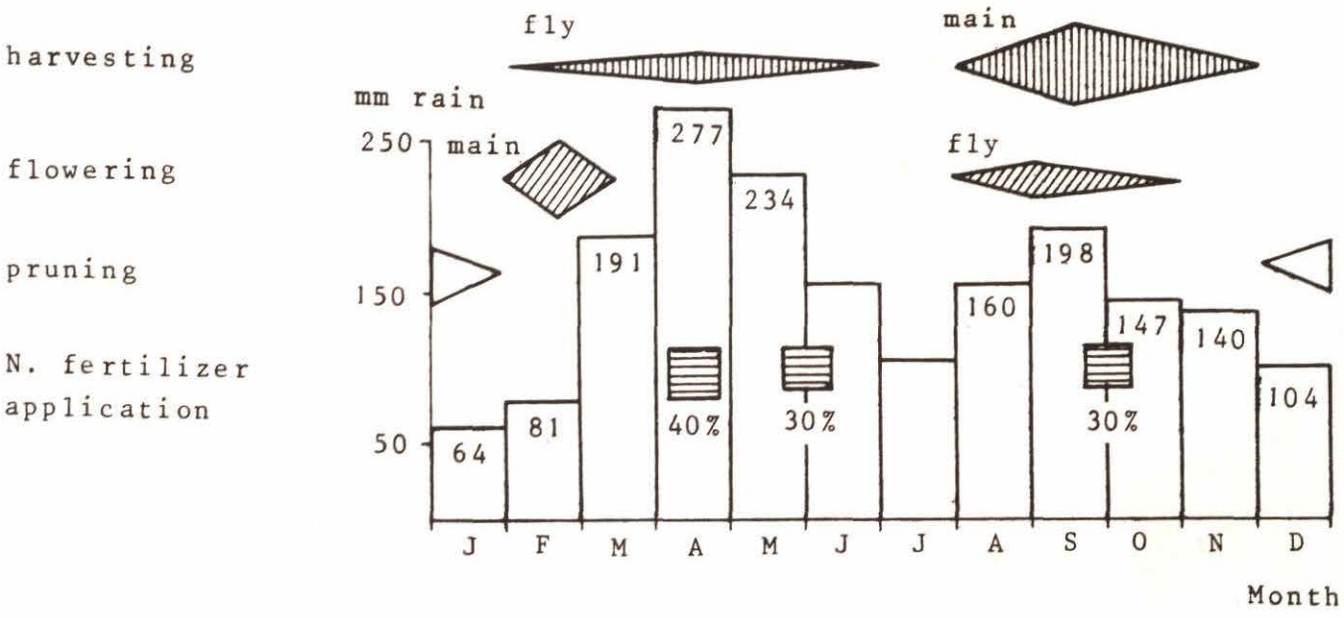
TRAINING PROJECT IN PEDOLOGY

KISII KENYA

coffee flowering, harvesting and N. fertilizer application card



Cash Crops in the Kisii District (Coffee and Pyrethrum)

PRELIMINARY REPORT NO 25

AGRICULTURAL UNIVERSITY

WAGENINGEN - THE NETHERLANDS

CASH CROPS IN THE KISII DISTRICT
(coffee and pyrethrum)

by

K. van der Torren

Preliminary report no 25
April 1977

TRAINING PROJECT IN PEDOLOGY, KISII - KENYA

Agricultural University, Wageningen - The Netherlands.

CONTENTS

Preface

This report of the Training Project in Pedology at Kisii, Kenya, of the Section of Tropical Soil Science of the Agriculture University at Wageningen, the Netherlands, is the twenty fifth one of series to be presented to Kenyan Officials.

The project started in November 1973 after assent had been granted by the Office of the President of Kenya. It is meant for training of post-graduate students of the Agricultural University at Wageningen and for furnishing research opportunities to the staff. The activities of students and staff are directed to obtaining a better knowledge of the soils and the agricultural conditions of the project area to provide a basis for the further agricultural development of the area.

The Project in Kisii is condacted by:
Ir. W.G. Wielemaker, teaching and research ,
Ing H.W. Boxem, management
visiting specialish from the Agricultural University of Wageningen help to resolve special problems.
This report has been written by Mr. K.v.d. Torren, who also excecuted the field investigation between August 1974 and February 1975. The compilation and editing of the report was done by Mr. Boxem.
In this report on the agricultural system in the Kisii District attention is focused on two main cash crops: pyrethrum and coffee. The third important cash crop tea will be dealt with later. The agricultural system will be described is the report about the soils of mapsheet 130 but this version goes much more in detail. So it was decided to publish this as a preliminary report. This survey is however restricted to the Kisii District. Even the Sotik settlement scheme has been excluded.
This report is the result of some litterature studies, discussion with the farmers and district agricultural officers.
We hope to pay back with these reports a small part of the great debt we owe to Kenya in general and to many Kenyans in particular for their valuable contributions to the good functioning of the project.

The supervisor of the project
J. Bennema, Professor of Tropical Soil Sience

1. The Kisii District.

1.1. Physical conditions.

The physical conditions of major importantance for explanation of the differences in cropping systems within the district seem to be the altitude and land-form (steepness of slopes etc.) and the climate.

Within the district altitude varies from 1390 m, which is the lowest point, where the river Gucha crosses the Western border, to 2210 m, which is the highest peak near the eastern border of the district. The 6000 ft (± 1800 m)contourline divides the district approximately in two halves (see contour map, Fig. 1)

The climate is rather moist: No part of the district receives less than an annual average of 1200 mm, distributed rather even over year with two rainfall peaks.

Near the western border of the district temperature is higher than in the eastern part.

As the district lies between $0^{\circ}30'$ and $1^{\circ}00'$ south, day length does not vary significantly (see climate map, Fig. 2 , Page 5).

The physiography and the soils of the Kisii district are described in two other publication (PR 1 and Report Mapsheet 130). Within the climate and altitude zones of the district there are no great differences in soil types. The higher part of the district consists mainly of deep clayey soils of andesitic, rhyolitic and basaltic origion, while near the western border sometimes gravelly, but also clayey soils of granitic and quartzitic origin occur.

Because of this correlation of soil types and climatic zones it seems rather difficult to separate the results of each of these factors. This is confirmed by the vegetation map (Trapnell ao.'69), which shows that the eastern part of the district consists of moist mountane forest clearings (type 35 and 35d) This type borders either via a transional zone of lower moist forest clearings (type 25d) in the northwest or directly a broad leaved savannah vegetation type, (40), which stretches into south Nyanza.

Fig. 1. Contour map of the Kisii District.

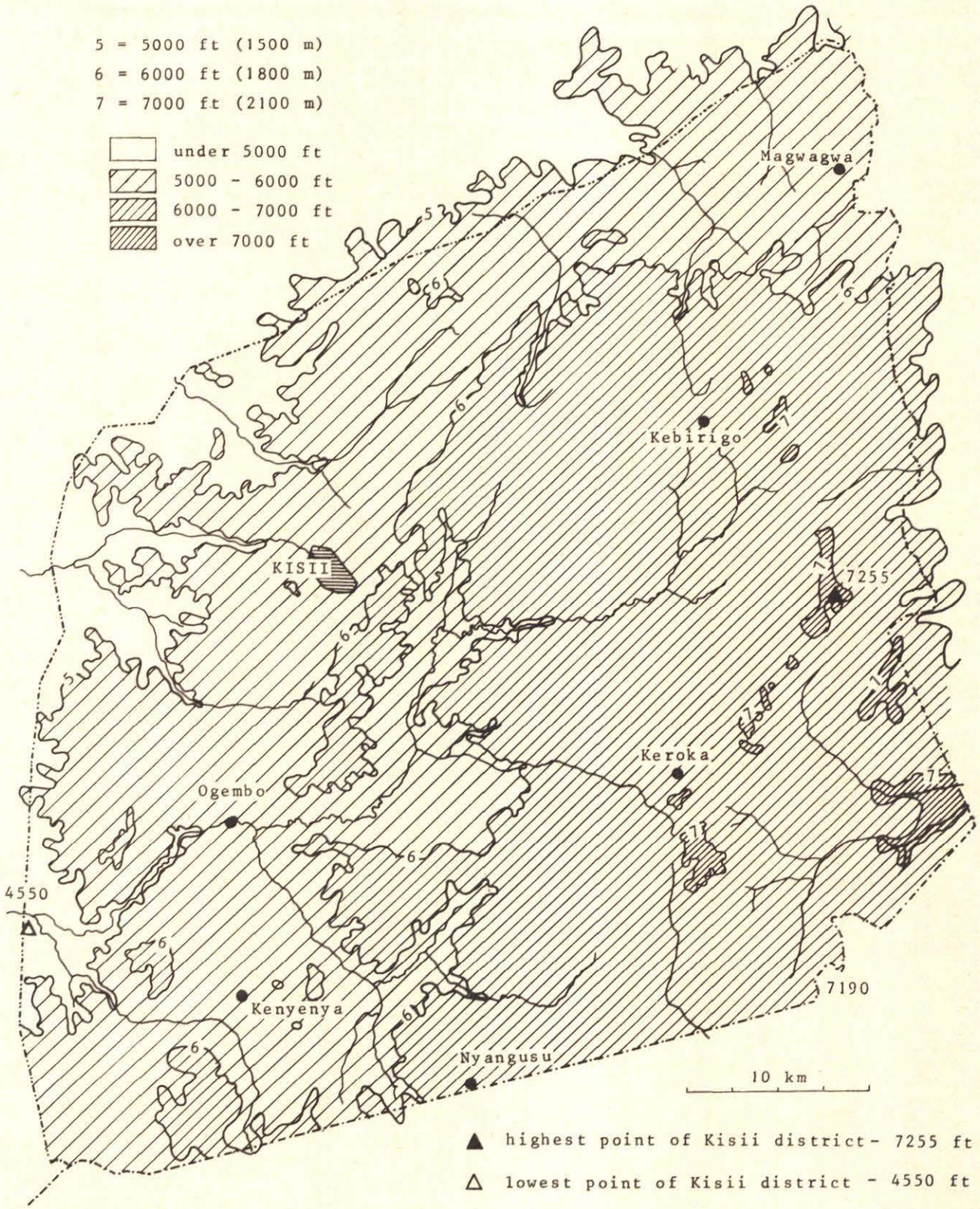
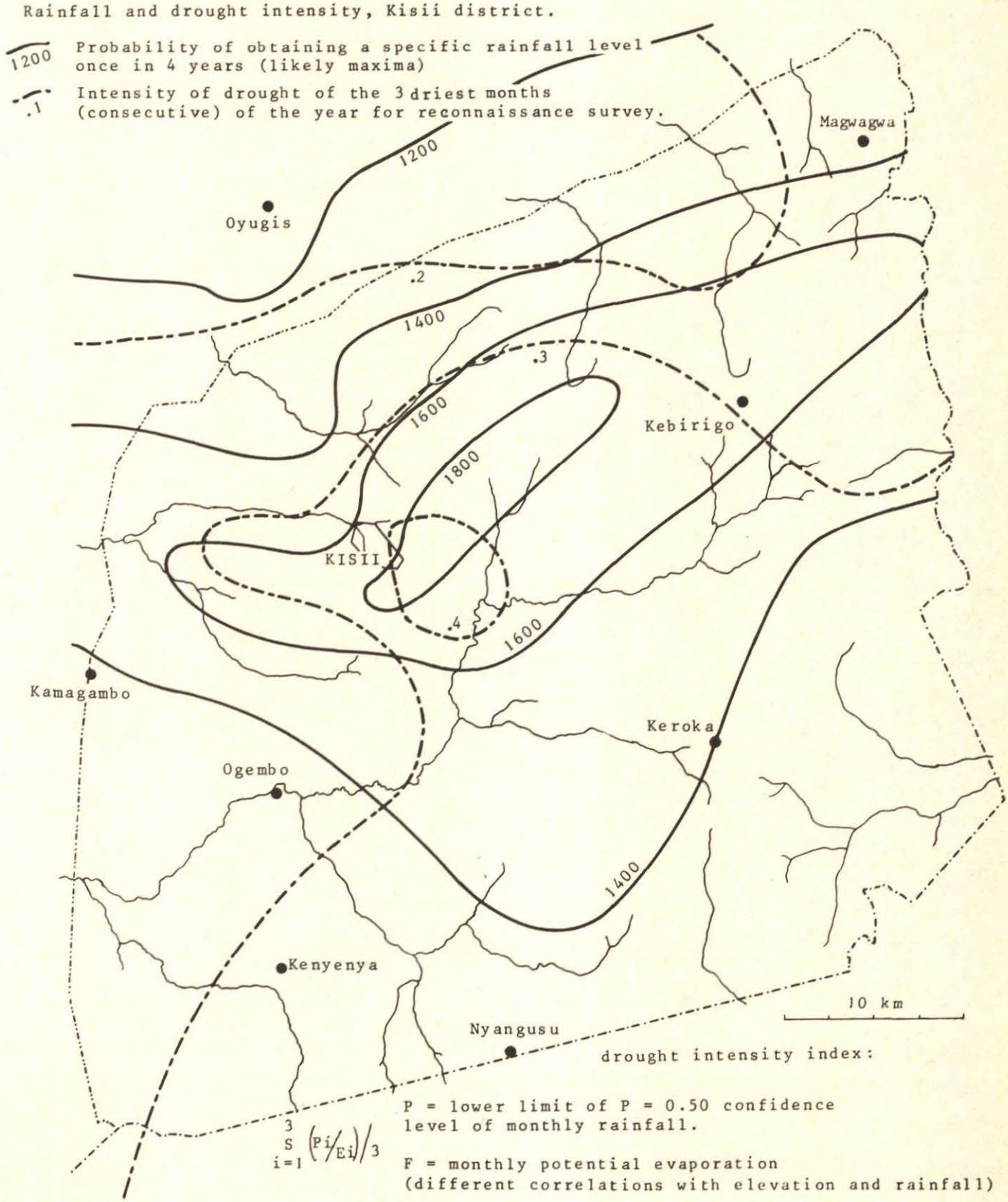


Fig.2 Climatic map of the Kisii district.



In the high, but somewhat dryer southern and eastern parts of the district some patches of montane Acacia-vegetation (type 5) occur. Dispersed over the district are peaty valleys with impeded drainage, which carry a wide variety of sedges (type 8a, 9).
On the hilltops with shallow soils poor grasslands, mainly consisting of "Loudetia kagerens is" with some shrubs occur (type 2a)

1.2. Population and administration.

Administratively the Kisii district is divided in four divisions, each divided in locations or subdivisions (see map: Divisions in Kisii district).
This division is in the content of this report only important, as some crops are registered per division.

The average population density is high in the district. With a population estimated at 840.000 persons in 1975 it should be 390 persons/km^2. But the population is not evenly spread over the district: In Central- and East-Kitutu in the central part of the district it is estimated over 500 persons/km^2, while along the borders it is lower than the average.

About a hundred years ago the Kisii-tribe, a Bantu tribe, invaded the untill then nearly uninhabited Kisii-highlands, surrounded by the Nandi and the Masai tribes from the East and South and by the Luo tribe from the West and the North. We find the Kipsigis tribe now East of Kisii.
The thickly forested highlands frustrated the originally pastoral way of life of the Kisii, who turned then to the cultivation of grains and vegetables.

For safety and health reasons the Kisii tended to build their houses on the tops of the flat-topped ridges. In the former times they could see their enemies invading their area easily from there.

Besides on the lower valley bottoms temperature inversions and moisture content of the air are much greater. Nowadays homesteads are often created in the middle of the farm, which is normally a strip of land from the valley bottom to the top of the hill.

The district contains a lot of small villages, consisting of some shops, hotels and houses along the main road or around a marketing place. Some divisional headquarters and bigger village also have repair worshops and petrol sales point, like Keroka, Kebirigo, Manga, Kenyenya and Nyangusu, but most of the workshop activity has its centre in Kisii-town, which has regular electricity supply and where also nearly all administrative facilities are centered.

Of the total surface of the Kisii district, ± 2200 km^2 including the Sotik settlement area, ± 1945 km^2 was available for smallholder registration, of which on 31-12-1972 nearly 1600 km^2 was already registered and in 1975 the entire disrict was consolidated. After registration title deeds are supplied to the owner.

Average sizes of the farms differ somewhat from division to division within the district, but these differences from the district average of 2.13 ha are not pronounced (see table). The differences in farm sizes appear to be much bigger when we have a look at the breakdown by size of the holding. In Kuja division for example of the total number of registrated farms on 31-12-1972, 16.969 farms,

10.391 farms were smaller than 2 ha,

4.524 farms were between 2 ha and 4 ha,

2.054 farms were larger than 4 ha.

Such figure confirm the idea that there is a certain inequality between the possibilities of the different Kisii farmers. This idea occurs when visiting some farms under the guidance of ministry of agriculture staff members or looking through the files of loan-applicators at the land & farm management division.
The loan application forms show size averages of ± 4 ha and some farms of over 10 ha (see tables).

1.3. Farming.

Before classifying the farming system in the Kisii district it can be useful for good understanding of these farming systems and their dynamic development to know something more of the farming objectives of the Kisii farmers.

The most basic and original objective is to produce most of the food, which is consumed on the farm.
Besides this objective all farmers are cash profit seeking for which generally two reasons can be given: ditures such as: salt, cooking oil, made tea, etc.; clothes, furniture, building and repair materials, school fees and uniforms, transport fees, medical assistance a.s.o.
For these purposes much farmers are employed elsewhere.
Secondly a lot of farmers want to invest in their farms to fetch out of farming the bigger part or all of their income. These farmers need money for: Buying seeds and fertilizers, investing in new cash crops, buying cows and paying veterinary services, paying transport for these commodities and their products, buying more land and and repaying loans, and a lot of other things.

When some farmers try to buy land, it is clear that others are invited to sell, which can become more and more attractive with increasing land prices. In 1973 a survey team noted already a market value of 5750 Kshs per hectare as an average for four Kisii farms (PRP '74) Besides, only farmers with a large farm than average tend to apply for loan.

Out of these assumptions we can classify the Kisii farmers as:

1. Stayers: The skilled farmers, who invest in new enterprises and more land; these are presently owners of the bigger farms

2. Marginal stayers: The farmers, who have the necessary skills and strongly want to stay, but do not have much financial power and much land. This is the vast majority.

3. Leavers: The farmers, who have difficulties proving their necessary household income and are tempted by the high prices to sell land.

The first and second groups of farmers are the ones who take risks in investing in cash enterprises. The risks are some times too big for the second group, which means they will join group three.

The classification mentioned here may also be a classification according to the degree of commercialisation of the farms. This field needs still a lot of study.

A very rough division in three agroecological regions in the district is given by Hubert (1972):

1. Over 1800 m. altitude; tea and pyrethrum typical crops,

2. Between 1500 m and 1800 m; coffee and bananas typical crops,
3. Under 1500 m; sugarcane groundnuts and irish patatoes typical crops.

Another approach was made by van Wissen (TPIP'74), who mapped regions with different vegetation types, climates, physiographic properties, population densities and altitudes, and afterwards described the land use in these regions in terms of crop systems and arable cultivation and grazing intensities.

Preferably the approach of the farming systems of the Kisii district from an evolutionary point of view with "Farming Systems in the Tropics" (H. Ruthenberg, 1971) as a guide is taken.

Ruthenberg defines seven main farming systems, three of them can be distinguished in the Kisii district:

1. Systems with regulated ley farming,
2. Systems with permanent cultivation on rainfed land,
3. Systems with perennial crops.

When the Kisii tribe started settling in the centre of the present district, approximately near Manga, they had to leave their former farming practices as nomads and semi-nomads (frustrated by the thick forest). They began to clear the forest and to develop a system of regulated ley farming. Grains, vegetables and tubers were cultivated and animals were kept on fenced patched of sometimes planted grass fallow.
The fences could easily be constructed by planting and shaping dense shrubs hedges.

