power. Studies undertaken in southern Kenya (Kennedy,1991) indicate that although non-farm income has a significantly negative effect on household food security, a

general increase in household income, especially from own-farm sources, is associated with improved household food security and caloric intake of pre-schoolers. A possible explanation offered for the former finding was, the non-farm income is more likely to be controlled by males who have different expenditure responsibilities other than purchase of food.

There was a slight improvement in household and individual food security associated with income increases among farmers and members of their households in a study undertaken in the highlands of Guatemala (Maarten et al,1991). An explanation for the less robust improvement in household food security was, with increased income, households became more dependent for adequate food availability on market conditions, as there was more total food expenditures, yet as Smith (1986) cautions, if crops formerly grown for home consumption have to be purchased, the cash required to buy them would be greater than the monetary value when sold due to the differential between wholesale and retail prices. In a case-study in Senegal (Marek et al,1990), where there was no association between income and caloric intake, it was found that diets were reasonably adequate before an income generating project was introduced, hence the added money was not spent on food.

A study undertaken in Ethiopia (Seyoum et al.,1986) indicated that an increase in nutritional status of children in a community which had a significantly higher income, due to the production of Khat¹, was insignificant. However the same study showed that, Khat producing households had significantly higher family sizes and higher level of family investments (houses owned, source of light, radio and livestock ownership). In addition, the income from Khat was controlled exclusively by men. These might then be the reasons why the increased income was not used to improve the health condition of the household members.

It should be noted that, in the short run, the effects of income increases on nutritional status are not clearly evident (IFPRI,1988). However, with significant income increases for a long enough period, levels of malnutrition may be alleviated (Maarten et al.,1991; Kennedy,1991). Though farmers have their own rationales for household food security, which employ a number of strategies designed to provide a relatively even flow of food, one of them may involve the purchase of food with cash raised through off-farm occupations (Longhurst,1985). Therefore, significant increases of income in the hands of women, for a sufficiently long period of time, may still be an important pre-requisite for improved household food security and nutritional status of children among poor communities.

¹ Khat is a local herb which is used as a stimulant and is chewed while still fresh

2.3 Dairy development and household food security

In many parts of Africa, livestock are important in terms of income, employment and resource utilization. Developing countries are increasingly being identified with high rates of unemployment and therefore the considerable labour requirements of zero-grazing could make excellent use of surplus household labour, particularly in slack labour periods of the crop production cycle (Sisler,1988). Sisler (1988) further indicated that, there would be a reduction in the use of family labour if livestock keeping was not emphasized. The introduction of intensive methods of livestock production such as zero-grazing have become appropriate given the small productive land sizes by households in developing countries. This is reflected in the Kenyan 6th development plan where it is stated; 'the possibilities for increasing livestock production lies mainly in intensive feeding zero-grazing because the supply of land for extensive grazing in the medium and high potential areas is getting increasingly scarce' (Republic of Kenya,1989).

Animal products are in demand, which has important implications from the standpoint of both human nutrition and trade (Nestel,1986). It is assumed that animal products especially milk can be consumed by households, and milk sales will improve their income. Milk sales can become a very handy source of income given that the sales can be continuous throughout the year. Milk is among the seven major commodities which are central in achieving the development goals and targets

established for agriculture in Kenya (Republic of Kenya,1989). Cows' milk is an important food component for infants after the age of 4-6 months as it contains relatively high percentages of calcium, essential for growth. It is also a reliable source of vitamin B₁₂ and a major source of preformed niacin and tryptophan (Pond et al.,1980).

For a study conducted in India (Bowonder et al.,1986), the dairy development programmes helped to improve the milk yield which in turn increased the consumption of milk and milk products by the participating households. The consumption of milk, milk products and food intake in general was higher in villages with dairy programmes compared to those without dairy programmes. It was also found that the consumption of milk, milk products and total food products was higher among holders of very small land sizes within the dairy programmes compared to consumption among holders of the same land sizes outside the dairy programmes. However there was no substantial difference in food intake between owners of large farms within and outside the dairy programmes although milk consumption was still significantly higher within the dairy programme. This supported the argument that dairy development is more beneficial to the diet of the poor.

Operation flood² (Martin et al.,1987) does not seem to have a significant impact on the income of the participating farmers. This is because, the programme was only geared to improve the marketing of the already available milk and milk products, hence no significant increase in milk production occurred. In addition, the majority of farmers involved in the programme were relatively wealth, hence the need for cash income may not have been as great as the landless and marginal farmers, most of whom did not participate.

Another study done in India (Bowonder et al.,1986) indicated that providing low yielding cows alone did not result in substantial improvements in income levels of households without complementary services such as milk collection centres, distribution of fodder programmes and distribution of mineral mixture on a subsidized basis. However, providing high yielding Buffaloes helped to increase income levels in the same circumstances. Therefore the introduction of high yielding dairy animals among the rural poor communities is a key element in improving their income levels, in addition to the high milk intake and increase in general food consumption.

2

Operation flood is an Indian dairy development programme supported by the World Food Programme, the EEC and several other international donors.

2.4 Agricultural development and labour constraints

Kennedy and Cogil (Kennedy,1988) found that for almost all study households, labour is more of a constraint to production than is land. Research conducted in Malawi (Quinn et al.,1990) indicated that for households with smaller land sizes, especially those under 0.7 ha, the conflict between cultivation on their own smallholdings and the necessity to earn off-farm income during the growing season gives rise to widespread labour requirement conflicts. This may have a serious impact on availability of food in low income households although few quantitative estimates are available. Maarten (1991) notes that labour inputs of household members are often higher on farm holdings where new technologies have been introduced. This may increase household energy requirements. Improved husbandry practices, including disease control, intensified fodder and pasture management and the preservation of feed stuffs inevitably require increased labour inputs. Studies undertaken in Kilifi District (Leegwater et al.,1991) indicated that for those farmers who were dependent upon family labour to maintain dairy activities, competition existed between dairy farming and other activities. This would imply that the introduction of dairy farming shifts some labour inputs from crop activities and this may lead to lower production of food crops on the farm. This might be particularly so among small scale farmers who do not have resources to hire labour.

Women comprise one-third to one half of Africa's agricultural labour force and they are also responsible for many food-related agricultural activities (Dey,1984). With respect to animal production, women have important labour roles which vary according to type of animal and type of production system (Dey,1984). For an Indian study (Martin et al.,1987), the workload of women increased with the introduction of milk production.

Women's participation in production activities (both on-farm and off-farm) may have negative consequences for the nutritional well-being of their children, the assumption being that if they are active in production they have less time to spend on child care and feeding. However an analysis of the relationship between the time mothers spent in the field and child nutrition status undertaken in rural Tanzania (Wandel et al.,1992) gave no conclusive support to the notion that women's workload has negative consequences for the child. The suggested reasons were that women carry children with them to the field if breast-feeding or leave them in the care of relatives, neighbours or older siblings if they are weaned. These compensatory mechanisms pointed to the conclusion that women's time constraint was not a very important factor in explaining the variations in children's nutritional status. What seemed more important was the quality of diet fed to the young children.

Data available from a study in rural Iran (Rabiee et al,1992) on the other hand indicate that, maternal workload can have a negative effect on the nutrition status of young children through mechanisms affecting food consumption and health. Therefore the introduction of new technologies on farms are likely to bring into focus constraints and shifts, with respect to labour allocations, among household members. The constraints and shifts may, sometimes, have detrimental effects on the health condition of household members, particularly the children who are the most vulnerable group.

2.5 Gaps in knowledge

A common draw-back in most of the cited research relate to the fact that, the programmes studied did not specifically target the rural poor. For instance, in the IFPRI (1988) studies, the average households, with the exception of Guatemala, were self-sufficient in staple food production. The samples were therefore composed of surplus producers. The Leegwater (1991) studies in Kilifi sampled farmers of very diverse socio-economic status, ranging from wealthy farmers who also had off-farm formal employment, to those that depended mainly on agriculture. For the Indian study (Bowonder et al.,1986) which determined the impact of dairy development programmes, nutritional status was investigated through proxy measures such as food intakes, including milk consumption. Hence, no anthropometric analysis was done to determine the real nutritional status. Other Indian studies (Martin et al.,1987; Terhal et al.,1983) evaluated dairy programmes which had been targeted to farmers who already had

dairy animals. Hence they do not provide information regarding the outcome of dairy programmes targeted to those who initially do not have dairy animals, particularly the poor and marginalized.

CHAPTER THREE

BACKGROUND

3.1 Introduction

This study was undertaken in Bahati Division of Nakuru District in the Rift Valley Province. Three sub-locations namely Lanet, Kabazi and Munanda were involved. These are the sub-locations where the F.S.K dairy project is concentrated. According to the current District Development Plan (Republic of Kenya, 1989), the total area of the district is 7200 km² (720,000 ha) and that of Bahati Division is 514 km² (51,400 ha). Most of the district falls above 1800 m above sea level and Bahati in particular lies between 2100-2500 m above sea level. The whole district is divided into three zones with respect to rainfall. Zone I receives rainfall of over 1015 mm per annum. Zone II receives between 760-1015 mm of rainfall per annum while Zone III receives less than 760 mm of rainfall per annum. Bahati Division falls within Zone II and Zone III. Specifically, Kabazi and Munanda are in Zone II while Lanet is in Zone III (Republic of Kenya, 1989). There is a bimodal rainfall distribution throughout the year. The long rains occur between March and June while the short rains occur between October and December.

3.2 Agricultural potential, communication and marketing

The study area falls into two agro-ecological zones namely: the wheat/maize-pyrethrum (lower highland two-LH₂) zone and the sunflower/maize or upper sisal (upper midland four-UM₁) zone. Kabazi and Munanda sub-locations lie in the former which is relatively high in agricultural potential, while Lanet sub-

location lies in the later which is lower in agricultural potential (Republic of Kenya,1989). In the higher potential zone, the cash crops grown are pyrethrum and tea along with maize which is also a major food crop. The growing of tea and its management has dropped due to poor incentives with respect to payments. The growing of wheat for commercial purposes stopped after land was further sub-divided into small land holdings (personal communication). Pyrethrum production is improving greatly due to the apparently streamlined marketing of the crop, i.e after the establishment of pyrethrum buying centres. In the lower potential zone, maize serves both as a major cash crop and a major food crop. Beside maize as a cash crop, vegetable growing is on the increase in the lower potential zone due to its proximity to Nakuru town.

