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MINISTRY OF AGRICULTURE



**LARGE FARM
REHABILITATION STUDY**

PROGRESS REPORT NO. 2

CONSULTANTS

WARD ASHCROFT & PARKMAN (EAST AFRICA)

in association with

HUNTING TECHNICAL SERVICES LIMITED

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CHAPTER I
INTRODUCTION AND SUMMARY

This report is the second in a series of informal reports originally intended to be submitted by the consultants at two monthly intervals. It is submitted however, after an interval of four months. To have reported in October when field work was approaching completion would have meant that no more than a brief statement of progress could have been offered. The delay has enabled field work to be completed, the data collected to be analysed and results interpreted. It has also allowed a strategy for the future development of the large farm sector based on the findings of the survey to be prepared. The report therefore raises issues and proposes solutions upon which we would welcome discussion at an early meeting of the steering committee.

A detailed survey of some 88 farms was completed, the broad objectives being to identify the main problems and constraints within the sector and to establish the present levels of performance. The survey would thus indicate ^{where} physical potential was being underutilized, provide an analysis of the present situation and a basis upon which the incremental benefits to a further phase of the rehabilitation programme could be estimated.

The survey was carried out during a three month period which fell in mid-season between planting and harvest. Farm records were not well kept but were used as a source of data wherever available. Where records were not available invoices or returns from the supplying and purchasing agents (KFA and Kenya Seed Company and KCC) were used as a source of information; in some instances these agencies themselves were visited. Where no records or alternative source^s of data were available the word and memory of the farmer had to be relied upon. Despite these limitations we believe that the data collected represents a fair picture of the present state of large mixed farms.

Although farms were either whole, partly subdivided or completely divided results were analysed in two basic groups; large scale operations and small scale operations on smallholdings or subsistence plots.

The results showed a general underutilisation of resources as indicated by low intensity of the farming system and poor yields. Even on the better farms yields were considerably below what could potentially be achieved. Dairy enterprises were particularly poor, milk yields were low, calving intervals long and mortality high; all reflecting a poor understanding of dairy husbandry.

The over-riding ^sconstraint, however, was the lack of skilled farm management. Capital and credit are also limiting factors but on most farms where the management was good, access to credit did not pose a serious constraint.

Regression analyses were carried out on the results obtained from the large scale operations to examine the relationship between the size of the farm and indicators of management efficiency such as intensity of use of cultivable land, gross output and net returns. Although no strong general relationship was established the analyses did indicate an inverse trend suggesting that productivity in the large scale units did increase with decreasing size. The conclusion drawn was that where small groups or partnerships wish to divide a large unit into few smaller parts it should not be discouraged.

Analysis of data on the smallholdings and subsistence plots indicated that performance on these holding was no worse than on the large units. Overall the intensity of use of cultivable land was higher and average maize yields (by the far the most important crop grown) were similar to the mean for all the large farms surveyed. Although the farm gross output per hectare was not calculated because of limitations in the data available for livestock, it is expected that it would be of a similar order to the mean for the better large units. It is concluded therefore that providing subdivision is carried out on a planned and controlled basis, there would be no economic disadvantage.

In the final chapter a strategy for the^{future} development of the sector is proposed. The strategy recognizes that there is a need for both large scale units and smallholdings, if the aspirations of the majority of owners are to be met. The farms in the sector are treated as falling into three categories based on the number of owners in relation to the land area available: They are:

- Category 1: farms in individual ownership, or owned by a small number of partners (less than the legal maximum of seven). In this section the farms are still run well or badly as a single unit or units where the techniques of large scale farming are still appropriate.
- Category 2: farms in group ownership but where the number of owners in relation to the overall size of the farm would permit each owner in the event of subdivision to have a small holding of sufficient size to undertake planned commercial mixed farming.
- Category 3: farms in group ownership^{where} the number of owners is greater than the area could support as individual commercial farmers or even as subsistence farms.

Within each category further separation may be made on the basis of farming system, level of indebtedness, quality of management etc. For the purpose of presenting a future development strategy, however, these three categories of farms are considered the most important divisions to which proposals should be directed.

^{w/e} For category 1 farms the development plan would aim at providing assistance in the form of physical planning, preparation of cropping and operational plans, budget preparation and managerial support; ~~infact~~ a package similar to that provided for group owned farms in the current phase of the rehabilitation programme.

^{v/e} For category 2 farms controlled and planned subdivision is recommended supported by small development and planning teams. The programme would involve land adjudication, authentication and registering of shareholders' claims and the provision of extension, credit, supply and marketing services. All services would be provided on a group basis, the group being comprised of all the authentic shareholders in the farm. The group structure recommended is the co-operative although owners would not be compelled to form one.

u/c
For category 3 farms the strategy recommended is to regularise the ownership situation through adjudication and authentication of claims conferring some form of ownership rights. This would be accompanied by "buying out" owners where possible, and extending the Integrated Agricultural Development Programme (IADP) to incorporate these farms and provide them with the assistance needed to move from subsistence farming to the production of marketable surpluses. It is recognized that this will be a slow process and that the objective may be unattainable unless some of the shareholders can be accommodated elsewhere.

Ideally all three proposals should be implemented in parallel. In practice this may not be possible and if priorities must be established it is our view that category 2 farms should be subject of the next phase of the rehabilitation programme.

During the next 6 weeks priority will be given to study and review of factors affecting development. These will include market prospects and prices for commodities produced, population and land pressure, government policies towards agricultural production and the need to create employment opportunities. A review of the current phase of the rehabilitation programme will also be carried out and preparation of model farm budgets begun.

- Technical standards such as soil fertility, water supply, etc.
- Intensity of land use, its relation to soil fertility, etc.
- Net returns from different enterprises.
- Efficiency of use of labour and machinery.
- Other aspects such as management experience and training and maintenance and use of land resources.

Farm Ownership and Organization

- The type of ownership.
- The structure of the decision-making process; type of management in relation to farm ownership.

CHAPTER 2

OBJECTIVES AND METHODOLOGY OF DETAILED FARM SURVEY

2.1 Objectives

In our proposal¹ of October 1975 the need to carry out a detailed study of a sample of farms, which would as far as possible be representative of the considerable variation within the large farm sector, was pointed out. The detailed study would have the broad objectives of identifying the main problems and constraints within the sector and of establishing the present levels of performance in order that the extent to which resources were being under utilized could be assessed. Such a study would also enable an analysis of the present situation to be made, thus providing a basis upon which incremental benefits to a further phase of the rehabilitation project could be estimated. To meet these broad objectives, attention in the survey would be given to the following:-

(a) Indicators of management efficiency:-

- Yields and gross output from the individual crop and livestock enterprises, and the whole farm gross output.
- Levels of inputs.
- Technical standards such as calving intervals and livestock mortalities.
- Intensity of land use, in relation to land capability.
- Net returns from different enterprises.
- Efficiency of use of labour and machinery.
- Other aspects such as management experience and training and maintenance and use of farm records.

(b) Farm Ownership and Organisation:-

- The type of ownership.
- The structure of the decision making process, type of management in relation to farm ownership.

Note 1 Proposal for Large Farm Development Study
(October 1975)

- The degree of sub-division.
- The number of owners/shareholders.

(c) Finance and Credit:-

- The financial and credit status of the farm.
- Access to credit in relation to the farm organisation.
- The level of annual loan repayments and the degree of indebtedness.
- The relative importance of short, medium and long term loans in the farm system.
- Sources of credit.

(d) Social Aspects and Co-operation :-

- Problems associated with production on group farms, the causes of ^Sdissent among members.
- The level of co-operation between members.
- The mechanisms involved in the group marketing of agricultural products.
- The existence and importance of machinery syndicates.

(e) other Information:-

- The level of investment in, and condition of fixed assets (buildings roads etc).
- The availability of farm services (water, electricity).
- The use made of the agricultural extension service and the soil conservation unit.

2.2 Methodology

2.2.1 The Population Sampled

Although the sectoral development plan will incorporate all large farms and estates in the sector it was agreed that the emphasis in the detailed survey ^{should} be on the large 'mixed' farms ^{v/c} single enterprise (tea, coffee, sisal, sugarcane etc.) estates and plantations have therefore not been included. The number of 'mixed' farms and hence the size of the population sampled and studied in detailed ~~is~~ is approximately 1500.

2.2.2 The Sample Frame

The large farm population occurs in 21 districts scattered throughout the country, thus in view of the time available and the distances involved

between the large farm areas, it was decided to confine the frame to those districts where the large farm population is concentrated. The districts selected were Nakuru, Uasin Gishu, Trans Nzoia and Kericho in Rift Valley Province which contain some 1363 farms out of the total of approximately 1500 'mixed' farms ie. 76 per cent of the total, and 149 ranches (approximately 30 per cent of the total number of ranches¹). These districts cover some 83 per cent of the total area of cereals in the large farm sector, 91 per cent of the pyrethrum area, 55 per cent of leys and fodder crops and 34 per cent of uncultivated meadows and pastures. In spite of the omission of the outlying farms from the frame it is considered that these four districts adequately cover the range of farm types encountered and that very little advantage would be gained by spreading the frame over a wider area.

The frame itself was compiled from farm lists provided by the district agricultural officers. These lists are between 2 - 3 years old, but were up-dated where necessary before the sample was selected. Although a few farms had been 'double counted' on some divisional lists they are otherwise thought to be sufficiently accurate.

2.2.3 The Sampling Unit

The unit was defined as a farm (within the mixed and ranching systems) over 20 hectares in size. This lower limit has been taken purely for convenience as it is the minimum 'large farm' size as defined by Government statistical publications. Most farms in the sector, however, are well above 20 hectares (the sample mean 'mixed' farm size was 525 hectares).

In the case of large farms which have been unofficially subdivided into separate production units, ~~then~~ the data supplied by the individual farmers concerned has (for comparative purposes) been aggregated to give an estimate covering the area of the original large farm, which forms the unit being sampled. Because many of the questions were concerned

Note 1 Provisional estimate only based on a) Agricultural Census of Large Farms 1970 & 71 (Table 1(a)). (b) Statistical Abstract 1975 (Table 92e) (c) Large Farm Rehabilitation Study Progress Report No 1 (Table 1)

both with subdivided units and subsistence plots as well as the commercial farm area, the number of individuals questioned was considerably more than the 88 farms in the sample and is estimated to exceed 300 persons.

2.2.4 The Sampling Procedure

Mixed farms and ranches clearly constitute different systems which can be separated for study and analysis. Even within the mixed farm group, however, the population is heterogeneous both in terms of system, organisation and ownership. It was decided therefore to stratify the frame, first on the basis of the farm system practised. The five strata identified were defined in the 'Large Farm Rehabilitation Study' Progress Report No 1, and for convenience ^{ace} is reproduced below. The extent of each system is shown in Map 3.

System 1

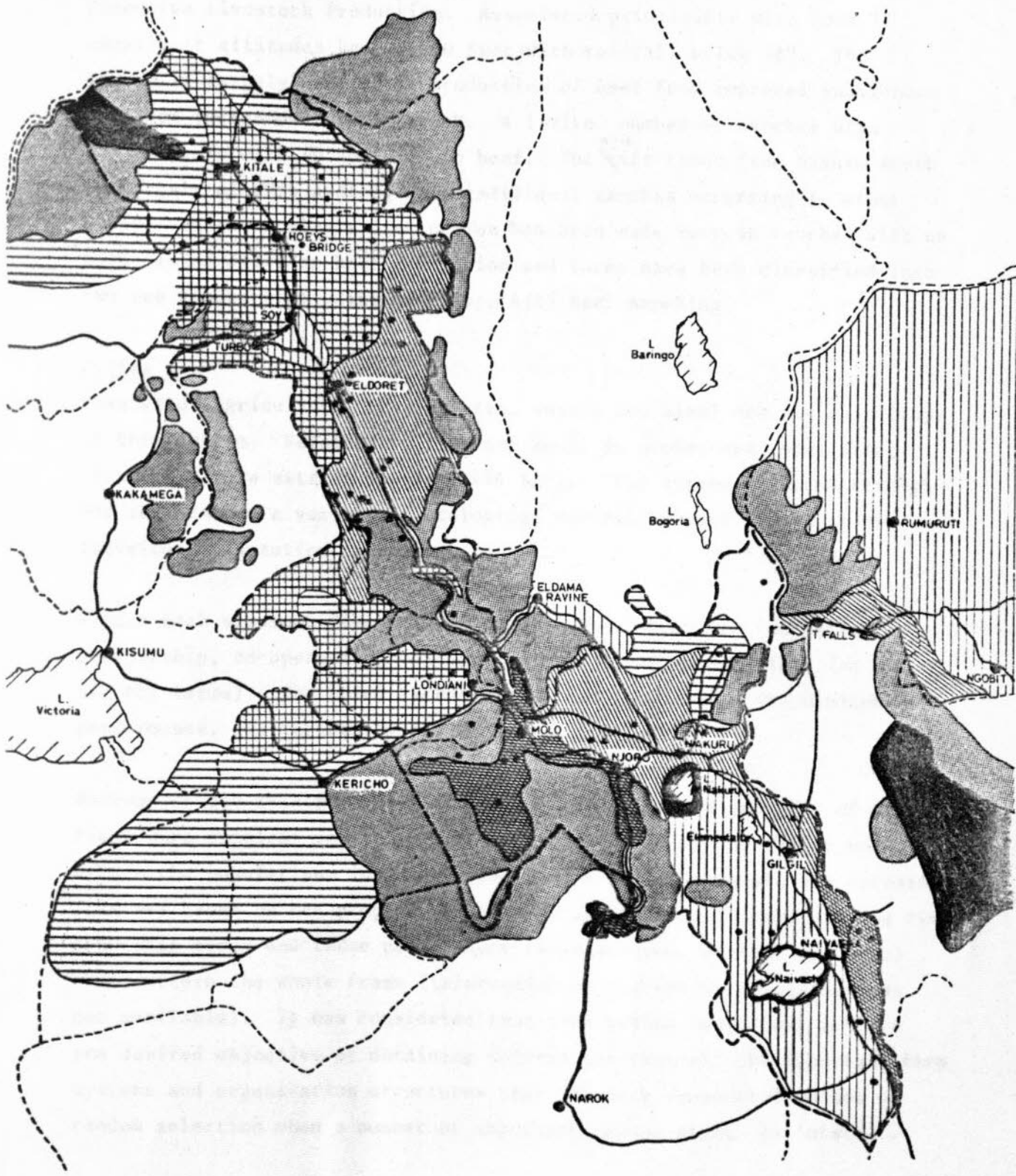
Wheat/Maize/Dairy. This system is found largely in Ecological Zone III where soils are not limiting, at intermediate altitudes of 6500 feet to 7500 feet. Much of Uasin Gishu and both sides of the ^{u/c} rift in Nakuru are typical of this system. Wheat is the dominant arable crop but some maize and barley are grown.

System 2

Maize/Dairy (Wheat). A similar system to the previous one, found in areas of similar ecological potential, possibly at slightly lower altitudes with a higher rainfall. Maize is the dominant arable crop but wheat and barley are also grown. Changes in farm ownership pattern since the mid-sixties have contributed to the expansion of this system and it is found in some areas ^{u/c} (Kipkelion division) which on purely ecological grounds would be considered more suitable for other systems. The whole central Trans Nzoia, the Kipkelion division of Kericho and the Turbo division of Uasin Gishu are typical of this system.

System 3

High Altitude - High Rainfall. Largely related to Zone II at altitudes in excess of 7500 feet, the system often embodies intensive land use with a wide mix of crops and livestock. Pyrethrum is typical of this system with wheat and barely as the principal grain crops. Livestock enterprises include dairy, intensive beef production and sheep for fat, lamb and wool. Parts of Kipkelion and Molo and part of Bahiti divisions of Nakuru are the main areas of this system.



KEY

- WHEAT / DAIRY (1)
- MAIZE / DAIRY (2)
- HIGH ALTITUDE (3)
- RANCHING (4)

- PLANTATION CROPS (5)
- FOREST
- NATIONAL PARKS
- SMALL SCALE SETTLEMENT OR NOMADIC PASTORAL AREAS

- SURVEYED FARMS
- ROADS
- DISTRICT BOUNDARIES
- BOUNDARY MIXED FARM SURVEY AREA

SCALE 1 : 2,000,000

MAP 3 LAND USE : FARMING SYSTEMS & SURVEYED FARMS

3 Maps 1 & 2

System 4

Extensive Livestock Production. Associated principally with Zone IV usually at altitudes below 6500 feet with rainfall below 30". The system is largely devoted to production of beef from improved indigenous and from indigenous/exotic stock. A limited number of ranches also produce some milk in addition to beef. The ^{up to} rift floor from Nakuru south is largely of this system, with individual ranches occurring in other areas. In our analysis distinction has been made between ranches with an emphasis on dairy or beef production and farms have been classified into two sub groups 4(a) Dairy Ranching, 4(b) Beef Ranching.

System 5

Plantation Agriculture. Coffee, tea, wattle and sisal are the main crops of this system. Relatively, they are small in number and total area, although single estates may be quite large. The system is found throughout the area in a variety of ecological situations best suited to the individual plantation crop grown.

Within each stratum, five main ownership types occur, ie individual, partnership, co-operative, company and miscellaneous ownership (eg ADC and SFT farms). The third factor taken into account was the management performance, (as defined by the extension officers).

Because of the relatively small sampling fraction (4.8 per cent of mixed farms were sampled) in relation to the variability of the sample units within the population, it was decided that a selected sample was necessary. This was based on the proportion of farms in the five systems and the five ownership types and three performance ratings (good, average and poor) found within the whole frame (information on the entire population was not available). It was considered that this method would best achieve the desired objective of obtaining information from all the important farm systems and organisation structures than the more conventional method of random selection when a number of important groups might be 'missed'.

It should be noted therefore, that although the analyses of data in Chapter 3 need not be (and were not intended to be) statistically valid, it is argued that the advantages to be gained from a formal random sampling procedure is out-weighed by the disadvantages from the possible omission of important farm types that would have inevitably occurred in

a sample of the size undertaken.

The distribution of farms and selection was given in Progress Report No 1 which outlined the number of farms in each district, system, ownership type and performance group to be selected. From this list the consultants (assisted by District Agricultural Officers) were able to select the appropriate number and type of farm to complete the sample. In practice the sample selected differed from the distribution originally decided upon. Firstly, there were a few managers who refused to be interviewed and in other cases the absence of the owner/manager from the farm prevented a visit being arranged. There were also instances where farms selected as being in System 2 (Maize farm^s) were subsequently found to fall within the definition of System 1 (Wheat farms), resulting in an increase in the number of System 1 farms at the expense of those in System 2. This has not thought to have effected the validity of the data. Finally it is noted that out of a target of 100 sample farms, 88 farms were visited and provided the team with information. Farms in systems 1 and 2 were unaffected by this, though a short-fall did occur in the remaining three Systems, particularly in the ranching sector where considerable difficulty was experienced in persuading managers to be interviewed. After some valuable field-time had been wasted it was decided to reduce the total sample number to the 88 farms visited, 28 in both Nakuru and Uasin Gishu, 24 in Trans Nzoia and 8 in Kericho. The distribution of the sample of farms visited is given in the following three tables and is shown in Map 3.

2.3 The Composition of the Sample

The distribution of the sample by the five systems, the five ownership types and performance is shown in Table 2.1

Table 2.1 Distribution of sample by system and ownership type

System	Ownership Type	Number of Farms
System 1	Commercial	2
System 1	Partly subdivided	11
System 1	Completely subdivided	15
System 2	Commercial	1
System 2	Partly subdivided	1
System 2	Completely subdivided	1
System 3	Commercial	1
System 3	Partly subdivided	1
System 3	Completely subdivided	1
System 4	Commercial	1
System 4	Partly subdivided	1
System 4	Completely subdivided	1
System 5	Commercial	1
System 5	Partly subdivided	1
System 5	Completely subdivided	1
Total		33

Table 2.1 Distribution of sample by system, ownership and performance.