The grasses, which tend to invade the plots naturally after several years of grain, vegetable and tuber cultivation are grasses with good grazing and feed qualities like Kikuyu grasses and star grasses (Pennisetum clandestinum and Cynodon dactylon or C.plectostachyus).

This farming system is still quite common in a wide strip along the borders of the district.
The cultivation period as well as the ley period can last 5 - 10 years the latter tending to become longer.
In the lower, warmer, areas double cropping of grain is possible; in the higher, colder, part of the district only one crop of maize in a year is possible.

According to Ruthenberg, areas where ley systems occur have one or more of the following features:

1. Vigorous growth of palatible grasses is possible,
2. The dependence on the long-fallow system is not pronounced, i.e. relatively few years of grasses are sufficient to restore soil fertility,
3. Land becomes so scarce that intensification is required beyond permanent grazing or unregulated ley farming, yet is not so scarse that permanent cropping is necessary,
4. The health risks of intensive animal - keeping are comparatively low,
5. Price relations favour intensive forms of meat and milk production
6. Sufficient draught animals or tractors are available to plough the leys,
7. Farmers have sufficient knowledge and capital to organise a proper fodder economy over the year.

The first five features are characteristics of the Kisii district, though to a lesser extent for the small part which lies under 1500 m and far from the Sotik milk plant.

The sixth and seventh feature are given attention. The sixth means for the district not only a shortage of drought animals, but also difficulties in the uprooting the tough, matting grasses, so that the ley periods tend to become much longer than necessary for soil fertility restoration. On the seventh feature work is done by the land and farm management division and the FTC (loans and extension).

The third feature is important for the evolution of the farming systems of the Kisii district, as can be seen clearly in the centre of the district, where population density is highest and land scarcety is greatest. There the basis for permanent cultivation on rainfed land, urgent land shortage and deep fertile soil combined with a good rainfall pattern is present.

The important constituent parts of the cropping systems within these farming systems are the subsistance and cash food crops, which include in the first place gains, like maize, and wimbi (fingermillet) and tubers like sweet potatoes. Vegetabes, sometimes as a pure stand but mostly as an intercrop include a wide variety in beans, cabbages and kales,

chillies and peppers and several spinaches, e.g.
Gynandropsis gynandra, Solamum nigrum and Portulacca edulis.
Vegetables, which are commonly planted as a pure stand are cabbages and beans. Some vegetables and fruits are nearly exclusively planted in pure stands for cash purposes, like onions, tomatoes, lettuce and strawberries. This is also the case with rather recently introduced and and within the district merely low altitude (under 1500 m) crops like irish potatos, tobacco, soybeans, groundnuts, sunflower, castor beans etc. For irish patatoes and tobacco the ley system can be particularly interesting to avoid nematodes.

The farming systems, which are economically the most important systems of the Kisii district are definitely those with perennial crops. Within the farming systems with perennial crops two entirely different cropping systems can be distinguished:

Firstly, the perennial field crops;
prethrum, sugarcane, bananas, pineapples, fodder grasses, sisal.
These crops do not have the characteristic of shrubs or trees.

With the exception of bananas, they mostly require a considerable degree of cultivation, and can thus be considered from the farm management angle as something between arable farming crops and shrub and tree crops.
Secondly, shrub crops; coffee, tea and passionfruit, and tree crops wood, wattle bark and tree fruits, such as citrus, avocado, manga, loquat. For these crops the vegetable cycle generally lasts much longer, but also the period between planting (normally with intercrop) and the beginning of the returns is longer, which makes the invesment risk higher.

Comparing perennial crops with arable crops we can conclude that there is a good chance of conservation soil fertility and prohibiting erosion, due to the longer period of soil cover and shading of the soil. This factor is less important for perennial crops, which cannot compete with weed and have to be clean weeded (e.g. pyrethrum).

Some perennial crops can be grown under circumstances, where it is not possible or dangerous to grow arable crops; for example tea, bananas on steep slopes, or tea, fruit trees and trees for woodproduction on rocky terrains, or wood trees and fodder crops in swampy areas.

Within the perennial crops we can make another distinction, which is probably more relevant for the Kisii district: Firstly, some perennial crops resemble most of the arable crops by the fact that after a certain period of growth the whole production is harvested in a short period, and the plants are destroyed by harvesting them.
This is the case with black wattle and trees for wood production, and partly also with sugarcane and fodder grass, which can be ratooned.

Secondly, quite a lot of perennial crops have a permanent fully productive life after a period of young-growth and a period of rising production. These crops are generally financially high productive and have high labour requirements.
Within this group of crops an important distinction can be made on basis of the spread of labour requirements over the year. The highest labour requiring crops generally coincide with the harvest period. So, the longer the harvest period, the higher productivity per manyear can be obtained. This is clearly the case with tea, pyrethrum, bananas, passionfruit and pineapple under the regular Kisii climate. This is also the case with dairy production systems.

Crops, whereby labour requirements in the highest labour peak period can become a limiting factor for productivity, are coffee; sugarcane, some fruit trees and, without doubt most arable crops.

Another important aspects for these crop, as well as for most of the arable field cash crops, are the processing, transport and marketing facilities for the products.

The Kisii district lies far from the main trade,centers of the country, and the only way of transporting products from the district is by road. There are only two tarmac roads out of the Kisii district.

The possibilities for export of bulky, relatively low-value-per unit-weight products, such as vegetables, fruits and milk, are limited until now, but this can change rapidly.

The main export products until now, pyrethrum, coffee and tea, are dried or processed within the district by the farmers themselves or by cooperative factories, and are then transported as high-value-unit-weight products.

From the other side, low-and very low-value-per-unit-weight products,

such as fuel wood, construction material (wood thatch) and subsistence food always were to be produced within the district.
This is probable also going to change when transport facilities become easier, and subsequently, transport prices drop.

1.4 Agricultaral production.

Some estimates and quantifications of land use, productivity and production are given in table3; crops in the Kisii district.

One of the highest land consuming farming activity. of the Kisii farmers, animal husbandary, is omitted, because estimates on this fie field seem to be far from reliable.

It can be estimated that ± 26.000 heads grade and upgraded dairy cattle within the district need (at a rate of 0.5 ha/L.U,) about 13.000 ha of grazing land fodder crops. The rate, used by the L.& F.M. division for loan approval is 0.8 Ha/Livestock Unit, but, looking at the available land must be lower

The estimates for the number of zebu cattle, mainly for meat production but also for milk and traction, vary around 250.000 (1972-1974). The number of goats and sheep can be estimated as high as that of the zebu cattle. Estimating the available grazing land about half of the total available land in the district, means that only 0.1-0.2 ha/L.U is available, which seems rather low, even considering the amount of crops residues (maize stalks, banana-stems etc.)used as fodder.
Coffee: ± 6700 ha owned by over 51.000 growers in 26 cooperatives societies with 67 factories in 1 union (KFCU) produced 4.000 tons of clean and mbuni, value over 20 million Kshs.
Tea; ± 6000 ha owned by ± 23.000 growers produced over 14 million kg green leaf, value over 14.7 million Kshs. This green leaf was processed in 3 factories, a fourth is under constraction.
Banana: ± 0.25 million bunches marketed earned ± 1.2 Kshs (million)
Passionfruit: 2700 growers with 766 ha marketed 1.3 million kg of fruit earning 0.4 million Kshs.
Notes: 1973 farmers sold a surplus of 54.000 bags of maize to the M.& P.Board, but in May/June 1974, just before the 1974 harvest, people bought 60.00 bags from M. & P. Board. The surface under

maize seems to decline rapidly, probably because productivity increases by increasing use of hybrid maize, double cropping with quick growing varieties and increasing use of fertilizers and pesticides.

For comparison values of 1972 and 1973 productions in million Kshs:

pyrethrum	37.9	27.3
coffee	21.1	18.7
tea	8.7	10.2

These crops will be dealt with in the following chapters.

Bananas are a typical product of the north-west of the district, where relatively much rain falls on relatively low altitude land. Marketing is a difficult problem, since transport is said to be monopolized by some traders. Kisii is said to be the greatest banana-producing district of the Republic.

Passionfruit production posses psychological since the processing factory is transferred from Sotik to Thika and technical problems in fungus disease control.
The crop needs very highly qualified labour.

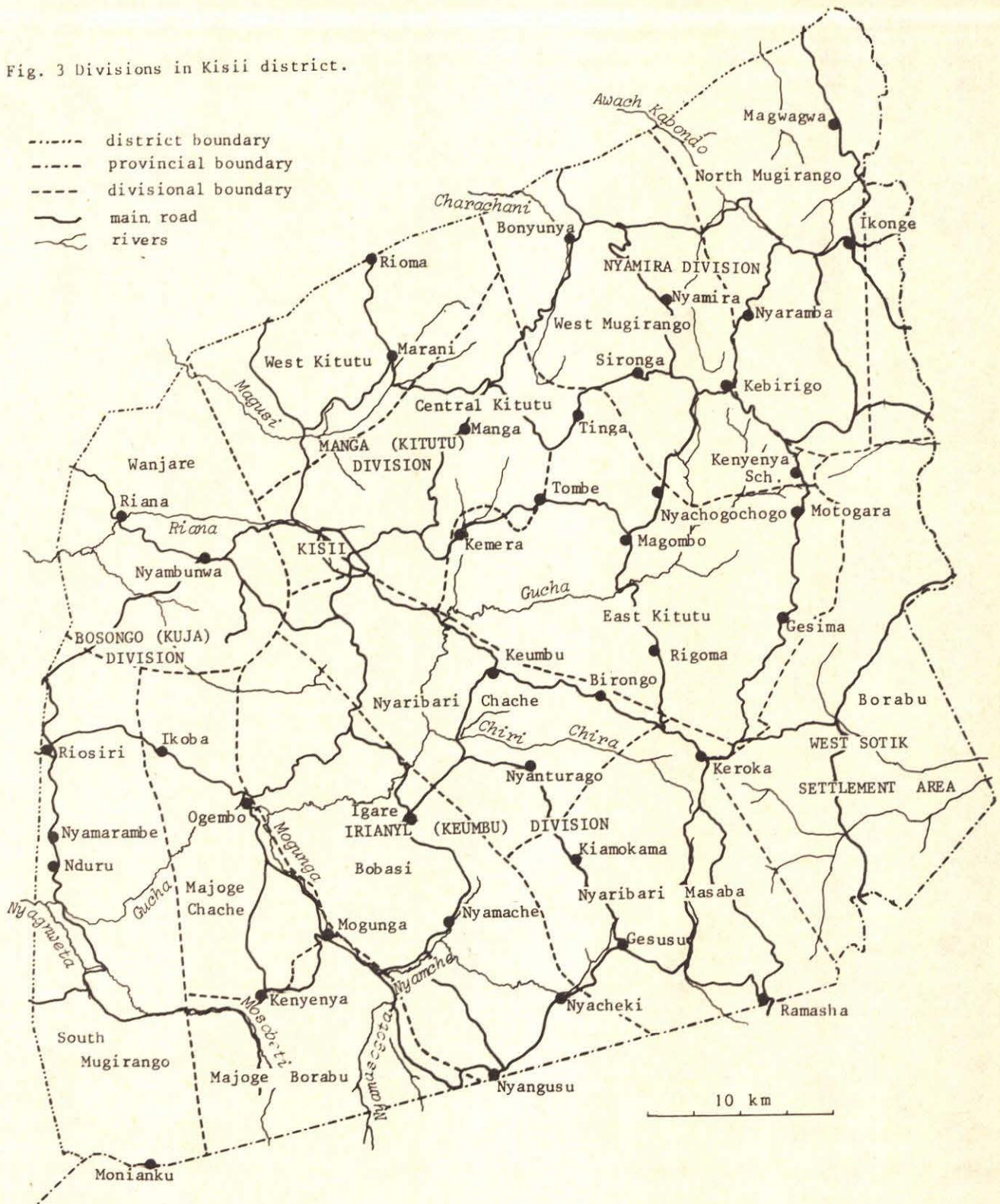
The figures for land-use and production, as well as those for the value of the production, must be considered with care. Only figures for the main cash crops, pyrethrum, coffee and tea, are based on rather exact statistics, mainly from the processing and the collecting cooperatives societies. Besides, these products are not partly consumed within the district, as is the case with most of the other export products of the district.

The total agricultural production in 1973 was estimated at a value of ± 160 million Kshs., of which about 60% has been marketed. This indicates a rather high average degree of commercialization of the farmers.

The figures in table 3, crops in the Kisii district, are mostly extracted from the annual reports of 1972 and 1973, written by the District Agricultural Officer. Some of the figures are estimated or calculated with the help of "East African Crops" (J.D.Acland, 1971).

For 1974, the D.A.O. of the Kisii district, Mr. J.J.Gichuki, gives the following figures for the main product in the district in his introduction to:
"Agicultural in the Kisii district" compiled by the German Agricultural Team in Kisii (1975):

Fig. 3 Divisions in Kisii district.



Maize: ± 21.000 ha were planted., which ± 19.500 ha hybrid maize. Total production was estimated on 760.000 (80kg) bags, of which 79.000 bags were sold to the Maize & Produce Board, earning the farmers 4.8 million Kshs.

Meat: Over 46.000 head of cattle were sold or slaughtered, value ± 18 million Kshs. Over 117.000 sheep and goats sold or slaughtered value over 8 million Kshs.

Milk: 26.000 head of grade or upgraded dairy cattle produced 2 million kg milk worth 2,2 million Kshs, hereof 0.75 million kg was processed at the Sotik KCC factory.

Pyrethrum: Over 20.000 ha planted by over 45.000 growers in 45 cooperative societies under 2 unions Mosaba F.C.U. and Kisii F.C.U. produced 8.056 tons dry flowers, value over 35 million Kshs.

Table. 1. Surface of the Kisii district and its divisions (see for location Fig. 3) Population- & farm density (Hubert 1972)

	Area	total population	persons/km^2	number of farms	av.size of farms (ha)	persons/(km^2) farm
Keumbu	543.2	195009	359	23500	2.30	8.3
Kuja	553.1	172014	311	24000	2.48	7.2
Kitutu	477.2	219989	461	26500	1.71	8.3
Nyamira	411.6	145.001	352	17000	2.34	8.5
Subtotal	1985.1	732013	369	91000	2.13	8.0
settlement	242.1	23000	95			

Table: 2. Planimeter results from the vegetation map (Trapnell 1969)

Vegetation type		surface (ha)	%
2a	: open grassland, rock outcrops	6440	3.3 %
8a+9	: poorly drained falt valley bottoms +	7000	3.7 %
5	: montane acacia	9475	4.9 %

40	: broad-leaved savanna	16320	8.4 %
25d	: lower moist forest clearings	17160	8.8 %
35+35d	: moist montane forest clearings	138645	70.0 %
	Kisii district without settlement:	195040	100.0 %
	West-sotik settlement area :	25040	
	Total Kisii district :	220080 ha	

Table 3. Crops in Kisii-district.

	1972			1973		
	production (tons)	area (ha)	yield (ton/ha)	production (tons)	area (ha)	yield (ton/ha)
CROP.						
Maize						
hybrid	95753	27358	3.5*	149450	42700	3.5*
local	12685	5074	2.5*	26250	10500	2.5*
total	108438	32432		175700	53200	
Pyrethrum (dry fls)	8556	21000	0.4*	5577	14000	0.4*
Coffee (cherries)	11808	6645	1.77	10402	6488	1.60
Tea (green leaf)	9012	4655	1.94	11005	5620	1.96
Bananas (bunches exported)	1114372	1166	0.965	2191438	2000	1000*
Passionfruit	2000	970	2.06	1000	322	3.11
Groundnuts	438	600	0.73	21	180	0.12
Beans and Peas	1061	1657	0.64	2064	4300	0.48
Soybeans	83	130	0.64	-	-	0.48
Castor	11	20	0.57	9	16	0.57*
Sugarcane	94800	1264	75.0	97500	1300*	75.0 *
Fingermillet	1450	2263	0.64	1170	1830	0.64*
Sorghum	845	704	1.20	384	320	1.20
Cassava	-	185	-	-	120	-
Sweet potatoes	-	2374	-	-	4160	-
Irish potatoes	842	208	4.05	1260	311	4.05*
Cabbages	216	297	0.73	390	539	0.73
Tomatoes	222	124	1.79			

Carrots	77	16	4.94		
Oninns	217	134	1.62		220
Pineapples	-	31	-		
Chillie & Peppers	-	48	-		
Wattle bark	20	130	-	2	130

-Source: Annual reports 1972 & 1973, Min. of Agric., Kisii

Calculations; *Estimates*

Table 4a. Crop & farm surface of the most important crops, average. 39 farmers in Majoge chache, Kuja, and 62 farmers in centeral & east Kitutu.

Calculated from loan application forms 1970 - 1973,

Land & Farm Management division, Ministry of Agriculture, Kisii.

Present and proposed situation (after loan approval)

	farmers with the crop		Total acreages		percent		average crop surf farmer	
	pres.	prop.	pre.	prop.	pres.	prop.	pres.	prop.
KUJA								
coffee	31	31	25.4	24.0	6.0 %	5.6 %	.82	.77
bananas	22	23	16.3	16.9	4.0	4.0	.74	.74
tea	2	18	1.5	23.0	-	-	.75	1.28
pyrethrum	1	9	1.0	9.4	-	-	1.00	1.04
maize	35	33	145.2	94.8	34.4	22.4	4.15	2.87
pasture	39	38	166.7	188.4	39.5	44.4	4.28	4.96
TOTAL	39	39	422.5	424.0	100%	100%	10.83	10.87
							(average farm size)	
KITUTU								
coffee	12	6	7.1	5.7	-	-	.59	.95
bananas	4	1	1.6	0.3	-	-	.39	.30
tea	52	56	69.8	119.6	12.1	20.7	1.34	2.14
pyrethrum	52	60	60.1	105.5	10.4	18.2	1.16	1.76
maize	61	59	155.3	84.7	26.9	14.7	2.55	1.44
pasture	61	58	161.9	200.1	28.0	23.6	2.65	3.45
TOTAL	62	62	578.0	578.0	100%	100%	9.32	9.32
							(average farm size)	

note:
for the KUJA sample the altitude range was 1500 - 1700 m,
for the KITUTU sample the altitude range was 1800 - 2000 m.
In Majoge chache tea-development and the accompanying road construction was just started by KTDA, as well as the construction of a tea factory at Kiamokama.