Nakuru District as a whole has a fairly extensive road network of bitumen/tarmacked roads, gravel roads, earth roads and rural access roads. The area of study is served by two tarmacked roads making it relatively easy to get farm produce to Nakuru town which is the major marketing centre. All smaller major marketing centres are located along the tarmacked roads.

3.3 Demography, social and settlement patterns

According to the 1979 population census (Republic of Kenya,1991), the population of the district was 522,709 with a population increase of 6 % per annum. The population increase was well above the national average. The population of Bahati Division was 55,391 with a population density of 108 persons per

km², which was considerably higher than the district figure (74 persons per km²). At the given rate of population increase (6 %), the current (1993) population of Bahati is projected to be 113,778. Using the provisional results of the 1989 population census (Republic of Kenya, 1991), the population increase of Nakuru District had dropped to 5 % per annum while the population increase of Nakuru municipality had reached the highest rate ever of 7.5 % per annum. This is indicative of the great influx of the rural population into the urban centres, particularly Nakuru town. The population in Nakuru municipality grew from 62,851 in 1979 to 162,800 in 1989 (Republic of Kenya, 1991). The movement into the urban centre may be prompted by the search for employment either in the formal or informal sector as Nakuru is Kenya's 4th largest urban centre and it is the major agricultural, commercial, manufacturing and industrial centre in the area. In the urban centres, the nominal wage earnings (on average) per employee in 1990 in the private sector of agriculture and forestry was ksh 11,406 per annum according to the economic survey 1991 (Republic of Kenya, 1991). Therefore a significant differential in income earnings between the rural and urban sector can easily lead to such an influx. It is also noteworthy that the influx is biased towards the male population therefore draining the male labour force in rural Nakuru (Republic of Kenya, 1991; personal communication). consequently, most of the work in rural households especially in Bahati is done by women.

In terms of ethnic composition in the whole district, the largest group was the Kikuyu (60.8 %) in 1979. Kalenjin, the second largest group comprised 15.6 % and the other major groups, the Luo, the Luyha and the Kisii comprised 6.93 %, 6.91 % and 2.36 % respectively. However the specific area of study consisted of Kikuyu people only. The families have monogamous set-ups and the land parcels are owned individually. Within households, land is sub-divided to be given to sons and in some cases daughters who have children but are not married (personal communication). The study area consisted of small-scale farmers with less than 10 acres of land, the majority of them having less than 5 acres of land. Bahati Division is one of the areas where continued land sub-division and settlement of people on the former white settlers' farms was undertaken through the government settlement fund/ trustee, companies or cooperatives (Republic of Kenya, 1989).

3.4 Dairy farming

Dairy farming is a favoured activity in the farming community of Bahati (personal communication). Improvement in social economic status seems to be closely linked to the acquisition of a dairy animal(s). Milk for home consumption is primarily used in making tea for the household which is drunk practically at any time of the day and always after every meal. Some of the excess milk is either sold to the Kenya Cooperative Creameries (K.C.C, a government cooperative dairy) or neighbours and the remaining excess milk is given out to close family members that don't have an animal to milk.

3.5 Nutritional status

According to the rural child nutrition surveys of 1982 and 1987/88 (Republic of Kenya,1991; Republic of Kenya,1992), it was found that the estimates of nutritional status with respect to stunting was higher than expected in Nakuru. The District had a higher prevalence of stunting than the national rate, yet it is located in the Rift Valley Province, which is among the provinces with the lowest rates of malnutrition. One possible explanation for the poor nutritional status was that cooperatives in the area had contributed to the emergence of small land holdings, due to land sub-division, which may have led to low food production (Republic of Kenya,1989).

3.6 Background information of the F.S.K project

Farming Systems Kenya limited (F.S.K) is a non-governmental organization that operates in Nakuru District. It was started in 1982 with the main objective of raising the income levels of the poorest households in rural Nakuru along with improving their food security. Its main strategy is to give credit facilities and agricultural-related resources to needy farmers. The facilities include the supply of dairy heifers or inputs for crop production especially maize, irish potatoes and tomatoes. The dairy heifers are given to the qualifying farmers after they pay a deposit of ksh 2500 which is about 25 % of the market value of the animal. The farmer is then only required to give back to the project the first heifer calf. The identification of farmers to be included in the project is purely done by the

F.S.K field staffs. To qualify for the heifer calf, the farmer should fulfil the following selection criteria:

1. Must be needy.
2. Must be willing to set aside 1/4 an acre for fodder.
3. Should have no other cow.
4. Must be willing to attend a two to five days' training sessions before receiving the cow.
5. Must be willing to follow F.S.K's advise, however the farmer is welcome to make suggestions.
6. Must agree to receive an in-calf heifer, not money to buy his/her own.
7. Must agree to pay 25 % of the value of the heifer before receiving it.
8. Must agree to return the first heifer to F.S.K, to be passed on to another farmer within the location.
9. Must have somebody on the farm to read for him/her if he/she is illiterate.
10. Must be a small-scale farmer with, preferably, not more than ten productive acres.
11. Must be a full-time farmer.

Bahati is one of the divisions where the dairy project was started and so far the project has reached 167 farmers. Of the total number of farmers who have received a cow, only 20 % (33) are registered under men, the rest are women. Different animal breeds are given depending on the farmers location with respect to the agro-ecological zone. Immediately after receiving the heifer, the farmer is closely supervised by the F.S.K field

assistants and the project veterinary Doctor until the farmer gives back the first heifer calf to the project. The follow-up involves constant farm visits by F.S.K field staffs. They check and advise on the conditions of the zero-grazing units and other general husbandry practices like dig control, pasture management and proper milking. Farmers training days (field days) are periodically organized where non-F.S.K farmers are also welcome to attend. During these sessions, the farmers are taught on all crop and animal husbandry practices along with general farm management principles.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction and tools used

The study was undertaken as a cross-sectional survey to elicit information on income, milk availability, labour involvement and nutritional status of pre-school children. This was done among F.S.K farmers with milking cows and pre-school children and non-F.S.K farmers (acting as a comparison group) with pre-school children. The following tools were utilized:

1. Structured interviews:
 - a set of questionnaires.
2. Weight and height measurements of pre-school children (anthropometry):
 - a Salter scale calibrated from 0 to 25 kg in 100 gm sub-divisions.
 - a plastic trouser with a harness for supporting children during weighing.
 - a height-metre graduated upto 200 cm.
3. Estimate of milk consumption by the index child per week:
 - a measuring cylinder up-to 1 litre.

The questionnaires were developed in October 1992 and pre-tested on the study site in early November 1992, on households which were not included in the main study. The pre-testing was done on 15 households (10 households from among F.S.K farmers and 5 households from among non-F.S.K farmers. Thereafter, necessary modifications were done on the questionnaires before the main study was started.

4.2 Sample size determination

Initially a sample size of 140 households (70 F.S.K households and 70 non-F.S.K households) was targeted. Prior knowledge of the study area indicated that it was segmented into two well defined agro-ecological zones giving rise to two distinct areas with respect to land potential (low and high potential areas). Accordingly, each of the study groups (F.S.K and non-F.S.K) was stratified into two strata. Each stratum was to have at least 35 households. A figure of at 30 households was chosen to allow for statistical analysis on income and nutritional status. The extra number of at least 5 households was to cater for any refusals in the course of the study and a possible removal of outliers during analysis. At the same time each stratum was to have at least 30 index children. This was to give a total of at least 120 index children. At the end of the sampling exercise, there was a total sample size of 169 households with 130 index children. A breakdown of the sampled population is shown in Table 1.

4.3 Sampling procedure

Multiple stage sampling was used through the following stages: By means of a list from the F.S.K office, all the project farmers in the study area satisfying the criteria below were selected for the study:

- A farmer must have one milking cow which produced milk in 1992.

- The farmer's family must include a pre-school child who is at least 2 years old^a.

Using these criteria only, 59 F.S.K farmers were identified. This necessitated the inclusion of the remaining F.S.K farmers because of the insufficient number. Further 25 F.S.K farmers who had milked the cow but had no pre-school children with at least 2 years of age were identified. A field assistant from the F.S.K project and one of the F.S.K farmers assisted in the identification of the F.S.K farmers.

Table 1 Distribution of the sampled population

	Number of Households	Number of children	*Number of index children
F.S.K			
low potential	41	42	29
high potential	43	38	30
sub-total	84	80	59
Non F.S.K			
low potential	44	60	39
high potential	41	46	32
sub-total	85	106	71
Total	169	186	130

* The number of index children doesn't coincide with the number of households because some households did not contain a child of the required age. To eliminate the possible effects of breastfeeding, at least 2 year olds were considered

For the non-F.S.K farmers, the nearest farm holdings to the F.S.K farmers with the following criteria were included:

- a farmer without a dairy animal.
- The farmer's family must include a pre-school child who is at least 2 years old.
- a farmer most qualified to be recruited into the F.S.K project (i.e less than 10 acres of land and needy).

For every F.S.K farmer, one non-F.S.K farmer was taken except in three cases where two or non of the non-F.S.K farmer(s) was taken. In cases where two non-F.S.K were taken, it was to compensate for cases where non of the neighbouring non-F.S.K farmers qualified. The identification of non-F.S.K farmers was facilitated by the accompaniment of a technical assistant from the Ministry of Agriculture.

4.4 Training of field assistants

Three field assistants out of five candidates, two of whom were form six leavers and three were form four leavers, were selected. The three assistants were selected after an interview during which their ability to express themselves clearly was assessed. The identification of the five candidates was facilitated by staff of the F.S.K project. The selected assistants were then trained for two days. The first day comprised an overview of the study, its objectives and the contents of the questionnaires. The second day was spent in training and practice of taking anthropometric measurement (weights and heights) of identified children belonging to friends. Five children were involved at this stage. Practice on

administration of the questionnaires, and further measuring of children was done during the pre-testing sessions under close supervision. During the main study, two of the field assistants, both of whom were females, did all the interviewing while the one male field assistant alternately assisted each of them in taking anthropometric measurements.