Ownership	INDIVIDUAL		PARTNERSHIP		CO-OP		COMPANY		OTHER		TOTAL
	G	AP	G	AP	G	AP	G	AP	G	AP	
System											
1	8	7	4	4	-	3	-	5	1	1	33
2	5	4	2	14	-	5	-	9	1	-	40
3	1	-	-	1	1	1	1	3	1	-	9
4	-	-	-	-	-	1	-	3	-	-	4
5	1	-	-	-	-	1	-	-	-	-	2
Sub Total	15	11	6	19	1	11	1	20	3	1	88
Total	26		25		12		21		4		88

Notes: G = good management performance

A/P = average to poor management performance

The distribution of the sample by System and degree of sub-division is shown in Table 2.2.

Table 2.2 Distribution of sample by system and sub-division

Farm System	1	2	3	4	5	Total
Sub-division code						
Whole farm (A)	20	12	3	2	1	38
>60% commercial (B)	6	7	3	1	-	17
<60% commercial (C)	5	5	3	1	1	15
Completely subdivided (Less than 20 ha units) (D)	2	11	-	-	1	13
Completely subdivided (More than 20 ha units) (E)	-	5	-	-	-	5
Total	33	40	9	4	2	88

The sample was spread across four districts in a population approximating to the total number of farms found in each area. The distribution of the sample by district is shown in Table 2.3 below.

Table 2.3 Distribution of sample by district and farming system
(Nos of farms)

Farming System	DISTRICT				Total
	Nakuru	Uasin Gishu	Trans Nzoia	Kericho	
1. Wheat Dairy	13	14	2	4	33
2. Maize Dairy	3	12	22	3	40
3. High Altitude	8	1	-	-	9
4. Extensive Livestock	4	-	-	-	4
5. Plantation	-	1	-	1	2
TOTAL	28	28	24	8	88

2.3 Mean Farm Size

The mean farm size of the 84 'mixed' farms in the sample was 525 hectares, and of the four ranches 13129 hectares. The wheat farms of system 1 had a mean size above those in system 2 (maize farms), being 590 hectares and 443 hectares respectively. The mean farm size of the sample compares with the mean farm size calculated from a total of 1565 farms in the four districts of 634 hectares (mixed farms and ranches). The sizes of 'mixed' farms sampled ranged between 80 and 1795 hectares.

Table 2.4. Distribution of mean 'mixed' farm size by farming system (hectares)

Farm organisation		Whole Units			Commercial + Subsistence Farm			Subdivided			Mean Total Area
		Total	C	S	Total	C	S	Total	C	S	
System	1	562	562	-	686	436	269	338	-	338	590
	2	286	286	-	612	350	262	502	-	502	443
	3	836	836	-	457	247	210	-	-	-	583
	5	668	668	-	955	29	926	-	-	-	812
Mean Farm Size											<u>525</u>

- Notes
1. Total = total area of farm in hectares
 2. C = commercial area in hectares
 3. S = subsistence area in hectares
 4. The four ranches in the sample are not included in the calculation of the mean farm size.

RESULTS OF FARM SURVEY

3.1 Introduction

The analyses of the data collected during the farm survey are presented in this chapter. ~~The results are presented~~ X in three parts. The first part (Sections 3.2 and 3.8) deals with general information on farm infrastructure, credit and finance collected on all farms whether whole, partly subdivided or completely subdivided. In the second part (Sections 3.3 - 3.7) data referring only to the commercial or large scale farm area of whole or partly subdivided farms is analysed. Finally, the third part (section 3.9) deals with data on the subsistence plots or smallholdings of partly or completely subdivided farms.

3.2 Farm Infrastructure and Services

During the survey, information was recorded on the present condition of the farm buildings, roads, fences etc., throughout the sector.

The data reflected the subjective view of the enumerator, who graded the infrastructure or asset as "good", "average" or "poor" relative to the level encountered throughout the large farms. Although this method has obvious disadvantages, it was considered, in the time available, impractical to attempt to quantify the investment in buildings or roads, but that the data would provide an indication of the overall state of infrastructure and infrastructural needs.

Information was also collected on the farm services available, such as electricity and water, and the existence of, or potential for irrigation.

3.2.1. Farm Infrastructure

The general impression gained from the survey was that whilst the level of farm infrastructure (although often basic) was generally adequate, it had in many cases been developed by the former owners but has since been allowed to deteriorate. This deterioration is largely due to poor management or lack of capital and, if continued, will threaten the long term production potential of the sector. The grading of each item of infrastructure by district and management group is summarised in Tables 3.1 and 3.1(a) respectively.

(a) Roads

Farm roads in the three districts studied were by most "farm standards" generally adequate, though often in a deteriorating condition. This assessment was made during July, August and

September, thus allowing a critical appraisal to be made. Most farms surveyed were accessible by ordinary saloon car, except for areas in Kericho and in parts of Trans Nzoia.

Out of the total of farms visited, 25 per cent were estimated to have good roads, i.e. the farms were fully accessible, usually on gravelled or graded roads, and where feeder roads extended throughout the farm.

Table 3.1 Quality of Infrastructure and Services By District (Percentages) of Farms.

Infrastructure		District					All Districts
		Nakuru	Uasin Gishu	Trans Nzoia	Kericho	All Districts	
ROADS	Good	21	36	13	38	25	
	Average	46	39	54	38	45	
	Poor	32	25	33	25	30	
FENCES	Good	32	46	29	50	36	
	Average	43	25	17	-	29	
	Poor	25	29	54	50	35	
BUILDINGS	Good	43	43	25	63	40	
	Average	39	21	42	-	30	
	Poor	18	36	33	37	30	
IRRIGATION	Existing	4	4	17	-	7	
	Potential	25	46	46	13	36	
FARM SERVICES	Electricity	36	32	33	25	33	
	Water	89	79	71	50	77	
	Telephone	57	29	4	25	30	

Forty five per cent of the farms were assessed as average, and 30 per cent as poor. In the case of the latter group, this implied that the farms were inaccessible to vehicles other than those with four-wheel drive, and that only unmaintained tracks existed on the farm itself. In some cases a previously adequate farm road system had been allowed to deteriorate and erosion had made the roads impassable.

The variation in roads between districts is shown in Table 3.1 which indicates a low proportion of good roads in Trans Nzoia. A more useful comparison is that of the quality of roads related to management groups and subdivided farms (Table 3.1(a)) where, for example, all well managed farms had good or average roads and the majority of subdivided farms had poor roads. In some areas, access to subdivided farms was particularly difficult.

Table 3.1(a) Level of Infrastructure and Services by Management Performance (Numbers of Farms)

	Management	Good	Average Poor	Subdivided	All Farms	Percent All Farms
ROADS	Good	13	17	2	22	25
	Average	13	23	4	40	45
	Poor	-	18	8	26	30
FENCES	Good	22	7	3	32	36
	Average	3	19	3	25	29
	Poor	1	22	8	31	35
BUILDINGS	Good	21	12	2	35	40
	Average	3	23	1	27	30
	Poor	2	13	11	26	30
IRRIGATION	Existing	3	1	-	4	7
	Potential	11	13	5	29	36
FARM SERVICES	Electricity	17	12	-	29	33
	Water	23	35	9	67	77
	Telephone	16	9	-	25	30
Total Number of Farms in Category		26	48	14	88	100

(c) Buildings

The number and quality of buildings varied greatly between management groups, though little variation was observed between districts.

A number of farms classified as having poor buildings in fact had none at all. This was particularly true in the case of subdivided farms, but also occurred on some individually owned. On mixed dairy farms, simple open-structured cow sheds were the norm, some benefitting from a concrete floor, others not. On-farm crop storage is not normally a problem as most farmers sell to the Maize and Produce Board or other bodies within two months of harvest. Farms described as average or good would normally have some form of storage facility with capacity for most of the crop during this period.

Some 75 per cent of large farms classified as being in the average and poor management group and subdivided farms will require a building improvement maintenance programme to run concurrently with other more direct forms of investment.

3.2.2 Farm Services

Tables 3.1 and 3.1(a) give the number of farms with electricity (either mains or generator,) those with adequate water supplies (for both domestic purposes and for cattle) and the proportion of farms in the sample which had a telephone installed.

(a) Electricity

One third of the sample farms were supplied with electricity. Although, clearly an advantage, electricity is not a prime

requirement of efficient large scale farming operations as 9 out of the 26 well managed sample farms had no electricity. Significantly, no subdivided farm had the use of electricity, although they had in a number of cases been connected previously. In some farms the absence of electricity (in all types of farms) was due to a minor fault in the generator which had not been repaired, again lending weight to a general impression of deteriorating assets.

(b) Water

The majority of farms had adequate water supplies, although a number of respondents repeatedly stressed that lack of water was one of their major problems. This was particularly true when the farm contained a sizeable cattle herd and where lack of finance was preventing investment in a reservoir or borehole. On certain farms, therefore, water development will be a necessary investment before increases in production can be considered. It is noted that no attempt was made to ascertain the quality of water supply or to differentiate between sources; the data simply refers to the adequacy of the supply in relation to overall farm demand.

(c) Telephone

This is not, of course, an essential item and was present on only 30 per cent of the sample farms. There was however a wide variation in usage over the area studied. Thus, almost 60 per cent of the sample farms in Nakuru district possessed a telephone, compared to only 4 per cent in Trans Nzoia.

3.2.3 Irrigation

No large scale irrigation is practised on the farms surveyed, although some 7 farms (about 8 percent of the total) cultivated a small area of crops (usually vegetables) under irrigation. A further 36 farms (41 percent of the total) had potential for limited irrigation, but the number of farmers intending to invest in the necessary equipment was very few. In general, irrigation is not likely to play an important part in the large farm sector, although as the average farm size tends to decrease, intensification through irrigation of high value crops may become more widely applicable.

This initial grouping was used in selecting the sample of farms for detailed survey, particularly to ensure that the farms selected would represent the great variation which exists in the level of management. This assessment was based solely on the subjective opinion of the District Agricultural and Land and Farm Management Officers and of the Extension Officers in the various divisions. The criteria used included: the intensity of the farming system, utilization of recommended techniques and general impression gained from visits to farms. Farms which were already completely subdivided were generally regarded by the Extension Officers as falling into the group of very large. This is not necessarily true in every instance and some of these farms could be regarded as having average management overall. However, in both the initial assessment of management by the officers of the Ministry of Agriculture and the consultants' assessment made after completion of the farm analysis, farms which are completely subdivided are grouped separately. The assessments therefore refer to the farms as parts of large, which are organized on a large scale commercial basis. The consultants' assessment was made by the team members who had carried out the interview and was based on a comprehensive range of criteria which included: intensity of the farming system, performance in terms of yields, efficiency in use of resources such as machinery and labour, and of recommended practices and the general impression created. The assessments are summarized in Tables 3.2 and 3.3.

Farm Management and Indicators of Efficiency

3.3 Farm Management

3.3.1 Assessment.

In the initial appraisal of large mixed farms in Rift Valley Province (described in Progress Report No.1) farms were grouped into three categories of management; good, average and poor. This initial grouping was used in selecting the sample of farms for detailed survey, particularly to ensure that the farms selected would represent the great variation which exists in the level of management. This assessment was based solely on the subjective opinion of the District Agricultural and Land and Farm Management Officers and of the Extension Officers in the various divisions. The criteria used included; the intensity of the farming system, utilisation of recommended techniques and general impressions gained from visits to farms. Farms which were already completely subdivided were generally regarded by the Extension Officers as falling into the group of poor farms. This is not necessarily true in every instance and some of these farms could be regarded as having average management overall. However, in both the initial assessment of management by the Officers of the Ministry of Agriculture and the consultants' assessment made after completion of the farm analyses, farms which are completely subdivided are grouped separately. The assessments therefore refer to the farms or parts of farms which are organised on a large scale commercial basis. The consultants' assessment was made by the team member who had carried out the interview and was based on a comprehensive range of criteria which included; intensity of the farming system, performance in terms of yields, efficiency in use of resources such as machinery and labour, use of recommended practices and the general impression created. The assessments are summarised in Tables 3.2 and 3.3.

Table 3.2

Ministry of Agriculture Staff's Assessment of Management in Farms Selected for Detailed Survey.

District	ASSESSMENT			Subdivided ¹ Farms
	Good	Average	Poor	
Trans Nzoia	9	8	4	3
Kericho	2	2	4	-
Nakuru	11	7	9	1
Uasin Gishu	10	6	3	9
	32	23	20	13

Note 1. Completely subdivided farms with no large scale or commercial area.

TABLE 3.3

Consultants' Assessment of Management of Farms Selected for Detailed Survey

District	ASSESSMENT			Subdivided ¹ Farms
	Good	Average	Poor	
Trans Nzoia	7	7	7	3
Kericho	2	1	5	-
Nakuru	11	8	8	1
Uasin Gishu	8	6	5	9
	28	22	25	13

Note 1. Completely subdivided farms with no large scale commercial area.

3.3.2. Experience and Training

Nineteen Managers, or 25 per cent, had received at least one year of formal training. Of these, 14 (a high proportion) were assessed as good managers. However, of the 14 remaining good managers, four had attended short courses at farmers' training centres and ten had received no formal training at all. Although this would indicate that formal training may not be essential, there is little doubt that it will extend the capability of an inherently good manager and should not be neglected. A review of the existing large farm management training institutions will therefore form a part of this study. It is emphasised however that selection of the individual to undergo training is as important as the training itself.

The number of years experience as a manager or assistant manager was recorded for each of the managers or owner/managers interviewed. The number of years of experience ranged between one and twelve years, with an average between four and five years. The nineteen good managers had an average of 7 years of experience.

3.3.3 Farm Record Keeping.

In common with privately owned farms in other countries the quality and quantity of records kept was generally poor. As can be expected, however, it was better on farms where the manager was hired than on farms managed by the owner. A frequent failing in record keeping was that the system was rarely designed to aid management and in most instances records were not used in making management decisions. A persistently recurring example of this was found in dairy herds. On many farms daily milk yields were recorded for each cow, but only in a few instances were these daily yields summed at weekly intervals or at the end of the lactation. On a small proportion of farms, fuel and oil usage and repair costs were recorded. Usually, however, they were recorded in total, ^{and} could not be attributed to any specific machine and were hence of limited value.

A section of the survey questionnaire was allocated to collecting information on the type of farm records kept. In analysing this information, the recording system on each farm visited was graded into three groups; no records, basic records and detailed records. Basic records implied no more than information on all sales and purchases, mainly K.F.A. and K.C.C., being available in at least one or two files supported by a basic labour muster roll. In other words, receipts, invoices and statements were at least filed and available for use if required. Records were described as detailed where a deliberate attempt had been made to set up a formal system where information on yields and inputs such as seeds, fertilizer, chemicals, fuel and oil, labour, machinery was recorded. The incidence of record keeping is shown in Table 3.4.

TABLE 3.4 The Incidence of Record Keeping on Farms Visited.

RECORDS	Crops			Dairy/Livestock			Financial		
	Nil	Basic	Detailed	Nil	Basic	Detailed	Nil	Basic	Detailed
NOS.OF FARMS	24	26	19	25	18	27	23	29	23
PERCENTAGE OF TOTAL	35	38	28	36	26	39	31	39	31

3.4 Indicators of Management Efficiency

3.4.1 Crops

(a) Yields.

The information collected on crop yields was obtained from detailed farm records, delivery notes to K.F.A. or Kenya Seed Company or simply from the word of the farmer where no records or definite proof were available. The memory of the farmer had to be relied

upon mainly on farms where all or part of the crop was sold through unofficial channels to private dealers. The majority of sales were, however, substantiated by records or delivery notes to K.F.A. or the Kenya Seed Company etc., and hence the information obtained is considered to be a reliable indicator of yield levels during the 1975 season. It should be noted, however, that data refers to one year only and may not be representative of the yield obtained in an 'average' year. An attempt was made to determine whether the year in question was an average year or whether yields were higher or lower than those normally achieved. In Uasin Gishu the response to this query was that yields were lower than usual but in the Trans Nzoia and other districts it appeared that yields were at the normal level expected. Historical information on crop yields was only available on a very few farms and was thus of little value in determining whether 1975 was a normal season.

Yield data has been analysed primarily by farming system and by two management groups. The results from good farms are analysed separately whilst the average and poor farm results are bulked together. Within the farming system and management grouping, data on farms which are completely whole and data on the commercial area of farms which are partly subdivided are also analysed separately. The results of the analysis of yield data are given in Table 3.5

TABLE 3.5 - overpage

Table 3.5 Average Crop Yields (kgs/ha.)

Crops and Farm System	Whole Farm	Good Management		Average & Poor Management		
		Partly Subdivided Farms	All Farms	Whole Farms	Partly Subdivided Farms	All Farms
Maize:						
System 1	3321	3942	3393	-	-	3078
System 2	4905	3807	4539	3897	3528	3708
System 3	2250	-	2250	-	-	-
Wheat:						
System 1	2304	1836	2232	1422	936	1206
System 2	1026	-	1026	-	-	1395 ¹
System 3	1980	1746	1890	-	-	1530
Barley:						
System 1	-	-	-	-	-	1800
System 3	-	-	2700	-	-	2880 ¹
Sunflower:						
System 2	848	384	664	-	-	664
Beans:						
System 2	-	-	1332	-	-	288
Pyrethrum:						
System 3	-	-	665	-	-	372

Notes: 1 - Only one result available.

The most complete yield data was available for maize and wheat. Results for sunflower and beans were confined to farm System 2, and barley and pyrethrum mainly to System 3. As would be expected, the variation in results was considerably higher in the average and poor group of farms than in the good. In the good farms the standard deviation from the mean varied between 15 ^{and} 25 per cent of the mean X whilst with the average and poor farms it ranged between 25 and 35 per cent of the mean. Although yields on the whole farms frequently exceeded yields on the commercial area of partly subdivided farms, the results on the latter were too few to be significant.

Maize (Yields):

Amongst the "good" farms, the average yield in farm System 2 was 4539 kgs or 50.4 bags per hectare, considerably higher than in Systems 1 or 3. This is as expected and demonstrates that the areas where System 2 is practised are generally better suited to maize production. The mean yield on average and poor farms in System 2 was 3708 kgs (41.2 bags), again higher than the good Systems 1 and 3 farms.

The yields on the good farms in System 2 are strongly influenced by yields in the Trans Nzoia, where occasionally up to 8000 kgs per hectare are recorded. Therefore, yields in good System 2 farms, although higher than the others, fall far short of the potential yields achievable. It is worth noting that the average maize yield on ADC farms during the 1975 season was 4997 kgs per hectare.

Wheat (Yields):

Wheat yields were highest on the good System 1 farms where the mean of all the results obtained was 2232 kgs or 24.8 bags per hectare.

This is higher than the Ministry of Agriculture's estimates of average yields in Nakuru, Uasin Gishu, Trans Nzoia or Kericho Districts. Three farms in Njoro, however, achieved yields of over 2880 kgs (32 bags) per hectare. Wheat yields recorded on System 2 farms were generally very low, considerably less than yields on either Systems 1 or 3 farms.

Barley:

Barley yields were recorded on System 3 farms. Results, however, were few and hence a less reliable indicator than yields for maize or wheat. The average yield on good farms was 2700 kgs per hectare. Only one result was available for the average and poor farms and should therefore be discarded.