Table 4b

Farmlayout of 39 farms in Majoge chache location, Kuja division acreages and proposed acreages from loan application forms (acres;) application and recording years: 1970 - 1973.

total farm	coffee now	coffee prop.	bananas now	bananas prop.	maize now	maize prop.	grazing now	grazing prop.	other crops	other crop now	other crop prop.	other use now	other use prop.
north:	Kanyimbo.												
5.1	1.2	1.2	-	.4	.8	.4	2.0	2.2	scn	.6	.6		
7.0	1.4	1.4	.3	.3	1.9	.8	2.2	3.1	tea	-	1.0		
												igr. 2	.2
7.4	.4	.4	-	-	.7	1.4	4.6	3.6	i/p	-	1.0		
8.3	.5	.5	-	-	3.0	1.4	3.9	4.1	tea	-	1.0		
												pfr 1.0	-
9.7	1.5	.5	-	-	5.1	3.0	2.5	2.5	tea	-	1.0		
												pyr	- 1.0
									i/p	-	1.0		
10.0	1.0	1.0	-	-	-	-	7.2	7.7	-				
10.2	.8	.8	.3	.3	3.5	3.5	5.4	5.4	-				
10.2	.5	.5	.5	.5	4.1	1.9	4.9	6.2	tea	-	1.0		
middle; Booch.													
4.6	-	-	-	-	2.1	2.1	2.2	2.2	-				
5.0	-	-	-	-	1.3	1.3	3.5	2.8	i/p	-	.7		
5.5		-			-	1.3	5.0	5.0	-			h/s .5	.5
5.5	.4	.4	.4	.4	1.8	.7	2.1	2.1	tea	-	1.3		
												fim .2	-
5.9	.4	.4	-	-	1.5	1.5	2.1	3.6	pia	1.2	1.2		
												trs .2	.1
prop:7.4									scn	.2	.2		

5.9	.3	.3	.5	.5	1.3	-	3.1	2.9	tea	-	1.0	pyr	-	.7
6.2	.8	.8	.3	.3	1.4	-	2.8	3.5	tea	.5	1.0	ftr	.8	.8
									swp	.7	.7			
6.5	.5	.5	.5	.5	1.4	.9	3.5	4.4	veg	.3	.3	bsh	.9	.9
6.8	.5	.5	-	-	1.3	.3	2.8	3.7	igr	.3	.3			
6.9	.5	.3	.7	.5	1.3	1.5	3.2	4.1	i/p	-	1.0	fim	.9	.5
									swp	.4	-	bsh	.7	-
7.4	1.3	1.3	.6	-	3.6	2.0	1.0	2.0	tea	-	1.0	sun	-	.6
8.8	.7	.7	.9	.9	4.6	2.2	1.6	2.3	tea	-	1.0			
8.9	.8	.6	-	-	5.7	2.0	1.5	2.0	tea	-	2.0	pyr	-	.6
									i/p	-	.5			
9.2	.5	.5	.6	1.2	4.7	.9	1.9	4.0	tea	-	1.0	pyr	-	.6
9.4	-	-	-	-	3.0	2.0	5.9	5.9	i/p	-	1.0			
10.2	.6	.6	1.1	1.1	2.6	1.1	4.2	4.2	tea	-	1.0			
10.7	1.2	1.2	.3	.3	4.3	3.4	3.2	5.2	pia	.3	.3			
10.8	1.4	1.4	2.1	2.1	-	-	6.4	6.4	-					
13.5	1.3	1.3	1.3	1.3	6.6	5.3	4.2	5.5	-					
14.2	.5	.5	-	.6	8.4	3.2	4.2	7.8	i/p	-	1.0	h/s	.8	.8
18.3	.5	.5	.6	.6	11.2	8.2	4.9	6.9	i/p	-	1.0	scn	.5	.5
22.9	1.3	1.3	-	-	4.5	3.5	8.7	10.0	igr	-4	.4			
38.7	2.0	2.0	2.5	2.5	13.2	12.2	13.5	11.5	tea	-	1.0	pyr	-	2.0
south;Boseti									i/p	-	2.0	swp	1.0	1.0
4.7	-	-	0.6	.5	-	-	2.7	2.5	tea	-	.7			
6.2	.7	.7	.2	.2	3.2	.6	.7	-	tea	-	1.0	pyr	-	.6
9.6	.5	.5	-	-	5.0	5.1	2.1	2.1	i/p	.8	.8			
10.4	-	-	1.2	1.1	4.1	2.9	3.6	4.0	tea	-	1.0	ftr	.5	.5
10.7	-	-	.6	.6	5.7	4.7	3.6	4.6	scn	.2	.2	pia	.1	.1
18.8	1.0	1.0	-	-	7.3	4.8	5.6	7.2	-					
24.3	.8	.8	-	-	9.0	5.0	9.0	10.0	tea	1.0	4.0	pyr	1.0	2.0
28.9	-	-	-	-	6.2	5.4	14.0	13.8	tea	-	2.0	pyr	-	1.1
									crop	-	1.0	h/s	2.0	1.0

i/p=Irish potatoe, pyr=pyrethrum,scn=sugarcane,igr=improved grass pfr=passionfruit, pia=pineapple,ftr=fruit trees, swp=sweet potatoe, fim=finger-millet veg=vegetables, bsh=bush, trs=trees, h/s= homestead.

2. Coffee in the Kisii district.

2.1 History and development.

Before the Second world war Kenyan coffee was nearly exclusively produced by expatriates on estates. The government did not encourage African small holders to grow coffee, because fear existed that native poorly tended coffee plots should become breeding grounds of pests and diseases, and that bad quality of smallholder coffee should damage the reputation of the estate coffee.

There may have been some truth in these objections, because the production of disease-free, high quality coffee by local growers requires a high level of technical supervision, which was not available at the time. On the other hand, more and more local farmers came into contact with the money economy, a process which has been accelerated by the war, and became very eager to grow cash crops. In 1946 the Government began to foster cash crops production by smallholders in suitable areas.

The expansion of peasant coffee got another pulse by the appearance of the Swynnerton-plan in 1954, which rested on three proposals: land consolidation, farm planning and a rapid expansion of cash crops for smallholders.

Presently of the total coffee surface surface of Kenya, 85,000 ha, 31,000 ha lies on estates and 54,000 ha is cultivated by smallholders, of which 6,700 ha (12 %) in the Kisii district. After some small introductions in the district of coffee growing halfway in the thirties, Kisii smallholder coffee began to expand rapidly in the early fifties. Of the 86 farmers interviewed, 11 planted coffee as early as 1952 and '53 and the majority planted coffee between 1957 and 1964, when the Government stopped to encourage coffee-planting, considering the world coffee price. Some farmers (15 of the interviewed) began introducing or expanding coffee on their farms around 1966-69.

In the course of coffee production from 1955- '75 (table 1) the main planting periods appear clearly about 5 - 7 years after planting, when the trees can be considered fully productive

In the recent years, coffee developement in the Kisii district has slowed down considerably, giving room to pyrethrum and tea development in the medium altitude areas (1600-1800m). These latter cash crops have several advantages over coffee, of which the most important are:

- The harvest period, and thus the labour peak, is much better spread over the year,
- Yield differences between years are smaller,
- Product price fluctuations are smaller,
- Monthly payment, contray to the yearly payment for coffee,
- Probably collection, transport and work-up of tea and pyrethrum are more efficiently organised than of coffee.

In fact, after 1970 nearly no coffee is planted, and a lot of farmers in the higher areas seem to neglect or uproot their coffee in favour of pyrethrum and tea production. Most of the cooperative societies under the KFCU, originally only dealing with coffee, presently also collect pyrethrum.

2.2. The Survey

The survey carried out on coffee in the Kisii district can be divided in two parts Viz.

1. The questionnaire on management.

After some discussions with mr. B.K.Lusweti, coffee officer in the Ministry of Agriculture in Kisii,and Mr. Lubanga, diretor of the Coffee Research Station in Kisii, a questionnaire was made in order to obtain an idea how farmers manage their coffee fields.
The questionnaire consisted of questions to the famers, which were asked with the help of an interpreter, and of data, which had to be measured or estimated in the field.
The intention was to collect yield data of the visited coffee plots at the coffee factories after the 1974 harvest, but this proved to be very difficult, as the administration of the factories had not yet been finished by March 1975 (when I left Kisii).

Originally the aim of the survey was, to find a relation between the management and productivity on one side and soil types and/or physiographic units on the other side. This appeared to be very difficult, because there existed great differences in manage-

ment practices influencing yields within the units, yield data were not available.

For the above mentioned reasons the survey was started within the detailed soil survey areas of Marongo ridge (PR3) and Irrigonga (PR 1) in Wanjare. These areas were considered representative for the Western part of the district from a soil science point of view and as nobody mentioned the contrary, it was assumed that these areas were also representative for coffee management and productivity, which appeared not to be true after a closer look on the statistical data oN coffee productivity of different cooperative coffee societies.

2. Search for and interpretation of coffee production figures.

Considering the locations of the 26 Cooperative Societies and knowing the cherry-intake it is possible to draw some very rough conclusions about the relation between the productivity and factors as altitude, rainfall and competing crops, assuming that the productive area of a coffee factory.

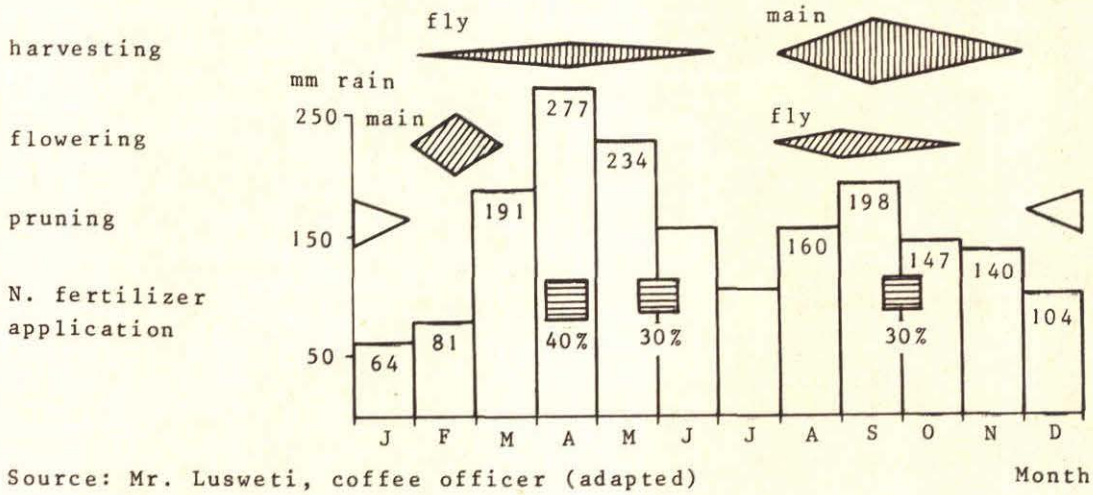
These conclusions can be made more pricese, when the figures are split per coffee factory, so that 67 productivity zones can be distinguished. The area delivering to a factory must be located around the factory, because cherries have to be processed the same day of picking, and they are 6-7 times as heavy as clean coffee, which makes it senseless to transport it too far. For the factories of a coffee society this is not always the case, sometimes the factories lie in a strip along side a river (e.g. Mogunga), or sometimes the society head office is situated at the factory nearest to a main road or a market centre (e.g. Kenyoro)

Besides the big amount of calculation work, needed for an approach per factory, it was impossible to map the exact places of all the factories.

Data were gathered of licenced acreage, number of growers and cherry-intake per CS. for different years and from different sources. Most figures came from the KFCU head office and from the office of Mr. B. K. Lusweti.

Fig.4 Coffee management in the Kisii district

coffee flowering, harvesting and N. fertilizer application card



Source: Mr. Lusweti, coffee officer (adapted)

Fig.5 Coffee production in the Kisii district (see table 5, page 25)

Table 5. Coffee production and value, 1956 - 1973
Deliveries from Kisii district to the K.C.P.U. (Kenya coffee planters union). Clean exparchment.

Year	Production (tons)	Value (x 1000 Kshs)	Price (Kshs / kg)
1955 /56	80	191	2.40
1956 /57	233	546	2.30
1957 /58	260	658	2.50
1958 /59	470	1206	2.60
1959 /60	610	1439	2.40
1960 /61	975	1617	1.70
1961 /62	1136	3318	2.90
1962 /63	704	3686	2.50
1963 /64	2023	12326	6.10
1964 /65	1722	10760	6.20
1965 /66	3423	19240	5.60
1966 /67	1660	9060	5.50
1967 /68	3226	19718	6.10
1968 /69	2469	13650	5.50
1969 /70	1908	14490	7.60
1970 /71	1797	12958	7.20
1971 /72	2980	21071	7.10
1972 /73	2164	18740	8.10
1973 /74 ±	1850 (estimate)		
1974 /75 ±	4000 (estimate)		

Source: Mr. B. K. Lusweti, coffee officer.(with exception of the estimates)

2.3 Crop management in the Kisii district.

Fig. 4 gives a very general indications of the main management practices in coffee and their place in the year.

Flowering is initiated by the first rain after a dry period, so in the bimodal climate to the Kisii district there are two flowering periods:

- In the beginning of the long rains after the long dry period; the main flowering for the cherries of the harvest.
- In the beginning of the short rain after the short dry period a secondary flowering for the cherries of the secondary harvest, the fly crop.

Pruning should be done in the long dry period, and fertilisation during the start of the cherry-formation, about one month after the start of flowering.

Planting and pruning.

Nearly all coffee in East Africa is planted at 2,7 (9 x 9 ft) in square, which gives ± 14 trees/ 100 sqm. Afew farmers were observed in Kisii, where the trees were planted (in 1964) at 1.8 m (6 x 6 ft). At Kisii coffee research station trials were laid out in other plant densities, which were not succesful until now. Most coffee is planted in plots of 100 - 250 trees.

Up to 1962 the variety "Blue Mountain" was planted, after 1962 the variety "K-7", so 75 % of the Kisii coffee is Blue Mountain" and 25 % is is "K7". All Kisii coffee is propagated from seed. Coffee is nearly exclusively planted on very deep soils (more than 120 cm) with a topsoil pH of 4.5-6.5 and on slope of 3-15 %.

Pruning is always done according to the multiple stem pruning system, whereby the laterals are cut of after two crops, so that the crops are borne higher and higher, until the system is cut of after 4-6 years and a new stem is formed from the stump at ± 40 cm height. Annual pruning should consist of cutting the sublaterals and the used laterals. In Kisii, the main pruning cycles are generally made too long, so the stems grow to a height of 3 to 4 m. which makes picking difficult. Sometimes 5 or more stems are allowed to grow, whereas 2-4 stems make a good shrub.

Other vegetation on the coffee plot.

a. Shade trees and shrubs. Lower than 1620 m (5400 ft) the use of shade trees is advised in the Kisii district, mainly to reduce fungus diseases although a positive effect of shade trees on these diseases has not yet been proved. No difference was found in the use of shade trees at different altitudes. The influence of shading on the occurrence of diseases, including N-deficiency, could not be established, but the impression occured that shade may help against weeds and overbearing. Also shade trees may yield the farmer valuable timber (e.g Grevillea robusta) and can be regarded as an intercrop.

b. intercrops.

Quite commonly farmers /grow part of their foodcrops within parts of their coffee plots. Crops which are nearly as high as or even higher than coffee trees are most common, such as bananas, maize and the popular maize/beans mixture. These crops may give considerable shading. Sometimes pure stands of beans or vegetables can be seen in coffee plots. In the higher areas also pyrethrum is used as an intercrop.
The impression was, that coffee with a clean weeded intercrop looked healther than unweeded coffee, and that intercrops, in the way they are used, do not influence coffee production adversely.

c. Weeds.

However clean weeded and cultivated coffee should be best from the point of view of competition of weeds with the rather shallow feeder rooting system. Cultivation should however not be done too often with regards to erosion hazards and root damage.
Most visited plots had a weed cover higher than 50%. But ± 2/3 of the plots were weeded less than months ago. It must be kept in mind that the survey was done during a harvest time rendering extremely high yields, which probably caused a time shortage for weeding. Also, much of the weed cover consisted of dicotyledons and seedlings, which were sometimes slashed. In very few plots weeding was done by plow and oxen, in most cases only a jembe was used. In some plots infestations of couchgrass (Digitaria app.) and/or star grass (Cynodon spp.) occured. Weeding appeared to be neglected and coffee on these plots looked rather poor.

Table 6. List of cooperative Coffee Societies and Factories in the Kisii district.

Kuja-division: 7 societies, 18 factries

1. Kenyoro, Gesuguri, Nyamagundo, Gesebe.
2. Iyabe, Kebacha.
3. Nyachenge, Iringa.
4. Gakero, Itabogo.
5. Nyamarambe, Nyakorere, Mosache, Nyamonari.
6. Ryasuta, Orienyo.
7. Kenyenya, Nyabioto, Mogumo.

Kitutu-division (mainly west) 8: societies, 21 factories

8. Nyaigwa, Ekerubo, Mekoko.
9. Kiomooncha, Sieka, Nyagoto.
10. Marani, Nyabonge, Nyachogu, Rigoma.
11. Moromba,Keera
12. Nyakee,Kiogo, Igenge.
13. Kemera, Gesongo
14. Gesarara, Getwanyansi, Bochura (not in K.F.C.U.)
15. Girango.

Nyamira-division : 3 societies, 10 factories.

16. Magwagwa, Igare, Nyaigena, Matongo.
17. Eaka, Nyakenimo, Bisembe.
18. Nyabomite, Nyangoko, Kioge.

Keumbu-division : 8 societies, 18 factories.

19. Mombasa, Masongo, Mosasa.
20. Nyosia.
21. Nyaguta, Nyaboterere.
22. Nyakegogi, Nyansongo, Motonto, Nyamokenye.
23. Nyaturubo.
24. Mogunga, Magena, Nyamongo, Ekerongo. (Partly in Kuja-division)
25. Nyamache,
26. Nyambunde, Kionyo

Minerals and diseases.

At the time of the survey most coffee looked unhealthy, having lost much of its leaves. This was probably due to the extremely high yields of the 1974 crop. Leafrust (Hemileia vastatrix), leaf-fall and over-bearing disease (tip-back) were commonly seen, specially in lower altitude coffee. (coffee berry disease, Colletotrichum coffeeanum) was common nearly everywhere; hot & cold disease and crinckle leaf were more or less restricted to higher altitude coffee. Nitrogen deficiency could be seen nearly everywhere by the yellowing leaves, probably mainly caused by redistribution of nitrogen from the leaves to the cherries. Phosphorus deficiency could also be seen, but was difficult to distinquish from overbearing sings. Fertilizer use on coffee was very rare and fungus disease control was not or ineffectively carried out. Mulch was seldom used, since crop residues and grass are used as fodder.

Harvest and transport.

Harvesting of coffee is a very labour intensive job, which was formerly mainly carried out by women and children, but as nowadays children are going to school, there seems to be a labour shortage. For selecting the ripe cherries, picking has to be done every two weeks in the harvest period. Also difficulties arise when the crop of trees, over 3 m, has to be picked, for which ladders much be used. The crop has to be transported within the same day of picking to the coffee factory and is generally carried on the head or on mules. At the fact-factory, the cherries are weighed and roughly graded.
Two grades are distinguished. Most coffee brought to the factories is first grade. All coffee entering the factories is wet processed and sun dried afterwards. 6-7 kg cherries make 1 kg of clean coffee.
Some 5-10% of the Kisii coffee is traded as sundried cherries, called buni.

Table 7. COFFEE statistics, Kisii-district.

Society	No.of growers (1)	Ha.(2)	Cherry-intake,KFCU(tons) 1971	1972	1973	1974	Min.Agr.(3) 1972	1973	clean coffee 71/72(4)
1. Kenyoro	3656	358.2	1195	711	645	968*	664	536	163
2. Iyabe	1780	178.1	358	187	190	430	138	204	49
3. Nyachenge	1202	231.5	657	348	489	494	303	421	90
4. Gakero	1345	311.2	839	423	796	965	530	619	111
5. Nyamarembe	1666	212.1	617	239	492	1343	152	355	80
6. Ryasuta	2588	227.4	859	579	226	827	539	166	78
7. Kenyenya	3162	276.8	1184	399	294	721	343	288	145
8. Nyaigwa	2217	348.0	1746	1695	881	2566	1143	753	238
9. Kiomooncha	1631	214.9	927	948	521	1647	942	456	122
10.Marani	2339	452.9	2082	1360	1572	2636	1325	1400	260
11.Moromba	1321	178.5	862	398	530	1102	644	561	119
12.Nyakoe	1753	317.7	567	350	348	851	350	400	77
13.Kemera	1679	182.1	481	127	218	413	113	214	57
14.Gesarara	1979	330.6					774	761	255
15.Girango	982	123.8	190	94	38	196	90	28	25
16.Magwagwa	2898	212.9	627	652	341	1304	538	317	80
17.Eaka	2014	274.4	834	861	411	1226	814	356	108
18.Nyabomite	2559	322.1	1320	1310	915	2231	1293	792	187
19.Mobamba	2020	343.6	1427	483	396	1548	332	345	180
20.Nyosia	603	85.4	59	44	16	181	68	27	8
21.Nyaguta	1040	190.2	276	172	116	572	150	110	37
22.Nyakegogi	2331	398.2	1211	785	701	1589	785	691	149
23.Nyaturubo	1162	145.7	212	116	72	158	104	61	23
24.Mugunga	3950	679.1	1346	245	527	908	214	490	174
25.Nyamache	2036	64.4	256	69	56	135*	67	53	33
26.Nyambunde	1836	206.8	545	190	119	276	124	96	63
total (Gesarara)	49770	6536.0	20677	12785	10910	25687*	11034	9641	2656
Total	51749	6866.6					11808	10402	2980*(+

(1) Personal information from Mr. B.K.Lusweti.