4.5 Data collection

By means of structured interviews with mothers, data were collected on the following parameters according to the study objectives:

- Demographic features.
- Household income.
- Milk availability and consumption.
- Food availability from own production.
- Farm related activities and the labour involvement among the activities.

4.5.1 Demography

Data were collected on;

1. The sex, educational level and ages of both the household head and the mother. The educational level was recorded in terms of the number of years in school (formal schooling).
2. Household size.
3. Number of pre-school children. These were children under 6 years of age.

4.5.2 Household income

Information on sources of income was collected. The sources were organized according to three sections; crop sales (both food and cash crops), milk sales (for F.S.K farmers only) and off-farm income sources. Off-farm income comprised income from casual labour (as a result of temporary employment on other farms for a daily wage), remittances from family members who are working away from the homesteads, business and salaries from formal employment. Income from milk sales was derived by estimating the total amount of milk sold in the year and recording the average price of milk sold in the same period.

Income from crops was arrived at by estimating the amount of each crop sold in the course of the year and their prices (see Appendix 1 for the units of measurements). The amount of maize sold was calculated from the previous year's crop (1991) since the crop for 1992 had not yet been sold. In as much as the sales from the 1991 maize crop may not precisely reflect the income from the maize sales for the year 1992 crop, the comparison between the two farming groups (F.S.K and non-F.S.K) is still valid because any environmental factors that may have influenced maize production in 1991 or 1992 equally applied to both groups. In any case the harvesting season in the area is around December and January. Therefore the maize planted in 1991 was actually sold in 1992.

4.5.3 Milk consumption

Information was sought on the amount of milk bought (in case of non-F.S.K households) or reserved (for F.S.K households) for home use, over the previous 7 days. This was determined by asking the number of days milk was bought/reserved and how much was bought/reserved each day. Data were collected on the quantity of milk consumed by the index child if any. This was done through a quantitative proxy measurement of milk intake by means of recall and measurement of similar quantities of water using the household cups or glasses and transferring to a measuring cylinder (see also Appendix 2).

4.5.4 Food availability from own production

For purposes of this study, only information on three major crops was sought. The food crops were maize, beans and irish potatoes, which were the common food crops produced in the study areas. Data were collected on the amount of the food crops produced, sold and reserved for home consumption during the year (1992). Maize is harvested in the months of December and January, therefore the maize sold and used for home consumption in 1992 was produced in 1991. However information on beans and potatoes was taken for the 1992 harvests.

4.5.5 Domestic and farm related activities and labour involvement

Information collected involved listing the 10 major activities done in the course of the year. This was followed by ranking the 4 top activities in order of intensity. For each activity, the people involved (father, mother, children, labourers or others) were listed in order of involvement starting with the individual most involved, for example;

Ranked activity	Type of people involved and the level of involvement				
	High	_____			Low
1. Weeding	(2)	(1)	(3)	(4)	()
2. Ploughing	(4)	(2)	(1)	(5)	()
	1 = Father				
	2 = Mother				
	3 = Children				
	4 = Labourer(s)				
	5 = Others				

The level of involvement were then converted to labour scores. For instance, the mother's labour score on weeding in the above example is 9 (4+5). Four is the maximum score for the activity rating (weeding is activity number one) while five is the maximum score for the level of involvement (the mother is at the highest level of involvement for weeding)

4.6 Anthropometry

Data regarding age, weight and height of the pre-school children were collected to allow for computation of nutritional status indices, namely height-for-age, weight-for-age and weight-for-height. The ages of children were determined by asking the respondent to recall the date of birth. Where the respondent could not provide accurate information, the clinic card for growth monitoring was used since all the children measured had the cards. Height was measured on the height-metre, and was read to the nearest 0.5 of a centimetre.

Before weighing the child, the mother was asked to remove the child's shoes if she/he had any and heavy clothing leaving only shorts and a vest or a t-shirt. Two hundred grammes (0.2 kg) was subtracted from the child's weight after weighing to take into account these light clothes. A figure of 200 gm was arrived at after weighing some sample shorts and t-shirts from 5 children and taking the average weight. The child was weighed using a hanging Salter scale. After the child was placed in the plastic trouser, which was then suspended from the hook of the salter scale, the scale was raised until the child's feet were clear off the ground. the weight was read to the nearest tenth of a kilogram. Two readings for weight and two readings for height on the same child were taken by two field assistants and the figures were averaged.

4.7 Supervision and validation of data collection

Questionnaires were collected from the field assistants every other day. The data were examined by the investigator and where there were discrepancies, the field assistant(s) concerned would return to the households to verify the anomalies. To ensure that anthropometric measurements were correctly taken and recorded, random spot checks were made by the investigator on the field assistants every other day. The Salter scale was calibrated every two weeks with a standard weight of a cooking oil (1 kg of kasuku). This was done to ensure that the scale was in good working condition throughout.

4.8 Method of analysis

The data were entered in the D-base III+ programme under two file names. One file contained information on anthropometry and the other file contained information on all the other study variables. The two D-base III+ files were transformed to SPSS files then merged together. Data cleaning was done by running the frequencies of all important variables to ensure that all the data had been entered correctly. Box plots of important variables were then drawn to identify extreme outliers. As a result, one household was dropped reducing the number of households to 168. Data transformation of some variables was also undertaken in SPSS. The transformation involved the computation of new variables such as per capita income per year, proportion of income from milk sales, proportion of income from crops sales and proportion of income from other sources. The analysis on labour involvement was carried out on a sub-sample

of 40 households (20 F.S.K and 20 non-F.S.K). Random systematic sampling was used to get this sample out of the total 168 households.

Cross-tabulations between important variables were undertaken in SPSS and EPI INFO version 5.1 while other statistical tests were done in SPSS. Categorization of important variables of income were done using medians as cut-off points. In the case of nutritional status, the analysis centred around the use of percentage medians of weight-for-height, weight-for-age and height-for-age. Categorization of weight-for-height was done using a percentage median of 80, according to the Waterlow classification which differentiates between normal and wasting (Quinn,1992). A percentage median of 90 was used for height-for-age (a percentage median of 90 differentiates between normal and stunting according to Waterlow). A percentage median of 80 was used as a cut-off point for weight-for-age.

The student T-test was used to determine whether there were significant differences between the two farming communities (F.S.K and non-F.S.K) with respect to the major variables of concern in this study i.e income (see table 3) and the nutritional status of pre-school children (see table 7). Using the same T-test, other variables that were deemed important for consideration in explaining any significant differences particularly in the nutritional status were compared. The comparison of these factors was both between F.S.K households

and non-F.S.K households (see table 8) and within the F.S.K households alone see (tables 5 and 6).

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CHAPTER FIVE

RESULTS

The general characteristics of the study population, according to selected variables are given in Table 2. The average age of household heads and mothers is significantly higher among the F.S.K farmers (50.5 and 45.0) compared to the non-F.S.K farmers (44.6 and 37.6 respectively). However the formal educational level of household heads and mothers is higher, though not significantly, among the non-F.S.K farmers. The average household size of F.S.K farmers (7.6) is not significantly different from that of non-F.S.K farmers (7.2) although the later have more pre-school children (see Appendix 3). F.S.K farmers have a significantly higher acreage (1.8 acres) than non-F.S.K farmers (1.4 acres). Therefore, the two farming communities in the study population are only different with respect to household age distribution and size of land holdings.

The estimated total average cash income per household per year among the F.S.K farmers is more than twice that of the non-F.S.K farmers as shown in Table 3. F.S.K farmers have a significantly higher income from food crop sales per year compared to non-F.S.K farmers although for the former, the income from food crop sales account for only 16.5 % compared to 19 % among the non-F.S.K farmers. The average annual income from cash crop sales is slightly higher, though not significantly, among non-F.S.K farmers.

Table 2 General Household Characteristics

Variable	means		
	F.S.K (n=84)	non-F.S.K (n=84)	p-value
Age of household head (years)	50.5	44.6	0.003
Mothers' age (years)	45.0	37.6	0.000
Formal education of hhold head(years in school)	5.8	6.3	0.210
Mothers' formal education (yrs in school)	5.6	6.3	0.133
Household size	7.6	7.2	0.375
Amount of land(acres)	1.8	1.4	0.001

Table 3 Mean Household Income by Source per year (in ksh)

Cash income source	F.S.K	non-F.S.K	p-value ^a
Total household income	10,520	4,990	0.000
Total income from food crop sales	1,740 (16.5)	950 (19.0)	0.037
Total income from cash crop sales	1,690 (16.1)	1,180 (23.6)	0.240
Total income from milk sales	4,260 (40.5)	-	
Total off-farm income	2,830 (26.9)	2,890 (57.9)	0.929

- a Significant at p=0.05.

- Figures in parenthesis are incomes expressed as percentage of total household income.

Milk sales within F.S.K households accounts for 40.5 percent of the total annual cash income while income from off-farm employment (income from other farms due to casual labour included) is not different between the two farming communities though for non-F.S.K farmers, it accounts for 57.9 % of the total income. Therefore with respect to cash resources, F.S.K households are better off, the greatest contribution being from milk sales. However, the situation is different for non-F.S.K farmers (who don't have cows) where the greatest contribution to total income is from off-farm employment.

The distribution of households getting at least some cash income from different sources is shown in Table 4. There are more F.S.K households with reported food crop sales (55 %) compared to non-F.S.K households (46 %). The same applies for cash crop sales where 57 % of F.S.K households have reported sales while it is 51 % for non-F.S.K households.