Beans:

Yields of beans were available on four of the farms surveyed, all of them in Trans Nzoia. On two farms, they were intercropped with maize and the yields were extremely variable. The mean on good farms was 1332 kgs per hectare which is approximately the average yield expected from pure stands. Only one result was available for the average and poor farms.

Pyrethrum:

Pyrethrum yields were available on System 3 farms. The average yield on good farms was 665 kgs of dried flowers per hectare and 372 kgs on average and poor farms. On all farms the plants were over three years old. Nevertheless, yields on the good farms were around the expected average.

(b) Levels of Inputs: Variable Costs

The data obtained on direct production costs is less reliable than that obtained on yields. Whereas the major proportion of crops sold was channelled through statutory marketing boards or their official agents, inputs such as fertilizers and agro-chemicals were purchased from numerous sources and because of poor

record keeping were not easily allocated between the different enterprises. The allocation of unskilled casual labour between different enterprises was also difficult. In most cases, therefore, the interviewer had to accept levels of input stated by the respondent and then cross-check with invoices or records available for the whole farm. Despite these limitations some general conclusions can be drawn:-

- Seed rates used at planting are usually at the recommended levels.
- Hybrid maize seed was used on all farms growing maize. Although a major proportion of wheat farmers purchased certified ^{seed} from Kenya Seed Company, some preferred to use their own seed.
- The amounts and types of fertilizer applied varied considerably. There was a general tendency to apply less than the recommended levels and on most farms top-dressing of maize with nitrogen, a recommended practice, was ignored.
- The recommended methods of pest control (stem-borer) in maize are usually carried out.
- Seed bed preparation for grain crops is fairly standard throughout, comprising three operations, one ploughing and two disc harrowings or two ploughings and one disc harrowing. In many instances, however, land preparation was late.

An analysis of the data collected on levels of inputs on direct costs is given in Table 3.6 .

TABLE 3.6 - overpage

Table 3.6 Mean of Direct or Variable Costs . (KSh./ha).

Crop and Farm System	Good			Average & Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
<u>Maize:</u>						
System 1	914	608	880	1062	797	885
System 2	978	1033	998	977	850	910
System 3	-	-	698	-	-	-
<u>Wheat:</u>						
System 1	664	610	654	644	589	619
System 2	684	-	684	681	-	681
System 3	639	779	695	-	-	1030
<u>Barley:</u>						
System 1	-	-	-	616	608	612
System 3	-	-	708	-	667	667 ¹
<u>Sunflower:</u>						
System 2	349	-	349	278	335	312
<u>Beans:</u>						
System 2	313	-	313	374	-	374
<u>Pyrethrum:</u>						
System 3			1670			750 ¹

Notes: 1 - One result only.

Maize:

The items regarded as direct costs and summarised in Table 3.6 included; seed, fertiliser, herbicides, insecticides and casual labour for weeding and harvesting. Tractor, machinery and transport costs have not been included, nor have gunneys or G.M.R. insurance. For the purpose of this analysis mechanisation costs are regarded as fixed (overhead) costs and the produce price used is ex-farm gate and net of the cost of gunneys. As G.M.R. was not universally applicable, G.M.R. insurance at 12/35 per hectare was also excluded.

Amongst the good farms the means for System ^s 1 and 2 ^{are} is K.Sh.880 and K.Sh.998 per hectare. The higher level in System 2 probably reflects the higher yields in System 2 and hence increased casual labour costs during harvest. Other inputs are of a similar level. In System 1 both the good and poor farm cost levels are of the same order whilst in System 2, the average and poor direct cost levels are lower, reflecting a difference in yield of some 830 kgs per hectare.

Comparing these levels with variable cost estimates¹ prepared for Trans Nzoia by the Ministry of Agriculture they are considerably lower at K.Sh.990 and K.Sh.1300 (the latter does not include mechanisation, gunneys and G.M.R. insurance, and hence is directly comparable). The difference is mainly accounted for by the ~~lower~~ ^{costs, applications} fertiliser applied being far less than the levels recommended. The average fertiliser cost on farms surveyed was K.Sh.305 per hectare whilst the cost of applying the recommended levels was in the order of K.Sh.700. Casual labour costs were slightly higher on the farms surveyed.

Note 1: Farm Management Information Handbook:
Trans Nzoia District: (1976 updated edition).
Ministry of Agriculture Extension Service.

Wheat:

The variable costs for wheat summarised in Table^{3.6} include only seed, fertilizer, herbicides and casual labour. Mechanisation, gunneys and G.M.R. insurance have been excluded. The means for each group vary between KSh.640 and KSh.695 per hectare, if the means of two results for ^{the} System 3 average and poor farms are excluded. The results indicate that the costs are lower than if the recommended levels of these three inputs (seed, fertilizer and herbicides) ^{had been} ~~were~~ used, i.e. KSh.740 per hectare. The difference again can be accounted for in lower levels of fertilizer use than is recommended.

Barley:

Considerably fewer results were obtained for barley than for wheat and maize. The costs summarised, however, include only seed, fertilizer and herbicides. They are of a similar order to those for wheat and to comparable estimates using recommended levels of inputs. The latter probably reflects the supervision of Kenya Breweries, for whom most of the barley is grown on contract.

Sunflower:

The data collected on variable costs of sunflower production contained considerably more variation than for maize, wheat or barley. The variations were almost entirely dependant upon the amounts of fertilizer used. This varied from nil to 2½ x 50 kg bags of compound fertilizer (at approximately KSh.140 per bag) per hectare.

Beans:

Only two results were available for beans and hence these cannot be regarded as a reliable indicator of the level of input used. In most cases seed and labour were the only inputs.

Pyrethrum:

The input levels and cost data for pyrethrum ^{were} ~~was~~ again available for a few farms. The data collected referred only to crops of over three years of age and hence costs ^{was} ~~were~~ mainly associated with the use of labour for picking, cutting back and weeding and drying. Fertilizer was not applied on any of the farms surveyed nor were chemicals used for weed or pest control.

(c) Crop Gross Margins

Crop gross margins have been calculated using the data on gross output and variable costs given in Tables 3.5 and 3.6. The gross margins are shown in Table 3.7 and indicate the relative profitability of the crops. It should be noted, however, that the variable costs for maize include harvesting as this was in almost every case carried out by hand using casual labour. Harvesting of wheat and barley was mechanised on every farm and either the farms' own combine harvester or a hired contractor was used. The charge for the latter varied between KSh.125 and KSh.175 per hectare. For the gross margins of the small grains and maize to be directly comparable, a harvesting charge of approximately KSh.150 per hectare should be deducted from wheat and barley.

Table 3.7 demonstrates the importance of growing crops in the areas to which they are agronomically best suited. Maize gross margins on System 2 farms are higher than either wheat or barley (in Systems 1, 2 and 3) and are only exceeded by pyrethrum on "good" System 3 farms. Wheat and barley gross margins, however, on Systems 1 and 3 farms (good management) are higher than maize gross margins on the System 1 areas or where maize is grown as the minor crop with wheat.

Sunflower does not compete with the three grain crops and should therefore take up only a minor proportion of cropping patterns. It should be noted, however, that no value has been attached to the sunflower heads which, after threshing, are crushed and used as cattle feeds.

3.7 Crop Gross Margins (Ksh./ha).

Crop and Farm System	Good			Average and Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
<u>Maize:</u>						
System 1	1392	1659 ¹	1445	1457	1281	1340
System 2	2643	1605 ¹	2297	1690	1600	1645
<u>Wheat:</u>						
System 1	1906	1392 ¹	1860	822	813	818
System 3	1522	1190	1356	-	-	690
<u>Barley:</u>						
System 3	1732		1732	-	-	925 ²
<u>Sunflower:</u>						
System 2	849	270	618	736	359	547
<u>Beans:</u>						
System 2	-	-	1912 ²			16 ²
<u>Pyrethrum:</u>						
System 3			2539			1230

Notes: 1 - Two results only
 2 - One result only and therefore of little value.

3.3.2 Dairy Herds

Only two results were available for beans; neither can be regarded as giving a reliable indication of their profitability.



Pyrethrum is clearly a high value, labour intensive crop ideally suited to the higher altitude areas and, because of the difficulties of securing adequate supplies of labour, to small scale or co-operative farming.

Milk yield data was collected from dairy units, records maintained on the farm, K.C.C. monthly returns of milk and cream sales at the local K.C.C. depot and in a few cases the farmers' estimates of monthly sales during the wet and dry seasons. Where production records were not kept and sales data was available, estimates of domestic consumption and quantity used in milk feeding were made and added to sales to give total production during the year (1975). This was then related to herd size of mature cows (dry and in milk) and the yield in terms of kg of milk per cow per year calculated. The results of this analysis are given in Table 3.10. The data has been analysed by the good systems and management groups as for crops. There is a major difference, however, between results from the various dairy systems; the major difference demonstrated is between the "good" and "average and poor" groups of farms. The mean yields from good farms was 1276 kg/cow per year (1065 gal/cow/year) and 802 kg per cow per year (676 gal/cow/year) from the average and poor farms. These yields are surprisingly low, given the considerable genetic potential of the cows. Milk yields have been recorded on a number of farms by the livestock recording Centre (Gwivasha). The average yields recorded for farms in similar areas to those in the survey sample were 1910 kg per cow per year.

3.4.2 Dairy Herds

The performance of dairy herds is less subject to year-to-year variation than yields of crops providing that there has been no widespread outbreak of disease such as foot-and-mouth.

Foot-and-mouth had spread throughout Trans Nzoia and parts of other districts during 1976 but during 1975 most districts were free of disease. The data obtained can therefore be regarded as representative of a fairly normal year. The herds surveyed in all but one instance comprised mainly exotic breeds or exotic crosses.

Milk yield data was collected from daily milk records maintained on the farm, K.C.C. monthly returns of milk and cream sales at the local K.C.C. depot and in a few cases the farmers' estimates of monthly sales during the wet and dry seasons. Where production records were not kept and sales data alone was available, estimates of domestic consumption and quantity used in calf feeding were made and added to sales to give the total production during the year (1975). This was then related to the number of mature cows (dry and in milk) and the yield in terms of kg of milk per cow per year calculated. The results of this analysis are given in Table 3.8. The data has been analysed in the same systems and management groups as for crops. There is no major difference, however, between results from the various farming systems; the major difference demonstrated is between the "good" and "average and poor" groups of farms. The mean yields from good farms was 1296 kg/cow per year (285 gallons per cow/year) and 802 kg per cow per year (176 gls/cow/year) from the average and poor farms. These yields are extraordinarily low, given the considerable genetic potential of the cows. Milk yields have been recorded on a number of farms by the Livestock Recording Centre (Naivasha). The average yields recorded for farms in similar areas to those in the survey sample were 1910 kg per cow per year.

TABLE 3.8 Mean Milk Yields From Farms Surveyed
(kgs/cow/year)

Farm Systems	Good			Average and Poor		
	Whole Farms	Partly subdivided farms	All Farms	Whole Farms	Partly Subdivided Farms	All Farms
System 1	1279	1263	1276	904	778	845
System 2	1285		1279	854	665	771
System 3			1410			904
Mean of all Farms			1296			802
SD			(393)			(323)

(b) Calving Interval

An attempt had been made to keep records of calving interval on a few of the farms surveyed. On all of the others, a crude estimate had to be made by relating the number of calves born in one year to the number of mature cows. Analysis of results for "good" farms indicated a calving interval of approximately 20 months whilst for the "average and Poor farms" it was 24 months. In both groups the interval was extremely long and an important contributor to the low yields obtained.

(c) Mortalities

Stock mortality is extremely high, particularly in young stock. The mean levels of mortality have been calculated for young and mature stock in good and average and poor farms. The result is shown in Table 3.9.

Table 3.9 Mortality in Livestock

	Mortality %	
	Good Farms	Average & Poor Farms
Calves (0.1yr)	14.5	20.0
Mature stock	4.8	11.3

(d) Gross Margins

Gross margins per cow have been calculated and are given in Table 3.10. Gross output has been taken as the value of milk sales, the value of milk used for domestic purposes and value of sales of cull cows, calves and surplus heifers. Variable costs included all purchased feeds, the value of homegrown cereals, dip, chemicals, veterinary bills and medicines and purchased minerals and mineral licks. Where fodder crops such as Napier or Calambas grass or grass leys were grown an annual charge covering establishment and maintenance was estimated and included in the variable costs.

Table 3.10 Gross Margins per Dairy Cow (KSh./cow)

Farming System	Good			Average & Poor		
	Whole Farms	Partly Subdivided Farms	Total Farms	Whole Farms	Partly Subdivided Farms	Total Farms
System 1	613	750	640	-	-	279
System 2	470	547	489	361	343	353
System 3			964			
			599			345

The gross margins per cow are low. On the "good" farms the mean was almost KSh.600 per cow and on the average and poor farms KSh.345. Given a carrying capacity of one mature cow per hectare on grass leys (arable land) and hence a gross margin of approximately KSh.600 per hectare, dairying does not compete in terms of profitability with arable crops. Although grass leys should have an important share in a cropping pattern, the farm survey indicated that on the majority of farms, grass leys were not being used to provide a break from cereal cropping. On many farms part of the arable area was cropped continuously and the original grass leys were allowed to revert to predominantly local species. A rotation was not being practised and none of the benefits from a grass ley break were being realized. In effect, a part of the farm was being devoted to a less profitable enterprise.

Grass leys are an essential part of the cropping pattern; they should be used as a break from continuous arable cropping, but given the present level of management in dairy herds, should be kept to the minimum necessary.

Management of dairy herds and dairy husbandry is perhaps the weakest part of the mixed farming systems. Milk yields are low due to poor feeding and long calving intervals. Production is distinctly seasonal, with yields dropping by two thirds during the dry months. On the majority of farms no attempt is made to conserve fodder for this four month period.

Bad husbandry is also reflected in the high levels of mortality, particularly in young stock. It is interesting that on most farms herd sizes remain static despite a small proportion of culls and few calves and heifers sold; the natural increase is in most cases being offset by high mortality.

3.4.3 Whole Farm Analysis

The information collected on the individual enterprises on each farm has been combined to present a picture of the intensity and yield performance of operations on the farm. Six parameters relating to the whole farm have been estimated. They are:-

- Intensity of use of cultivable land
- Livestock stocking intensity
- Gross output per hectare
- Gross margin per hectare
- Gross output per cultivable hectare
- Gross margin per cultivable hectare

(a) Intensity of Use of Cultivable Land

Information was collected on the area of each farm which could be cultivated. The data collected on present land use particularly the cropped area, was then compared with the potentially cultivable area to give an indication of the intensity with which cultivable land was currently being used. Temporary grass leys and fodder crops were included with the cropped areas except where grass leys had been established for longer than three years. The results of the analysis of intensity of use of cultivable land are summarised in Table 3.11.

Table 3.11 Intensity of Use of Cultivable Land

a

Farming System	Good Farms (% Intensity)	Average & Poor Farms (% Intensity)
System 1	74	77
System 2	53	45
System 3	78	79

Table 3.11 indicates that there is little difference in intensity of cultivation on Systems 1 and 3 farms; nor is there any marked difference in intensity of cultivation between the good and average and poor farms within these systems. The intensity of cultivation in System 2 farms is considerably lower (by 20%) and there is a significant difference between good and average and poor farms. It is possible that this results from maize being a more labour demanding crop (weeding and harvest) than wheat. Managers frequently stated that they had difficulty in hiring, organising and controlling labour and their reaction may be one of reducing their maize area. In some instances managers were changing to wheat because of these difficulties.

(b) Stocking Intensity

An estimate of stocking intensity has been made on those farms for which data is available by comparing the stock actually carried on the farm with the estimated carrying capacity. The factors used to convert various types and ages of stock to Livestock Units and the estimated carrying capacities of natural grazing, grass leys, fodder crops and crop residues are given in Appendix I. The results of the analysis of stocking intensities are summarised in Table 3.12

Table 3.12 Mean Stocking Intensities¹ on Farms Surveyed.

Farm Systems	Good Farms			Average & Poor Farms		
	Whole Farm	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
System 1	108	100	102	96	184	131
System 2			110	113	124	119
System 3		108				
System 4		144				
System 5		137				179

Note 1: Index Used = $\frac{\text{Actual Stocking (LU)} \times 100}{\text{Estimated Carrying Capacity (LU)}}$

On the good farms, stocking rates were reasonably well adjusted to the grazing and fodder available. The values were reasonably close to the optimal on the majority of farms (Systems 1,2 and 3). On the poor and average farms there was extreme variation in stocking intensities with gross understocking and gross overstocking. Although the means indicate overstocking, the standard deviation from the mean was as high as 60 per cent of the mean value. There was therefore very poor adjustment of stock carried to carrying capacity which is not wholly reflected in the mean figure.

(c) Gross Output per Hectare

The total gross output from all of the enterprises on each farm have been summed to give a total gross output for the farm. This has then been related to the farm area to give a farm gross output per hectare. The mean gross output per hectare for each group of farms is given in Table 3.13.

Table 3.13 Mean Gross Output per Hectare

Farming System	Good			Average & Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partiy Subdivided	Total
System 1	1326	752	1211	587	302	468
System 2	1115	949	1073	654	529	588
System 3			988			571
	TOTAL		1096			546

Table 3.13 shows that differences in gross output per hectare between systems is slight. The lower intensity of use of cultivable land in System 2 farms is compensated for by the higher gross output per hectare from maize.

(d) Gross Output per Cultivated Hectare

A small number of the farms surveyed had a high proportion of uncultivable land which meant the estimate of gross output per hectare was of little value except when the farm was being compared with farms with a similar proportion of uncultivable land. The gross output has therefore been compared with the area of cultivable land. The results of this analysis are given in Table 3.14.

Table 3.14 Mean Gross Outputs per Cultivable Hectare.

Farming Systems	Good Farms			Average & Poor Farms		
	Whole Farms	Partly Subdivided Farms	Total	Whole Farms	Partly Subdivided Farms	Total
System 1	1709	1176	1612	1280	1300	1287
System 2	1603	1076	1472	1017	935	980
System 3			1991			953
			<u>1629</u>			<u>1075</u>

(e) Gross Margin per Hectare

Enterprise gross margins have been combined to give a total gross margin for each farm. This again has been related to the total area and the cultivable area of each farm to give a gross margin per hectare and gross margin per cultivable hectare. The results of these analyses are summarized in Table 3.15. Given the variation within the data (standard deviation around 35 per cent) the differences between the mean values for each system are of little importance. The major difference demonstrated is between the "good" and "average and poor" farms.

3.3 Use of Machinery

Table 3.15 Mean Levels of Gross Margin per Hectare and Gross Margin per Cultivable Hectare.

Farming Systems	Good			Average & Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
<u>GM per hectare:</u>						
System 1	934	517	873	-	-	332
System 2	779	554	723	332	381	357
System 3	-	-	666			283
	TOTAL		788			330

GM per cultivated hectare

System 1	1255	786	1177			740
System 2	1128	630	1004	553	600	574
System 3			1 97			296
			1139			614

3.3.1 System 1 Mixed/Dairy Farms

(a) Capital Investment in Machinery

The investment in machinery on System 1 farms shows considerable variation throughout the sample. It encompasses the extreme

3.5 Use of Machinery

A considerable amount of data was collected on the complement of machines and use of machinery contractors on the farms visited. The aspects covered included the numbers, age and type of each machine (tractors included), costs of oil, fuel and repairs, costs of contracting services used, and machinery maintenance and servicing facilities on the farm. This data has been analysed in terms of the total investment in machinery on the farm and the annual machinery costs (including depreciation, fuel, oil, insurance, repairs and contractors' services). The latter has been related to gross output from the farm to give an indicator of efficiency of use. The analyses have been carried out for the two management groups "good" and "average and poor" farms and by farming system.