(2) " " " " " " " ,acres to hectares:X 0.4047.

(3) from the wallboard in the office of Mr. B.K.Lusweti.

(4) Annual Report 1972, by S.M.Wambua.

*CRF & KFCU

Table 8. Coffee statistics, Kisii district, calculation results.

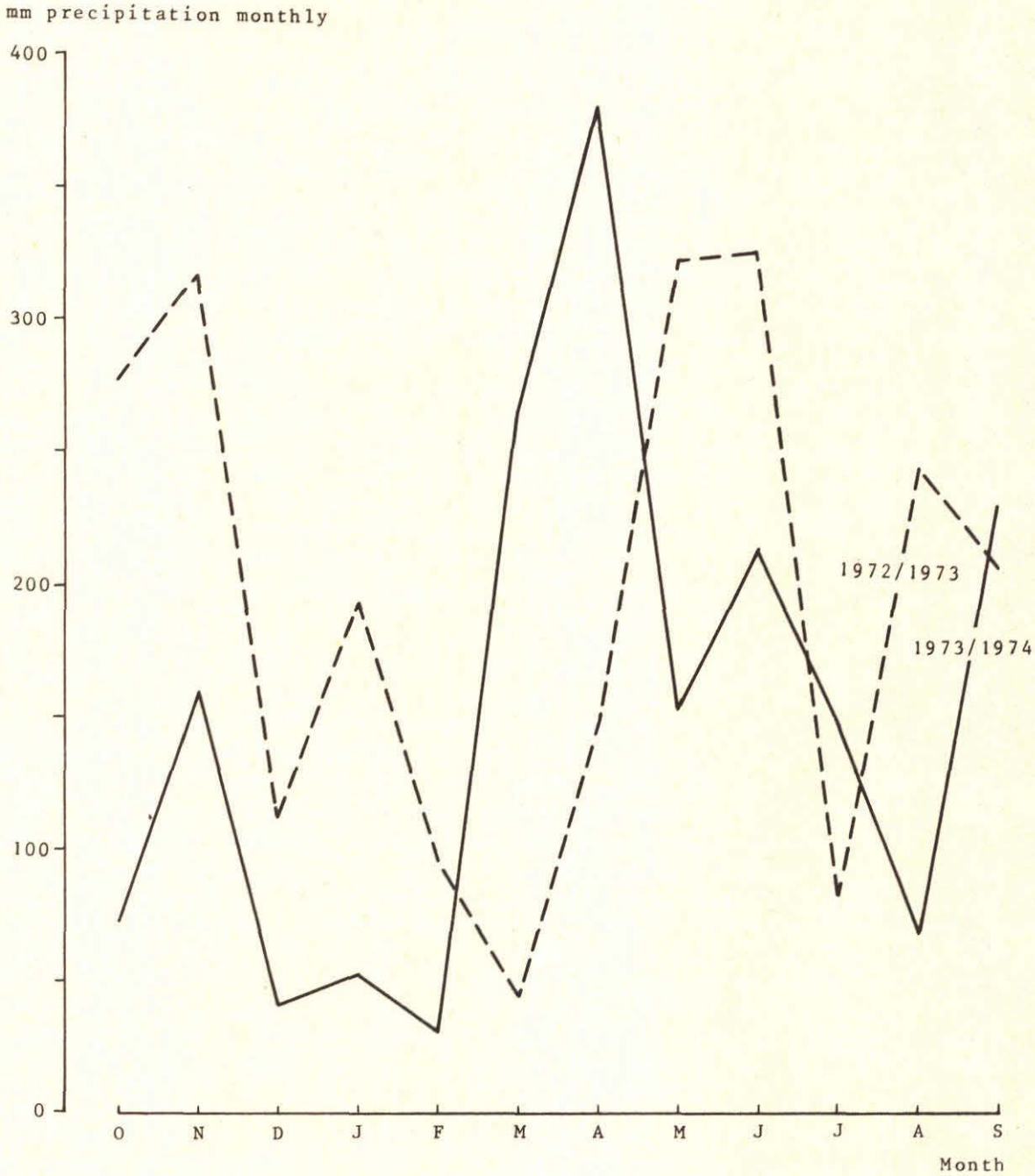
Society	area grower (are)	average yield(ton/ha) intake(KFCU)/Ha. 1971	1972	1973	1974	Turn-out(1) 71/72	Means: intake (tons)	1971 - '74 yield (t/ha)
1. Kenyoro	9.8	3.3	2.0	1.8	2.7	7.3	880	2.5
2. Iyabe	10.0	2.0	1.0	1.1	2.4	7.3	291	1.6
3. Nyachenge	19.3	2.8	1.5	2.1	3.9	7.3	597	2.6
4. Gakero	23.1	2.7	1.4	2.6	3.1	7.6	756	2.4
5. Nyamarambe	12.7	2.9	1.1	2.3	6.3	7.7	673	3.2
6. Ryasuta	8.8	3.8	2.5	1.0	3.6	11.0	623	2.7
7. Kenyenya	8.8	4.3	1.4	1.1	2.6	8.2	650	2.4
8. Nyaigwa	15.7	5.0	4.9	2.5	7.4	7.3	1722	4.9
9. Kiomooncha	13.2	4.3	4.4	2.4	7.7	7.6	1011	4.7
10. Marani	19.4	4.6	3.0	3.5	5.8	8.0	1913	4.2
11. Moromba	13.5	4.8	2.2	3.0	6.2	7.2	723	4.1
12. Nyakoe	18.1	1.8	1.1	1.1	2.7	7.4	529	1.7
13. Kemera	10.8	2.6	0.7	1.2	2.3	8.4	310	1.7
14. Gesarara(G)+	16.7	2.3+	2.3+	2.3+	4.2+		1100+	3.4+
15. Girango	12.6	1.5	0.8	0.3	1.6	7.6	130	1.1
16. Magwagwa	7.3	2.9	3.1	1.6	6.1	7.8	731	3.4
17. Eaka	13.6	3.0	3.1	1.5	4.5	7.7	833	3.0
18. Nyabomite	12.6	4.1	4.1	2.8	6.9	7.1	1444	4.5
19. Mobamba	17.0	4.2	1.4	1.2	4.5	7.9	964	2.8
20. Nyosia	14.2	0.7	0.5	0.2	2.1	7.4	75	0.9
21. Nyaguta	18.3	1.5	0.9	0.6	3.0	7.5	284	1.5
22. Nyakegogi	17.1	3.0	2.0	1.8	4.0	8.1	1072	2.7
23. Nyaturubo	12.5	1.5	0.8	0.5	1.1	9.2	140	1.0
24. Mogunga	17.2	2.0	0.4	0.8	1.3	7.7	757	1.1
25. Nyamache	3.2	4.0	1.1	0.9	2.1	7.8	129	2.0
26. Nyambunde	11.3	2.6	0.8	0.6	1.3	8.7	283	1.4
Average(total)	13.3	3.2	2.0	1.7	3.9	7.8	(17515)	2.7
(-Gesarara)							701	
Average highest 5 soc. (H); 8,9,10,11,18;	14.9	4.6	3.8	2.9	6.7	7.4	1362	4.5
Average lowest 5 soc. (L): 15,20,23,24,25;	13.6	1.9	0.6	0.6	1.4	8.1	277	1.1

(1) :Turn out = Kg cherries needed for 1 kg clean coffee.
(G)+ :Gesarara is not in KFCU, estimates given here are not calculated in the averages and totals.

(H),(L) :high and low groups of societies are selected on the average yield 1971-'74 (t/ha) (last column on this page)

Fig.6 Monthly rainfall 1972/1973 and 1973/1974, Kisii town.

1972/73 :2.373 mm
1973/74 :1.817 mm



Source: Pyrethrum Board of Kenya, Annual Report 1973/74 Nyanza Province

2.4 Distribution of coffee production.

The largest surface under coffee are situated around Kisii town and along the road to the North, where also the main part of the Kisii coffee is produced. There are 26 cooperative societies of coffee growers, varying in size from ± 4000 growers on 680 licenced hectares to 600 growers on 85 licenced hectares. (Table 6). The larger societies have 3-4 factories, the surface per factory varies from 50 to 170 ha.

The coffee surface figures, given in table 7, are based on licenced handed out to the societies.
The real productive surface is supposed to be smaller for some societies, for example the smaller societies at a higher altitude and also Mogunga CS., which stretches from around Nyangusu to around Ogembo, where much coffee is neglected or uprooted. Probably also most members of Nyamache CS., are only dealing with pyrethrum.

An increasing part of the coffee production of the district is provided by the best production CS. such as Nyabomite, Nyaigwa, Kiomoocha, Marani and Moromba, which together had producted ± 33% of the cherries produced in 1971 and ± 40 % in 1974. Less productive CS., such as Mogunga, Kenyenya, Nyambunde and Nyamache appear to take a decreasing part of the total production (Table 8).

When we have a closer look at the distribution of the production over the past years (table 5. Fig. 5) we can distinguish a tendency of all Kisii coffee to produce a good crop once in two to four years. This can partly be explained by the biannual bearing of coffee trees, which is normally amplified by poor growing conditions. This does not explain however, why most trees should bear a good crop in the same year, while most trees bear a poor one in another year; the normal biannual bearing should not be synchronised.
Another explanation for the great variations in coffee output of the district can probably be found in the variations of the climate. It could be imagined that in some years the ripening of the fly crop can interfere with the flowering of the main crop. This assertation should be proved by figures on the relation between the fly crop and the main crop for several years. In 1974, a year with extremely

high yields, the fly crop was only 4% of the total production for the year.

As the a mount of crop depends on the flowering, which is highly influenced by drought intensity in the dry period and the rainfall in the following wet period. The more the climate for a given year approaches a monomodal with a pronounced dry period, the better the main crop could be. For the good 1974 crop this is clearly demonstrated by the rainfall distribution from March 1973 to March 1974 (Fig 6. page 32).

The distribution of the 1974 crop over the year (Table 9) shows that the CS., which had a fly crop of more than 7-8 % of their total intake for 1974, Kenyoro, Nyachenge, Kyasuta, and to a lesser extend Nyamarambe, all near the western border of the district, had mediocre average yields (2-3 ton/ha over 4 years).

An eyecatching fact, arising from table 9 could be, that for most societies nearly 50% of their cherry-intake came in one month. For the lower altitude CS. this was generally one month earlier (October) than for the higher altitude CS. (November). This probably indicates a slower growing and ripening in the colder higher altitude areas of the coffee growing part of the district.

2.5. Yields and quality.

Average yields of cherries in the Kisii district are rather low (Table 10). In general in East Africa the regular average yield are around 4 tons of cherries per ha; the average of Kisii for over four years (1971 - 1974) reached only 2.7 tons/ha.

Partly this low average is caused by some poor yielding societies, e.g. Girango, Nyosia, Nyaturubo, Mogunga and Nyambunde, which have an average yield of 1.1 ton cherries/ha. This constrast clearly with the five best yielding societies in and around West Kitutu, ton/ha.

With good management, regular yields of 7-8 ton cherries per hectare should be obtained these yield figures are reached in a good year (1974) as societies average by the West Kitutu societies. Some of the farmers within these societies have a rather high management level. The turn-out rates as they are calculated by dividing the 1971 cherrie-intake by the clean coffee production for the same year, reach 8.7 kg cherries for one kg clean coffee as an average.

Table 9 Coffee societies KFCU Ltd., Cherry-intake 1974; percentage per society per month.

CS. no.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	% of total
1.	-	-	-	1.1	1.6	3.0	1.6	0.9	12.9	62.0	15.5	1.5	3.8
2.	-	-	-	.1	.4	.6	.5	.2	9.4	65.8	22.1	.9	1.7
3.	-	-	-	5.3	1.4	1.6	.8	.2	5.4	47.0	30.2	8.1	3.5
4.	-	-	-	.3	.4	1.2	1.9	.3	3.4	47.8	36.7	8.0	3.8
5.	-	-	.3	2.8	1.1	.8	.7	.2	1.4	52.8	37.1	2.9	5.2
6.	.1	-	.5	4.0	.9	4.4	3.0	.5	6.5	57.7	21.4	1.1	3.2
7.	1.2	-	-	1.3	.4	.1	1.3	.5	2.1	29.3	56.4	7.4	2.8
8.	-	-	-	.2	.4	1.7	.6	.11	8.1	37.9	38.8	12.1	10.0
9.	-	-	-	.5	.4	1.9	1.4	2.1	15.8	53.1	22.5	2.5	6.4
10.	.4	-	-	.5	1.0	1.7	.6	.8	11.2	37.2	37.7	9.3	10.3
11.	-	-	-	.6	.4	.6	-	.3	5.0	26.1	47.5	19.6	4.3
12.	-.1	-	-	.5	.7	2.1	2.0	1.6	15.9	48.7	26.2	2.1	3.3
13.	7.4	.3	-	-	.3	.1	-	.1	3.7	13.0	57.8	17.3	1.6
14.	(not in KFCU, no figures available)												
15.	3.3	.6	.0	1.8	1.0	.2	.9	.3	1.9	6.4	63.3	20.2	.8
16.	.2	.0	-	.2	.4	1.5	1.8	1.1	6.4	46.6	36.4	5.5	5.1
17.	-	-	-	-	.1	.5	1.2	.4	9.3	34.5	51.0	2.9	4.8
18.	-	-	-	-	.2	1.4	.2	.5	10.0	42.4	39.5	5.9	8.7
19.	1.0	.0	-	.3	.2	1.0	1.7	.7	9.9	38.1	38.6	8.6	6.0
20.	1.9	.1	-	.8	.2	-	.4	.3	2.7	13.8	61.9	17.8	.7
21.	2.6	.0	-	.3	.2	-	.0	.1	2.0	15.2	55.8	23.8	2.2
22.	-	-	-	-	-	.3	.9	.6	4.2	43.7	39.7	10.6	6.2
23.	5.3	-	-	.2	.5	-	-	-	1.7	5.6	73.4	13.2	.6
24.	-	.0	-	.5	.5	.1	1.3	1.0	1.9	44.6	45.7	4.3	3.5
25.	.6	.2	-	.6	.8	.1	.1	.4	.1	2.6	73.9	14.8	.5
26.	2.1	-	-	.3	.4	-	.0	.5	.6	18.6	68.8	8.6	1.1
over all:	.5	.0	.0	.8	.5	1.3	1.0	.6	7.7	41.3	38.4	7.9	100

The turnout should a verage 6-7 kg cherries for one kg clean coffee. Much low quality (e.g floating) cherries influence the turn-out adversely.

The quality of the Kisii coffee, as it is graded in Nairobi, is rather low. The reasons Mr. Lusweti gave for this are: The blue mountain variety produces a mediocre quality coffee in East Africa. The management, at the factory is not what it should be. The farm management, especially the disease control, leaves much room for improvement. The (predisposed) opinions of the coffee judges about the Kisii coffee are not very positive.

2.6. <u>The suitability of the Kisii district of the coffee growing.</u>

The present coffee belt of the district as a whole cannot be considered very suitable for coffee production, given the current prices (1974). Probably the areas between 1450 and 1650 m, where the climate is relatively monomodal with one prounced dry period, which is probably the case in West Kitutu, are the most suitable ones for coffee growing within the district.

Much reseach remains to be done on the connections between yields and micro-and macroclimate, especially within given years. Something can probably be done on prohibiting or inducing flowering in different times of the year by means of plant hormones. This could enlarge the areas suitable for coffee growing.

Table 10 : Kisii farmers Co-Operative union Limited. coffee societies. Cherry-intake 1974 (kg cherries)

Society	Jan.	Feb.		March	April	May	June	July
1. Kenyoro	-	-		10527	15163	28915	15580	8753
2. Iyabe	-	-		589	1868	2445	2007	791
3. Nyachenge	-	-		47219	12309	14365	6730	1690
4. Gakero	-	-		2897	4279	11245	18626	2724
5. Nyamarambe	-	4127		37157	14134	10537	9978	2926
6. Ryasuta	792	4246		32761	7079	36602	14594	4379
7. Kenyenya	8897	-		9175	3000	695	9229	3898
8. Nyaigwa	-	-		5347	11373	43037	15557	1973
9. Kiomooncha	-	-		7598	5802	30495	23073	34998
10. Marani	10112	-		13306	27008	44506	14606	20896
11. Moromba	-	-		6194	4233	6947		2755
12. Nyakoe	1234	-		4168	6217	18033	17296	13569
13. Kemera	30656	1383		-	1279	279	-	478
15. Girango	6481	1159	76	3553	1978	381	1687	642
16. Magwagwa	2276	13		2009	5505	19342	22957	14567
17. Eaka	-	-		-	1522	5968	14149	5284
18. Nyabomite	-	-		-	4435	31792	4565	10690
19. Mobamba	15295	214		4275	2536	15936	25764	11508
20. Nyosia	3375	235		1506	389	-	677	507
21. Nyaguta	14902	228		1552	1000	-	227	438
22. Nyakegogi	-	-		-	-	5080	14903	9484
23. Nyaturubo	8383	-		275	761	-	-	-
24. Mogunga	-	207		4781	4970	897	12170	8930
25. Nyamache	8596	291		832	1055	112	149	511
26. Nyambunde	5853			948	1096		72	1431
Total	116843	3730	8449	196669	138991	327609	254596	163822

Table 10 : continued.