Table 4 Distribution of Households by Reported Income Sources

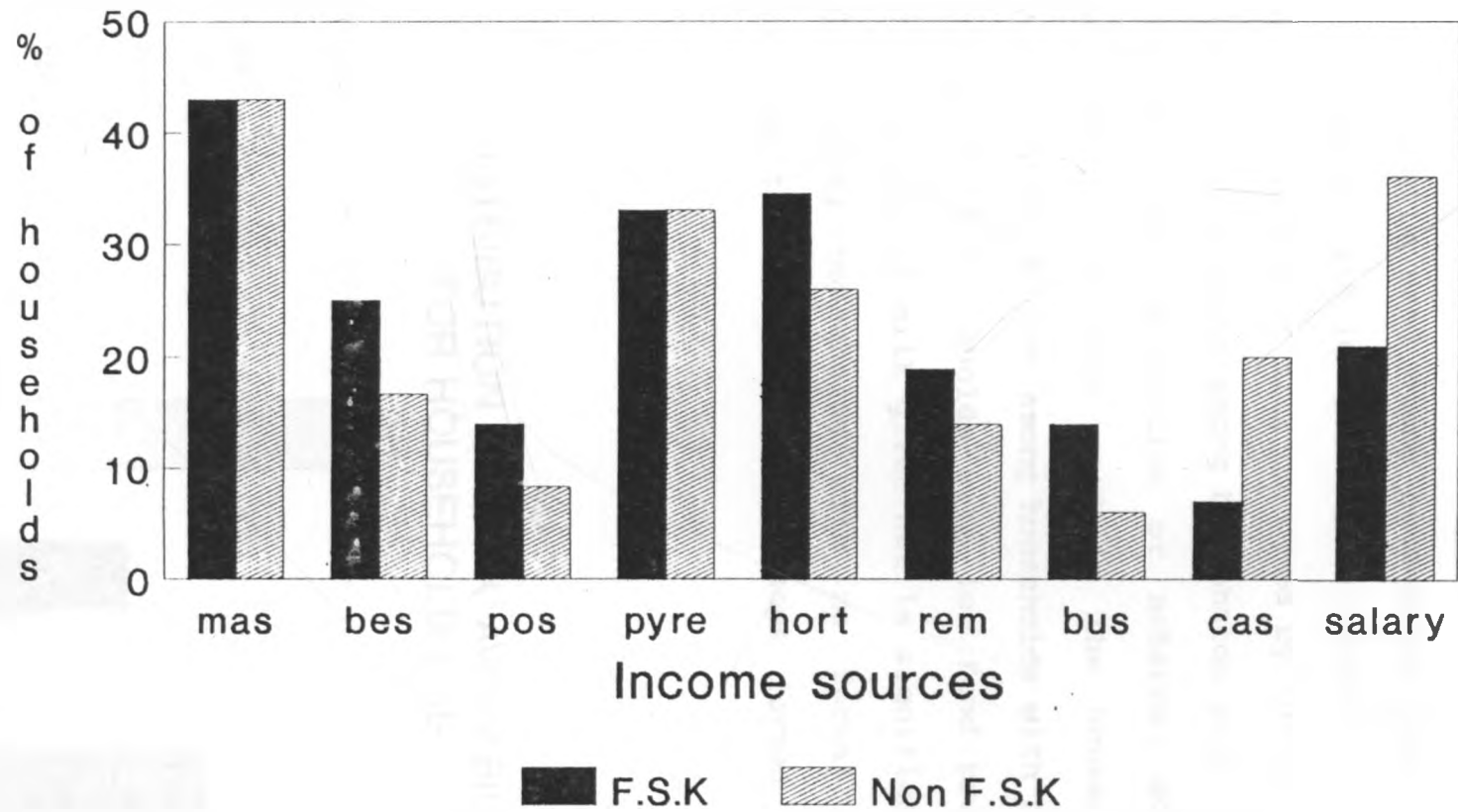
Reported cash income sources	F.S.K (n=84)		non-F.S.K (n=84)	
	number of hholds	%	number of hhold	%
Food crop sales	46	55	39	46
Cash crop sales	48	57	43	51
Off-farm income	47	56	61	73

However, there are considerably more non-F.S.K households getting income from off-farm employment (73 %) compared to F.S.K households (56 %). Therefore in comparative terms, F.S.K households are more involved in crop sales while more non-F.S.K households are involved in off-farm employment.

The distribution of households by reported specific cash income sources is shown in Figure 2. There is no difference in the proportion of households involved in the sale of maize and pyrethrum among the two farming groups. However, there are more F.S.K households involved in the sale of beans, irish potatoes and horticultural crops. There are also more F.S.K households involved in business and receipt of remittances. On the other hand, the non-F.S.K households have more salaried household heads and mothers in addition to more involvement in casual labour on other farms. Therefore, more F.S.K households are involved in minor crop sales (beans, potatoes and horticultural crops) while non-F.S.K households are more salaried and at the same time more involved in casual labour.

Milk is far more available in F.S.K as shown in Figure 3. Approximately 90 percent of F.S.K households reserve at least one litre of milk per household per day from own production. On the other hand, only 20 percent of non-F.S.K households acquire at least one litre of milk per household per day.

FIG 2: DISTRIBUTION OF HOUSEHOLDS BY SPECIFIC INCOME SOURCES

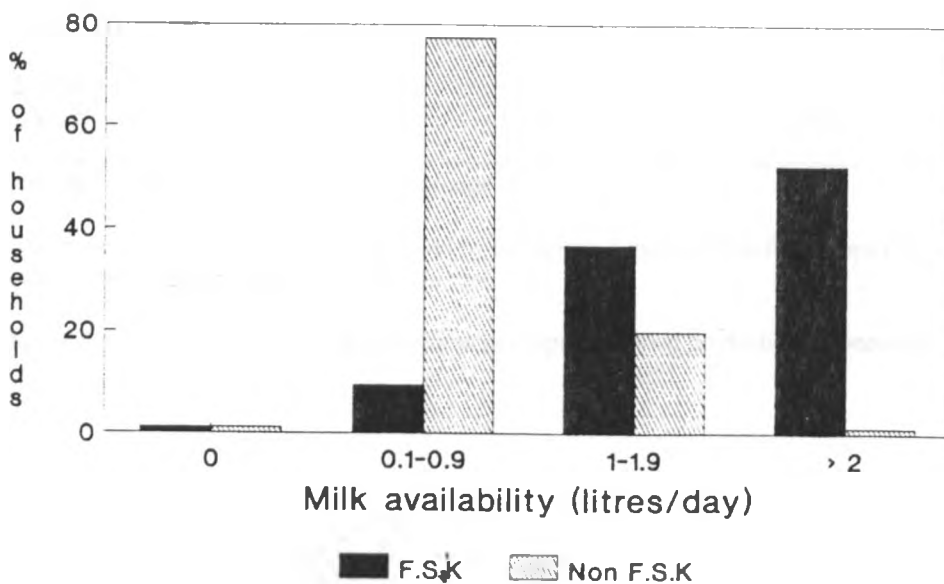


mas:maize bes:beans pos:potatoes pyre:
 pyrethrum hort:horticulture rem:
 remittance bus:business cas:casual

Milk use by different household characteristics among the F.S.K farmers is shown in Table 5. According to this analysis, there is no significant difference in the quantity of milk given out or the quantity of milk used among households with high per capita income and those with low per capita income. The results also show that the quantity of milk consumed by the index child is not significantly different among households with different income per capita, food production or maternal education. However, the quantity of milk used in the households is significantly (at $p=0.05$) higher among households with high food production compared to households with low food production. Similarly, the quantity of milk given out is significantly (at $p=0.05$) higher among households with no formal maternal education compared to households with some formal maternal education.

Figure 3

DISTRIBUTION OF MILK AVAILABILITY FOR HOUSEHOLD USE



Therefore, there are differences in the quantity of milk used and the amount of milk given out among F.S.K farmers depending on the level of food production or formal maternal education.

Table 5 Household Characteristics by Milk Use Among F.S.K Farmers

Household characteristic	mean(mls/day)		
	Milk given out per day	milk used by the household per day	milk consumed by the index child per day
Income per capita (ksh/year)			
Low (<824) ^c	950	1800	190
High (>824)	800	2000	240
Food production (ksh/year) ^a			
Low (<4,180) ^d	700	1650 *	210
High (>4,180)	900	2200	230
Maternal education			
No formal education	1100 *	2100	250
some formal education	600	1850	200

* significant difference between the two groups (at p=0.05).

^a food production in this case is represented by the potential income from food crops if all of it was sold at the market prices at the time of harvest.

^d 824 and 4,180 are median values for income per capita and food production respectively.

A comparison of some important variables between households with high food production and those with low food production among F.S.K farmers is shown in Table 6. The results show that for all variables considered except income and amount of land possessed, i.e quantity of milk produced, quantity of milk sold, proportion of milk sold and household size, there are no significant differences between households with high food production and those with low food production.

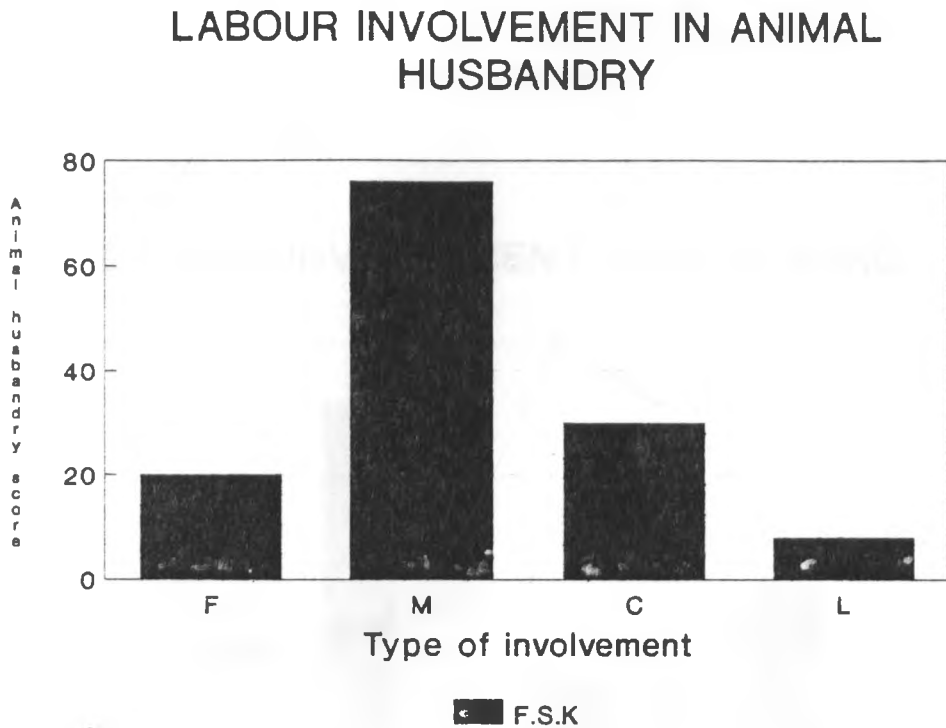
Table 6 Comparison of Households with Low and High Food Production(means of different selected variables)-F.S.K

Variable	Food production levels		p-value ^a
	low production (ksh =<4,180)	high production (ksh >4,180)	
Milk produced per year (litres)	1,541	1,910	0.097
Milk sold per year (litres)	545	736	0.082
Proportion of milk sold(%)	34.9	37.7	0.423
Total income (ksh)	7,297	12,932	0.000
Income per capita (ksh)	1,228	1,891	0.017
Amount of land (acres)	1.5	2.1	0.002
Household size	7.6	7.8	0.729

^a Significant at p=0.05

Labour involvement in animal husbandry by different household members among F.S.K households is shown in Figure 4. It is clear that mothers are the most involved members of the households followed by children, then fathers and lastly the hired labourers.