It is emphasised, however, that the costs presented are best used for comparison purposes rather than as absolute values. In estimating the total investment in machinery, current prices were used and the value written down according to the age of the machines. Similarly, for depreciation charges, the current prices were used and an annual cost estimated using an assumed life for each machine. This methodology may lead to an over-estimate of the actual costs. However, to have attempted to use the original purchase prices might have proved an impossible task and certainly would have meant that the level of investment was underestimated. The assumptions and costs used are given in Appendix 2

3.5.1 System 1 Wheat/Dairy Farms

(a) Capital Investment In Machinery

The investment in machinery on System 1 farms shows considerable variation throughout the sample. It encompasses the extreme

range from farms possessing no machinery whatsoever, which rely entirely on contractors, to fully mechanised farms employing farm equipment only. Most farms in the sample, however, use their own equipment for basic operations and contractors' services for operations requiring more specialised or high cost equipment (e.g. spraying and combining).

The average capital value of the machinery investment is shown in Table 3.17. On "good" farms it was estimated to be 368,000 shillings, equivalent to 690 shillings per hectare. These farms relied on their own farm machinery for most operations. The investment per cultivated hectare was equivalent to 1225 shillings.

By contrast, the "average and poor" farms had an average investment per farm of only 111,000 shillings (about one third of the level of investment in the "good" group). As expected, the level of investment varied considerably. Three of the 18 farms within this group had no machinery at all. The average investment was equivalent to 227 shillings per farm hectare and 711 shillings per cultivated hectare. Although none of the farms had an investment above the average level of the "good" group, a few "average and poor" farms matched the well managed farms in terms of investment per cultivated hectare. The gross output from sales of crop and livestock produce however remained poor.

Table 3.17 overpage

Table 3.17 Average Numbers of Tractors and Capital Value of Machinery (System 1)

	Standard	Good			Average and Poor		
		Whole Farm	Partly Subdivided	Total	Whole Farm	Partly Subdivided	Total
No tractors per farm	4.6	1.5	4.1	2.9	1.7	2.3	
Cultivated area per tractor ha. ¹	87	201	104	74	86	80	
Value of machinery Sh.	386470	269130	368420	119160	103488	111325	
Value of machinery per hectare Sh.	628	1033	690	238	215	227	
Value of machinery per cultivated hectare Sh.	1104	1804	1225	692	729	711	

Note: 1 - Excludes farms with no tractors.

The services of contractors are frequently available and it is therefore difficult to determine an optimum level of machinery investment incorporating a mix of 'own farm' and contractors' services. From the experience of the sample of farms there does, however, appear to be an economic maximum/minimum range in which farms can vary their level to suit individual needs. Judging from the investment in machinery in the "good" group, a value of machinery of about 900 shillings per farm hectare and 1200 shillings per cultivated hectare would appear to be the "preferred" maximum level at current yields and prices. Farm models have not yet been constructed based on the assumption that all machinery was purchased new, although it is expected that these would indicate a higher level of investment than the farms in the sample.

At the other end of the scale, it would appear that at least some investment in machinery is desirable, if only to reduce the rigidities of a system based entirely on hired equipment. Unfortunately, there is insufficient information on gross output from farms relying on contractors' services to evaluate this aspect objectively.

Most of the farmers interviewed owned at least some of their own machinery, though the level of investment during the early years of a farm's operation appeared to be geared to capital availability rather than being based on a detailed examination of the financial implications. On the poorer managed farms, capital is obviously a limiting factor and the low level of investment would support this. As a general principle, farms in this category should not be encouraged to "tie up" scarce working capital in machinery, and in most cases they appear to be following this course. It is possible, however, that the average investment figures taken by themselves obscure certain features of the 'poor' farms. Whilst investment in overall terms is low (and probably correctly so) it is often due to the purchase of a few pieces of expensive new equipment and very little else, whereas a more appropriate course of action would be to select a wider range of second-hand equipment. Other farms attempted to rely mainly on obsolescent basic equipment, yet purchased new crop sprayers which would be only rarely used.

(b) Annual Machinery Costs

The average annual machinery costs (depreciation, operating, maintenance and contracting services) are given in Table 3.18.

Table 3.18 overpage

Table 3.18 Average Machinery Costs (Sh.) and Output per 1000/- Machinery Costs.

	Good			Average and Poor		
	Whole Farms	Partly Subdivided Farms	Total	Whole Farms	Partly Subdivided Farms	Total
Total annual costs	219630	102001	198245	86880	120789	101010
Cost per ha.	359	251	339	272	240	263
Cost per cultivated ha.	675	771	692	861	850	856
Farm gross output per 1000/- machinery cost	3511	3164	3448	2667	2024	2453
Crop gross output per 1000/- machinery cost	2941	2395	2842	2307	1745	2082

On the "good" farms, the annual machinery costs averaged 359 shillings per hectare and 692 shillings per cultivated hectare. Except in the case of one farm which had recently purchased a range of new equipment and another where a large wheat area allowed considerable economies of scale, costs varied between 460 shillings and 880 shillings per cultivated hectare. The average cost of 692 shillings per cultivated hectare compares with the estimated cost of contractor charges to complete all operations, of between 800 - 900 shillings per hectare.

The "good" farms achieved an average gross output of 245 shillings per 100 shillings of machinery cost, and an average gross output of 245 shillings per cultivated hectare. The machinery costs on "average and poor" farms were at a lower level, averaging 263 shillings per farm hectare. When calculated in terms of the cultivated area, however, costs were generally higher than on the "good" farms and averaged 856 shillings per hectare (i.e. an increase of 25 per cent). This difference in costs appears to be due to a number of factors.

Firstly, this group whilst maintaining a low investment per cultivated hectare, and hence incurring low depreciation charges, tend to have higher tractor running costs (both fuel and repairs) than in the case of the well managed farms. Secondly, greater reliance is placed on the services of contractors: in some cases the manager had attempted to perform farm operations with unreliable machinery, fell behind with the work, and then brought in contractors. One farm had a machinery cost of some 1150 shillings per hectare, compared to the estimated 800-900 shillings per hectare required for contractors alone. In others, the level of investment and hence the depreciation costs were above those justified by the area of arable land involved. Over-mechanised farms were found in all ownership types including S.F.T. farms, although they form a minority of the poorly-managed group.

(c) Machinery Costs and Farm Gross Output

Machinery costs alone cannot be directly interpreted as being at an economic level unless they are discussed within the context of the whole farm system and particularly in relation to use of labour and to overall farm output. In this analysis, the gross output from the farm's arable enterprises was compared with the cost of machinery, and used as an indicator of management efficiency, the reason being that a dairy or beef herd on a mixed farm can make a considerable contribution to the farm gross output, whilst at the same time receiving very little direct benefit from the investment in machinery. This is particularly important as only a minority of farms regularly sow leys as part of the arable rotation.

The "good" farms achieved an average gross output of 3450 shillings per 1000 shillings of machinery cost, and an output from arable enterprises of 2840 shillings per 1000 shillings of machinery. The most efficient producers were achieving a gross output to machinery cost ratio of over 4:1. The "average and poor" farms typified by high costs and low output had a much lower ratio. In these, gross output per 1000 shillings of machinery cost was 2450 shillings, and crop output 2100 shillings. In two poorly managed farms, gross output had declined to almost 1000 shillings per cultivated hectare, and in one case was substantially below.

A similar pattern is repeated when gross output is compared to the cost of labour and machinery (discussed in Section 3.7).

(d) Service Facilities

Access to on-farm service facilities is shown in Table 3.19

Table 3.19 Availability of Service and Repair Facilities

	Good			Average and Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
Service Only (%)	100	100	100	78	78	78
Minor repairs (%)	100	100	100	56	44	50
Major repairs (%)	45	50	46	11	22	17

All farms in the "good" group carried out at least minor repairs on the farm, and about half of the farms sampled had facilities for major machinery repairs and overhaul. The average/poor management group were less well equipped. About a quarter had no provision even for a basic tractor service and only half of the farms carried out minor repairs. 17 per cent attempted major repairs.

3.5.2 System 2 Maize/Dairy Farms

Within the "good" farms, there appears to be a considerable difference (a) Capital Investment in Machinery (Table 3.21), between the whole farms and the subdivided farms.

The pattern of machinery investment on the maize/dairy farms indicates that farms in the good management group are investing considerably more in machinery than the "average and poor" farms, by a factor of about 3:1.

Machinery investment levels are summarised in Table 3.20. "Good" farms averaged 712 shillings per hectare and 2288 shillings per cultivated hectare respectively. "Average and poor" farms had invested 226 shillings per hectare and 745 shillings per cultivated hectare. It should be noted, however, that there was considerable variation in the latter, probably accounted for by the differing use of contractors.

Table 3.20 Average Numbers of Tractors and Capital Value of Machinery (System 2).

	Good			Average and Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
Tractors per farm	2.2	2.0	2.2	1.0	2.0	1.6
Cultivated area per tractor. Ha.	40	122	61	36	48	42
Value of machinery Sh.	178000	94340	155580	18990	168110	84230
Value of machinery per ha. Sh.	873	227	712	135	343	226
Value of machinery per cultivated ha. Sh.	2875	527	2288	500	1061	745

(a) Annual Machinery Costs and Farm Gross Output

Within the "good" farms, there appears to be a considerable difference in machinery investment and annual machinery costs (Table 3.2 1), between the whole farms and the commercial areas of partly subdivided farms. In the latter, both are lower. This may be of no importance as only two farms in the category were able to supply information. Given the variation in the data this is clearly too few to have any significance.

Comparing the investment in machinery on the maize/dairy farms with the wheat/dairy farms, it can be seen that the capital investment in machinery is at a similar level. When compared on the basis of the farm's cultivated area, maize farms had a higher level of investment in the "good" management group. There is no obvious explanation for this, and the fact that the cultivated area per tractor is little more than half that found on the dairy/wheat farms. It is possible that the optimal maize planting season is more restricted and that maize farms have in general a smaller area under cultivation, giving less opportunity to spread costs.

(b) Annual Machinery Costs

The average cost of machinery in the "good" farms was 216 shillings per hectare and 699 shillings per cultivated hectare. The "average and poor" farms again emerged as relatively high cost producers (particularly the group farms) with an average of 147 shillings per farm hectare and 1050 shillings per cultivated hectare. The reasons are similar to those discussed for the wheat/dairy farms. In addition, a considerable variation in the proportion of cultivated land to the whole farm area occurred between farms in the sample. About three quarters of the sample farms have less than 20 per cent of the farm area cultivated. The remainder varied between 21 and 50 per cent. Because most farms within this System are also relatively small, as discussed in the previous section, 'lumpy' machinery purchases may not be as effectively utilised as on wheat/dairy farms.

(d) Service Facilities

(c) Annual Machinery Costs and Farm Gross Output

Machinery service facilities are shown in Table 3.22. In general the gross output from arable and livestock enterprises per 1000 shillings of machinery was 3450 shillings within the "good" group of farms and 2450 shillings in the "average and poor". (See Table 3.2 1.) This efficiency indicator shows considerable variation between farms, particularly where the dairy enterprise is a more important contributor to the farm income than maize: for all farms, however, the farm gross output per 1000 shillings of machinery was higher than on the wheat/dairy farms.

Table 3.2 1 Average Annual Machinery Costs per Hectare and Gross Output per 1000/- Machinery Cost.

Standard	Good			Average and Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
Total Farm (Sh)	70040	83220	73810	19870	72550	35680
Costs per ha. (Sh)	234	171	216	122	205	147
Cost per cultivated ha. (Sh)	832	365	699	805	1622	1050
Farm Gross output per 1000/- machinery cost	5453	6153	5570	4580	2203	3788
Crop Gross output per 1000/- machinery cost	3046	3205	3091	2394	1404	2097

The crop gross output per 1000 shillings machinery costs is 3091 shillings and 2097 shillings for "good" and "average and poor" farms respectively. These are remarkably similar to System 1 farms (Table 3.18), the maize farms' higher machinery costs being compensated for by higher gross output from maize.

(d) Service Facilities

Machinery service facilities are shown in Table 3.22. In general, maize/dairy farms are less well served than wheat/dairy farms, only 13 per cent of the "good" farms having major repair facilities. In the "average and poor" farms over 40 per cent of the sample had no service facilities at all. The relatively small size of these farms may be a contributory factor in this case.

Table 3.22 System 2: Machinery Repair and Servicing Facilities on the Farm

Facility	Good			Average and Poor		
	Whole Farms	Partly Subdivided	Total	Whole Farms	Partly Subdivided	Total
Basic Service %	100	100	100	70	63	67
Minor Repairs %	100	100	100	60	50	56
Major Repairs %	-	50 ¹	13	10	13	11

Note: 1 - Only two farms in this group.

3.5.3 System 3: High Altitude Farms

(a) Capital Investment in Machinery

Only seven System 3 farms (ie. high altitude farms, usually growing wheat as a main crop with pyrethrum, beef and sheep as subsidiary enterprises) provided complete data on machinery investment and costs. Whole and partly subdivided farms have not been analysed separately.

Of the farms studied, investment in machinery was at a similar level to the farms in System 1, and averaged 630 shillings per hectare and 1240 shillings per cultivated hectare. The farms in the "average and poor" group had machinery investments of about half this level. (See Table 3.23).

Table 3.23 System 3: Average Number of Tractors and Capital Value of Machinery

	Good	Average and Poor
Tractors per Farm	3.5	2.0
Cultivated area per tractor (ha.)	82	112
Value of machinery (Sh)	510110	147400
Value of Machinery per ha.(Sh)	630	384
Value of Machinery per cultivated ha.(Sh)	1243	597

(b) Annual Machinery Costs

The Machinery costs are generally lower than in Systems 1 and 2 farms. On "good" farms the costs were 280 shillings per farm hectare and 580 shillings per cultivated hectare; on the "average and poor" farms they were 250 shillings and 470 shillings respectively. The difference between the two management groups was opposite in trend to the other two systems, where the better managed farms kept machinery costs below those on the poorly managed farms. The sample, however, is small, and it is unlikely that the difference is of any significance.

Facility	Good	Average and Poor
Basic Service only	100	45
Minor Repairs	100	25
Major Repairs	50	23

(c) Annual Machinery Costs and Farm Gross Output

The gross output on "good" farms was 4350 shillings per 1000/- of machinery cost (this lies between the level achieved on Systems 1 and 2). In the "average and poor" management group it was 3880 shillings. The most efficient producers in this System were achieving an output/machinery cost ratio of 5:1. Machinery costs in relation to farm gross output are given in Table 3.24

Table 3.24 System 3: Average Annual Machinery Costs and Output per 1000/- Machinery Cost.

	Good	Average and Poor
Farm total annual machinery cost (Sh)	191450	113930
Cost per ha. (Sh)	281	250
Cost per cultivated ha.(Sh)	583	465
Farm gross output per 1000/- machinery cost	4354	3879
Crop gross output per 1000/- machinery cost	NA	NA

(d) Service Facilities - System 3

The availability of service facilities on the farms are shown in Table 3.25 and are comparable to those found in the other Systems.

Table 3.25 System 3: Machinery Repair or Servicing Facilities on the Farm.

Facility		Good	Average and Poor
Basic Service only	%	100	66
Minor Repairs	%	100	66
Major Repairs	%	50	33

3.6 Labour

3.6.1. General

The study and analysis of labour use on the farms in the sector has been confined to a comparison of the overall level of labour use and cost on the three main Systems studied. The efficiency of labour use has been compared by calculating gross output in relation to labour costs alone, and also to labour and machinery costs. No attempt has been made to allocate labour costs to individual enterprises, nor have profiles of labour use been derived from the information supplied.

3.6.2 Analysis of Labour Use

On the majority of farms studied within farming Systems 1, 2 and 3 approximately three-quarters of the annual wages expenditure is taken up by permanent employees. (Table 3.26). An exception to this occurred in the good System 2 farms; no obvious explanation for this is available.

The costs of labour on the "good" farms for Systems 1, 2 and 3 were 139, 202 and 199 shillings per farm hectare. Costs in the "average and poor" were generally lower in all Systems. This difference is to be expected and is probably due to the lower intensity of land use on these farms.

Table 3.26 overpage

Table 326 Labour Costs; Gross Output per 1000/- Labour and Per 1000/- Labour and Machinery.

	Good			Average and Poor		
	Whole Farm	Partly Subdivided	Total	Whole Farm	Partly Subdivided	Total
<u>System 1</u>						
Permanent Labour as percentage of total labour %	73	70	73	72	88	77
Labour Cost per ha. (Sh)	142	105	139	83	33	68
Gross output per 1000/- labour (Sh)	10382	5868	10006	10140	6278	9174
Gross Output per 1000/- labour and machinery (Sh)	2584	1747	2500	2036	-	2036
<u>System 2</u>						
Permanent Labour as percentage of total labour cost %	71	34	64	74	84	79
Labour cost per ha. (Sh)	153	306	202	126	116	121
Farm Gross Output per 1000/- of labour cost (Sh)	6299	4465	5932	5392	5568	5451
Farm Gross Output per 1000/- of labour and machinery (Sh)	3108	2587	3004	2134	1635	1990
<u>System 3</u>						
Permanent Labour as percentage of total labour cost %			88			60
Labour cost per ha. (Sh)			199			170
Farm Gross Output per 1000/- of labour cost (Sh)			10053			6292
Farm Gross output per 1000/- of labour and machinery			3255			2371

As with machinery costs, the farm gross output has been related to 1000 shilling^s labour costs. The mechanised wheat farms in Systems 1 and 3 were the most efficient farms in this respect. In the "good" group the input/output ratio was 1:10. The "average and poor" farms had a gross farm output of 9200 shillings and 6300 shillings per 1000 shillings of labour costs in Systems 1 and 3 respectively. AB X

On the maize/dairy farms (System 2) which rely more heavily on labour, for weed control and harvesting, a generally lower input/output ratio was achieved despite the higher gross output. The well managed farms in this System gave a gross output of 5900 shillings per 1000 shillings of labour and the "average and poor" farms 5450 shillings.

A thorough examination of labour would require comment on seasonality of labour use, allocation of labour between various enterprises, present wage levels and supply of labour in and adjacent to the large farm sector. These aspects were not covered in detail during the farm survey, and only general impressions were obtained. It was clear, however, that some of the larger farms were, where technically possible, attempting to substitute machinery for labour. This policy included the expansion of the wheat area at the expense of maize and the use of herbicides instead of hand labour on maize farms. Some large farms in the high altitude zone have now abandoned the growing of pyrethrum, mainly due to the problems of organising large gangs of labour and also because of the difficulty of obtaining an adequate and reliable supply. On most farms, milking was performed entirely by hand, although some farmers expressed the intention to change to machine milking, another indication of this trend.

3.7.. Farm Gross Output compared to Labour and Machinery Costs

The efficiency of the three major farming Systems in terms of gross output and combined labour and machinery use was examined. (Table 3.26).

3.3. Credit and Finance

The lack of capital is generally regarded as one of the primary factors contributing to the failure of the large farm sector.

The most efficient users of labour and machinery appeared to be System 3 farms, which gave a gross output per 1000 shillings of labour and machinery of 3250 shillings. On the well managed farms in System 2 (maize/dairy) the gross output was 3000 shillings and on System 1 farms (wheat/dairy) it was 2500 shillings.

In the case of the "average and poor" group the average farm gross output per 1000 shillings of labour and machinery was similar throughout the three systems, varying between 1990 and 2370 shillings.

Although owners were sensitive to explicit financial questions, in some instances full co-operation was given. Exceptions did occur, however, on subdivided farms where individuals were reluctant to work with others. This affected the group as a whole. Nevertheless the response to financial matters was better than had been anticipated.