Society	August	sept.	Oct.	Nov.	Dec.
1. Kenyoro	124554	600000*	150000*	15000*	968492*
2. Iyabe	40444	283248	95014	3954	430358
3. Nyachenge	48132	420654	270218	72843	894160
4. Gakero	32994	461079	354297	76903	965044
5. Nyamarambe	19049	708950	498032	38532	1343422
6. Ryasuta	53518	477041	176580	9121	826713
7. Kenyenya	15012	211617	406726	53056	721305
8. Nyaigwa	208137	972778	996739	310874	2565815
9. Kiommoncha	260350	873862	370127	40345	1646650
10. Marani	296311	979731	984780	244331	2635587
11. Moromba	555255	287138	522798	216241	1101561
12. Nyakoe	135029	414223	223044	18096	850909
13. Kemera	15369	53665	238382	71236	412727
15. Girango	3809	12585	123740	39485	195576
16. Magwagwa	83685	608363	474467	71167	1304351
17. Eaka	114388	422877	625742	35969	1225899
18. Nyabomite	220827	945926	880389	132102	2230726
19. Mobamba	152632	589326	597628	132852	1547966
20. Nyosia	4975	25045	112058	32308	181075
21. Nyaguta	11432	87228	319047	136002	572056
22. Nyakegogi	66160	695054	630587	168044	1589312
23. Nyaturubo	2716	7814	115947	20890	157883
24. Mogunga	16988	404788	414782	39268	907781
25. Nyamache	136	3571	100000*	20000*	135253
26. Nyambunde	1593	51382	189694	23854	275913
Total	1983491	10599043	9870818	2022473	25686534

Fig.7 Coffee Societies in Kisii district (1-26)

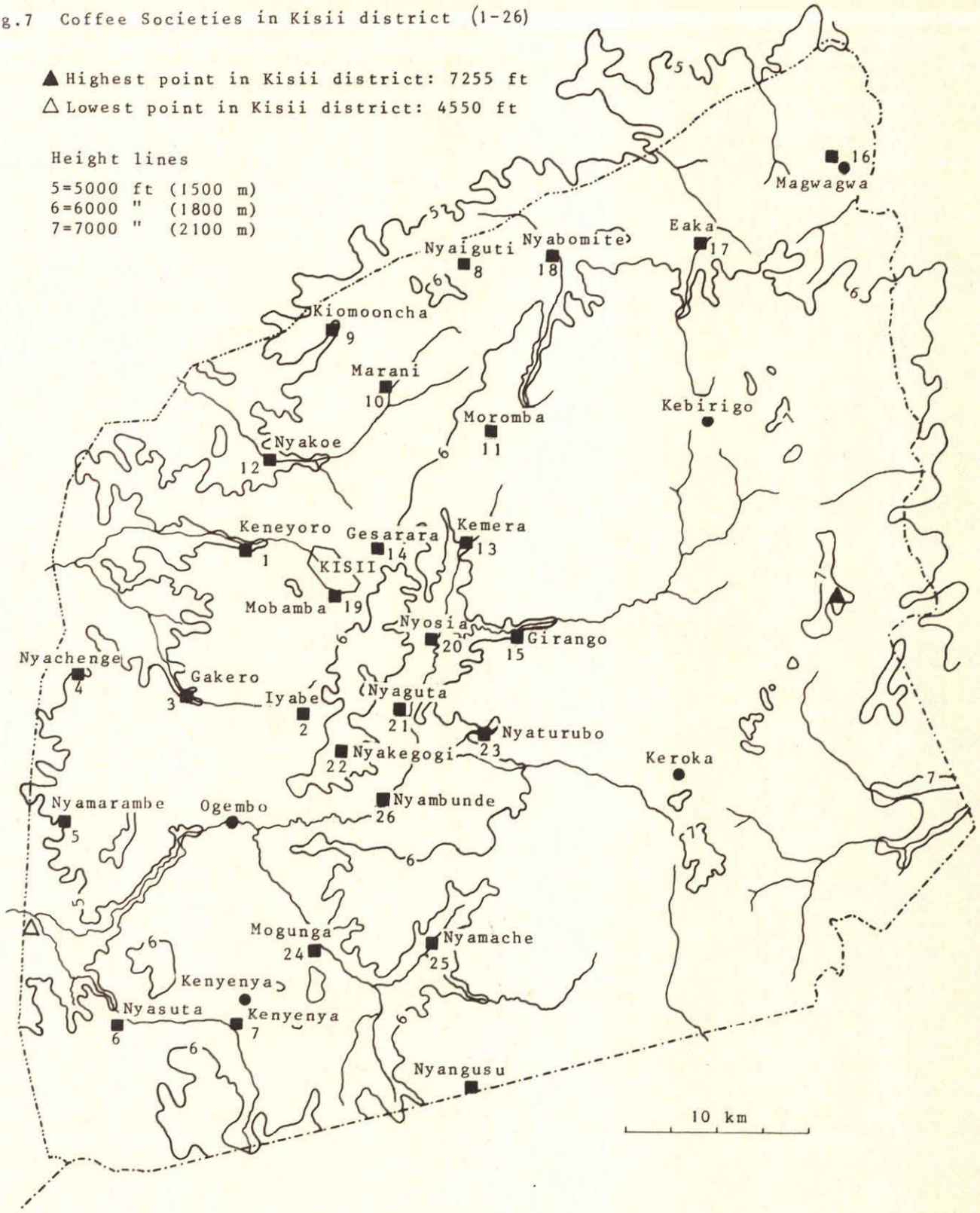


Table 11 List of names of surveyed COFFEE farmers

1.	Gesaro Okindo, Boochi, N. Ogembo, cf. Nyamongo.	reg. no. ?
2.	Momanyi Nyamwario, Boochi, Ogembo-Ikoba road. cf. Nyamongo	1861
3.	Kebate Omabere, Boochi, " " " "	2777
4.	Harrison Tinega, " " " " "	3040
5.	Mogunde kegesa " " " " "	183
6.	Vincent Okongo " " " " "	1042
7.	Manoti Okenyuri, Bootabori, n. Ikoba, CF. Gakero.	1307
8.	?	
9.	Nyagiro Mochamo, Bogetonga, no. Ikoba, CF. Mosache	1317
10.	Mainge Mochama, " " "	2189
11.	Samson Nyanchoni, " " "	198
12.	Nyangau Ruora, " " "	1792
13.	Tungai omuria, " " "	286
14.	Mochama Magare, " " "	1152
15.	James Mogire, " " "	?
16.	Yosita Anyona, Nyaramba, CF. Nyamarambe (S. Mugirango)	446
17.	Maota Ogero, " " "	927
18.	Mokera Ogero, " " "	927
19.	Magoto Oganga, " " "	917
20.	Orangayo Mosaro, Bogetonga, n. Riosiri, cf. Nyamarambe	
21.	Omoro Oyugye, Kamagambo, n. Nyakino, cf. MIsathi (S.Nyanza)	587
22.	Manashon, Kamagambo, n. Riosiri, cf. Maathi (S.Nyanza)	265
23.	Oteyo Ketakwa, n. Riosiri, cf. (S.Mugirango), cf. Nyamarambe	1749
24.	Sabonsi Onyoni, Nyaramba, cf. Nyamarambe	
25.	Okioga Mbaka, " "	
26.	Jacob Ogendo, " "	210
27.	Genchabe Onyando, Bomariba (Wanjare), CF. Nyamagundo	1321
28.	Sebastiano Odora," " "	2022
29.	Okeyo Masiemo, " " "	1110
30.	Otete Osoro " " "	1755
31.	Philipo Obiri, " " "	2286
32.	Matiesi Twara, " " "	
33.	Samson Kenyanya, Biokanga (S. MUgirango CF. Nyamarambe	234
34.	Odero Ayienda, " " "	1667
35.	Okongo Nyakundi, " " "	1421
36.	Okongo Nyakundi, " " "	1886

37. Orosa Patrict, Nyaramba " " 1205
38. Nathan Nyooka, " " " 2059
39. Nyakundi Mekenye, " " " 66
40. Mirika Bitengo, " " " 2047
41. Ruben, Mogere, Boikanga " " 1068
42. Ndege Onyoni, " ", CF. Nyakorera 1975
43. Onyoni Migere, " CF. Nyamarambe 1125
44. Ochiagi Ombati, Nyaramba (on Marongo-ridge); CF. Nyamonari 1029
45. Mageto Ogindi, Boikanga " " " 2019
46. Onyoni Mageto, " " " CF.Nyakorere 1621
47. Nyachongi Momanyi, Nyaramba(n.Nyamarambe), CF.Nyamonari 422
48. Mgiza Okemwa, " " CF.Nyamarambe 120
49. Omuro Okemwo, " " "
50. Ndiege Rangondi, Bootabori (Koba-Tabaka road),CF. Gakero 1460
51. Zebedec Bongoye, Bomariba (Wanjare), CF. Nyamagundo 535
52. Ombati Matinde, " " " 2306
53. Matinde Ouko, " " " 3953
54. Matisha Ongoncho " " " 2281
55. Abuga Osore, " " " 481
56. Konyiri Osore, " " " 565
57. Nyangau Nyakabari, " " " 353
58. Mariakia Mgero, " " " 2500
59. David Oruru, Boochi,(Ogembo-Ikoba road), CF. Nyamoyo 3132
60. Magoro Nyambaso, Boochi " " 2854
61. Juvenalis Makiya, " " CF.Mosache 823
62. Mikel Msota, " " CF.Nyamoyo 2826
63. Omwowa Nyanweya, C.Kitutu, n.Gerare, CF. Gesarara 1553
64. Areri Matara, " " " 1261
65. Keburo Marukunga, " " " 1796
66. Michira Marukunga, " " " 471
67. Kaniki Maroko, " " " 1695
68. Coronel Gisemba, " " CF. Mosasa(Samuel) 773
69. Yuvenalis Nyakebogo, " " CF. Gesarara 1726
70. Ombati Msuti, Bokione(Majoge chache)n. Sengera,CF. Nyabioto, 337
71. Tai Mouti " " " " " 1016
72. Francis Mouti, " " " " "

73. William Tinega, " " " n.Kenyenya, CF. Mogonga 108
74. Ayienda Onsase, Bogetaorio(Bassi chache) CF. Nyamache 142
75. Mose Ayienda, " " " " " 821
76. Bosire Ayienda " " " " " 537
77. Onsongo Maiko " " " " " 529
78. Omagwa Babu, Bombaba(Majoge Borabu)n.Rionyego, CF. Magena 4045
79. Benson Ionsongo, Monyerero(C.Kitutu)n.Itibo, CF. Moromba 992
80. Angwenyi Onsongo, " " " CF. Nyaigwa? 912
81. Maeta Mutieri, oburia(Nyaribari chache)CF.Masongo (Evans) 1685
82. Mokano Machini, " " " CF.Nyaguta 895
83. Motanya Nyakundi, Nyagonyi(W. Kitutu)n.Eronge, CF. Marani 850
84. Nyakundi Moraria, " " " " 8
85. Guchana Kebagendi, " " " " 1582
86. Kerobi Outinta " " " " 1142

Table 12 Results of the coffee survey in the Kisii-district, for explanation Legend (table 13)

No.	Gen.		Soil					Alt.	other			Prune				disease					C.S.
	1.	2	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	--
01	4	2	B	2	2	B	1	1	0	2	2	3	0	1	.	.	3	1	0	.	3	24
02	3	2	B	2	2	C	2	2	0	2	2	4	0	0	.	.	1	.	5	.	0	24
03	3	1	B	1	2	B	1	2	3	2	0	1	1	2	2	1	1	.	2	.	0	24
04	2	1	B	1	2	A	1	2	3	2	0	1	0	2	1	.	1	.	2	.	1	24
05	3	2	B	1	2	B	1	3	2	2	1	1	1	0	1	.	2	.	2	.	0	24
06	2	2	B	1	2	B	1	3	2	2	2	4	0	1	2	.	1	1	2	.	3	24
07	3	2	B	1	3	C	1	2	0	1	0	2	1	1	1	1	1	.	3	.	0	4
08	2	3	B	1	2	D	2	2	0	1	1	1	2	1	.	.	0	0	0	b	0	.
09	2	2	Q	1	3	C	2	2	3	0	0	3	0	1	1	.	1	.	0	.	.	5
10	3	2	Q	1	3	C	2	2	0	2	1	2	0	1	.	.	1	1	.	.	2	5
11	2	1	Q	1	2	D	2	2	2	2	2	3	1	1	2	1	0	0	0	.	1	5
12	3	2	Q	1	3	C	1	2	2	0	1	2	0	1	.	.	1	.	0	.	1	5
13	3	1	Q	1	3	D	1	2	1	0	2	3	0	1	1	1	1	.	0	.	1	5
14	2	1	Q	1	3	D	2	1	1	1	1	3	1	1	2	1	1	.	0	.	1	5
15	1	1	Q	1	3	D	1	1	2	0	1	.	1	1	1	2	1	.	0	.	1	5
16	3	1	G	1	3	B	1	1	3	0	0	1	0	2	1	2	3	3	0	a	3	5
17	3	1	B	3	3	B	1	1	0	0	0	1	0	1	2	1	3	2	1	a	2	5
18	3	2	B	3	3	B	1	1	0	0	0	1	0	0	.	.	2	2	1	.	2	5
19	2	1	B	4	3	B	1	1	0	0	2	3	0	1	1	2	2	2	0	.	1	5
20	4	2	G	1	2	B	1	1	2	1	0	1	0	2	.	.	1	2	1	a	1	5
21	3	1	G	2	3	B	2	1	1	0	0	2	1	1	2	2	1	0	2	.	0	30
22	3	2	G	1	3	B	1	1	0	0	2	3	0	2	1	2	3	2	2	a	2	30
23	3	2	G	3	3	B	1	1	1	2	0	1	0	1	1	1	1	1	0	.	1	5
24	3	1	G	2	3	B	2	1	1	0	1	2	0	1	2	2	2	1	1	a	1	5
25	3	1	G	2	3	B	2	1	0	0	2	4	0	2	1	2	3	2	0	a	3	5
26	3	1	G	1	3	B	2	1	0	0	1	2	0	1	2	2	1	2	0	a	1	5
27	3	1	G	1	3	B	2	1	3	0	1	3	1	2	2	2	2	2	1	a	1	1
28	3	2	G	1	2	C	2	1	3	2	1	1	1	1	.	.	3	2	1	a	1	1
29	2	1	G	1	3	B	2	1	3	2	1	3	0	1	1	2	2	1	1	a	1	1
30	3	1	G	1	3	A	2	1	2	2	1	2	0	1	2	.	2	1	.	a	2	1
31	3	2	G	1	2	C	2	1	2	2	0	1	2	1	2	1	1	1	2	b	1	1
32	3	1	G	2	3	C	3	1	3	0	1	1	0	2	.	1	3	2	0	a	3	1

No.	Gen.		Soil					Alt.other				Prune				disease					C.S.
	1.	2	1	2	3	4	5	1	2	3	4	1	2	3	4	1	2	3	4	5	--
33	3	1	Q	1	3	C	2	3	0	2	1	1	2	1	2	0	3	2	b	0	5
34	3	2	Q	1	2	C	2	3	1	2	2	2	0	1	2	2	0	3	1	b	0	5
35	3	1	Q	1	3	B	2	3	1	2	1	1	1	2	2	2	0	1	1	b	0	5
36	3	1	Q	1	3	B	2	3	0	0	2	1	0	0	.	.	0	3	1	b	0	5
37	3	1	Q	1	1	B	1	2	2	0	2	2	0	1	.	.	2	3	0	a	1	5
38	3	2	Q	1	3	B	2	2	0	0	2	2	0	1	.	1	3	3	1	a	2	5
39	3	1	Q	1	3	B	2	2	0	0	2	3	0	1	2	2	1	1	1	.	0	5
40	3	1	Q	1	2	B	2	2	0	0	1	2	0	0	1	2	1	2	1	a	0	5
41	3	1	Q	1	2	B	2	3	2	0	2	4	0	0	2	1	0	3	0	a	1	5
42	3	1	Q	1	1	D	2	3	1	1	1	1	.	0	2	1	1	1	0	.	1	5
43	3	1	Q	1	3	B	2	3	3	0	1	2	0	1	2	1	1	2	1	.	1	5
44	3	1	Q	1	3	C	1	3	3	2	0	1	1	0	2	2	0	1	1	b	1	5
45	3	2	Q	1	2	C	2	3	3	2	1	1	1	0	.	.	0	1	1	a	0	5
46	3	2	Q	1	2	C	2	3	1	2	2	1	0	0	.	.	0	1	1	a	0	5
47	3	2	G	1	3	B	2	1	1	0	2	3	0	1	2	2	2	1	2	a	1	5
48	1	2	B	2	3	B	2	1	1	0	2	4	1	1	2	1	2	2	0	.	1	5
49	3	2	B	3	3	B	2	1	1	0	2	4	.	2	2	2	1	1	0	a	1	5
50	2	2	B	1	2	A	2	1	2	0	2	2	1	0	2	.	2	3	0	.	1	4
51	3	2	G	1	3	C	2	1	1	2	2	4	1	1	2	1	3	3	0	a	2	1
52	3	2	G	1	3	C	2	1	2	2	2	3	1	1	2	1	3	3	0	a	2	1
53	3	2	G	1	2	C	2	1	1	2	2	3	1	0	.	.	2	1	0	a	2	1
54	3	2	G	2	2	C	2	2	0	2	2	4	1	1	2	2	3	3	0	a	2	1
55	2	2	G	1	2	C	2	2	1	2	1	2	1	1	2	2	2	1	2	a	0	1
56	3	2	G	2	3	C	2	2	0	2	1	3	1	1	1	2	3	2	1	.	1	1
57	3	2	G	2	2	C	2	2	2	0	2	1	1	1	2	1	2	1	0	a	2	1
58	3	2	G	1	3	B	1	1	1	0	1	2	1	1	1	1	2	2	0	a	1	1
59	1	1	B	2	3	C	2	2	2	1	1	2	1	2	2	2	1	1	1	.	1	24
60	2	2	B	3	2	C	2	2	3	0	0	1	0	1	1	1	0	0	1	.	0	24
61	1	2	B	1	2	D	2	2	2	2	2	3	0	1	.	.	3	2	0	a	2	5
62	2	2	B	1	2	C	2	2	1	2	1	2	0	1	2	2	2	1	0	a	1	24
63	3	1	B	1	3	C	3	2	2	2	1	2	1	1	2	2	2	1	2	a	1	14
64	2	1	B	1	2	B	3	2	2	1	2	1	0	2	1	2	2	2	2	a	1	14
65	3	1	B	1	1	D	3	2	0	2	2	4	1	2	2	2	2	2	0	a	2	14
66	2	1	B	1	2	C	3	2	1	0	2	2	0	2	.	2	1	1	0	.	1	14

No.	Gen.		Soil	Alt.other	Prune	disease	C.S.
	1.	2	1 2 3 4 5	1 2 3 4	1 2 3 4	1 2 3 4 5	---
67	2	1	B 1 2 C 3	2 1 2 2 1	0 1 1 1	1 1 1 a 1	14
68	2	1	B 1 3 C 3	2 3 2 2 2	0 1 2 1	2 3 0 a 1	19
69	2	1	B 1 3 C 3	2 2 2 1 2	0 1 1 1	2 2 1 a 3	14
70	3	1	B 1 2 C 3	2 1 1 1 1	1 1 1 1	1 1 0 b 0	7
71	3	1	B 1 2 C 2	2 0 0 2 4	1 2 1 1	1 2 0 b 1	7
72	3	1	B 1 3 C 3	2 1 1 1 1	1 1 2 .	0 0 0 b 0	7
73	2	1	B 1 3 C 2	2 2 1 0 1	1 1 1 1	1 1 0 b 0	24
74	3	1	A 1 3 D 3	3 0 1 0 1	0 1 2 2	1 1 1 b 0	25
75	3	2	B 1 3 D 3	3 0 1 0 1	1 0 1 1	0 1 1 b 0	25
76	3	2	A 1 3 D 3	3 0 2 2 3	1 1 2 2	1 1 1 b 0	25
77	1	1	A 1 2 D 3	2 0 2 2 3	0 0 1 1	2 2 1 a 0	25
78	1	1	A 1 2 D 3	2 0 2 1 1	1 1 1 2	2 1 0 b 1	24
79	3	3	Q 1 2 D 3	3 3 2 1 2	1 0 . .	1 0 1 . 0	11
80	3	1	Q 1 2 D 3	3 2 0 1 2	0 1 1 2	2 2 1 a 0	8
81	2	1	B 1 1 C 3	3 3 0 1 3	0 1 1 1	0 1 0 . 0	19
82	3	1	B 3 3 D 3	3 3 0 2 4	0 1 1 2	1 2 0 . 1	21
83	3	1	B 1 3 B 1	2 3 0 1 2	0 1 1 1	1 1 2 . 0	10
84	1	1	B 1 3 B 1	2 3 0 1 4	0 1 1 2	2 2 2 . 1	10
85	1	1	B 3 3 B 2	1 3 2 1 2	0 1 1 2	2 2 1 a 0	10
86	2	1	B 2 3 B 3	1 2 0 2 4	0 1 1 1	1 2 2 a 1	10

Table 13 Legend and total data of the coffee survey in the Kisii district carried out in November 1974.
(figures between brackets indicate the number of surveyed coffee-plots in this class).