Figure 4

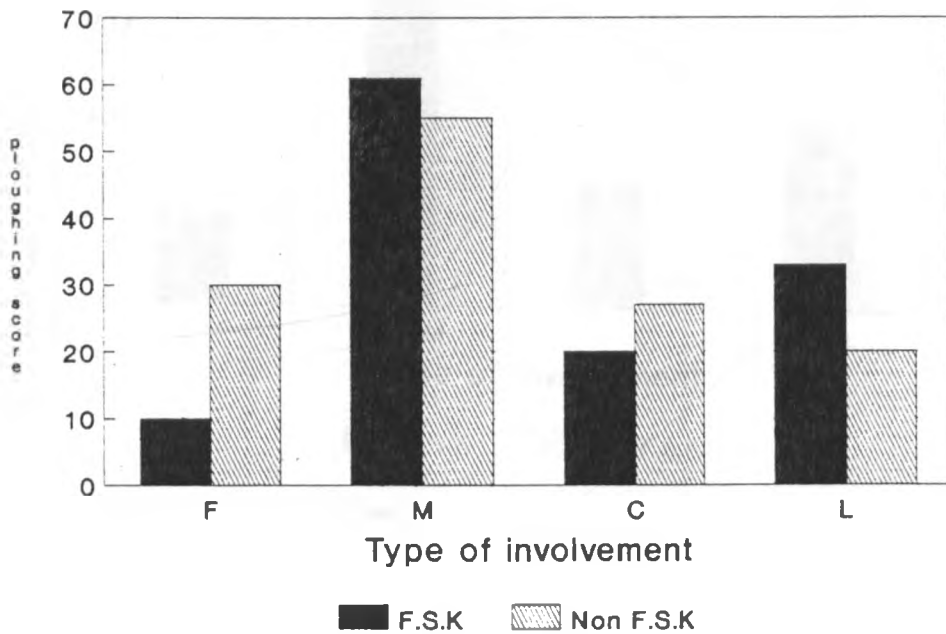


F:father M:mother C:children L:labourer

In most cases, ploughing is undertaken by mothers in both F.S.K and non-F.S.K households as is shown in Figure 5. However, mothers in F.S.K households are slightly more involved in ploughing than their counter-parts in non-F.S.K households. Fathers in non-F.S.K households on the other hand are more involved in ploughing than fathers amidst F.S.K households. At the same time, hired labourers within F.S.K households are more involved in ploughing than those among non-F.S.K households.

Figure 5

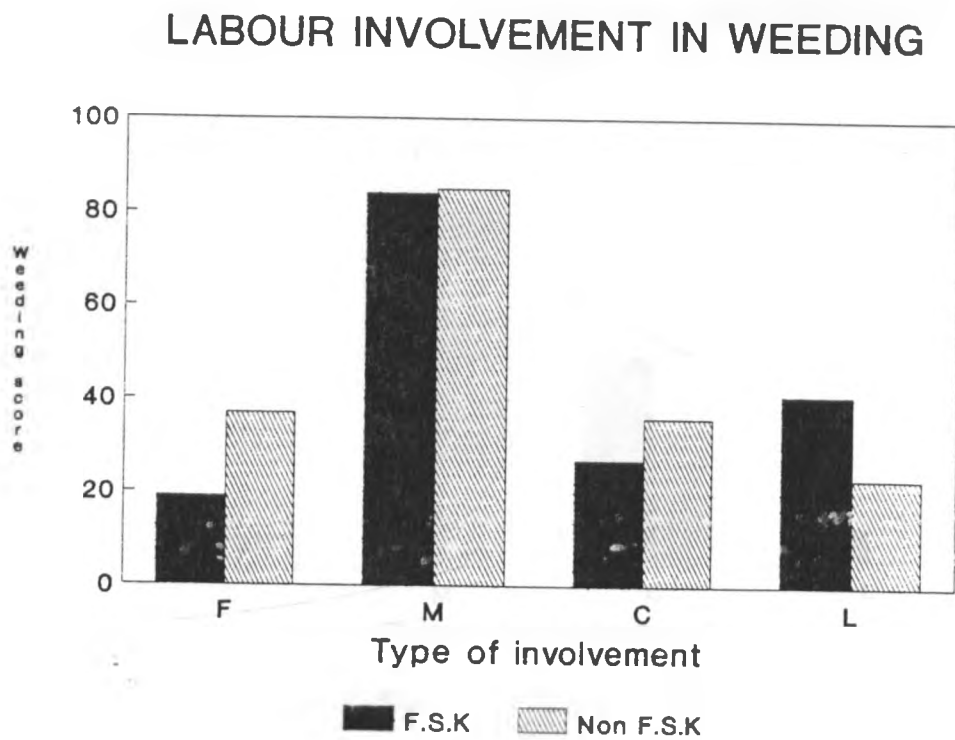
LABOUR INVOLVEMENT IN PLOUGHING



F:father M:mother C:children L:labourer

Mothers' involvement in weeding among F.S.K households and non-F.S.K households is similar. This is shown in Figure 6. However, fathers in non-F.S.K households are more involved than fathers in F.S.K households while hired labourers are more engaged within F.S.K households.

Figure 6

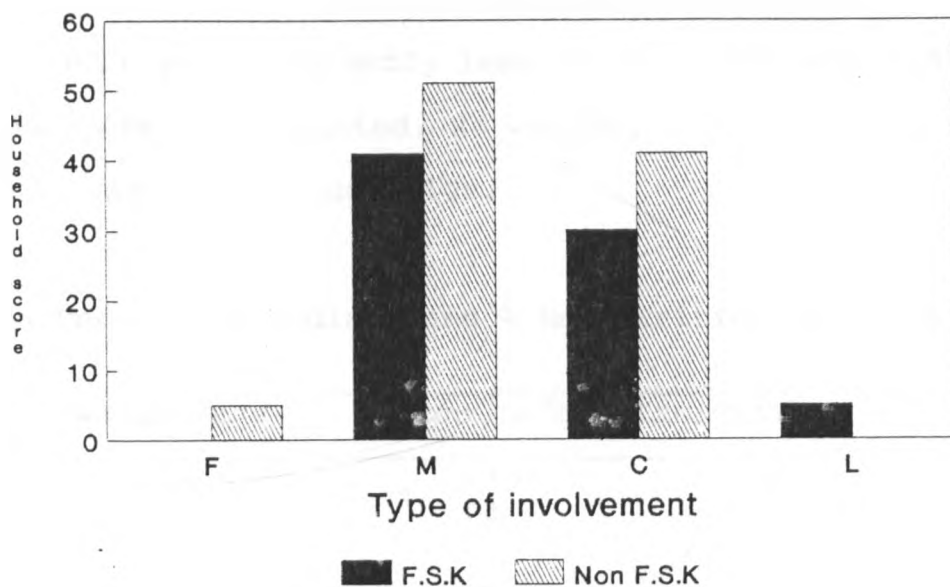


F:father M:mother C:children L:labourer

Mothers in non-F.S.K households are more involved in household work than their counter-parts in F.S.K households as shown in Figure 7. Fathers and hired labourers play a minor role in household work activities in both communities.

Figure 7

LABOUR INVOLVEMENT IN HOUSEHOLD WORK



F:father M:mother C:children L:labourer

The results on labour involvement generally indicate that, mothers are more involved in on-farm activities than any other member of the household though F.S.K mothers are somewhat more engaged in ploughing than non-F.S.K mothers who are more absorbed in household work activities than the aforementioned.

The nutritional status of children in the study population is given in Table 7. The percentage median weight-for-age, weight-for-height and height-for-age of children are not significantly different between F.S.K and non-F.S.K households. However, looking at the proportion of children who are malnourished, non-F.S.K farmers include significantly less children who are wasted but more children who are stunted. No wasting is recorded among the children of non-F.S.K households.

Table 7 Mean Percentage Medians and % Malnutrition by Scheme

Scheme	weight/age	weight/height	height/age
F.S.K(n=80)	89.4 (21.2)	97.5 (3.7)	95.5 (13.7)
Non-F.S.K (n=104)	87.6 (18.3)	97.2 (0.0)	94.2 (23.1)
P-value ^a	0.248 (0.312)	0.836 (0.024)	0.092 (0.054)

Figures in parenthesis are percentages of children who are malnourished and the corresponding p-values

^aSignificant at p=0.05

The nutritional status of pre-school children with respect to stunting by different household characteristics is shown in Table 8. The analysis show that there is no difference in the degree of stunting between F.S.K and non-F.S.K households where both groups have higher income per capita or higher available calories from own production. However, non-F.S.K households include more children who are stunted than F.S.K households when analysed between groups with low income per capita or low available calories from own production.

Table 8 Household Characteristics by Nutritional Status (height/age)

Household characteristic	F.S.K		non-F.S.K	
	n ^a	% maln. ^b	n	% maln. ^b
Income per capita (ksh/year)				
Low (= < 824)	18	22.2	49	28.6
High (> 824)	41	14.6	21	14.3
Available calories from own production (kcal/capita/day)				
Low (= < 1050) ^c	26	19.2	42	31.0
High (> 1050)	33	15.1	28	14.3

^a Number of children

^b Percent malnourished

^c 1050 is the median value for the available calories from own production

In general terms therefore, children from F.S.K families are less stunted than those from non-F.S.K families. In addition, F.S.K children of poorer households are better off with respect to stunting than their counterparts in non-F.S.K households.