3.4

It is not intended that the data presented should be taken as indicative of a global picture of indebtedness throughout the large farm sector. This will be dealt with by the consultants' Credit Specialist. The results from the farms surveyed may indicate a better overall picture than is actually the case. However, it would appear that in the past 18 months there has been a marked improvement in the financial situation in the large farm sector.

3.5.1 Land Purchase

Of the total farms surveyed, 84 farms supplied information on land purchase. This analysis concentrated on determining the proportion of farms in the sector which fully paid for the land. Those which were ahead of their loan repayment schedule, those which were up-to-date and the proportion of farms with land purchase loan arrears.

The data given in Table 3.5.1 illustrates the financial status of farms in the good management group, the average and poor group and the subdivided farms.

3.8. Credit and Finance

The lack of capital is generally regarded as one of the primary factors contributing to the decline of the large scale farm sector. The financial status and degree of indebtedness was therefore investigated on the farms surveyed. In particular an attempt was made to determine the following:-

- the amounts borrowed for land purchase
- the amounts borrowed for land development and purchase of assets
- the amounts borrowed for short term crop loans (GMR)
- the loan agency and terms of the loan
- arrears in repayments for each type of loan

Although owners were sensitive to explicit financial questions, in most instances full co-operation was given. Exceptions did occur, however, on subdivided farms where individuals were reluctant to speak about affairs that affected the group as a whole. Nevertheless the response to questions on financial matters was better than had been anticipated.

It is not intended that the data presented should be taken as complete or a global picture of indebtedness throughout the large farm sector. This will be dealt with by the consultants' Credit Specialist. The results from the farms surveyed may indicate a better overall situation than is actually the case. However, it would appear that in the past 18 months there has been a marked improvement in the arrears situation in the large farm sector.

3.8.1 Land Purchase

Of the total farms surveyed, 64 farms supplied information on land purchase. This analysis concentrated on determining the proportion of farms in the sample which had fully paid for the farms, those which were ahead of their loan repayment schedule, those which were up-to-date and the proportion of farms with land purchase loan arrears.

The data given in Table 3.27 illustrates the situation for 3 farm groups; the good management group, the average and poor group and for all subdivided farms.

Table 3.27 Status of farms regarding Land Purchase Loans (percent)

Group	Paid in Full	Ahead of Payments	Up to date	in arrears	Total
Good Management group	29	24	35	2	100
Average/Poor Management group	21	6	44	29	100
Sub-divided farms	54	nil	31	15	100
All farms	30	9	39	22	100

Note: Loans from commercial banks were not included.

Almost all the farms (98 percent) classified as having good management had been paid for in full or were purchased by means of a loan, whose payments were either up-to-date or ahead of schedule, thus only 2 per cent of this group had loan arrears. In the average/poor management groups, 21 per cent of the farms had been paid for in full (as compared to 29 per cent in the good management group) and 50 per cent were either up-to-date or ahead of payments. In this class 29 per cent of the farms had loan arrears, more than in any other of the three groups.

Of the 14 sub-divided farms in the sample, only two had land loan arrears and 31 per cent were up-to-date on repayments. Significantly, over half of the farms had already paid-off their loan commitments and owned the land outright. In the case of sub-divided farms this pattern is of course well established and is carried out by the shareholders/partners in an attempt to reduce group commitments and also with a view to obtaining acceptance of their sub-divided status.

The amounts involved in land loan arrears were not large, and based on information supplied by farms, they averaged slightly over KSh 10,000

per farm, the maximum repayment outstanding amounting to KSh 24,000.

Of the farms which had taken out long-term loans, usually for 20-25 years terms, annual repayment commitments were not high by the standard of, for example, GMR repayments. The average repayment level in the sample was KSh 14,300 per farm. It varied from a few thousand shillings a year to KSh 52,000. Farms which had been purchased using short term (2 - 3 years) loans were excluded from the calculation of this mean.

3.8.2 Loans for purchase of assets and development loans

Loans for the purchase of a farms' ^emovable assets such as livestock and machinery are sometimes covered in the overall long-term purchase loan agreed between the buyer and the lending agency. In other instances a separate medium-term development loan is taken out, perhaps several years after the purchase of the land, to finance new machinery or livestock. A third type of medium-term development loan may also be provided to carry out conservation or drainage works. X

For the purpose of the analysis all medium-term loans have been treated together. An attempt has been made to establish the proportion of farms in the sample which in 1976 still had medium-term loan commitments, the average level of annual repayments, the number of farms which were in arrears, and the average amount in arrears.

Of the total of 88 farms, about one quarter failed to provide information on whether or not they had any medium-term loan commitments. Of the remainder, 61 percent had either never taken out a medium-term loan or had repaid an earlier loan (Table 3.28). The 39 percent of farmers with current loans faced an annual repayment schedule of KSh 21,070 per farm. The loan period varied throughout the sample from between 3 to 15 years, (5, 10 and 15 year periods were the most commonly reported.

Table 3.28 Numbers of farms with medium-term loans

Item	No loan	Current loan	Total farms	Loan arrears
Number of farms	39	25	64	5
Percent of farms	61	39	100	8

Of the farms which had current medium-term loans, 20 percent reported that they were behind in their repayments, although the amount involved was small, averaging KSh 7,000 on the two farms which detailed their arrears. As a proportion of the whole sample which provided information only 8 percent of farms had medium-term loan arrears. Because of the relatively small proportion of farms with medium-term loans no breakdown by district or management performance was attempted.

The overall level of short-term loan arrears was considerable. Of all the sample farms (including those outside the 1976 survey and without access to official credit) 33 per cent of respondents stated they had short-term loan arrears. Of the total, 8 per cent had repaid some of their previous loans and 26 per cent had only partly repaid their loans.

Of the 38 farms that had short-term loans in 1976, 20 per cent had repaid some of their loans since 1975 or previous years, although in all farms except one, the loan had been partly repaid. Table 3.29 shows the loan position of farms with short-term credit in 1976 and the breakdown in terms of the two main management classes and for completely subdivided farms.

3.8.3. Short Term Credit

The provision of institutional short term credit is vital to the operation of the majority of farms. Some 61 per cent of the farms in the sample received loans in 1976, mainly for seed, fertiliser and for financing mechanical cultivations.

The main agency providing short term credit was the AFC, who administered the credit through the Guaranteed Minimum Return Scheme (GMR). This is provided (according to certain loan conditions) at a rate of approximately K.Shs. 865 per hectare mainly for wheat and maize enterprises above a minimum area of 6 hectares. In only two of the farms surveyed did respondents state that their main source was either a commercial bank or their local supplier/^{of} agricultural goods. It is thought, however that the survey may have underestimated the role of these sources, particularly the commercial banks, which through the medium of overdrafts, also play an important part. No information was obtained on non-institutional forms of short term credit.

The overall level of short-term loan indebtedness was considerable. Of all the sample farms (including those outside the GMR scheme and without access to official credit) 32 per cent of respondents stated they had short-term loan arrears. Of the total, 6 per cent had repaid none of their previous loan and 26 per cent had only partly repaid their loan.

Of the 38 farms that had ^{taken} out a loan in 1976, ten (26 per cent) had GMR loan arrears from 1975 or previous years, although in all farms except one, the loan had been partly repaid. Table 3.2 9. shows the loan position of farms with short-term credit in 1976 and the breakdown in terms of the two main management classes and for completely subdivided farms.

Table 3.29 Number of Farms with Short Term Loans in 1976 and Previous Repayments.

Farm Type and Management Class	Loan 1976	Previous Loan		Nil Repaid
		Repaid Fully	Part Repaid	
Whole Farm 'good'	13	13	-	-
Group Farm 'good'	2	2	-	-
Whole Farm 'average/poor'	10	7	3	1
Sub-divided farms	2	1	1	-
TOTAL	38	28	9	1

The remaining 24 farms (39 per cent) received no short-term credit in 1976. These farms are considered in two categories; those with loan arrears and those with no loan arrears. (Table 3.29a) In the first category, ten farms reported having loan arrears dating back from 1970 to the present time. These farms were probably prevented from receiving short-term credit in 1976 on account of their indebtedness, although GMR arrears do not in practice automatically exclude farms from the scheme.

In the second category 14 farms had no loans in 1976 and no short-term loan arrears. Of these farms, 5 were sub-divided, and were excluded on account of their status, although some sub-divided farms have however been able to obtain GMR. Why the remaining 9 farms with no arrears had not received a GMR loan was not investigated, although it is likely that short-term inputs were obtained on bank overdraft, suppliers credit or personal funds.

Table 3.29 (a) Number of Farms with no Short-Credit in 1976.

Farm Type and Management Class	No Loan 1976	Previous Loan			No Loan 1976 No Arrears
		Repaid Fully	Part Repaid	Nil Repaid	
Whole Farm 'good'	-	-	-	-	1
Group Farm 'good'	-	-	-	-	1
Whole Farm 'average/poor'	1	-	1	-	5
Group Farm 'average/poor'	4	-	2	2	2
Sub-divided Farm	5	-	4	1	5
TOTAL	10	-	7	3	14

The GMR loan may in absolute amount be less than the credit extended for land purchase, but because it is repaid within 12 months, annual GMR premiums represent the most important loan commitment the farmer has to service. The average amount loaned to the farms receiving GMR in 1976 was K.Shs.119,600. A number of respondents claimed, that GMR was insufficient for their needs, the GMR loan, however, is not intended to cover all the production costs associated with the arable enterprises concerned.

The amount of short-term loan arrears was substantial. Based on the information supplied by those farms which had fallen behind on their repayment schedule, the average amount owing was K.Sh. 54,700 per farm. The current level of indebtedness indicates that GMR may in the past have been disbursed without due consideration to the farms credit rating. Although loan arrears attract an annual interest charge of 10 per cent per annum, no attempt was made to differentiate between the proportion of principle and interest outstanding, nor to record the number of years the repayments were overdue.

One important observation which has arisen from the survey, is that the GMR scheme must be commended for operating both with a certain degree of flexibility and also for allowing decisions regarding advance of claims, to be delegated and taken at a local level. It was particularly apparent that where loans were still overdue in 1976, that this did not prevent new loans being negotiated, if it was considered that there was a reasonable chance that one more injection of credit would enable the farmer to pay off the accumulated debts.

In some cases, unofficially sub-divided farms were receiving GMR, although it was well known that the total amount would be split between members upon receipt. Clearly it is preferable that loans should reach such farmers, by official means designed to cater for their needs rather than by bending the rules. This aspect of alternative credit strategies is at present being investigated by the consultants Credit specialist.

An analysis by farming system has not been carried out, data has been analysed within the categories above and for all holdings is local. The response to questions on livestock was very poor and has not been analysed, although livestock make a significant contribution to farm output. The results are summarized in Table 3.36.

Table 3.36 Analysis of Smallholding or Subdivided Farm data.

Parameter	Category			Total
	1	2	3	
Total Number of Farms	13	13	13	49
Number of Farms Supplying Information	13	13	13	39
Plot Size (hectares)	1.4	1.3	1.3	1.4
Arable Area/Family (hectares)	1.4	1.3	1.3	1.4
Intensity of Land Use (per year)	85	87	87	77
Net Farm Yield (kg. per hectare)	3013	3018	3023	3045
Proportion of Crop Sold (per cent)	31	31	31	46

3.9 Smallholdings and Subsistence Plots.

Of the farms surveyed, 44 were either partly or completely subdivided into smallholdings or subsistence plots of less than 20 hectares^s. Within the subdivided farms three categories have been defined:-

- Category B: those with a minor proportion (less than 50 per cent) subdivided.
- Category C: those with a major proportion of the farm subdivided.
- Category D: completely subdivided farms.

The farms are distributed between the five main farming systems with the major proportion (about 80 per cent) in either System 1 or System 2. Data was obtained from 39 of the 44 farms with subdivided areas; on each of these between 5 and 10 plot holders were interviewed. In all over 200 smallholders supplied information. In all cases the word and memory of the respondents had to be relied upon.

An analysis by farming system has not been carried out, data has been analysed within the categories above and for all holdings in total. The response to questions on livestock was very poor and has not been analysed although livestock make a significant contribution to farm Gross Output. The results are summarized in Table 3.30.

Table 3.30 Analysis of Smallholding or Subsistence Plot Data.

Parameter	Category			Total Farms
	B	C	D	
Total Number of Farms	17	15	13	45
Number of Farms Supplying Information	13	13	13	39
Plot Size (hectares)	1.8	4.2	10.8	6.0
Arable Area/Family (hectares)	1.6	1.5	4.9	2.4
Intensity of Land Use (per cent)	86	77	67	77
Maize Yield Kgs. per hectare	3618	3618	3825	3645
Proportion of Crop Sold (per cent)	31	46	68	48

3.9.1. Plot Size.

The farm size in the total sample ranged between 0.5 hectares and 19 hectares. The mean for all farms was 6.0 hectares; for categories B,C and D individually the average size was 1.8,4.2 and 10.8 hectares respectively. This follows the trend expected; the greater the proportion of the farm subdivided, the larger the individual holding.

3.9.2. Arable Area Per Plot

The mean family arable area in B and C categories are similar, 1.6 hectares. In D category they are considerably larger 4.9 hectares. The mean for all farms was 2.4 hectares.

3.9.3. Intensity of Use of Cultivable Land.

The intensity of use follows the expected trend ^{in which} ~~the~~ smaller ~~the~~ plot size Y
~~the~~ higher ~~the~~ intensity of use. A overall intensity of 77 percent was X
indicated; this is comparable with intensities on good large system I farms.

3.9.4. Yield of Maize.

The maize yields are of a similar order for each category of subdivision. Overall an average yield of 3645 Kgs. per hectare was indicated. This is of a similar order to the average yield on large scale maize farms ^{u/c} (3681 Kgs. per hectare). It is higher than the average yield of all system I large scale growers and lower than the average yield obtained by large scale growers in ^{u/c} system 2. It should be noted however that although hybrid seed was used in almost all cases, fertilizer was applied on less than 50 per cent of the farms. Furthermore the small scale growers involved have limited access to services or facilities available to smallholders in conventional settlement schemes or even traditional small scale areas.

There was not enough data obtained on yields of other crops to allow analysis.

3.9.5. Proportion of Crop Sold

An attempt was also made to determine whether maize from the small plots was sold and if so what proportion. Overall a proportion of about 48 percent of the total production being sold was indicated. As expected the proportion sold decreased as plot sizes became smaller.

3.9.6. Use of Machinery on Subdivided Farms.

Partly subdivided farms usually had access to machinery from the large scale commercial area. Of the 13 completely subdivided farms 12, provided information on their use of and access to machinery. Six had no machinery at all and relied entirely on contractors. A few of the remaining had pooled their resources to purchase a group tractor. The precise mechanism whereby individual farmers were allowed access to this group tractor was not investigated in detail. Casual observation indicated that it worked tolerably well in some cases, though badly in others. It would seem essential however, that a competent full-time tractor driver should be employed, and that farmers ~~are~~ ^{should be} charged a rate to cover fuel, repairs and depreciation. In some instances, only the cost of fuel was charged, with consequent complications arising when major repairs were required. A single example of this situation was observed on a subdivided farm in Uasin Gishu where a 3 year old tractor remained unrepaired and unutilised for a whole season, due to a dispute over financial responsibilities. Successful mechanisation of subdivided farms also occurred ^{where} one or two members owned a significantly larger share (and hence area of land) than others. The individuals concerned possessed their own tractors, which were used to cultivate their own unit, and were then contracted out to the smaller shareholders.

Farmers who relied entirely upon contractors did complain of difficulties in obtaining contractors on time, although this was not universal. In the case of one subdivided wheat farm visited, the farmers stated that they followed a deliberate policy of late planting (with a reduction in potential yield) to insure that a combine harvester would be available when the crop matured.

THE INFLUENCE OF SIZE ON COMMERCIAL FARM OPERATIONS.

4.1 Introduction

The data collected ^{has} have been examined to determine whether there is any close relationship between the size of the commercial large scale areas, and the levels of production from crops and dairy cows. The relationships investigated were:

- Farm size and intensity of use of cultivable land.
- The number of dairy cows and yield per cow per annum.
- Farm size and gross output per hectare.
- Farm size and gross output per cultivable hectare.
- Farm size and gross margin per cultivable hectare.
- Farm size and gross margin per hectare

The farms were analysed in two basic groups; 'good' and 'average' and 'poor' farms. Within these groups ^{the} systems 1 and 3 results were pooled and ^{the} system 2 results analysed separately. A total of 39 regression analyses were carried out.

The formulae used to determine the regression equation $y = n x + c$

Where:

$$n = \frac{\sum x y - (\sum x \sum y)}{\sum x^2 - \frac{(\sum x)^2}{n}}$$

$$\text{and } c = \bar{y} - n \bar{x};$$

$$\text{where } \bar{y} = \frac{\sum y}{n} \text{ and } \bar{x} = \frac{\sum x}{n}$$

4.2 Results of Analyses

The results of the 39 analyses are summarised in Appendix 3. Eight pairs of variants were found to have a close relationship at 0.01-0.05 levels of significance. The regression equations, correlation coefficients and level of significance are given in table 4.1. Of the remaining 31 results which were not significant 25 gave negative correlation coefficients and six positive.

Table 4.1 Significant Results From Regression Analysis

1. Farm Size (x) by Intensity of Use of Cultivable Area

Good Farms

All Systems ¹ ($y = 58.65 + 0.02x$ (n = 25; r = 0.41; P = 0.05))

Average and Poor Farms

System 2 ($y = 82.8 - 0.24x$ (n = 8; r = -0.76; P = 0.02))

2. Farm Size (x) by production (y)

Good Farms

Gross output/ha by Farm Size

All Systems ($y = 1407 - 0.52x$ (n = 24; r = -0.44; P = 0.05))

Gross margin/ha by Farm Size

System 2; ($y = 1063 - 1.05x$ (n = 8; r = -0.63; P = 0.05))

Gross Output/cultivated ha by Farm Size

System 2; ($y = 2203 - 2.26x$ (n = 8; r = -0.75; P = 0.02))

Gross Margin/cultivated ha

System 2; ($y = 1545 - 1.67x$ (n = 8; r = -0.75; P = 0.02))

Average and Poor Farms

Gross Output/cultivated ha by Farm Size

System 2 ($y = 571 + 1.14x$ (n = 13; r = 0.55; P = 0.05))

Gross Margin/cultivated ha by Farm Size

System 2 ($y = 193 + 1.11x$ (n = 12; r = 0.79; P = 0.01))

Note 1 Including farms 1000 ha 2 Whole farms only

4.2.1 Analysis of intensity of Use by Farm Size

(a) Good Farms

The analysis for all Good Farms (Systems 1,2,3;) showed that there was a possible significant relationship between the size of the farms and the intensity of use (Figure 4.1), when three exceptional farms of over 1000 ha were included. If these farms are excluded, the relationship is negative but not significant. Subsequent analysis of the various separate systems 1,2 and 3 showed that within the subdivisions of Good Farms there were no other significant relationships.