General : General characterisitics of the surveyed coffee-plots.

1. Size of the plot: 1. more than 30 are (8) (The trees being planted
2. 15 - 30 are (20) at 9 x 9 ft., there are
3. 5 - 15 are (56) ± 14 trees on an are($100m^2$)
4. less than 5 are (2)

2. Year of planting: 1. before 1961 (51)
2. 1961 - 1968 (33)
3. after 1968 (2) not yet in full production.

Soil: some characteristics.

1. Parent material (according to physiographic map)
   - B: basalt (35)
   - Q: quartzite (23)
   - G: granite (23)
   - A: andesite (5)

2. Soil depth (according to detailed soil surveys and augerings during the coffee survey).
   1. very deep, more than 120 cm. (66)
   2. deep, 80 - 120 cm. (12)
   3. moderately deep, 40 - 80 cm (7)
   4. shallow less than 40 cm. (1)

3. Organic matter, dark topsoil (colour transition, augering during coffee survey)
   1. more than 80 cm (4)
   2. 40 - 80 cm. (34)
   3. less than 40 cm. (48)

4. Slope % (Abney hand-level)
   A. 0 - 3 % (3) 3% C. 8 - 15 % (34) 40%
   B. 3 - 8 % (33) 38% D. 15 - 30 % (16) 19%

5. Acidity of the top-soil (pH fluid indicator checked with pH-meter)
   1. 4. 0 - 5.0 (21)
   2. 5. 0 - 6.0 (45)
   3. 6. 0 - 7.0 (20)

Alt.: altitude (map contour lines and altitude meter)

1. under 1620 m. (30)
2. 1620 -1800 m. (37)
3. over 1800 m. (19)

Other: other vegetation on the coffee plot, eg. weed intercrops, shade trees

1. Shade (estimate) 0. none (25)
   1. slight (21)
   2. moderate (21)
   3. heavy (19)

corr.: shade:

	0	1	2	3
Alt.1.	(7)	(10)	(7)	(6)
2.	(13)	(7)	(10)	(7)
3.	(5)	(4)	(4)	(6)

2. Intercrop. 1. none . . . . . (37) (often, only part of the coffee plot is planted with intercrop)
   2. low (beans, vegetable, pyrethrum) (12)
   3. high (maize, bananas) (37)

3. Weed cover % (average of 2 estimates)

   0. less than 30 % (16)
   1. 30 - 70 % (35)
   2. more than 70 % (35)

4. Last weeding done (information from farmer; no information: (1)

   1. less than 1 month ago (28)
   2. 1 - 3 months ago (26)
   3. 3 - 6 months ago (18)
   4. more than 6 months ago (13)

corr. last w.ing.

weed cover:	1	2	3	4
0.	(13)	(2)	(1)	(-)
1.	(11)	(17)	(5)	(1)
2.	(4)	(7)	(12)	(12)

Prune: pruning measures and their effect.

1. Tree height, average (measured/estimated)

   0. more than 2.80 m. (48)
   1. 1.50 - 2.80 m. (34)
   2. less than 1.50 m. (2) recently cut back)

2. Number of stems, average (counted/estimated)

   0. 1 - 3 stems (15) 1. 2 - 5 stems (55) 2. more than 5 (16).

3. Last cut-back, year (information of farmer) (no information: (18))

   1. before 1971 (33) 2. after 1970 (35)

4. Cut-back height, average (measured/estimated) (not detected: (22))

   1. under 40 cm. (30) 2. over 40 cm. (34)

Diseases: occurrence of some important diseases.

Leafrust (Hemileia vastatrix), (estimate)

0. nearly none (14)
1. slight (33)
2. moderate (26)
3. heavy (13)

corr.leafrust:

Alt.	0	1	2	3
1.	(-)	(9)	(12)	(9)
2.	(4)	(17)	(12)	(4)
3.	(10)	(7)	(2)	(-)

2. Coffee-Berry-Disease(CBD)(Colletotrichum coffeanum)(estimate) (no estimate: 10)

0. nearly none (6)
1. slight (32)
2. moderate (26)
3. heavy (12)

correlation:

Alt.	0	1	2	3
1.	(1)	(9)	(14)	(4)
2.	(4)	(13)	(9)	(4)
3.	(1)	(10)	(3)	(4)

3. Number of fungicide sprays/year. (information of farmer(no inf.:(2)).

0. 0x (38) 1. 1x(30) 2. 2x (14) 3. 3x (1) 4. 4x (-) 5. 5x (1)

4. Other frequently observed diseases (no other diseases observed:(32)).

a. overbearing dis., leaf fall, tip die back: (39)
b. hot & cold disease, crinckle leaf: (15)

correlation:

Alt.:	1	2	3
a.	(20)	(15)	(4)
b.	(1)	(7)	(7)

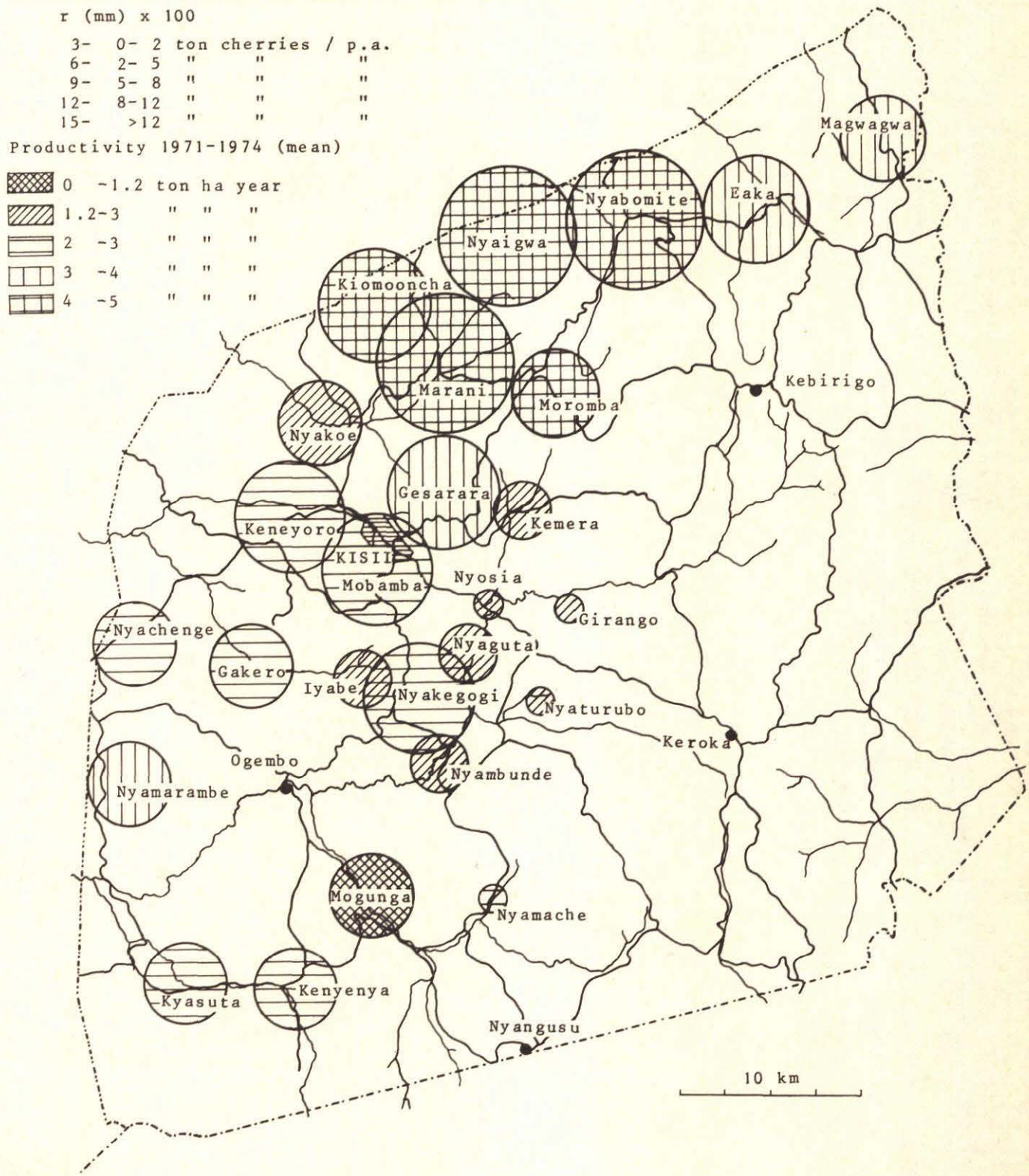
5. Nitrogen-deficiency signs, yellowing (estimate) (ex: (1)).

0. nearly none (28)
1. slight (39)
2. moderate (12)
3. heavy (6)

C.S.: Cooperative society, see also list of names of surveyed coffee farmers and list of coop. societies and coffee factories

1. Kenyoro (14)
4. Gakero (2)
5. Nyamarambe (34)
7. Kenyenya (3)
8. Nyaigwa (1)
10. Marani (4)
11. Moromba (1)
14. Gesarara (6)
19. Mobamba (2)
21. Nyaguta (1)
24. Mogunga (11)
25. Nyamache (4)
30. Misathi-S.Nyanza (2)

Fig.8 *Coffee Societies* in the Kisii District



3. Pyrethrum in the Kisii district.

3.1. History and development.

During and after world war II, the most important pyrethrum producing country, Japan, was cut of from the main pyrethrum market in the U.S.A. The Kenyan Highlands, with their advantages of a temperate climate the whole year round, took over the key position in the production of this, originally Dalmatian, insecticide crop.

The crop was introduced in the beginning of the thirties by coffee-planters trying to produce their own insecticides for pest control in coffee. In the Mid fifties, after the appearence of the Swynnerton-plan, pyrethrum entered the African smallholder areas and expanded rapidly during the sixties, while large scale production declined rapidly.

Presently the Eastern part of the Kisii district produces large part of the world pyrethrum production:

YEAR:	1969/70	70/71	71/72	72/73	73/74
World prod.(tons dry fls).	11722	15633	21780		
Kenyan prod (ton dry fls)	5909	9748	14414	10698	13722
Kisii prod. (tons dry fls)	2378	5733	8556	5577	8057
Kisii % of World prod.	20.3	36.7	39.3		
Kisii % of Kenyan Prod.	40.2	58.8	59.4	52.1	58.7

source: Agric. in the Kisii district; pyrethrum post.

The area under pyrethrum is still increasing rapidly in the Kisii district, as the formerly recommended lower limit for pyrethrum growing (2000 m) was lowered considerably as a result of the development of lower altitude varieties. Presently Kisii farmers grow pyrethrum down to an altitude of ± 1650 m (5500 ft.).

Pyrethrum as a cash crop for smallholders in Kisii is competing with tea and coffee. The advantages of pyrethrum and tea growing over coffee growing are already mentioned in chapter 2.1. The most important advantages and disadvantages of pyrethrum growing compa compared to tea growing are the following:

- Pyrethrum is a short-term perennial crop; it can be uprooted and abandoned rather easily in favour of another crop when product price relations change.

- Pyrethrum begins producing flowers in the year of planting and is fully productive in the 2nd year; tea begins producing only in the 3rd year or 4th year after planting and is considered fully productive in the 7th year or 8th year, which makes the time-gap between investment and beginning of returns bigger.
- Pyrethrum flowers are dried by the farmers himself and rather easilty transported. For tea transport and work-up the farmers is heavily depending on the organization of the tea factory.
- Soils under pyrethrum are highly erosion sensitive, while tea can restrict erosion and can be grown on places not very suitable for pyrethrum (steep slopes, stony soils).

Both pyrethrum and tea are very intensive and labour is evenly spread over the year, the more when climate, rainfall and temperature is more regular.

3.2. The survey.

Like the coffee survey (chapter 2.2), the pyrethrum survey falls apart in a management survey and a search for and interpretation of production data in different parts of the district. The pyrethrum survey began with some interpretation of production statistics, which eased the choice of the sites for management survey. The main statistics data gathered were data on dry flower production and pyrethrum-content from the different Coop.Societies dealing with pyrethrum. Unfortunately, it was impossible to obtain data on the pyrethrum grown surfaces of the different Coop.Societies.

The origins of the statistics material used were:
The Masaba Farmers Cooperative Union (MFCU) in Keroka, with 25 Coop. Societies; the Kisii Farmers Cooperative Union (KFCU) in Kisii-town, with 15 Cooperative Societies dealing with pyrethrum, and the pyrethrum office of the Kisii ministry of agriculture (Mr. A.A. Langweni, pyrethrum officer). In February 1975 an excursion was made to the Pyrethrum Board of Kenya and their processing plant in Nakuru, where some addition information was obtained.

As the area under pyrethrum is still expanding, it can be expected that some more KFCU Coop.Societies are going to deal with pyrethrum.

Table 14 Monthly Pyrethrum production of the Kisii district in the pool years 1971/72, 1972/73 and 1973/74 (Oct.-Sept.) (tons dry flowers)

	1971/72	1972/73	1973/74
October	1110	757	641
November	1122	862	1182
December	592	568	862
January	778	509	799
February	714	437	609
March	744	234	312
April	638	-(+)	211
May	462	-(+)	425
June	474	797	806
July	515	183	709
August	677	699	710
September	731	530	785
TOTAL	8556	5577	8056

(+): farmers delivery strike.

Table 15: Pyrethrum production by the Coop.Societies under K.F.C.U. Tons dry flowers produced in the pool-year 1973/74 (Oct.-Sept) and Oct.-Feb. 1974/75 (4 months)

no.	name	prod. '73/74 (tons)	10/73-2/74 (tons)	10/74-2/75 available	pyrethrum content% 10/74-2/75
1.	(17) Eaka	28	7	145	1.22
2.	(15) Girango	26	7	26	1.33
3.	(13) Kemera	25	12	14	1.21
4.	(7) Kenyenya	86	16	154	1.23
5.	(16) Magwagwa	40	12	22	1.30
6.	(19) Mobamba	-	-	7	1.26
7.	(24) Mogunga	72	10	82	1.18
8.	(18) Nyabomite	19	3	21	1.46
9.	(21) Nyaguta	40	9	42	1.24
10.	(22) Nyakegogi	32	5	50	1.22
11.	(25) Nyamache	136	29	101	1.21
12.	(26) Nyambunde	103	22	45	1.20
13.	(23) Nyaturubo	41	7	39	1.25
14.	(20) Nyasia	36	17	23	1.27

15. (6) Riasuta	-	-	2	1.25
TOTAL	686	156	775	1.27(average)

Figures between bracket: numbers of coffee Coop.Societies as in chapter2.
Sources: K.F.C.U. pyrethrum statistics.

Data on the production of pyrethrum in the Kisii settlement area, which is administered by the Settlement Authority in Sotik, were not collected.

For the management survey a questionnaire form(appendix 2) was used nearly identical to the Coffee questionnaire form.

Farmers were in interviwed 26 pyrethrum fields around 4 Cooperative Societies selected per location and per average pyrethrums content for 1971-1974 measured.

	location	alt. (m)	pyr. cont.%	prod. 71-74	members
Nyanturago	centre	1800	1.23	307 ton	2806
Gesima	east	1930	1.30	313 "	1340
Nyansugu	south	1940	1.14	313 "	2144
Ting'a	north	1990	1.63	397	2424

The aim of the survey was to find out whether the differences in quality (pyrethrums %) could probably also be explained by differences in management or soils used for pyrethrum growing, a part from the climate.
It appeared that it was not easy to find the production of a single field or the yield/ha. Probably with some more patience or time available it would have been possible to obtain these figures.

3.3. Crop Management.

Planting and pruning.

Pyrethrum is multiplied vegetatively in pyrethrum nurseries at a relatively low altitude, where vegetative growth is rather great. The Pyrethrum Board of Kenya supplies the plants to the nurseries, for Kisii in Nyosia and Sotik. The closes used in Kisii are: 4331, 4729, SB/65/58, ma/65/99, L/64/129, etc. and a mixture, called Subukia bulk. The plants from the nurseries or from former fields are split and planted in the farmers fields. According to cland the usual spacing in smallholders fields is 1 x 2 ft. this gives 540 plants/are, but in the Kisii district plant density is much greater, at some societies up to ower 1000 plants/are,(table 4),

which probably makes the plants to reach their normal soil cover and to produce flowers earlier.

Pyrethrum is generally planted in rows with 20-50 cm distance between plants in the row and 30-70 cm between the rows, sometimes widespread. Planting in the beginning of the long rains gives the best chance of a good start. Most pyrethrum in Kisii is planted in April or May.

Pyrethrum fields are generally on not too steep slopes. Soil pH in the surveyed plots was generally around the remmended lower limit of 5.6; around Tinga, where pyrethrum content is the highest within the district the average pH of the surveyed plots was 5.3 in the topsoil and 4.6 at 120 cm depth.

Pruning away the old flower stems, necessary for maintaining production and facilitating picking, is generally done at least once a year.

Weeds and intercrops.

Weeding after picking, is the most labourious task in pyrethrum production. It has to be done at least once in 8 weeks to maintain production, because the shallow rooting pyrethrum plants can not stand competition of weeds.

A weeding trial near Keroka (Mwakha) led to the following results:

Weeding frequency	fresh flower yield (tons/ha)
once in 2 weeks	2,56
once in 4 weeks	2.78
once in 8 weeks	2.62
once in 16 weeks	0.25
once in 32 weeks	0.05
unweeded	0.07

On the survey farms weeding frequency was generally once in two months and the weed cover was subsequently rather low. Although pyrethrum should be weeded with a forked jembe to reduce damage of the pyrethrum roots, only 4 of the 26 interviewed farmers weeded with a forked jembe,normal jembe. The major weedsome other weeded with a small composite seedlings or perennial grasses. (table 4).

Pyrethrum is sometimes planted as an intercrop in other perennial crops, such as passionfruit (around Gesima) or young tea, but generally it is planted in nearly pure stants. Some single plants of other crops

can often be seen in pyrethrum plots, e.g. cabbage, onions, patatoes, maize, peas (sweet lupins), ginsaga (Gynandropsis gynandra), etc.

Diseases and mineral feeding.

It is rather difficult to measure the impact of diseases and pests in pyrethrum. The fungus diseases bud-diseases (Ramularia bellunensis) and root rot (Sclerotina spp.) could sometimes be seen during the survey, but nowhere very serious. Nearly everyshere root knot nematodes (Meloidogyne spp.) were present, but damage was not very clear.

Pyrethrum requires rich soils and a good mineral feeding, especially of phosphorus, but I did not see deficiency sings although only 2 of the interviewed farmers fertilized their pyrethrum at planting time, one with a tablespoon of superphosphate/ plant and the other with cowdung. Too much nitrogen leads to excessive vegetative growth and reduces flowering .

Harvest and work-up.

Picking of the flowers at the two-rows-disc-flowers-open stake has to be done once in two-three weeks, and can be carried out by children, because the flowers are at 50-80 cm height. Directly after picking the flower-heads are sundried om mats or trays, generally on the ground. However for aeration elevated trays would be better. The quality of the product depends greatly on the right stage of the flowers at picking time and the method and speed of drying. Higher pyrethrums content is paid better. In sept. 1974 the Nyangusu product with 1.11 % made 406 cts/kg, whereas the Tinga product within 1.69% made 616 cts/kg, the average was 1.34 % and 491 cts/kg. Dry flower weight is $\pm$ 20% of the fresh flower weight. After drying the flowers must be transported rather quick and well protected from moist to the processing plant in Nakuru by the Coop.Societies and the Union.

Crop rotation.

As pyrethrum is a high demanding crop from the point of view of physical and chemical soil properties rotations should be planned carefully. The best practise is to alternate 3 years pyrethrum with at least 3 years of a well tended cereal crop or grazing follwed by one year cereal crop for destroying perennial grasses.