CHAPTER SIX

DISCUSSION

6.1 General characteristics

The basic difference between the two communities is with respect to age distribution of household members and size of land holdings. The difference seems to be as a result of the F.S.K selection criteria. The average maternal age among F.S.K households gives an indication that a number of mothers in this group are beyond their child bearing years. This may be the reason why the F.S.K households generally have fewer pre-school children. Beside, the average household size between the two communities is not different but because non-F.S.K households have more pre-school children, it means the F.S.K households have more older people. Therefore, a widespread effect on the welfare of pre-school children amidst the F.S.K farming community may be limited.

The requirement that a farmer must plant 1/4 an acre of Napier grass as a requirement for entry into the project may be affecting households with low acreage negatively. This is basically due to the fact that the majority of low acreage households possess 0.9 acres of land, hence, they may find it difficult to set approximately a half of their land for napier grass. On the other hand, farmers with higher acreage may have the necessary resources to raise the cash deposit (ksh 2500) which is required to facilitate the acquisition of the dairy heifer. Therefore, there may be a section of the community who are not being reached by the project though they are needy. This

concur with an Indian study (Martin et al., 1987) where it was found that access to livestock by the poor categories of the rural population was not relatively easy.

The two farming communities are relatively similar in terms of the formal educational level, for both the household heads and the mothers. In addition, the average formal educational levels indicate very clearly that the two farming communities consist of farmers who had not gone beyond primary level during their formal schooling. It is worthy noting that within each farming system, there is no significant difference in the formal educational level of the household heads compared to that of the mothers.

The composition of F.S.K households, with older household heads and mothers in addition to low formal educational background, may present a challenge to the project. This may be with regard to perceptions, by the farmers, of the training packages offered since most of them are technical in nature. It may therefore be necessary that the training be at an appropriate level for easy adoption.

6.2 Income

The three main sources of cash income among the communities studied are crop sales, milk sales and off-farm employment. Off-farm employment included formal employment, informal engagements in non-farm activities, sale of labour on other farms, and remittances. The total cash income among F.S.K households per year is on average significantly higher than that among non-F.S.K households because, almost half of the cash income among these households is from milk sales, yet milk sales apply only to F.S.K as the non-F.S.K ones do not possess milking animals. This finding does not support an Indian study (Martin et al., 1987) where it was found that the dairy programme did not significantly affect the income of the participating farmers. There is a difference between the two programmes in that, the Indian one was implemented among farmers who already had dairy cows whereas the present programme is targeted to non-dairy farmers. Therefore an economic impact may be registered when starting with farmers who are not in dairy production at all.

The relative contributions of crop sales and off-farm employment to the total household cash income among non-F.S.K households are relatively high because they are the only major sources of cash income on these farms. For instance, off-farm employment accounts for 57.9 percent of total household cash income among non-F.S.K households. This heavy reliance on off-farm employment among non-F.S.K farmers can be detrimental to the food security situation in the households. A study carried out by Kennedy (1991) among sugar-cane farmers in southern Kenya

showed that, off-farm income has a significant but negative effect on household food security. The explanation offered for this was, off-farm income is more likely to be male controlled, yet the major responsibility for food lies with women in households.

F.S.K households have on average significantly higher cash income from food crop sales than non-F.S.K households. This does not hold true when land size is controlled for in the analysis (Appendix 4). Therefore the difference in food sales may be due to the fact that F.S.K households have higher acreage, enabling them to produce more food and hence the reason why they sell more. F.S.K households may also sell larger quantities of their food crops due to the security they have, knowing that they can later on use the income from milk to purchase more food in case of any food deficits. On the other hand, the limited income sources among non-F.S.K households may make them feel more insecure to sell the food they produce.

In terms of reported maize sales, both farming systems have equal number of households involved because maize is the main staple food crop hence every farmer grows it. In the event of high cash requirements especially due to land preparation, purchase of farming inputs and paying of school tuition, maize selling is the only option the majority of farmers have irrespective of whether they are F.S.K or non-F.S.K. This normally occurs in the months of January and February. This agrees with LeFranc's (1981) argument that, the need for cash

income among subsistence farmers leads to selling part of their food crops. Selling part of their staple food product, maize, may in this case render non-F.S.K farmers vulnerable to food insecurity in the event of a general crop failure.

Non-F.S.K households are deriving as much cash income from cash cropping as F.S.K households though they generally have lower acreage. May be the non-F.S.K farmers are allocating more land to cash crops than other enterprises since they have limited alternative income sources. Looked at in terms of the proportion of households selling specific cash crops, horticultural sales are higher among F.S.K households. This may be due to the fact that horticultural practices in the area are not yet established, particularly with respect to marketing, as is the case with the major alternative cash crop, pyrethrum (personal communication), yet a clear marketing system is crucial for the commercialization of horticulture (Dijkstra, 1991). This is essentially because, most horticultural produce are highly perishable and therefore any flaws in the marketing system may lead to great losses. In the present circumstances, the non-F.S.K households with low acreage are likely to give horticultural cropping a slightly lower priority in comparison with pyrethrum.

While there is no difference in terms of the total household cash income from off-farm sources in the two communities, there are disparities with respect to specific off-farm income sources. Non-F.S.K households include more households who are involved in casual labour on other farms compared to F.S.K households and this may be because, there is excess labour due to lack of animal(s) which is diverted to this casual employment. In addition, non-F.S.K farmers are likely to be in a greater need for cash income hence being prompted to more casual work. Therefore, dairy farming seems to be increasing on-farm employment, consequently leading to a cut-down in the available labour for employment on other farms. Hence, those households depending on hired labour may have to resort to capital intensive enterprises in future, as more farmers get involved in dairy farming. Otherwise, they may have to go beyond the boundaries of their own community to look for labour to hire. It is important to note that the excess labour in non-F.S.K households is not diverted to business ventures to the extent found among F.S.K households. This may be due to the fact that with higher income levels, the F.S.K households are able to set up businesses more easily than non-F.S.K households.

Non-F.S.K households reported more salaries than F.S.K households. This could have been one of the reasons why these households did not qualify to enter the project as one of the requirements for entry was a farmer's availability. Therefore,

families with household heads or mothers in formal and informal³ employment are likely to have been disqualified due to their unavailability. On the other hand, some farmers might have qualified since they are not employed outside the farm yet they are not very needy. The available data show that, F.S.K households with fewer members on salaries are getting as much cash income from off-farm employment as non-F.S.K households though not necessarily from salaries. For instance, there are more F.S.K households getting cash income from remittances. The possible explanation for this could be that the F.S.K households may be having more older children who are therefore in some form of employment hence able to send some money to their parents. This may be contrary to the majority of non-F.S.K households who have more young children (may be still in school) who cannot be able to assist their parents in that respect.

Therefore, the identification of those who are needy may still present a great challenge to the F.S.K project. It may mean re-examining the present considerations being used to identify this group and then designing a proforma to generate very in-depth data, which may assist in truly identifying the needy ones. This is not to suggest that the process is an easy one.

3

This refers to any type of engagement in the informal sector, where a salary is offered.

6.3 Milk

Milk consumption in the study area is relatively high due to the practice of taking tea any time of day (Personal communication). Therefore the introduction of dairy cows in the area must be a welcome idea to the residents. The idea of consuming large quantities of milk is exemplified by the fact that 63.5 % of the milk produced by F.S.K households is on average reserved for consumption. As a result, the F.S.K households have more milk available for home consumption as compared to non-F.S.K households. These findings are consistent with the Bowonder study (Bowonder et al,1986) in India where it was found that, consumption of milk and milk products was higher within villages with the dairy production development programmes than those without. Therefore, the quest for more income may not have outweighed the fact that, households participating in the F.S.K project may still be determined to reserve enough milk for consumption. This would be a positive trend which can go a long way in eliminating malnutrition among children. This idea is also implied by Bogahawatte (1984) who advocates for increased livestock farming among rural communities as a way of improving the health condition among children. However, selling little milk in the present case may alternatively be due to some apparent draw-backs in the marketing system (Personal communication)

Among the F.S.K households, there are no significant differences in the utilization of milk except in two cases. In the first place, the amount of milk used by the households per day is

significantly higher among families with high food production than those with low food production. This difference may be due to the fact that households with high food production also produce more milk. The higher milk production in this case is associated with households that are generally well off because they have larger pieces of land and higher total household cash incomes on average (see table 6). This can then enable them to have their animal better managed as they may more easily afford the required inputs for improved animal husbandry. Similar findings are recorded in India (Bowonder et al., 1986) where milk production, land size and income were positively correlated.

In the second case, the amount of milk given out to neighbours is significantly higher among households with no formal maternal education than those with some formal maternal education. There could be many reasons for this. First, households with no formal maternal education are likely to belong to the couples who are relatively old. In which case they may have more older sons and daughters who are married and have their own homesteads nearby thereby facilitating the giving away of milk for free. On the other hand, households with some formal maternal education are likely to belong to relatively young couples who may not have many married sons and daughters to give milk. In addition, households with no formal maternal education produce more milk than households with some formal education and yet they sell less milk than the latter (Appendix 5). Consequently households with no formal maternal education have more milk to give out to neighbours while those with some formal maternal education sell

more of the milk produced. The latter sell more because they are likely to belong to relatively young couples, who have higher income requirements as a result of having more young children that require greater health care in addition to high educational expenses. It is therefore appropriate to have more young couples involved in the project, as far as direct economic gains are concerned, since raising of income is the overall objective.

6.4 Labour

Mothers do the majority of farm work in all the households in the two communities studied. This serves to confirm the idea that, women provide a sizable contribution to the labour force in the rural areas (Purvis,1985; Paolisso et al,1989). The introduction of the dairy project by F.S.K in the area appears to have served to increase the involvement of women in on-farm activities. This is shown by the fact that they have the greatest involvement in animal husbandry practices in addition to being engaged the greatest in other on-farm activities. This agrees with the Indian study by Martin (1987), who found an increased workload by women with the introduction of milk production.