(b) Average and Poor Farms

There was no significant over-all relationship between the size of average and poor farms and their intensity of use. There was, however, a significant negative relationship for System 2 farms, indicating that the intensity of use declined as the size of the farm increased. (Figure 4.1)

OVERALL RELATIONSHIP BETWEEN FARM SIZE AND INTENSITY OF GOOD FARMS AND SYSTEM 2 OF AVERAGE AND BAD FARMS

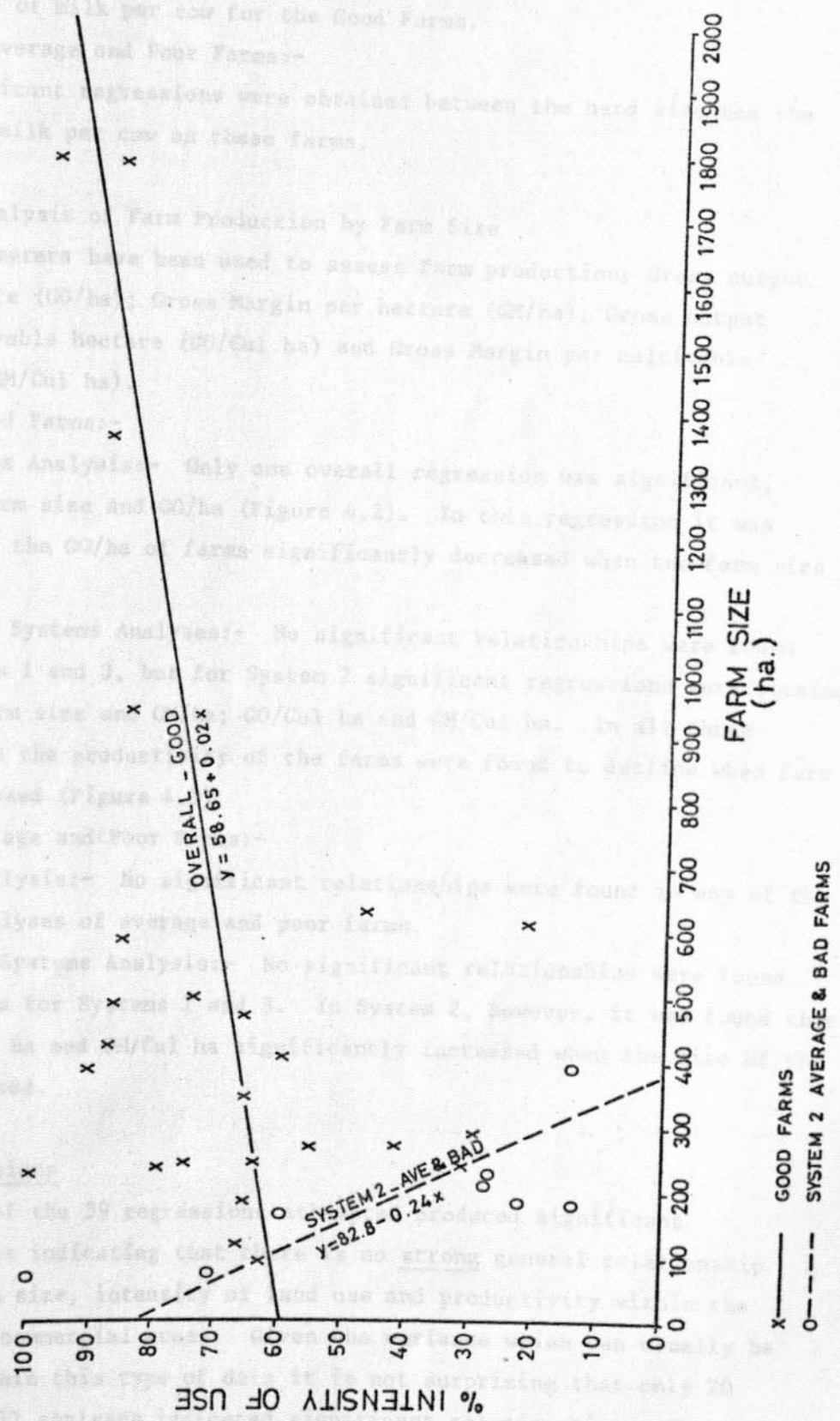


FIGURE 4.1.

The analyses of dairy production here involved assessing the effects of the size of each farm herd on the yield per cow.

(a) Good Farms:-

No significant regressions were obtained between the herd size and the yield of milk per cow for the Good Farms.

(b) Average and Poor Farms:-

No significant regressions were obtained between the herd size and the yield of milk per cow on these farms.

4.2.3 Analysis of Farm Production by Farm Size

Four parameters have been used to assess farm production; Gross output per hectare (GO/ha); Gross Margin per hectare (GM/ha); Gross output per cultivable hectare (GO/Cul ha) and Gross Margin per cultivable hectare (GM/Cul ha).

(a) Good Farms:-

All Systems Analysis:- Only one overall regression was significant, between farm size and GO/ha (Figure 4.2). In this regression it was found that the GO/ha of farms significantly decreased when the farm size increased.

Individual Systems Analyses:- No significant relationships were found for Systems 1 and 3, but for System 2 significant regressions were obtained between farm size and GM/ha; GO/Cul ha and GM/Cul ha. In all three regressions the productivity of the farms were found to decline when farm size increased (Figure 4.3)

(b) Average and Poor Farms:-

Overall Analysis:- No significant relationships were found in any of the overall analyses of average and poor farms.

Individual Systems Analysis:- No significant relationships were found for the data for Systems 1 and 3. In System 2, however, it was found that both GO/Cul ha and GM/Cul ha significantly increased when the size of the farm increased.

4.3 Conclusions

Only eight of the 39 regressions attempted produced significant relationships indicating that there is no strong general relationship between farm size, intensity of land use and productivity within the large scale commercial areas. Given the variance which can usually be expected within this type of data it is not surprising that only 20 percent of all analyses indicated significant relationships. The two major management groups into which farms were divided were by no means homogenous and contained enough variation to prevent the establishment

of significant relationships. However, the analysis gave no indication that increasing size was related to increasing productivity. If anything the higher number of inverse significant relationships and high proportion of negative correlation coefficients would indicate that advantages in increased productivity are more likely to be gained from decreasing commercial farm sizes.

The implications are that subdivision of large farms owned by small groups (partnerships, companies) of 3 to 5 members should not be discouraged as economic advantages such as increased productivity are quite likely to accrue.

OVERALL GOOD FARMS : FARM SIZE & C.C.

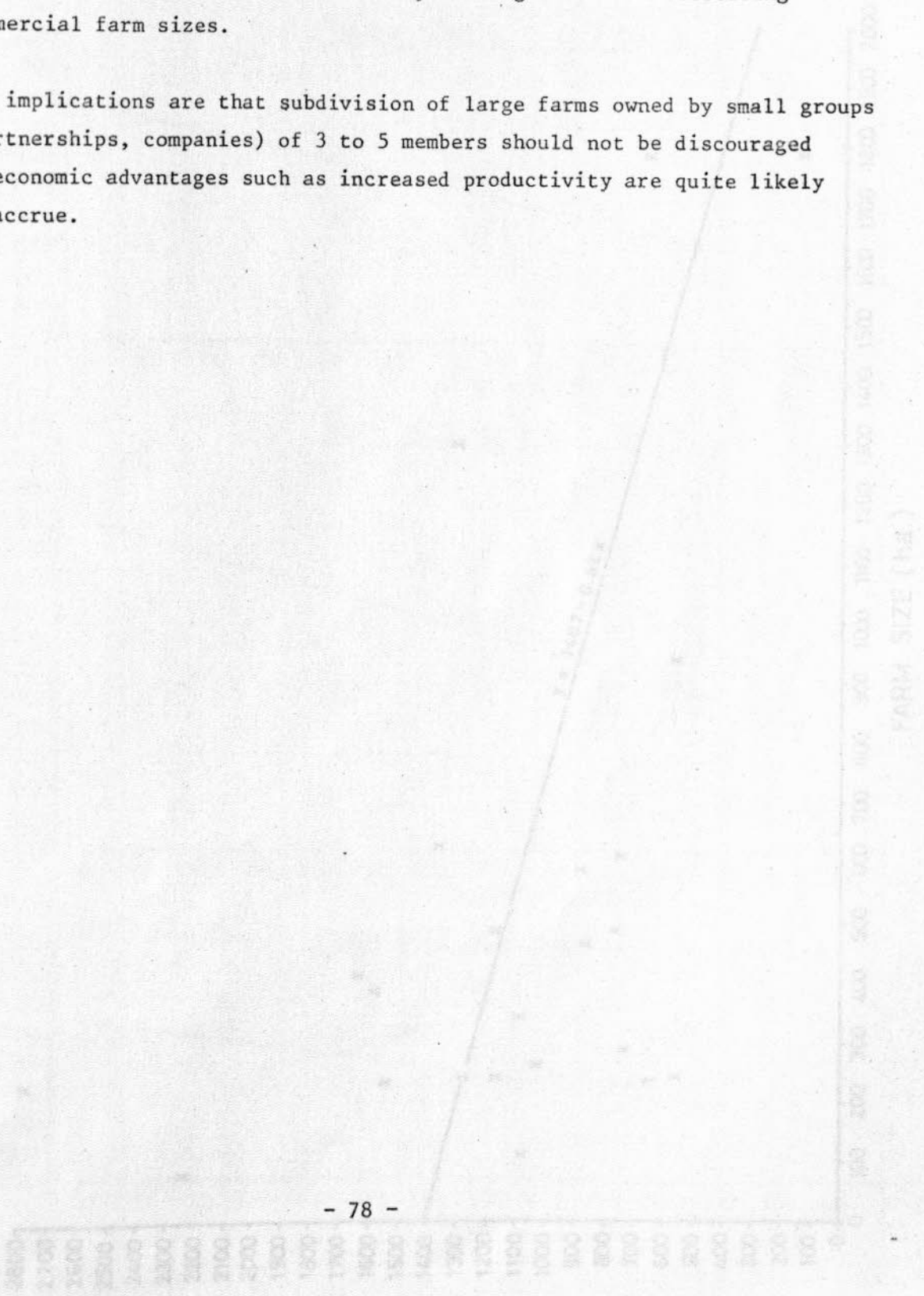
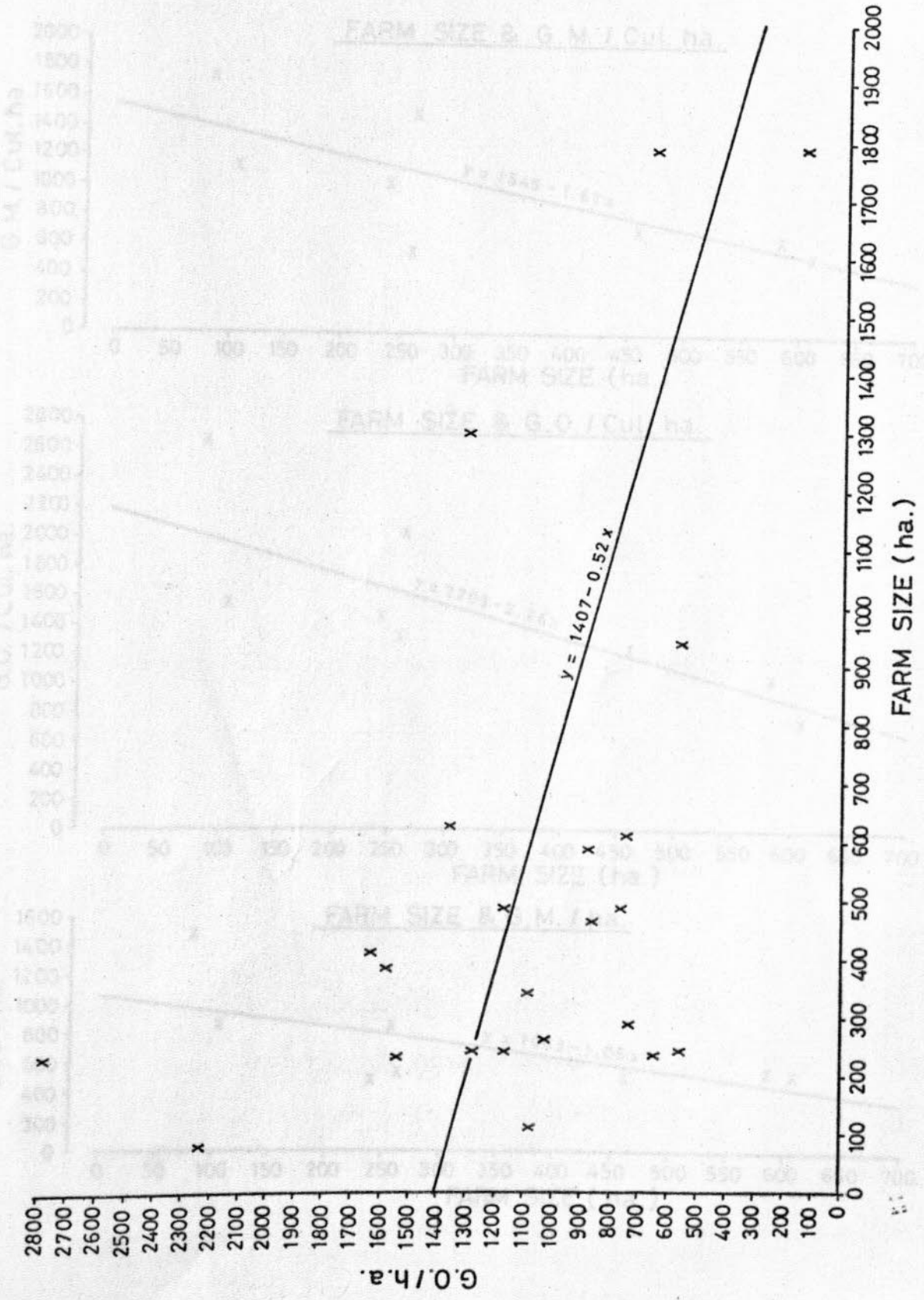


FIGURE 4.2.

OVERALL GOOD FARMS : FARM SIZE & G.O./ha.



GOOD FARMS : SYSTEM 2

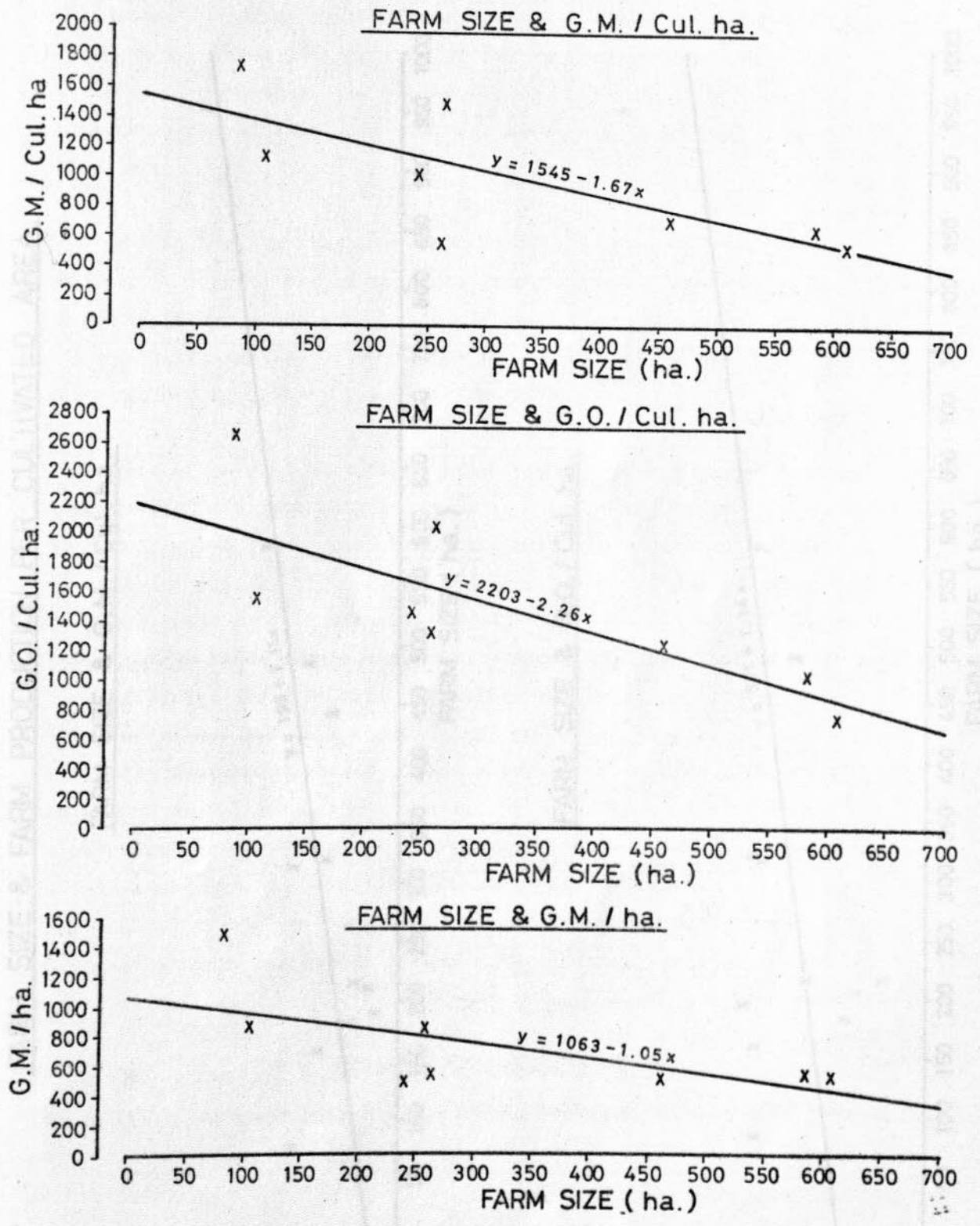
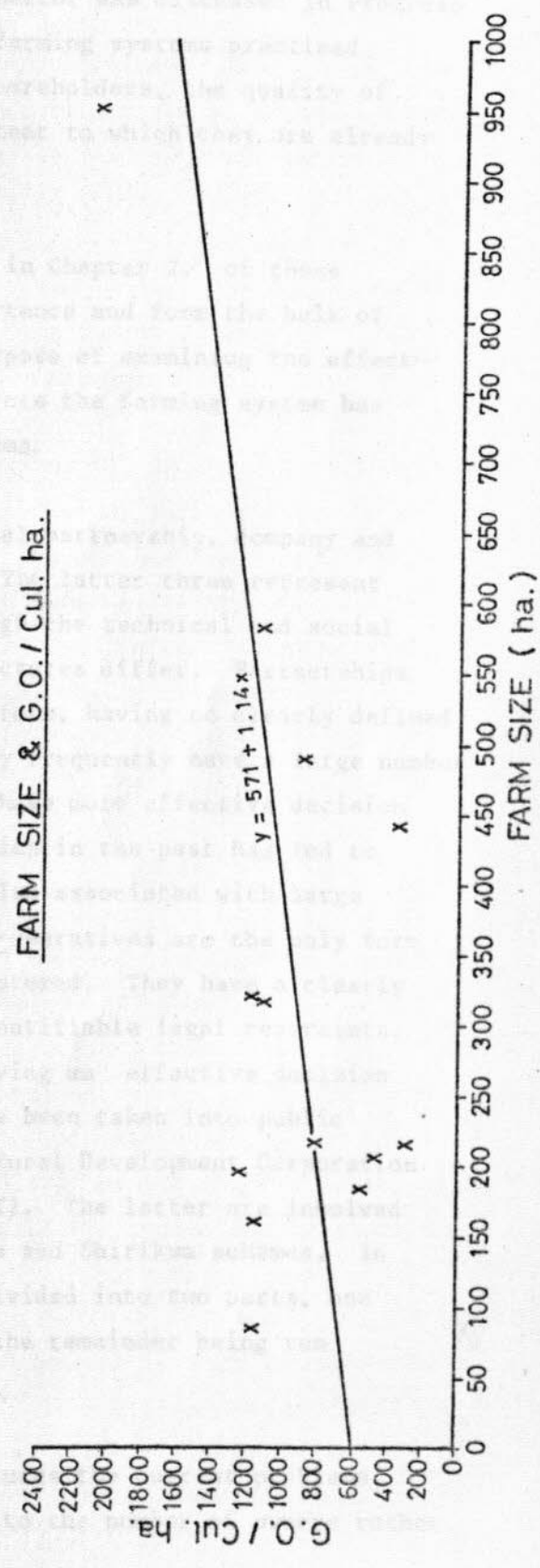
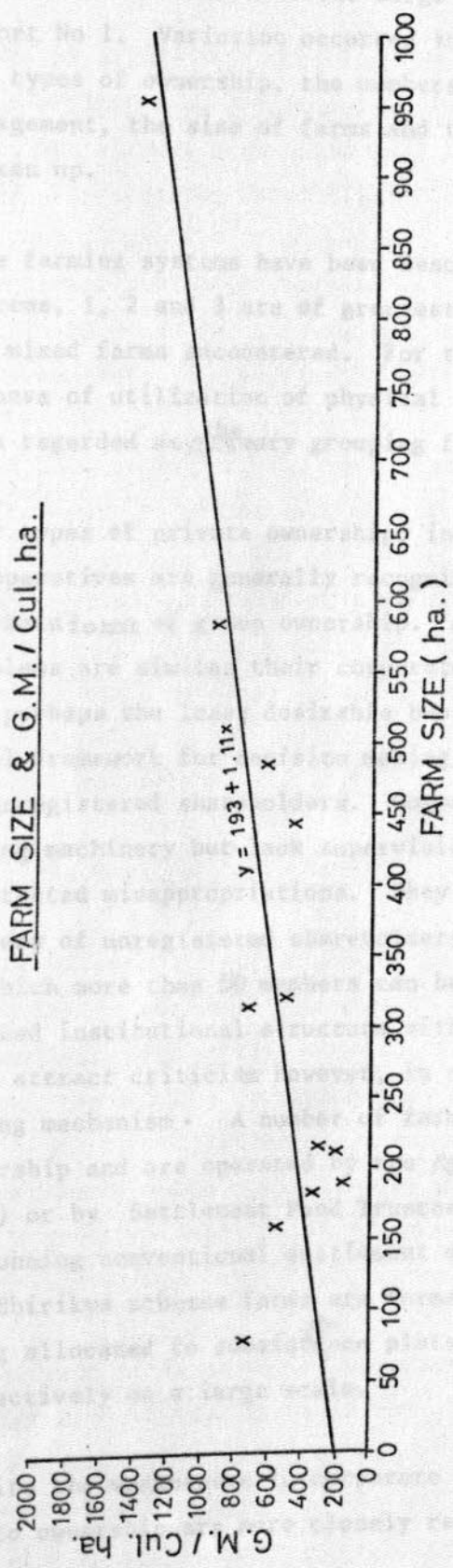


FIGURE 4.4.