According to the interviewed a lot farmers seem to follow these recommendations, but it must be kept in mind, that a lot of farmers in the lower areas have planted pyrethrum for the first time.

Table 16: Pyrethrum production by the Cooperative Societies L.P.C.U. No. of members. Dry flower prod., Pyrethrums content and prethrins prod. in the pool years from Oct. to Sept. 1971/72, 1972/73 and 1973/74.

C.S.	no.of	1971/72			1972/73			1973/74		
name	members	A	B	C	A	B	C	A	B	C
	1972/73	ton	%	ton	ton	%	ton	ton	%	ton
1. Birongo	2995	522	1.31	6.84	302	1.27	3.83	366	1.29	4.72
2. Esani	941	167	1.16	1.94	96	1.11	1.06	110	1.14	1.25
3. Gesima	1340	361	1.32	4.77	243	1.28	3.11	335	1.30	4.36
4. Ibacho	1593	380	1.30	4.94	270	1.25	3.37	302	1.25	3.78
5. Gesusu	1254	280	1.33	3.72	192	1.29	2.48	374	1.29	4.82
6. Itibo	2400	432	1.35	5.71	295	1.27	3.75	344	1.30	4.47
7. Kebirigo	1954	226	1.22	2.76	131	1.25	1.64	195	1.27	2.48
8. Kerina	1435	279	1.25	3.49	204	1.24	2.53	267	1.25	3.34
9. Keroka	2544	519	1.31	6.80	288	1.28	3.69	414	1.30	5.38
10.Kiamokama	1784	419	1.30	5.45	270	1.32	3.56	397	1.32	5.24
11.Magombo	754	84	1.19	1.00	45	1.12	0.50	49	1.14	0.56
12.Majimazuri	2032	379	1.26	4.78	195	1.25	2.42	268	1.24	3.32
13.Makairo	1212	151	1.28	1.93	71	1.32	0.93	108	1.36	1.47
14.Masimba	2000	423	1.28	5.41	302	1.24	3.74	382	1.27	4.85
15.Mochenwa	1128	226	1.30	2.94	134	1.22	1.63	179	1.23	2.20
16.Motagara	1225	220	1.33	2.93	144	1.27	1.83	194	1.27	2.46
17.Nyacheki	1890	406	1.22	4.95	245	1.18	2.89	388	1.16	4.50
18.Nyamasibi	1396	327	1.29	4.22	223	1.18	2.63	248	1.19	2.95
19.Nyangusu	2144	392	1.21	4.74	274	1.10	3.01	272	1.20	1.99
20.Nyanturago	2806	384	1.27	4.48	276	1.19	3.29	262	1.22	3.20
21.Ramasha	1173	240	1.30	3.12	167	1.23	2.05	236	1.25	2.95
22.Rigoma	1978	268	1.24	3.32	123	1.17	1.44	160	1.18	1.89
23.Sironga	2553	404	1.58	6.38	309	1.56	4.82	458	1.57	7.19
24.Tinga	2424	416	1.66	6.91	308	1.61	4.95	468	1.62	7.58
25.Tombe	2402	287	1.35	3.87	176	1.28	2.25	225	1.34	3.02
TOTALS	45357	8208		107.90	5293		67.40	7003		91.04
Average %			1.31			1.28			1.30	

A: Dry flower production
B: Pyrethrum content
C: Pyrethrins production
Sources: Annual reports, 1973 and 1972, D.A.O.

Annual report Nyanza province 1973/74. Pyrethrum Board of Kenya.

3.4. Distribution and quality.

The production of pyrethrins is rather equally (map 1) spread over the eastern part of the district, with the notable exception of the lower area in East Kitutu around Magombo, where probably temperatures are rather high. Along the 1800 m contourline production is starting and increasing quickly. The quality of the dry flowers, expresed by the pyrethrins content (map 2), is best around Tinga and Sironga, where relatively high altitudes coincide with relatively high rainfall, which probably also gives the cooling to under $\pm$ 16°C, necessary for bud initiation.

Much research remains to be done on the relation between the quality of the pyrethrum at one side and the meso-and microclimate on the other. A lot of different pyrethrum clones are developed or in development for a wide range or climatological situations.

The total surface under pyrethrum in the district was 19.200 ha in 1974 (Mr. A Langweni). With the 1973/74 production of 8056 tons dry flowers this indicates an average yield of 420 Kg dry fls. fls./ha, which is not bad as a average. For individual farmers it should be possible to reach 750 kg dry fls./ha with a high management level (according to the land & farm management div., min. of agric. Kisii).

3.5. Pyrethrum Suitability.

The higher parts of the district with a rather high annual rainfall seem most suitable for pyrethrum growing, but with the use of adapted clones much can be done in the rest.

Table 17: List of names and registration numbers of interviewed farmers on surveyed Pyrethrum plots.
Survey: December 1974.

NYANTURAGON	Cooperative society registration no:	361
1. Nyasoga Omosa		668
2. Oirere Omosa		175
3. Mosoti Omosa		783
4. Nyanchama Kibani		1486
5. Nyamoita Tariri		
6. Onkoba Kooga		1579
GESIMA		
7. Omundi Nyangena		83
8. Samuel Omweri		933
9. Michael Auga		74
10. Monayo Rasugu		297
11. Okioga Siongi		262
12. Ebiba Kerubo		1180
13. Angira Morema		174
NYANGUSU		
14. Joseph Nyamari		1821
15. Nyangau Gechore		477
16. Joseph Nyaigoti		237
17. Osebe Nyaigoti		180
18. Ogada Nyandumo		134
19. Teresia Nyandumo		1526
20. Soteri Osoro		112
21. " "		
TINGA		
21. Okwanyo Nyakeri		38
22. Andrew Bwoma		52
23. Nyamamba Omoro		109
24. Monyenye Maronga		463
25. Wilson Anuri		80
26. Lusia Mongina		3078

Table 18: Pyrethrum Survey in the Kisii district around 4 cooperative societies under M.F.C.U., carried out in December 1974.

No.	Phys. Unit	o.m. depth cm.	pH top soil	pH 120 cm.	slope %	Altit. m	est. plant size are	spa- date	cing pl/a.	est.Pest/disease cover %	nem.	root r. bud,d.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11,12,13)		
NYANTURAGO													
1.	SwA	20	6.0	5.1	8	1800	40	1/74	280	25	++	+	=
2.	SwA	20	5.9	5.3	15	1830	60	2/72	310	40	++	+	+
3.	SwA	10	5.7	5.8	10	1800	50	6/74	360	50	++	-	-
4.	SwA	80	5.6	6.3	10	1800	50	/70	310	30	++	+	-
5.	SwA	15	5.3	4.7	0	1770	10	9/74	330	35	++	+	-
6.	SwA	20	5.4	4.6	3	1755	50	4/72	330	46	++	+	+
GESIMA													
7.	SsRp	60	5.5	6.2	4	1920	30	4/73	500	50	++	+	-
8.	SsRp	30	5.5	5.8	10	1920	80	3/74	830	45	++	+	-
9.	SsRp	30	5.7	6.1	13	1950	60	7/74	1200	45	+	+	-
10.	SsRp	30	5.6	6.2	10	1930	160	4/74	620	35	++	+	-
11.	SsRp	40	5.5	5.7	8	1930	130	4/73	670	45	++	+	+
12.	SsRp	40	5.8	5.8	8	1940	50	4/73	800	40	++	+	-
13.	SsRp	30	5.3	6.1	6	1940	160	7/74	670	35	+	-	-
NYANGUSU													
14.	SsQ	60	5.6	5.4	15	1970	80	4/74	570	40	++	+	-
15.	SsQ	50	5.7	5.0	10	1930	60	4/73	270	30	+	+	-
16.	SwB	45	6.0	6.4	7	1900	100	11/72	710	40	+	-	-
17.	SwB	60	6.1	6.7	4	1900	100	5/70	500	45	+	-	+
18.	SsQ	60	5.8	4.9	17	1960	160	4/74	950	40	+	+	-
19.	SsQ	60	5.8	4.9	17	1960	160	4/74	950	45	+	+	-
20.	SsQ	50	5.4	5.3	9	1960	100	12/73	480	30	++	+	-
TINGA													
21.	SmAd	40	5.4	4.6	10	2000	120	4/73	1500	50	+	+	-
22.	SmAd	70	5.3	4.4	8	2000	70	6/72	710	50	++	++	-
23.	SmAd	30	4.9	4.3	8	1980	40	5/71	710	30	++	++	+
24.	SmAd	30	5.3	4.3	3	1980	60	5/72	1200	40	+	+	+
25.	SmAd	50	5.4	5.1	10	1980	200	6/74	830	40	++	-	+
26.	SmAd	40	5.5	5.0	15	1990	60	11/72	450	40	++	+	-

Abbreviations: Phys. Unit: Physiographic unit according to the physio-

graphic map; o. m. depth: organic matter, colour transition from dark top soil to lighter subsoil; est. size: field size, estimated in acres, than calculated to areas; spacing pl/a: plants per are, estimated; est. cover: estimated cover % of the pyrethrum plants; nem.: nematodes; bud.d.: bud disease, root. r.: root rot; ++: clearly present; +: present: -: not seen.

Fig. 9. Coop. Societies dealing with Pyrethrum in the Kisii district

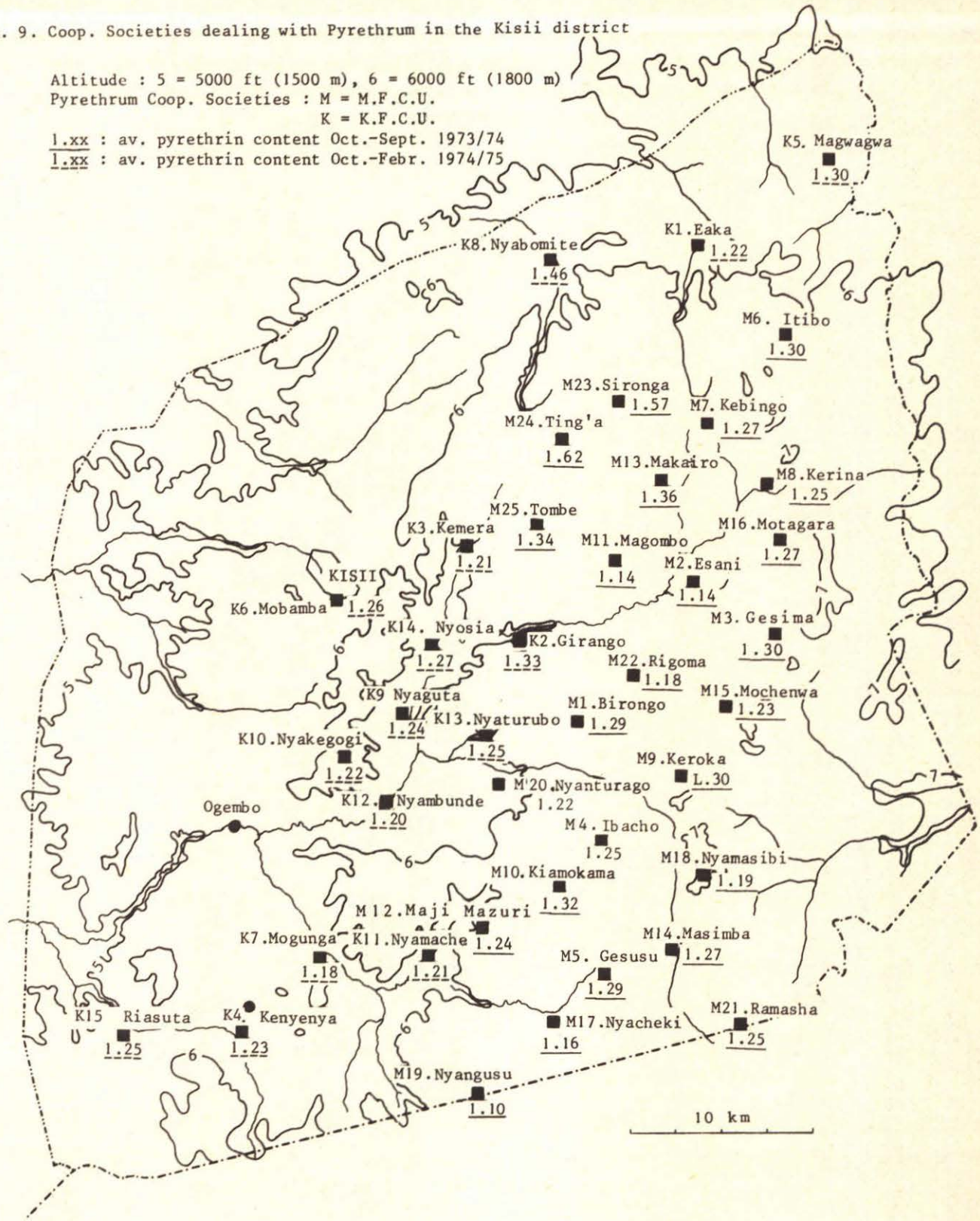
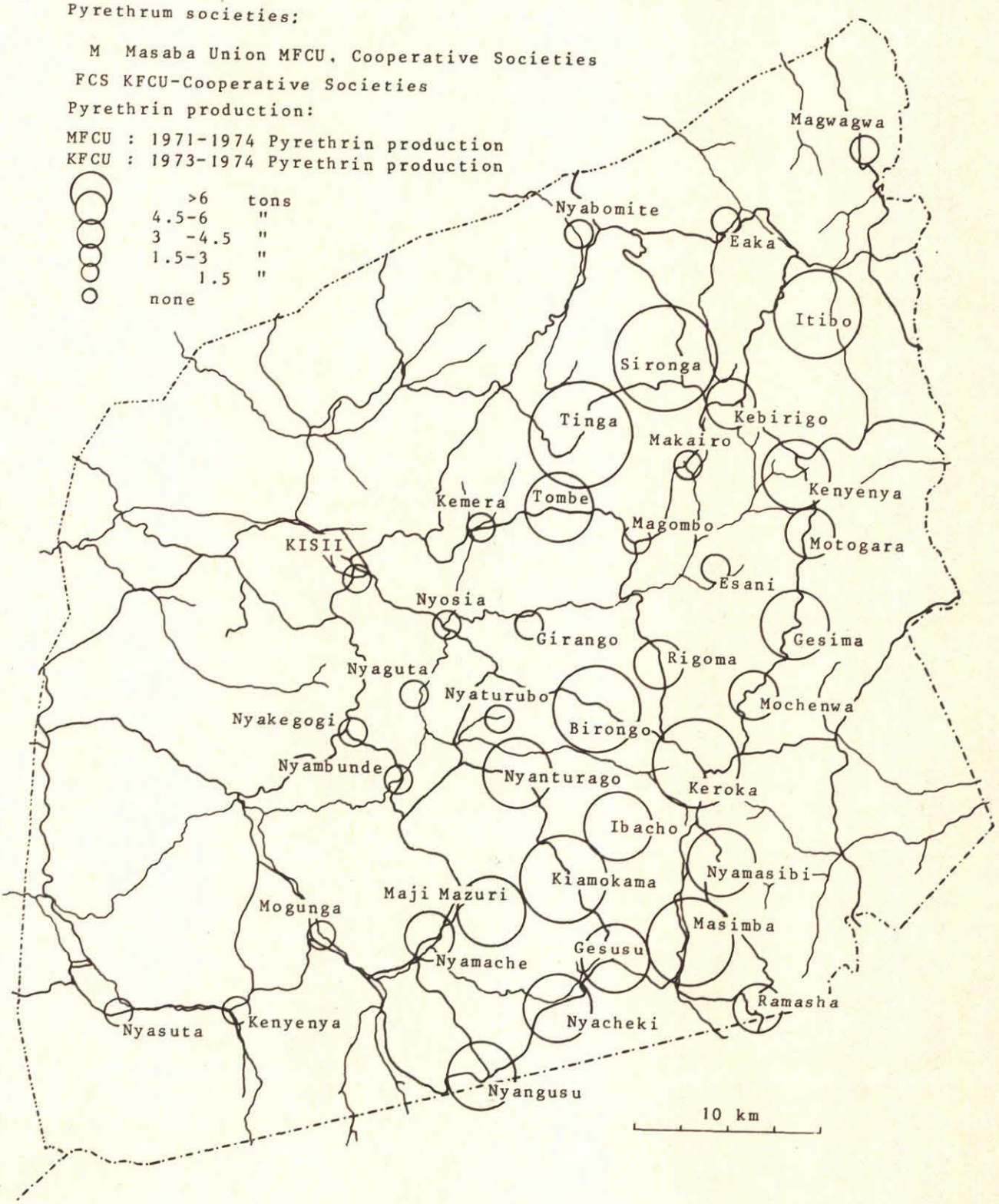


Fig.10 Pyrethrum societies and their production in the Kisii district



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APPENDICES.

Appendix 1. Coffee survey, questionnaire for the farmer.

Soil type: Phys. unit:
pH: Auger. 1.
Slope: 2.
Sealing: 3.
Depth; soil org.matter 4.

Date: Altitude:
Location: Reg. no.:
Name:
Coffee factory:
Size of plot:

Planting: year Spacing:
material, variety: Fert.:

Pruning;last: no. of stems:
Secondaries: Height of trees:
Cutback: date at cm. Hanging:

Pests, Visible: Leafrust, CBD, Antentest ia,
Diseases. Spraying; Medecin
Deficiencies:

Fertilizer; date type: amount:
Mulch; type:

Weeding, date (s):
Weed spp.:
cover %:

Intercrops:
Spacing:
date of planting:

Shade: type:
Quantity:

Distribution of crop over trees:
Time of harvesting:

Yield:

Remarks:
e.g. use before coffee:

Appendix 2. Pyrethrum survey, questionnaire for the farmer

PYRETHRUM No.

Soil type: ..... Phys.unit: .....

pH: ..... Auger. 1 .....

Slope: ..... 2 .....

Topsoil structure: ..... 3 .....

Depth, soil: Org.matter: 4 .....

Date: ..... Altitude:

Location: ..... Photo no.:

Name: ..... Reg. no.:

Society: .....

Size of field: .....

Planting time: ..... Gaps filled: .....

Spacing: ..... Cover %: .....

Size, Ø: ..... Height: .....

Weeding dates, Last: ..... Before: .....

Weeding method: .....

Weeds, Annual: ..... Cover %: .....

Perannual: Cover %: .....

Pests/Diseases, general;

Nematodes: ..... Root rot: .....

Bud disease: ..... Thrips: .....

Fertilizer: .....

Intercrops:

Previous use: 1. .....

2. .....

3. .....

Yield: .....

Remarks: .....

e.g. situation.

Appendix 3: A

Crop & farm surfaces of the most important crops, averages.

39 farmers in Majoge chache, Kuja, and 62 farmers in central & east Kitutu.

Calculated from loan application forms 1970 - 1973,

Land & Farm Management division, Ministry of agriculture, Kisii.

Present and proposed situation (after loan approval)

	farmers with the crop		Total acreages		percent		average crop surf. / farmer	
KUJA	pres.	prop.	pres.	prop.	pres.	prop.	pres.	prop.
coffee	31	31	25.4	24.0	6.0%	5.6%	.82	.77
bananas	22	23	16.3	16.9	4.0	4.0	.74	.74
tea	2	18	1.5	23.0	-	5.4	.75	1.28
pyrethrum	1	9	1.0	9.4	-	-	1.00	1.04
maize	35	33	145.2	94.8	34.4	22.4	4.15	2.87
pasture	39	38	166.7	188.4	39.5	44.4	4.28	4.96
TOTAL	39	39	422.5	424.0	100 %	100 %	10.83	10.87
							(average farm size)	
KITUTU								
coffee	12	6	7.1	5.7	-	-	.59	.95
bananas	4	1	1.6	0.3	-	-	.39	.30
tea	52	56	69.8	119.6	12.1	20.7	1.34	2.14
pyrethrum	52	60	60.1	105.5	10.4	18.2	1.16	1.76
maize	61	59	155.3	84.7	26.9	14.7	2.55	1.44
pasture	61	58	161.9	200.1	28.0	34.6	2.65	3.45
TOTAL	62	62	578.0	578.0	100%	100%	9.32	9.32
							(average farm size)	

note:

for the KUJA sample the altitude range was 1500 - 1700 m,
for the KITUTU sample the altitude range was 1800 - 2000 m.
In Majoge chache tea-development and the accompanying road-construction was just started by KTDA, as well as the construction of a tea factory at Kiamokama.