Contrary to the research hypothesis that, the involvement of F.S.K mothers in crop production activities on their own farms is different from that of non-F.S.K mothers, they are found to be similarly involved in weeding just like non-F.S.K mothers and are only slightly more involved in ploughing than non-F.S.K mothers. However non-F.S.K mothers may be selling their labour

on other larger farms as their farms are generally smaller, although this involvement is not specifically addressed in this study. The sale of labour on small land holdings is also reflected in a study undertaken in Malawi (Quinn et al,1990) where it was found that for small agricultural households where half of their total income comes from off-farm sources, family members had to find off-farm employment to provide sufficient household income.

Maternal involvement in household work in this study is found to be slightly higher among non-F.S.K households compared to F.S.K households. This may be due to the fact that F.S.K mothers are more involved in other on-farm activities (crop and the added animal husbandry practices) such that they have less time to devote to household work. This is in line with the assumption by Wandel (1992) and some findings in rural Kenya by Paolisso (1989), that if mothers are active in production (both on-farm and off-farm), they have less time to spend on child care and feeding. On the other hand, the less involvement in household work by F.S.K mothers could be due to the few pre-school children they have. This supports a study in Brazil (Connelly, et al,1992) where it was found that, a lower number of children under seven years of age has a positive effect on the mother's employment in other activities other than household work.

F.S.K mothers, because of being older, have fewer children at home. They may therefore have more time for crop and animal production activities on their own farms. Non-F.S.K mothers on

the other hand have more children, hence, they may be more tied down to household work activities in addition to a more likely involvement on other farms. Because of these, the above contradiction to the research hypothesis may not be true especially if all the intervening variables such as the number of children and the level of involvement on other farms are controlled for. Therefore, the actual shift of mothers' involvement in on-farm activities, due to the introduction of the cow and the eventual effects on the nutritional status of children may not be conclusively deduced from this study.

The higher involvement by hired labour among F.S.K households as compared to non-F.S.K households could be due to a number of reasons. The F.S.K households are associated with significantly higher incomes per year compared to non-F.S.K households. This may mean, they are in a position to pay the hired labour for farm activities. This is also reflected in a Food and Nutrition Studies Programme in Kwale District (Oosten, 1989) where it was found that only those households which had access to a considerable income could afford to hire additional labour. Ploughing in this study, in the majority of the households, is done by hand. Given the bigger acreage by F.S.K households alongside the dairy husbandry practices, the resulting high labour requirements may demand hiring of some extra labour to assist in the increased workload. This is a positive aspect of the project as far as the general agricultural employment in the area is concerned. However, the extra cost of hiring labour may

offset the economic gains in the individual households if proper farm management principles are not adhered to.

The higher involvement by hired labour among F.S.K households could also have been compelled by an apparent low involvement by fathers and children in on-farm activities in those households and especially when there is an added burden of looking after the animal. The low involvement by the fathers may be due to the fact that they are relatively old compared to their counter-parts among the non-F.S.K households. On the other hand, the low involvement by children may be as a result of F.S.K households having older children who have gone to look for off-farm employment.

6.5 Nutritional status

The level of wasting among the F.S.K and non-F.S.K households are generally low. This is in agreement with the low national levels of wasting which stands at 2.5 percent (Republic of Kenya, 1987). The significant difference in wasting between F.S.K (3.7 %) and non-F.S.K (0.0 %) households may be due to other factors not associated with whether the households were involved in dairy farming or not. The three wasted cases among the F.S.K households were associated with families consisting of high numbers of pre-school children and deceased household heads. The general low levels of wasting in the study population may however be explained by the fact that the study was carried out during the maize harvesting season when there is plenty of food available for home consumption.

Nakuru District, which ranks 10th in the Nation with respect to the level of stunting, has a percentage malnutrition level of 24.2 among children (Republic of Kenya,1987). This shows that the F.S.K households are associated with a lower level of stunting (13.7 %) in comparison with the District. On the other hand, the level of stunting among non-F.S.K households (23.1 %) is not different from the District. Therefore, not all households in Nakuru District are characterized by children with high levels of stunting as evidenced by the district average rate, 24.2 % (Republic of Kenya,1987). Hence, proper planning in future should involve disaggregated anthropometric data analysis to enable the identification of truly vulnerable groups.

At low income levels, for both the two farming communities, the analysis revealed a higher level of stunting among non-F.S.K children. A possible explanation lies in the amount of milk consumed per day where children from F.S.K households consume more milk than non-F.S.K children. In addition, non-F.S.K households may not be in a position to purchase other protein substitutes. The available calories from own production is not different between F.S.K and non-F.S.k households at this level of income (see Appendix 6), hence, it cannot explain the difference in nutritional status. At high income levels, there is no difference in the level of stunting among children between the two farming communities. This points to the fact that at high income levels, the non-F.S.K households may be equally capable of providing the necessary resources for better child

care just as the F.S.K households, especially protein rich foods such as meat and beans. This effectively substitutes for the low intake of milk by non-F.S.K households.

At low levels of available calories from own production, the results reveal a higher level of stunting among non-F.S.K children in comparison to F.S.K ones. One of the possible explanations lies in the significantly different income levels between the two groups (see Appendix 7) in addition to a difference in milk consumption. However, at high levels of available calories from own production, there is no difference in the level of stunting between the two groups. Therefore, there seems to a level of income or available calories from own production beyond which, belonging to the F.S.K project or not is immaterial as far as the level of stunting among children is concerned. In this study therefore, a combination of high incomes and high available calories from own production seems to be associated with a low level of stunting (see Appendix 8).

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

Households within the F.S.K project are associated with higher total cash income than non-F.S.K households. This can only be accredited to the dairy project among the F.S.K farmers since incomes from other sources (crop sales and off-farm employment) are basically the same between the two farming groups. For F.S.K households, there is comparatively less reliance on off-farm employment for cash income as evidenced by the lower contribution of this income to the total household cash income. This places the project farmers in a less vulnerable position with respect to adverse external forces that are likely to affect off-farm engagements.

The project has considerably increased the amount of milk available for home consumption within participating households. This has been made possible by the fact that a high proportion of the milk produced (63 %), among the project farmers, is not sold. Age and educational level of mothers among F.S.K households, on the other hand, have a bearing on the utilization of milk. Older mothers with no formal education sell less milk but give out more milk for free to neighbours or relatives. Therefore the spill-over effect (as a result of availing free milk to neighbours) is greater within households with older mothers.

Mothers are the most involved members in all on-farm activities including animal husbandry. This points to the fact that, the introduction of the dairy project has served to increase the mothers' involvement in on-farm activities. Therefore F.S.K and other developing agencies working in rural communities are faced with the challenge of designing intervention programmes that will attract the attention and interest of men. F.S.K mothers are involved in crop production activities just like non-F.S.K mothers. Contrary to expectations therefore, the project has not altered labour involvement of mothers in crop production activities.

Households within the project are associated with reduced off-farm employment, in particular, the sale of labour on other farms as casual labourers. This points to a full and better utilization of available farm labour, particularly during slack periods of crop production when hiring of labour on other farms is minimal. There is an increased involvement of hired labour on F.S.K farms. Hiring labour implies increased employment of local man-power. However, the resulting costs may off-set the economic gains for the participating households although this aspect was not addressed in this study.

The results of this study show that although F.S.K households include less children who are stunted than non-F.S.K households, the difference is not significant. This is in spite of the fact that F.S.K households have higher cash incomes and similar quantities of available calories from own production. However,

as to whether the increased income among F.S.K households has been, in this case, used to improve the health status of children or not, remains uncertain since the present study was not tailored to pursue that objective. In the long-run though, the high milk consumption among F.S.K farmers, in addition to the significantly high cash incomes, may go along way to facilitate the alleviation of malnutrition among children. The only set-back is in relation to the fact that just about a half of the F.S.K households in Bahati division have pre-school children. This is attributable to the selection criteria which largely determines the composition of farmers who participate in the project. As a result, F.S.K households have fewer young children and more work for mothers (who takes care of children) because some household heads are too old to work or their children have gone off to look for off-farm employment.

7.2 Recommendations

1. The project has great potential and hence should be expanded to cover more areas. However the F.S.K selection criteria should be reviewed to cater for more households with pre-school children. This would ensure that the project benefits are spread to towards the most vulnerable group; children.
2. A further study is recommended which should concentrate on income expenditure patterns, time series analysis on labour distribution among household members and cost-benefit analysis of the project. In addition, a food

consumption study should be included alongside utilization of health services and morbidity patterns. This would lead to more plausible conclusions regarding the health and nutrition impact of dairy farming in rural communities.

3. There may be a need to carry out a milk marketing survey with a view to improve the marketing services, particularly in the low potential area, Lanet, where the majority of farmers sell their milk to local traders (Personal communication). The local market does not have the capacity to handle all the milk the farmers produce. The official marketing agent which is K.C.C (Kenya Cooperative Creameries) should increase its price as it is low compared to that offered by the local traders.