AVERAGE AND BAD FARMS — SYSTEM 2
FARM SIZE & FARM PRODUCTION PER CULTIVATED AREA



CHAPTER 5
A STRATEGY FOR FUTURE DEVELOPMENT

5.1 Variation in the Large Farm Sector

The immense variation in the Large Farm Sector was discussed in Progress Report No 1. Variation occurred in the farming systems practised, the types of ownership, the numbers of shareholders, the quality of management, the size of farms and the extent to which they are already broken up.

Five farming systems have been described in Chapter 2. of these Systems, 1, 2 and 3 are of greatest importance and form the bulk of the mixed farms encountered. For the purpose of examining the effectiveness of utilization of physical resources the farming system has been regarded as ^{the} primary grouping for farms.

Four types of private ownership; individual, partnership, company and co-operatives are generally recognised. The latter three represent the main forms of group ownership. Although the technical and social problems are similar their corporate structures differ. Partnerships are perhaps the least desirable business form, having no clearly defined legal framework for decision making. They frequently have a large number of unregistered shareholders. Companies have more effective decision making machinery but lack supervision, which in the past has led to undetected misappropriations. They are also associated with large numbers of unregistered shareholders. Co-operatives are the only form in which more than 50 members can be registered. They have a clearly defined institutional structure within identifiable legal restraints. They attract criticism however, in not having an effective decision making mechanism. A number of farms have been taken into public ownership and are operated by the Agricultural Development Corporation (ADC) or by Settlement Fund Trustees (SFT). The latter are involved in running conventional settlement schemes and Shirikwa schemes. In the Shirikwa schemes farms are formally divided into two parts, one being allocated to subsistence plots and the remainder being run collectively on a large scale. X

Despite the weaknesses in corporate structures the current problems due to ownership are more closely related to the number of owners rather

than to any particular corporate form. The numbers can vary from a single owner to over a thousand on one farm. The numbers are best considered with regard to the area of the farm and the size of the plot to which the individual has a right. Where farms have been subdivided the range of the plot sizes is wide, with the smallest often less than half a hectare, too little to provide basic family subsistence needs.

Farms are either whole, partly subdivided or completely subdivided. In terms of land area approximately 30 percent of the total (Progress Report No 1) has already been subdivided into smallholdings or subsistence plots. In addition farms differ in financial status, degree of indebtedness and in quality of management, all of which will influence the effectiveness with which resources are utilized. These are discussed in Chapter 3 and it is clear that even in the top 30 percent of farms surveyed there is considerable unrealised potential.

Given this variation, the vast numbers of owners and their individual aspirations, it is unlikely that any single policy such as maintaining all farms as large units, or splitting all farms into small units will be appropriate or practically feasible. A workable solution is more likely to be found in a range of farm sizes from large through medium sized to small holdings. Such a combination would in turn be more likely to effectively exploit the human and physical resources encompassed in the sector.

5.2 The Need for Large Farms

Approximately 40 - 50 percent of farms are owned by individuals, small partnerships and small companies. The individually owned are unlikely to subdivide whilst the companies and partnerships, were they to subdivide, could still be regarded as large scale farms. Although the farm size would be well below the present mean of 550 hectares, the techniques of large scale farming would ^{still} be appropriate. There is therefore a group of farms which could be regarded as forming the basis of an inherently stable large farm sector.

An analysis of large scale operations has been carried out (Chapter 4) to determine whether there is any close relationship between performance as indicated by intensity of use of cultivable land, yields, gross outputs and net returns and the scale of operations. Although only a

small proportion of the results of the regression analyses carried out gave significant correlations, the majority of these indicated an inverse relationship between performance and scale of operation. Of the non-significant results the majority again showed negative correlations or inverse relationships if any. It has been concluded therefore, that where these farms wish to subdivide into a small number of still large scale units, they should not be discouraged even in areas which are regarded ^{as} strategically necessary large scale areas. X

At the national level the need for a nucleus of large scale farms is generally recognised. They are a significant contributor to Kenya's gross marketable agricultural production (around 48 percent) and although many farm products can be produced successfully on smallholdings there are some necessary supplies which are best produced on the large scale. These include wheat, barley, hybrid maize ^{be} seed and breeding herds of livestock. Seed production should certainly be confined to the larger holdings where control of quality can be more easily maintained. It is sometimes argued however, that wheat and barley need not necessarily be grown on a large scale; indeed; there are numerous examples of countries where they are grown on smallholdings and a technology to do this has been developed. It has been noticeable during the survey, that when farms in wheat growing areas are sub-divided, the owners will invariably grow maize. Wheat and barley are unlikely therefore, to be grown on the smallholdings and the nation's requirements will have to be grown on the large scale farms.

What has to be determined however, is the amount of wheat actually required and the extent to which wheat is inter substitutable with maize. With the present number of Government owned large scale farms (ADC and SFT etc) and private individual and small partnership or company owned farms there is likely to be adequate land area to meet all these needs.

Another consideration is the suitability of agro-ecological zones for subdivision into smallholdings. Some zones, particularly those marginal for crop production and currently utilized for dairy and beef ranching, are only suitable for large scale extensive operations and should not be subdivided.

5.3. The Pressures for Smallholdings.

Up to thirty percent of the total land in the large scale areas is already subdivided into smallholdings or subsistence plots. It has occurred on group owned farms and has often resulted from the failure to farm large units successfully. It also reflects however the overwhelming desire of the group farm owners, whether they are ^{he is a} partners, companies or co-operative shareholders to occupy and farm ^a specific area of land as ^{his} his own. Of the 45 group owned farms included in the survey, on only two did the shareholders state that they did not wish to subdivide. The shareholders' aspirations towards individual ownership have been investigated by the consultant sociologist to the study who has concluded that individual ownership is the aim of the majority of shareholders. There is no doubt therefore that collective farming, the alternative to individual holdings, will be contrary to the owners' wishes and aspirations and hence an inherently difficult policy to implement. X X

Much of the subdivision which has already occurred has happened spontaneously, it is unplanned and has led to misuses of land such as cultivation on steep slopes, clearing of river banks and to continuous cropping with maize. Much of it is in high potential areas but its owners have no access to the extension, credit, supply and marketing services available to conventional settlement schemes or to traditional smallholder areas. It is an important portion of the large farm area and future development planning must recognize its importance and provide for its needs. It is continuing at the present time and almost all of the group owned farms, which account for up to 60 percent of the total, can be regarded as having strong internal pressures to subdivide.

In discussion of the relative advantages or disadvantages of subdivision, distinction should be made between subdivision into subsistence plots and into smallholdings. The inflexibility in the former due to limited plot size often leads to the misuses of land mentioned above. With smallholdings of a size which will allow proper land use, there need be no economic disadvantage when compared with large holdings. Indeed the findings of D. Hunt and the early Central Bureau of Statistics small farm surveys would indicate that output is higher in smallholdings than large units. X

In this study an analysis has been made of data collected on smallholdings and subsistence plots within completely and partly subdivided farms (section 3.9). The results indicate that intensity of use of cultivable land was as high as that achieved on the "good" management group of large scales farms and higher than the overall intensity on the large scale farms surveyed. The mean maize yield was similar to the overall mean yield on the large farms; it was higher than the good system 1 mean yield but less than the average for all system 2 large farms. Gross output was not estimated as information on livestock output was too infrequent to include. Given the higher intensity of use of cultivable land and the average yield of maize, the farm gross output will almost certainly be higher than the average for all of the large scale farms surveyed and of similar order to that of the "good" management group. It should be emphasised however that the results currently being achieved are achieved with limited access to services.

The study also indicated that overall a sizeable proportion of the total production was marketed. In effect the proportion sold was dependant upon the size of the holding and varied between nil on a one hectare holding to over 90 percent on four hectares and over.

There are other advantages in an expanded smallholder sector. Firstly smallholdings tend to make greater use of labour intensive methods and a net increase in employment opportunity will result. Maize, which is likely to be the main enterprise on most smallholdings, is a labour intensive crop, even when grown on the large scale where weed control and harvesting are still predominantly hand operations. There is however an increasing tendency by the large growers to use herbicides and mechanical cultivations for weed control and to adopt mechanised harvesting methods. Smallholders although largely dependant on mechanised land preparation are likely to continue hand planting, hand weeding and hand harvesting. Secondly a policy allowing more smallholdings will enable the aspirations towards land ownership of a greater number of people to be met. Lastly given the shortage of skilled managers for large units, increased subdivision on a planned and controlled basis is likely to be the best means of intensifying land use and increasing output from the sector. The question also arises as to whether this limited managerial resource should in fact be deployed on group owned farms with social and technical problems and whose primary aim is to subdivide.

5.4. Future Development of Large Farm Sector.

In the foregoing the complexity of the large farm sector has been discussed in terms of farming systems, farm sizes, type of ownership, numbers of owners and their aspirations. In the preparation of a development strategy primary consideration has been given to the latter, as ultimately it is the response of the owners which will determine the success or failure of the plan. X
The strategy proposed is pragmatic, it recognizes the need for, and desire to retain some farms as large scale units and also that there is pressure for creation of more smallholdings. In outlining the strategy the large farm sector is treated as having three main categories of farms, identified not by farming system or type of ownership but by the number of owners in relation to the land area available in each farm. These categories are not necessarily clearcut and may overlap. In broad terms there are:

- Category 1 farms: Where farms are in individual ownership or are owned by a small number of partners, less than the legal maximum of seven. These farms are still run well, or badly as a single unit or in units of a size where the techniques of large scale farming are still appropriate.
- Category 2 farms: Where farms are group owned, but where the number of owners in relation to the overall size of the farm would permit each owner in the event of subdivision to have a holding of sufficient size to undertake planned commercial mixed farming.
- Category 3 farms: Where farms are also group owned, but where the number of members is greater than the area could support as individual commercial farmers or sometimes even as subsistence farmers. X

Within these three categories further differentiation on the basis of farming system, degree of indebtedness or quality of management could be made. These distinctions are ignored for the present as the purpose of this chapter is to describe a broad strategy, the detailed planning of which will be dealt with later.

Before outlining the proposals for each farm category, the national need for large scale units (to produce wheat, barley, hybrid maize seed, grade cattle etc) and the unsuitability of some agro-ecological zones to small-holder farming should be mentioned, as these will impose limitations on implementing the proposals. A first priority therefore is to estimate the area of land required for wheat, barley and hybrid maize seed production, identify its most suitable location and establish the geographical limits of the zones unsuitable for smallholdings.

Although the land area for the former has not yet been estimated the location of the most suitable areas has been demarcated on Map 4. which also shows the marginal areas unsuitable for smallholdings.

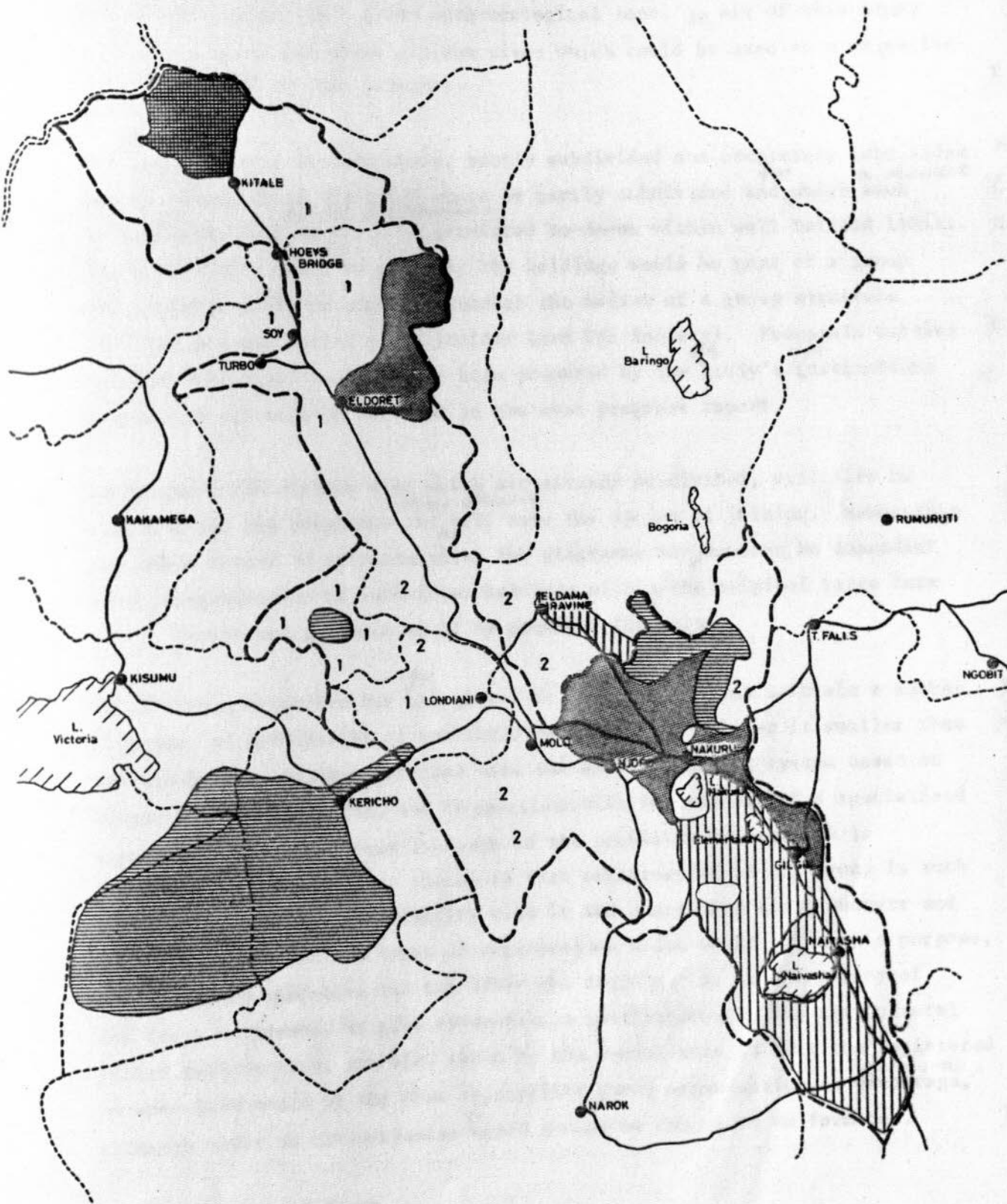
The areas demarcated are areas where subdivision should be discouraged. They will not affect category 1 farms, but will affect some in categories 2 and 3 which are located within the demarcated areas. Where the farms have already subdivided there is little that can be done ^{v/c} however, where they have not yet subdivided, subdivision should be discouraged. Furthermore any farms coming on the market should not be sold to large groups. Outside the designated areas the strategies proposed for each category of farm would have unrestricted application.

5.4.1. Category 1 Farms.

The shortage of skilled management common throughout the sector affects Category 1 farms, to a slightly lesser extent than the others. Nevertheless they will require considerable assistance if the potential of their physical resources are to be effectively exploited. This assistance will take the form of a package comprising physical planning, preparation of cropping and operational plans, budget preparation, development credit, short term loans and managerial assistance. In effect it will require all the services incorporated in the current phase of rehabilitation programme which is restricted solely to group owned farms. Subdivision into smaller medium sized units (80 hectares or over) would not be discouraged.

5.4.2. Category 2 Farms.

Category 2 farms are regarded as those which in the event of subdivision, the individual entitlement of each shareholder to land would be enough to allow him practise a balanced system of mixed arable grass ley farming,



- KEY**
-  SEED MAIZE
 -  WHEAT PRODUCTION AREAS
 -  RANCHING AREAS
 -  PLANTATION CROPS

1,2 PRIORITY FOR ALLOWING CONTROLLED SUB-DIVISION
 - - - - - PROJECT BOUNDARY

SCALE 1 : 2,000,000

MAP 4 AREAS WHERE SUB-DIVISION SHOULD BE DISCOURAGED

which would produce a marketable surplus. This implies a minimum size of individual holding in a given agro-ecological zone. An aim of this study will be to establish these minimum sizes which could be used as a criterion for eligibility to this category.

^{u/c} The category will include whole, partly subdivided and completely subdivided farms. ^{For} Those which are still whole or partly subdivided and which ^{for a demand} wish to ^{exists, subdivision} subdivide further would be permitted ~~to do so~~ within well defined limits. The subdivision would be planned, the holdings would be part of a group and services would be provided through the medium of a group structure (for the present called a ^{u/c} smallholder Land Use Society). ^{u/c} Proposals setting out how this might be done have been prepared by the ^{u/c} study's ^{u/c} institutions specialist and will be included in the next progress report.

Farms above the minimum size which are already subdivided, will also be eligible for the programme and ^{their owners} will have the option of joining. Membership and hence access to services under the programme may, however, be dependant upon reorganisation of individual holdings within the original large farm unit. Advice and guidance would be provided for this.