Appendix 3: B

Farmlayout of 39 farms in Majoge chache location, Kuja division acreages and proposed acreages from loan application forms (acres;) application and recording years: 1970 - 1973.

total farm	coffee now	coffee prop.	bananas now	bananas prop.	maize now	maize prop.	grazing now	grazing prop.	other crops	other crops now	other crops prop.	other used	other now	other prop.
north; Kanyimbo.														
5.1	1.2	1.2	-	.4	.8	.4	2.0	2.2	scn	.6	.6			
7.0	1.4	1.4	.3	.3	1.9	.8	2.2	3.1	tea	-	1.0	igr	.2	.2
									i/p	-	1.0			
7.4	.4	.4	-	-	.7	1.4	4.6	3.6	i/p	-	1.0			
8.3	.5	.5	-	-	3.0	1.4	3.9	4.1	tea	-	1.0	pfr	1.0	-
9.7	1.5	.5	-	-	5.1	3.0	2.5	2.5	tea	-	1.0	pyr	-	1.0
									i/p	-	1.0			
10.0	1.0	1.0	-	-	-	-	7.2	7.7	-					
10.2	.8	.8	.3	.3	3.5	3.5	5.4	5.4	-					
10.2	.5	.5	.5	.5	4.1	1.9	4.9	6.2	tea	-	1.0			
middle; Boochi.														
4.6	-	-	-	-	2.1	2.1	2.2	2.2	-					
5.0	-	-	-	-	1.3	1.3	3.5	2.8	i/p	-	.7			
5.5	-		-		-		5.0	5.0	-			h/s	.5	.5
5.5	.4	.4	.4	.4	1.8	.7	2.1	2.1	tea	-	1.3	fim	.2	-
5.9	.4	.4	-	-	1.5	1.5	2.1	3.6	pia	1.2	1.2	trs	.2	.1
prop:7.4									scn	.2	.2	veg	.2	.2
5.9	.3	.3	.5	.5	1.3	-	3.1	2.9	tea	-	1.0	pyr	-	.7
6.2	.8	.8	.3	.3	1.4	-	2.8	3.5	tea	.5	1.0	ftr	.8	.8
									swp	.7	.7			
6.5	.5	.5	.5	.5	1.4	.9	3.5	4.4	veg	.3	.3	bsh	.9	.9
6.8	.5	.5	-	-	1.3	.3	2.8	3.7	igr	.3	.3			
6.9	.5	.3	.7	.5	1.3	1.5	3.2	4.1	i/p	-	1.0	fim	.9	.5
									swp	.4	-	bsh	.7	-
7.4	1.3	1.3	.6	-	3.6	2.0	1.0	2.0	tea	-	1.0	scn	-	.6
8.8	.7	.7	.9	.9	4.6	2.2	1.6	2.3	tea	-	1.0			
8.9	.8	.6	-	-	5.7	2.0	1.5	2.0	tea	-	2.0	pyr	-	.6
									i/p	-	.5			

Appendix 3: B continued.

total farm	coffee now	coffee prop.	bananas now	bananas prop.	maize now	maize prop.	grazing now	grazing prop.	other crop	crop now	crop prop.	other use	other now	other prop.
9.2	.5	.5	.6	1.2	4.7	.9	1.9	4.0	tea	-	1.0	pyr	-	.6
9.4	-	-	-	-	3.0	2.0	5.9	5.9	i/p	-	1.0			
10.2	.6	.6	1.1	1.1	2.6	1.1	4.2	4.2	tea	-	1.0	pyr	-	1.0
10.7	1.2	1.2	.3	.3	4.3	3.4	3.2	5.2	pia	.3	.3			
10.8	1.4	1.4	2.1	2.1	-	-	6.4	6.4	-					
13.5	1.3	1.3	1.3	1.3	6.6	5.3	4.2	5.5	-					
14.2	.5	.5	-	.6	8.4	3.2	4.2	7.8	i/p	-	1.0	h/s	.8	.8
18.3	.5	.5	.6	.6	11.2	8.2	4.9	6.9	i/p	-	1.0	scn	.5	.5
38.7	2.0	2.0	2.5	2.5	13.2	12.2	13.5	11.5	tea	-	1.0	pyr	-	2.0
22.9	1.3	1.3	-	-	4.5	3.5	8.7	10.0	igr	.4	.4			
									i/p	-	2.0	swp	1.0	1.0
south; Bosoti														
4.7	-	-	0.6	.5	-	-	2.7	2.5	tea	-	.7			
6.2	.7	.7	.2	.2	3.2	.6	..7		tea	-	1.0	pyr	-	.6
9.6	.5	..5	-	-	5.0	5.1	2.1	2.1	i/p	.8	.8			
10.4	-	-	1.2	1.1	4.1	2.9	3.6	4.0	tea	-	1.0	ftr	.5	.5
10.7	-	-	.6	.6	5.7	4.7	3.6	4.6	scn	.2	.2	pia	.1	.1
18.8	1.0	1.0	-	-	7.3	4.8	5.6	7.2	-					
24.3	.8	9.0	5.0		9.0	5.0	9.0	10.0	tea	1.0	4.0	pyr	1.0	2.0
									crop	-	1.0	h/s	2.0	1.0
28.9	-	-	-	-	6.2	5.4	14.0	13.8	tea	-	2.0	pyr	-	1.1

.i/p= Irish patatos, pyr= Pyrethrum, scn =sugarcane, igr = improved grass, pfr = passionfruit, pia = pineapple, ftr = fruit trees, swp = sweet patatos, fim = fingermillet, veg = vegetables, bsh=bush, trs= trees, h/s = homes tead

Appendix 3 C. Layout of some farms in and around Magombo detailed survey area.(acreages and proposed acreages from loan application forms)

Date	Pyrethrum		Tea		Maize		Grazing		H/S	
	now	prop.	now	prop.	now	prop.	now	prop.	now	prop.
@5/73	1.75	3.5	-	1.0	1.75	0.5	3.50	5.25	0.5	0.5
5/73	-	-	-	-	1.3	0.3	1.5	-	0.25	0.25
4/73	0.6	1.7	0.9	1.9	1.3	0.6	0.8	-	-	-
4/73	0.7	1.8	0.7	2.1	3.3	1.4	3.6	4.4	0.1	0.1
3/73	0.3	1.1	1.6	2.4	1.4	0.9	0.8	0.8	0.1	0.1
3/73	-	-	-	-	5.5	3.5	2.7	4.15	0.7	0.55
4/71	0.25	0.55	1.0	2.6	1.0	0.75	5.95	4.95	0.4	0.4
5/72	0.6	1.6	0.3	1.0	2.1	-	0.6	1.9	0.3	0.1
4/72	0.1	1.3	-	1.0	1.0	0.5	2.7	1.3	0.2	0.2
5/72	0.3	0.8	1.2	2.2	1.7	0.5	-	-	0.1	0.1
11/71	-	0.5	-	-	1.1	1.3	1.9	2.0	0.2	0.2
1/72	1.0	1.5	1.1	2.0	-	-	0.5	-	0.2	0.2
11/71	0.5	0.9	0.4	1.2	1.2	0.2	0.2	0.2	0.2	0.2
9/71	0.8	1.5	0.8	1.3	1.5	0.9	2.7	2.1	0.2	0.2
11/71	-	0.5	1.7	1.7	1.6	0.2	1.0	2.0	0.1	0.1
2-@9/72	-	1.0	1.0	1.0	1.5	0.5	3.75	4.0	0.25	0.5
9/71	1.0	1.0	1.0	1.0	3.2	2.4	3.3	6.1	0.8	0.8
6/72	0.3	0.6	1.2	2.6	4.0	1.2	0.7	0.2	0.2	0.2
4/72	0.6	1.7	1.7	2.4	2.2	1.1	4.4	4.1	0.3	0.3
4/72	1.9	2.6	0.4	1.0	3.5	1.4	1.5	0.7	0.3	0.3
5/72	1.3	2.9	1.5	3.6	5.0	1.8	2.4	2.4	0.3	0.3
12/70	0.12	1.05	2.3	3.5	2.19	0.56	2.5	2.5	0.55	0.55
5/72	-	3.0	1.4	6.8	3.3	2.1	1.9	0.6	0.7	0.7
1/72	-	0.8	2.6	2.6	1.9	1.6	5.4	6.0	0.5	0.5
7/71	0.7	1.7	-	-	2.0	1.0	3.5	4.0	0.3	0.3
9/71	1.0	1.0	1.1	1.1	3.2	1.7	4.5	6.0	0.3	0.3
9/71	1.5	2.3	-	-	2.6	1.8	2.0	2.0	0.4	0.4
10/70	0.18	0.57	1.0	1.4	0.22	-	2.59	2.19	0.15	0.16
6/71	0.4	1.5	0.7	1.3	0.9	0.6	1.4	2.1	0.2	0.2

Appendix 3 C. continued.

Date	other crops					dairy cows prop.				TOTAL
	crop	now	prop.	crop	now	prop.	I	G	I G G	FARM
@5/73	cof	0.25	0.25	trs	4.75	1.75				13.0
5/73	I II cof	1.25	1.25	Pfr	-	1.50				
	veg	0.20	0.20	I/P	-	1.0				4.5
4/73	trs	0.8	0.2							4.4
4/73		1.5	0.1							9.9
3/73	bsh	0.9	-							5.1
	I cof	2.0	2.0	bsh	0.3	-				11.5
3/73	ban	0.3	0.3	I/P	-	1.0				
4/71	ban	0.45	-	S/P	0.3	-	cof	0.9	0.9/	10.25
5/72	bsh	0.5	-	cof	0.2	-				4.6
4/72	cof	0.3	-							4.3
5/72	Pfr	-	0.3			-				3.9
11/71	ban	0.4	-	bsh	1.6	1.2				5.5
1/72	bsh	0.6	-	cof	0.4	0.1				3.8
11/71	bsh	0.3	-	cof	0.3	-	Pfr	-	0.4	3.1
9/71	bsh	0.4	0.4	smp	0.7	0.7				7.1
11/71	-			-						4.5
2-©9/72	div	0.25	0.25	bsh	0.5	-				7.25
9/71	Tgr	0.8	-	bsh	1.2	-				11.3
6/72	bsh	0.3	0.1	-						6.7
4/72	bsh	0.8	-	-						9.7
4/72	bsh	0.2	-	Pfr	-	0.9	I/P	-	0.9	7.8
5/72	scn	0.3	-	bsh	0.2	-	2--		-1	11.0
12/70	I ban	1.0	0.5	S/P	0.25	0.25	1 1			
	scn	0.19	0.19						-1	9.1
5/72	Tgr	0.9	0.9	bsh	8.3	2.4	-		-	16.5
1/72	bsh	1.7	0.9	cof	0.3	-	1 1		-5	12.4
7/71	bsh	0.8	0.3	cof	0.5	0.5	3-		-2	3.8
9/71	Tgr	3.5	3.5	bsh	2.8	2.8	1 2		-3	16.4
9/71	cof	0.4	0.4	trs	0.4	0.4	2 -		-1	7.3
10/70	I mlt	0.17	-							
	S/P	0.32	0.32	bsh	0.55	0.55				5.18
6/71	cof	0.3	0.3	trs	3.8	2.1	2 -		-1	9.4

Appendix 3 C. continued

Date (2)	Pyrethrum now	Pyrethrum prop.	Tea now	Tea prop.	Grazing now	Grazing prop.	H/S now	H/S prop.		
7/71	0.1	0.6	1.5	2.1	1.9	0.6	3.4	4.0	0.5	0.2
7/71	-	1.0	1.0	2.2	2.5	1.3	2.3	4.0	0.2	0.2
3@										
3/73	1.0	1.8	-	1.0	0.9	0.8	2.6	1.0	-	0.3
3/73	1.2	2.7	1.3	3.7	3.2	3.4	2.9	7.3	0.2	0.2
4/73	0.5	1.1	1.0	1.0	3.0	2.2	1.4	2.0	0.1	0.1
7/71	0.4	0.4	4.1	4.1	3.1	2.2	1.1	2.0	0.1	0.1
5/72	1.5	1.5	0.7	1.0	1.9	2.4	1.5	2.0	0.2	0.2
5/72	1.2	1.9	0.8	1.0	2.9	1.3	1.1	2.0	0.1	0.1
4/72	1.1	1.1	1.7	2.4	1.8	1.1	2.2	2.2	0.3	0.3
5/72	1.9	2.6	-	-	4.7	3.6	3.6	4.0	0.3	0.3
5/72	-	0.5	0.9	1.8	0.7	1.0	4.2	4.0	0.4	0.4
4/72	1.0	1.0	1.3	2.0	1.7	1.3	1.7	2.1	0.9	0.3
5/72	-	0.8	1.4	2.0	1.1	1.3	0.8	2.9	0.2	0.2
4@										
4/73	0.5	0.5	4.0	4.0	2.75	1.5	5.2	6.45	0.5	0.5
6/72	2.3	3.1	1.3	2.3	2.6	1.3	2.6	5.7	0.4	0.4
5/72	0.5	1.5	0.9	2.1	2.9	0.8	1.4	1.7	0.5	0.2
4/72	1.0	1.5	0.3	1.8	2.3	0.8	1.9	4.3	0.2	0.2
4/72	1.8	3.5	1.3	2.7	5.6	2.1	2.3	4.0	0.1	0.1
11/71	0.9	1.0	0.9	1.6	1.5	0.9	1.4	2.1	0.4	0.4
3/72	1.1	1.4	1.4	2.6	1.5	3.6	4.6	4.6	0.3	0.3
4/72	0.8	1.8	1.0	2.6	4.9	2.5	0.7	4.1	0.2	0.2
4/72	1.7	1.7	0.8	2.8	5.6	3.2	1.3	2.4	0.6	0.6
11/71	0.8	1.8	-	1.5	3.1	0.6	2.0	4.1	0.1	0.1
11/71	1.1	1.9	0.7	1.1	2.5	1.0	1.7	2.0	0.1	0.1
11/71	2.6	3.3	1.0	2.6	3.8	1.3	5.9	6.1	1.0	1.0
11/71	1.2	1.2	2.3	2.5	1.2	1.2	2.2	2.0	0.4	0.4
1/72	0.5	1.4	0.4	1.4	2.4	0.5	2.4	2.4	0.5	0.5
8/71	1.0	3.4	1.0	1.6	3.2	1.1	7.1	6.2	0.4	0.4
8/71	2.0	2.0	0.9	1.0	2.5	1.4	1.0	2.0	0.1	0.1
5/73	2.5	2.5	5.0	5.0	7.5	4.0	5.3	12.5	1.5	1.5

Appendix 3 C. continued

Date		other crops					dairy now		dairy prop.		TOTAL
(2)	crop	now	prop.	crop	now	prop.	I	G	I	G	FARM
	I ban	0.4	-	Tgr	0.8	0.8					
	smp	0.5	0.5								
7/71	bsh	0.1	-				-	1	-	2	7.5
7/71	trs	2.5	-				1	-	-	2	8.5
3@											
3/73	bsh	0.4	-								4.9
3/73	trs	15.0	6.5								23.8
4/73	bsh	0.4	-								6.4
7/71	-										8.8
5/72	bsh	1.3	-								7.1
5/72	bsh	0.3	-								6.3
4/72	-										7.1
5/72	bsh	0.2	0.2								10.2
5/72	bsh	1.5	-								7.7
4/72	bsh	0.1	-								6.7
5/72	bsh	2.9	-								7.2
4/73	ban	0.5	0.5				1	-	-	3	13.45
6/72				bsh	3.6	-	2	-	-	3	12.8
5/72	Pfr	-	0.3				2	-	-	1	6.6
4/72	bsh	1.9	-				3	-	-	2	8.6
4/72	bsh	1.3	-				2	-	-	2	12.4
11/71	bsh	0.9	-				3	-	-	1	6.0
3/72	bsh	3.5	0.3	scn	0.4	-	2	-	-	2	12.8
4/72	bsh	3.9	0.3				2	-	-	2	11.5
4/72	bsh	0.8	0.1				3	-	-	1	10.8
11/71	bsh	2.1	-				2	-	-	2	8.1
11/71	bsh	0.2	0.2				2	-	-	1	6.3
11/71	bsh	0.3	0.3				2	-	-	3	14.6
11/72	trs	0.5	0.5				2	-	-	1	7.8
1/72	smp	0.6	0.6	orc	0.2	0.2	3	-	1	1	7.0
8/71	trs	0.9	0.9				3	-	-	3	13.6
8/71	-			-			1	-	-	1	6.5
5/73	I trs	0.5	0.5								

Date (4)	Prethrum now	Prethrum prop.	Tea now	Tea prop.	Maize now	Maize prop.	Grazing now	Grazing prop.	H/S now	H/S prop.
5/73	0.3	1.3	2.5	2.5	1.5	0.6	3.5	4.0	0.6	0.6
3/72	0.8	0.9	0.9	0.9	1.5	0.5	1.1	2.0	0.1	0.1
3/73	11.0	13.8	0.9	4.0	5.6	4.1	12.2	10.2	0.2	0.2
TOTAL & MEANS										
1- Mwabosire (e.g.Manga) 15 farmers.										
tot.	6.9	17.25	9.7	20.40	25.75	11.55	28.45	28.85	3.55	3.20
mean	0.46	1.15	0.65	1.36	1.72	0.77	1.90	1.92	0.24	0.21
2- Mwamokaya (e.g. Miriri, Gekano) 16 farmers.										
tot.	9,10	23.32	18.40	32.60	40.11	19.66	45.54	50.89	5.95	5.90
mean	0.57	1.46	1.15	2.04	2.51	1.23	2.85	1.18	0.37	0.37
3- Bonyamondo I (e.g Magombo, Nyambaria) 11 farmers.										
tot.	9.70	15.40	13.2	20.0	25.0	20.6	23.1	32.5	2.8	2.5
mean	0.88	1.40	1.20	1.87	2.27	1.87	2.10	2.86	0.25	0.23
4- Botabori II + III (e.g Esani, Tinga) 20 farmers.										
tot.	34.4	49.5	28.5	46.6	64.45	32.9	64.8	88.85	8.2	7.9
mean	1.72	2.48	1.43	2.33	3.22	1.65	3.24	4.44	0.41	0.40

Date (4)	Other crops						dairy cows now	dairy cows prop.	TOTAL FARM
	crop	now	prop.	crop	now	prop.	I G	I G	
	div	0.3	0.6	smp	4.0	-	2 -	- 6	26.6
5/73	bsh	0.5					2 -	- 2	8.9
3/72	-			-			1 -	- 1	4.4
3/73	bsh	4.4	1.0				3 1	- 5	33.3
tot.	bsh	10.15	3.55	cof	5.60	4.50			95.45
mean	bsh	0.68	0.24	cof	0.37	0.30			6.36
tot.	bsh	25.15	10.05	cof	1.50	1.20			133.83
mean	bsh	1.57	0.63	cof	0.09	0.08			9.61
tot.	bsh	22.1	6.7						96.7
mean	bsh	2.01	0.67						8.79
tot.	bsh	25.3	4.1			.43	1 1	43	232.05
mean	bsh	1.27	0.21						11.60