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APPENDICES

Appendix 1 Units of Measurement for Crop Production

The units of measurement for crop produce sold or reserved by which farmers were recalling were, a bag, a debe or a 2 kg tin, the weights of which are shown below for the three main food crops:

Unit of measurement		weights (kg)	
		potatoes	maize/beans
2 kg tin	-level	2.2	2.2
	-heaped	2.5	2.4
1 debe	-level	17.6	17.6
	-heaped	20	19.2
1 sack (6 debes)	-heaped	120	115.2

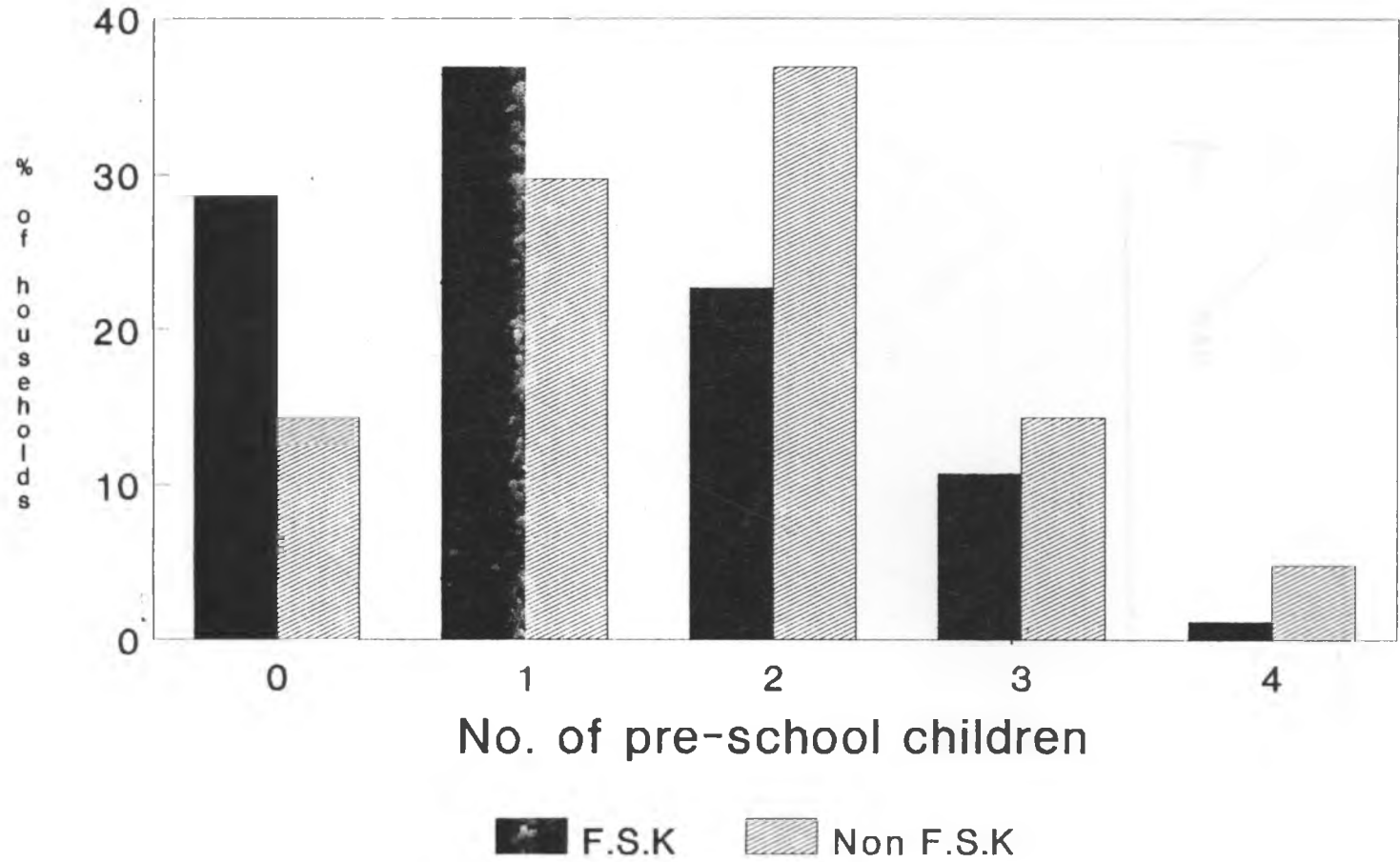
These measurements were arrived at by weighing the different units (except a sack) for the different crops in 5 households using a Salter scale and taking the average of the readings.

Appendix 2 Units of Measurement for Milk

The units of measurement for milk by which farmers were recalling were, a bottle, a glass or a tinned cup. Below are their capacities arrived at by measuring the units in 5 households (using a measuring cylinder and water) and taking the average reading.

Unit of measurement	capacity	
	mls	litres
1 bottle	700	0.7
1 standard glass	200	0.2
1 tinned cup	350	0.35

DISTRIBUTION OF PRE-SCHOOL CHILDREN



Appendix 4 Mean Cash Income from Crop Production per unit
Area of Land per Year

	F.S.K	non-F.S.K	p-value
Food crops sold (ksh)	820	740	0.714
Cash crops sold (ksh)	750	940	0.514

Appendix 5 Comparison of Households with or without Maternal Education (means of different selected variables- F.S.K only)

Variable	no education	some education	p-value
Milk produced per year (litres)	1,906	1,642	0.237
Milk sold per year (litres)	625	675	0.658
Proportion of milk sold(%)	32.2	39.6	0.031
Total income (ksh)	9,388	11,324	0.215
Income per capita (ksh)	1,504	1,681	0.532
Amount of land (acres)	1.9	1.8	0.749
Household size	7.4	7.9	0.402

Appendix 6 Household Characteristics by Available Calories
from own Production (kcal/capita/day)

Household characteristic	F.S.K	non-F.S.K	p-value
Income per capita (ksh/year)			
low (≤ 824)	810	870	0.586
high (> 824)	1390	1248	0.330

Appendix 7 Household Characteristics by Income per Capita
(ksh/year)

Household characteristic	F.S.K	non-F.S.K	p-value
Available calories from own production (kcal/capita/day)			
low (≤ 1050)	1040	500	0.002
high (> 1050)	2015	1160	0.002

Appendix 8 Nutritional Status (% malnourished) by Income per Capita and Calories per capita

	Available calories from own production (kcal/capita/day)	
	low (= <824)	high (>824)
Income per capita		
(ksh/year)		
low (= <1050)	29.8 (47)	20.0 (20)
high (>1050)	19.0 (21)	12.2 (41)

Appendix 9 Standard deviations for variables in table 3

	F.S.K	Non-F.S.K
Total household income	7,028	4,685
Total income from food crop sales	3,028	1,648
Total income from cash crop sales	3,299	2,255
Total income from milk sales	3,113	
Total off-farm income	4,604	4,166

Appendix 10 Standard deviations for variables in table 5

Household characteristic	mean(mls/day)		
	Milk given out per day	milk used by the household per day	milk consumed by the index child per day
Income per capita (ksh/year)			
Low (<824)	990	1100	250
High (>824)	880	960	220
Food production (ksh/year)			
Low (<4,180)	910	710	270
High (>4,180)	900	1120	200
Maternal education			
No formal education	1140	1320	240
some formal education	550	680	220

Appendix 11 Standard deviations for variables in table 7

Scheme	weight/age	weight/height	height/age
F.S.K(n=80)	10.3	9.2	4.9
Non-F.S.K (n=104)	10.0	7.0	5.0

Appendix 12 Questionnaire

BACKGROUND INFORMATION.

Date ____|____|____ Name of interviewer _____
 Area _____ Sample type (cycle): 1 2

(1=F.S.K, 2=Potential F.S.K)

(if F.S.K), then, year of entry into the F.S.K _____

Household No. _____

Name of the household head _____

Sex of the household head (cycle): M F

Age of the household head (years) _____

Educational level of the household head (years in school) _____

Name of the respondent _____

Sex of the respondent (cycle): M F

Age of the respondent (years) _____

Educational level of the respondent (years in school) _____

Household size _____

(Fill in the table below the names of children less than five years but more than two years old and their ages):

name	age	
	yrs	mon

Name of the index child _____

(index child is the youngest child but over two years old)

(a) INCOME.1. MILK SALES.

(fill the table below appropriately)

	1st quart. (Jan-Mar)	2nd quart. (Apr-Jun)	3rd quart. (Jul-Sep)	4th quart. (Oct-Dec)
No. Of cows being milked				
Q of milk produced per day (litres)				
Q of milk sold per day (litres)				

Q=quantity

What was the total income you got from milk sales this year (ksh.) _____

Where did you sell your milk:

Local consumers ()
 K. C. C. ()
 Other agents () _____
 (specify)

At what prices did you sell your milk.
 (fill the table below)

	price/litre (ksh)
Local consumers	
K.C.C	
Others	

2. FOOD CROP SALES:

How much land does the household possess (acres) _____
 How much land was under cultivation this year (acres) _____
 How much land was used for livestock production this year _____
 What were the main food crops grown in the course of the year.

1. _____
2. _____
3. _____
4. _____
5. _____

For each of the above food crops, how much was sold and at what prices.

	<u>Food crop</u>	<u>Q sold</u>	<u>Price (ksh)</u>	<u>Total (ksh)</u>
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____

What were the main food products consumed on the farm in this year.

3. CASH CROP SALES.

What were the main cash crops grown in the course of the year.

1. _____
2. _____
3. _____
4. _____
5. _____

For each of the above cash crops, how much was sold and at what prices.

	<u>Cash crop</u>	<u>Q sold</u>	<u>Price (ksh)</u>	<u>Total (ksh)</u>
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____

What were the other sources of income in the course of the year

	<u>Source.</u>	<u>Amount.</u>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

4. MILK CONSUMPTION.

(Using the last one week's recall, ask all the following questions on milk consumption):

Was milk reserved for home consumption

yes ()

no ()

(If yes), how many times was it reserved

[1=daily, 2=once, 3=others (specify)]

() _____

Was milk bought for home consumption.

yes ()

no ()

(If yes), how many times was it bought.

[1=daily, 2=once, 3=others (specify)].

(the following two questions should be only for the index child)

Was any milk given to the child

yes ()

no ()

How many times was it given (per week)

[1=daily, 2=once, 3=others (specify)].

()

In what form was the milk given to the under-five children who are more than 2 years old (1=pure form, 2=with tea, 3=with other foods)

5. ANTHROPOMETRY.

(This is to be carried out on all the children under five years of age but more than 2 years of age).

Weight, kg (tolerance of +/- 0.1 kg)

<u>Ser.no.</u>	<u>Name</u>	<u>Age (months)</u>	<u>1st reading</u>	<u>2nd reading</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Height, cm (tolerance +/- 0.5 cm)

<u>Ser.no.</u>	<u>Name</u>	<u>Age (months)</u>	<u>1st reading</u>	<u>2nd reading</u>
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

(b). LABOUR.

Which months of the year were the busiest periods on the farm in order of intensity

List 10 farm activities the household was involved in during the busiest periods of the year.

Of the above activities, which were the four main ones in order of intensity and who were mainly involved in those activities.

<u>Activity.</u>	<u>Type of people mainly</u>
<u>involved.</u>	()
_____	()
_____	()
_____	()
_____	()

Code for the type of people involved:

- 1=father
- 2=wife
- 3=children
- 4=labourers (hired labour)
- 5=others (specify)

Which months of the year were the least busiest periods on the farm starting with the least busiest month.

Was anybody hired on a permanent basis for the whole of this year.

yes ()

no ()

Appendix 13