^{u/c} The ultimate objective for category 2 is to establish and maintain a number of groups or communities of smallholdings, ^{in locations} where no holding is smaller than the established minimum for that area and where a farming system based on proper and intensive land use is practised with the support of a specialised extension service. A group approach to the provision of services is proposed. It is necessary therefore that organisation of the group is such that the smallholder can identify with it and understand its structure and purpose. There are two types of organisation which would serve this purpose, one is the co-operative and the other the company. As it the policy of the Kenya Government to give co-operative institutions in the agricultural sector full backing, the view taken by the consultants is that the registered co-operative would be the most appropriate group organisation to encourage, although under no circumstances ^{sh} would groups be compelled to form one.

5.4.3. Category 3 Farms.

^{in locations} Category 3 farms are those where the number of shareholders is greater than the area could support as individual commercial smallholdings (or sometimes even subsistence ^e holdings). They present the most serious problems. The

solution sought is essentially one of encouraging, through sale of shares, consolidation of subsistence holdings into groups of small holdings with a commercial potential. On farms that have already subdivided these need not necessarily, in the early stages, be of the minimum size stipulated for the zone in which ~~it is~~ ^{they are} located.

The broad strategy proposed is to introduce gradual change through the medium of service co-operatives with the aim of providing the assistance needed to move them from subsistence farming to the production of marketable surpluses. This aim is similar to that of the Integrated Agricultural Development Programme (IADP). It is recommended therefore that the IADP be extended to these areas as the first stage in ^{the} process which will move farms from a group of subsistence holdings to a group of commercial small-holdings eligible for category 2. Where farms have not already subdivided, subdivision would again be permitted on a controlled basis, but only after the numbers of owners had been reduced to a level that would allow the average holding size to be no less than the stipulated minimum for that area.

The question of unregistered shareholders has not been mentioned so far; it is a very real problem and is common to both ^{v/c} category 2 and 3 farms. In both categories it will mean authentication of claims through an adjudication procedure and establishment of a complete register of authentic shareholders. In ^{v/c} category 3 it may also mean the buying out of "surplus" shareholders. The appropriate legislation and procedures for doing this have been ^{considered} by our Institutions specialist and these proposals will also be included with the next progress report. As a general rule, however, shareholders who are not resident on the farm or who have land elsewhere would be the first candidates for buying out. Removal of the remaining "surplus" may, however, be ^a unattainable objective unless the plot holder can be accommodated elsewhere. Although unlikely to provide a complete solution, a contribution could be made if the Settlement Department were to have an option on any large farm suitable for subdivision which might come up for sale. If farms are not purchased by the ^{v/c} settlement Department, sales should not be allowed where the number of group members are such that the average entitlement to land is less than the minimum holding size proposed for that area. Lastly, where farms are sold to groups who wish to subdivide, subdivision should take place before completion of sale.

This broad strategy will involve existing institutions, the Ministries of Agriculture, Co-operative Development, Lands and Settlement, AFC and a number of current projects. The role of each is illustrated in Fig. 5.1.

5.5. A Priority for Development.

Three categories of farms have been identified each with a different problem requiring a separate solution. Ideally the solution should be applied in parallel but in practice this may not be possible. Some order of priority must then be established.

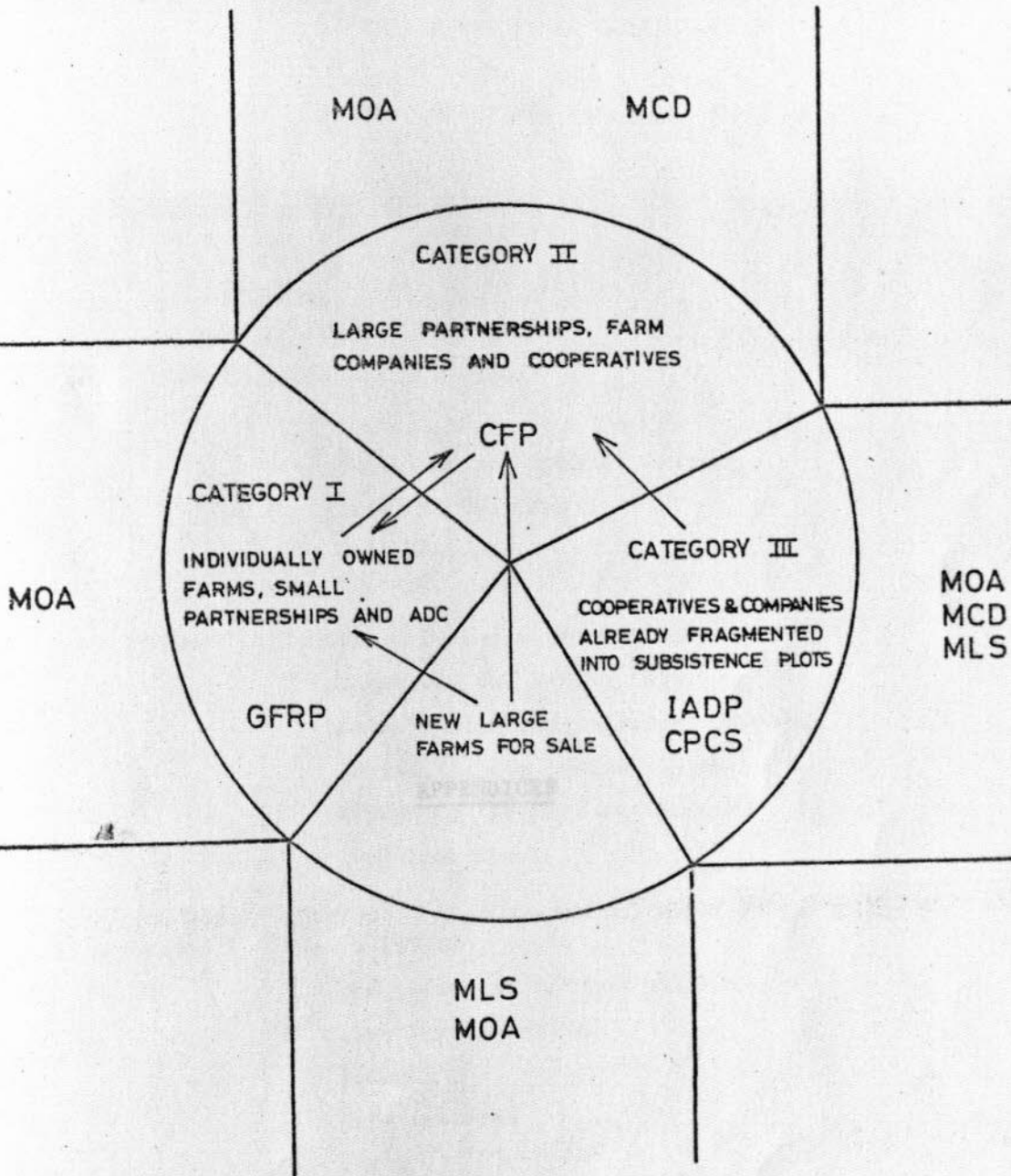
In ^{v/c} category 1 the problems are largely technical (mainly managerial) and financial and therefore more straight forward and easily soluable. The economic benefits should accrue rapidly and would be high.

In ^{v/c} category 2 the problems are again technical and financial but there are also social and legal problems such as authentication of claims of shareholders and the establishment of a basis for subdivision of the farm or re-organisation of existing holdings. The problems are not considered insoluable and economic benefits are again likely to be high.

Category 3 presents the most complex problems ranging from technical, financial, social and legal (land adjudication and registion of claims). Improvement can only be gradual and the objective of moving away completely from subsistence to commercial holdings may be unattainable. The problem of removal of "surplus" members will have to be tackled and alternative areas found. Progress will inevitably be slow and the economic benefits more uncertain.

If a priority has to be established our view is that the next phase of rehabilitation of large farms should aim principally at ^{v/c} category 2. The ^{if} problems are more complex than ^{v/c} category 1 but the economic benefits are likely to be at least as high and furthermore the benefits would reach a greater number of farmers.

LARGE FARM SECTOR



The arrows represent the movement between different categories which the recommended strategy would stimulate.

KEY

- MOA MINISTRY OF AGRICULTURE
- MCD MINISTRY OF CO-OPERATIVE DEVELOPMENT
- MLS MINISTRY OF LAND AND SETTLEMENT
- CFP COMMERCIAL FARMING PROJECT
- GFRP GROUP FARM REHABILITATION PROJECT
- IADP INTEGRATED AGRICULTURAL DEVELOPMENT PROGRAMME
- CPCS CO-OPERATIVE PRODUCTION CREDIT SCHEME

APPENDIX I

LIVESTOCK TECHNICAL COEFFICIENTS

1.1. LIVESTOCK CARRYING CAPACITIES (hectares per l.s.u)

NAKURU DISTRICT

Nakuru

Farm System	Division	ha/l.s.u.
Farm System 4	(Naivasha Division)	
	Rangeland and Natural Grazing	5
	Leys (Rhodes Grass)	2
	Crop Residues	3
Farm System 1	(Bahati, Mole and Njoro Division)	
	Rangeland and Natural Grazing	2
	Leys (Rhodes and Temperate Grasses)	1
	Forage (Napier, Sudan, Columbus)	0.3
	Irrigated (Fodders and Lucerne)	0.2
	Crop Residues	3
Farm System 3	(Uasin Gishu)	
	Rangeland and Natural Grazing	3
	Leys (Rhodes Grass)	1.2
	Forage	0.4
	Crop Residues	1.2
	Vleis	1.2
Farm System 2	(Trans Nzoia and Kericho)	
	Rangeland and Natural Grazing	2.0
	Leys (Rhodes and Nandi Setaria)	0.9
	Forage	0.3
	Irrigated (Fodders and Lucerne)	0.2
	Crop Residues (mainly maize stover)	2

N.B. based on average D.M. intake of 13 kg/l.s.u/day and allows for maintenance plus 4 kg milk or 0.5 kg l.w. gain per day.

1.2 VALUES FOR LIVESTOCK UNITS

1. CATTLE

a) All exotic beef and dairy breeds except Jerseys.

Mature Bulls	1.25
Mature Cows	1.00
Bulls, Steers and Heifers (1 -3 y.o)	0.75
Calves (6 month -1 y.o)	0.50
Suckling calves (\leq 6 month)	0.25

b) Borans and Jerseys.

Mature Bulls	1.00
Mature Cows	0.80
Bulls, Steers and Heifers (1 -3 y.o)	0.60
Calves (6 month -1 y.o)	0.40
Suckling Calves (\leq 6 month)	0.20

2. SHEEP (and GOATS)

a) Exotic breeds.

Rams and Ewes	0.20
Others (except lambs at foot)	0.10
Lamb at foot	0.05

b) Indigenous sheep (including Dorpar) and goats.

Rams and Ewes	0.10
Others (except lambs at foot)	0.05
Lamb at foot	0.02

APPENDIX 2

ASSUMPTIONS USED IN MACHINERY COST CALCULATIONS

The Capital value of farm machinery and the machinery depreciation element of farm machinery costs were calculated using average current 1976 prices (ex-Nakuru), written-off over the appropriate number of years. The initial purchase price, the value of machinery (over its economic working life) and the fixed cost or depreciation factor are given in Table 2.1. These prices are approximate and in most cases represent an average price based on the range of alternative pieces of equipment offered by the various manufacturers.

The annual cost of farm machinery was calculated based on the purchase price, (depreciated over a given number of years using the 'straight line method'), the annual expenditure on fuel and oil, maintenance and repair charges and miscellaneous costs such as insurance and tax. The cost of drivers and mechanics was ~~not~~ allocated to the cost of mechanisation and is considered under labour costs. Interest was not charged on capital expenditure. X

To arrive at the overall farm mechanisation cost, the expenditure incurred on the hiring of contractors services was added, and in the few cases where surveyed farms themselves undertook part-time contracting, the income was deducted before arriving at the total farm machinery cost.

YEARS

ITEM	PURCHASE PRICE 1976 SHS.	ECONOMIC LIFE (YRS)	YEARS												FIXED COST ERR YEAR SHS.		
			1	2	3	4	5	6	7	8	9	10	11	12			
Tractor 45-47 hp	66,700	8	66700	58400	50000	41700	33400	25000	16700	8300	-	-	-	-	-	-	8300
Tractor 62-68 hp	82,400	8	82400	72100	61800	51500	41200	30900	20600	10300	-	-	-	-	-	-	10,300
Tractor 72-79 hp	93,800	8	93800	82100	70400	58600	46900	35200	23500	11700	-	-	-	-	-	-	11,700
Tractor 90 hp +	118,300	8	118300	103500	88700	73900	59200	44,400	29,600	14800	-	-	-	-	-	-	14,800
Disc Plough 2 Furrow	7740	12	7700	7100	6500	5800	5200	4500	3900	3200	2600	1900	1300	600	600	600	600
Disc Plough 4 Furrow	9400	12	9400	8600	7800	7100	6700	5500	4700	3900	3100	2400	1600	800	800	800	800
Disc Plough 5 Furrow	15,000	12	15000	13800	12500	11300	10,000	8,800	7500	6300	5000	3800	2500	1300	1300	1300	1,300
Mould Board Plough 3 F.	13,210	12	13,200	12100	11000	9900	8800	7700	6600	5500	4400	3300	2200	1100	1100	1100	1,100
Disc Harrow(18 Disc)	14,500	12	14,500	13,300	12,100	10,900	9700	8500	7300	6000	4800	3600	2400	1200	1200	1200	1200
Trailer Harrow	30,450	12	30,500	27,900	25,400	22,800	20,800	17,800	15,200	12,700	10,200	7600	5100	2500	2500	2500	2500
Ridging Body	2,000	12	2000	1800	1600	1500	1300	1200	1000	800	100	500	300	200	200	200	200
Cultivator	5300	12	5300	4900	4400	4300	3500	3100	2600	2200	1800	1300	900	400	400	400	400
Tool Bar	4395	12	4400	4000	3700	3300	2900	2600	2200	1800	1500	1100	700	400	400	400	400
Seed Drill	36,060	9	36,100	32,100	28,000	24,000	20,000	16,000	12,000	8,000	4,000	-	-	-	-	-	4000
Maize Planter	10,170	11	10,200	9,200	8,300	7,400	6,500	5,600	4,600	3,700	2,800	1,900	900	-	-	-	900
Fertiliser Spreader	3,600	9	3800	3400	2900	2500	2100	1700	1300	800	400	-	-	-	-	-	400
Rotavator	14,900	8	14900	13,000	11,200	9,300	7500	5600	3700	1900	-	-	-	-	-	-	1900

WRITTEN DOWN VALUE/SHS. PER YEAR (Continued)

YEARS

ITEM	PURCHASE PRICE 1976	ECONOMIC LIFE	YEARS												FIXED COST PER YEAR SHS.
			1	2	3	4	5	6	7	8	9	10	11	12	
MOWER (rotary)	13,210	11	13,200	12,000	10,800	9,600	8,400	7,200	6,000	4,800	3,600	2,410	1,200	-	1,200
MOWER (reciprocating)	6,000	11	6,000	5,500	4,900	4,400	3,800	3,300	2,700	2,200	1,600	1,100	500	-	500
Combine Harvester	263,000	12	263,000	241,100	219,200	197,300	175,300	153,400	131,500	109,600	87,700	65,800	43,800	21,900	21,900
Trailer 5 Ton	19,710	12	19,700	18,100	16,400	14,800	13,100	11,500	9,900	8,200	6,600	4,900	3,300	1,600	1,600
Trailer 3 1/2 ton	12,940	12	12,900	11,900	10,800	9,700	8,600	7,600	6,500	5,400	4,300	3,200	2,200	1,100	1,100
Maize Shelter (manual)	2,700	12	2,700	2,500	2,300	2,000	1,800	1,600	1,400	1,100	900	700	500	200	200
Maize Shelter (motor)	5,910	12	5,900	5,400	4,900	4,400	3,900	3,500	3,000	2,500	2,000	1,500	1,000	500	500
Baler	53,200	12	53,200	48,800	44,300	39,900	35,500	31,000	26,600	22,200	17,700	13,300	8,900	4,400	4,400
Sprayer	11,800	9	11,800	10,500	9,200	7,900	6,600	5,200	3,900	2,600	1,300	-	-	-	1,300

ECONOMIC LIFE OF MACHINE/EQUIPMENT

1. Tractors: Based on 'Agricultural Mechanisation' booklet, Agricultural Extension Services, Kitale.

2. Other Equipment/Machines: Based on 'Profitable Farm Mechanisation' C. Culpin.

A P P E N D I X 3

Table 1. Results of Regression Analyses.

Analysis and Farm Group	Correlation coefficient r	Significant Probability P
<u>1. Intensity of Use (y) by Farm Size (x)</u>		
<u>Good Farms:</u>		
All systems (a) Including farms > 1000 ha	<u>+0.41</u>	<u>0.05</u>
(b) Excluding farms > 1000 ha	-neg	NS
Systems 1 and 3		
(a) Including farms > 1000 ha	-neg	NS
(b) Excluding farms > 1000 ha	-neg	NS
Systems 2	-neg	NS
<u>Average and Poor Farms:</u>		
All farms	-neg	NS
Systems 1 and 3	-neg	NS
System 2 (a) All farms	-neg	NS
(b) Completely whole farms only	<u>-0.76</u>	<u>0.02</u>
<u>2. Number of Dairy Cows (x) By Dairy Production Parameters (Y)</u>		
<u>Good Farms:</u>		
<u>Number of Cows by Yield/Cow</u>		
All systems	+ve	NS
Systems 1 and 3	+ve	NS
System 2	-neg	NS
<u>Average and Poor Farms:</u>		
<u>Number of Cows by Yield/Cow</u>		
All Systems	-neg	NS
Systems 1 and 3	-neg	NS
System 2	-neg	NS

Table 1. Results of Regression Analyses

(contd.)

Analysis and Farm Group	Correlation Coefficient r	Significant Probability P
3. <u>Farm Size (x) by Parameters of Production (y)</u>		
<u>Good Farm:</u>		
<u>Farm Size by Gross Output/ha</u>		
All systems	0.44	0.05
Systems 1 and 3	-neg	NS
System 2	-neg	NS
<u>Farm Size by Gross Margin/ha</u>		
All systems	-neg	NS
Systems 1 and 3	-neg	NS
System 2	-0.63	0.05
<u>Farm Size by Gross output/cul ha</u>		
All systems	-neg	NS
Systems 1 and 3	-neg	NS
System 2	-0.75	0.02
<u>Farm Size by Gross Margin/Cul ha</u>		
All systems	-neg	NS
Systems 1 and 3	-neg	NS
System 2	-0.75	0.02
<u>Average and Poor Farms:</u>		
<u>Farm Size by Gross Output/ha</u>		
All Systems	-neg	NS
Systems 1 and 3	-neg	NS
System 2	+ve	NS
<u>Farm Size by Gross Margin/ha</u>		
All Systems	-neg	NS
Systems 1 and 3	-neg	NS

Table 1. Results of Regression Analyses

(contd.)

Analysis and Farm Group	Correlation Coefficient r	Significant Probability P
<u>Farm Size by Gross Margin/ha (contd.)</u>		
System 2	+ve	NS
<u>Farm Size by Gross Output/Cul ha</u>		
All Systems	+ve	NS
Systems 1 and 3	+ve	NS
System 2	<u>+0.55</u>	<u>0.05</u>
<u>Farm System by Gross Margin/Cul ha</u>		
All Systems	-neg	NS
Systems 1 and 3	-neg	NS
System 2	<u>+0.79</u>	<u>0.01</u>

Notes:

NS = Not significant at 0.01 - 0.05 level of probability

-neg = Negative correlation coefficient or inverse relationship if any

+re = Positive correlation coefficient

