

UYOLE AGRICULTURAL CENTRE
MBEYA, TANZANIA

The basis for planning
an adaptive research
programme on rice for
small farmers in Kyela

by

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ABSTRACT

This report describes the Farming System of the Kyela Plain and tries to assess the management compromises in resource allocation and enterprise management by farmers. The study is based on the interviews of the village leaders during the pre-survey and sixty two farmers, randomly selected, during the survey.

The area receives around 2,800mm of rain annually. It is a representative of low coastal areas with an average altitude of 600m above sea level and the soils are clayey with imperfect drainage. Most of the original vegetation has been replaced by cultivation. The area is densely populated, with about 170 people per square kilometre.

During the 1977/78 season, 80% of the sampled farmers received an annual cash income of not more than shs 2,500. Rice was the dominant crop in the system grown both for food and cash. Other important starch staples were: maize, bananas, cassava and sweet potatoes. Fish, beans, peas, groundnuts, pumpkin, cassava and bean leaves were the preferred relishes.

In Kyela the concentration of planting occurs between December and February. Maize and, to a lesser extent, groundnuts, receive initial priority at the start of the rains in November with rice taking over in early December to the end of February. The concentration of harvesting occurs between May and July.

During the labour peaks, when the major crops are being established and when harvesting takes place, few farmers hire casual labourers. The majority depend on communal work parties during such periods. Few farmers also hire tractors and/or oxen for ploughing and harrowing their fields.

The last chapter of the report outlines the present rice management in the area, the reasons for the present practices and the possibilities for improvement.

ACKNOWLEDGEMENTS

The author gratefully acknowledges, the role played by Mr. I.S. Croon, Head of Research Department of Agricultural Economics, Uyoie Agricultural Centre, during 1977 - 1981, in making the production of this report a success. He initiated the project and was fully involved in data collection and processing.

Many thanks are also due to Messrs G.T. Mkindi, C.K.J. Ponjee, L. Mugarula, O.Y. Guga and Miss E. Magehema for interviewing the farmers.

A special debt is owned the sampled farmers and their leaders for their cooperation throughout the study period and finally thanks are due to Mrs. E. Sembuli for typing the draft of the report.

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1. INTRODUCTION

1.1. Background

The Farm Management studies carried out by the Department of Agricultural Economics and Rural Sociology during the major part of the 1970's were mainly descriptive. A lot of information on the farming system in different locations within the Uyo Agricultural Centre's (UAC's) responsibility was gathered. Although much of the data, collected through long fieldwork periods, is potentially useful, little of the information has been utilized in planning experimental programmes mainly because the studies were not directly designed to produce concrete proposals for experiments. Researchers in different fields have therefore not found these reports very useful.

In addition to these general and comprehensive types of surveys field studies focusing on particular crops or factors have been carried out at UAC. This latter type of surveys have contributed to identifying problems related to the enterprise or factor under study but they have not considered interactions and constraints in the particular farming system of which the studied aspect is a part.

Since the late 1970's UAC has started to reorientate some of its programmes towards being more directly responsive to solving the constraints of the small farmers in expanding agricultural production. The first effort along these lines was undertaken in cooperation with CIMMYT's Eastern African Economics Programme. The Kyela study is the second of its kind carried out at UAC. Whereas traditional commodity, or resource oriented agricultural research ignores the fact that farmers produce several commodities, by the management of several resources, in an integrated farming system, this study tries to deal with the farming system as a whole.

1.2 The approach

This report forms a basis for Farming Systems Research (FSR) at Uyo. The FSR conducted by economists in collaboration with technical scientists, will identify management compromises (in allocating the scarce resources to different enterprises) and will

allow the planning of experiments which will complement farmers' priorities. Recommendations based on the results from experiments planned in this way will likely be rapidly absorbed because they will not conflict with facets of existing management practices which are important to farmers. This report describes the Farming system of the Kyela Plain and assesses the compromises in resource allocation and enterprise management made by farmers.

1.3 The methodology

A preliminary visit to the Kyela Plain was made during the period 26th April - 29th April, 1978. During the visit the idea of the study was discussed with the District Authorities, i.e the District Development Director (DDD) and the District Agricultural Development Officer (DADO) and leaders of Ibungu, Ikolo, Itope and Ipinda villages which were selected for the study.

During the pre-survey the village leaders and some farmers were interviewed in each of the mentioned villages. The interviews were focused on the description of the local farming system, identification of resource constraints farmers' opinions on hazards and the identification of farmers' opinions on hazards and the identification of farmers' management strategies in the face of resource limitations and hazards faced.

The full survey (involving 62 farmers randomly selected in the plain) was done in May, 1978 to:

- a) Verify the description of farming, obtained in the pre-survey, including farmers' priorities and preferences, and thus the homogeneity of farming in the area under investigation.
- b) Verify the limiting factors identified in the pre-survey
- c) Verify the hazards faced by farmers and their relative importance.
- d) Verify the management strategies used by farmers.

The major problems encountered during both the pre-survey and the farmer survey were lack of funds, transport and few enumerators.

The frequency distribution and cross tabulation of the data were done in Sweden in early February, 1979 using the SAS-76 computer.

The write up of the report has taken such a long time because of shortage of staff in the Research Department of Agricultural Economics, UAC.

2. FARMERS' CIRCUMSTANCES IN KYELA

2.1 Introduction

This chapter describes farmers' circumstances in the Kyela Plain (the natural; economic and institutional features) forming a framework within which the farmer has to manage his limited resources to satisfy his priorities. The circumstances, ^{which} are exogenous to the farm, many influence farmers' management decisions, but the farmer himself cannot influence them.

The farmer's role as a decision maker is to allocate his scarce resources of land, labour and cash between crop and livestock production in a way which satisfies his and his family's priorities.

Appropriateness in adaptive experimentation is partly dictated by the framework within which the farmer has to manage his scarce resources to satisfy his priorities.

2.2 Climate

As noted by Nieuwolt (1973) in most tropical countries, where temperatures show little or no seasonal variation, rainfall is the main limiting factor in agriculture. In Tanzania rainfall is a particularly critical element because the amounts received are generally rather limited.

For Kyela the probability that the annual rainfall exceeds 2000 mm is 0.9 (Tanzania, United Republic of, 1967). Table 2 - 1 shows the rainfall monthly averages at Kyela Hospital. Rainfall probabilities are also shown in the table:

Table 2 - 1.

RAINFALL FIGS. FOR KYELA HOSPITAL 99. 33010

P.	YEAR a)	J	F	M	A	M	J	J	A	S	O	N	D	Total
0.8	1951-56	352	366	860	918	1083	472	116	32	51	0	188	339	4870
	1957-61	338	263	652	1275	395	327	280	102	3	0	119	203	
	1962-68	298	361	962	1369	1007	443	269	124	98	80	326	538	
	\bar{x}	329	330	825	1187	828	414	222	36	51	27	211	360	
0.5	1951-56	265	177	602	835	988	194	49	29	37	0	64	297	3378
	1957-61	267	148	611	893	323	238	152	9	0	0	99	159	
	1962-68	269	338	677	836	511	233	69	48	37	15	177	486	
	\bar{x}	267	221	630	855	607	222	90	29	25	5	113	314	
0.4	1951-56	124	168	396	829	440	154	26	0	16	0	3	161	2309
	1957-61	102	128	523	829	307	230	133	4	0	0	9	141	
	1962-68	156	102	541	457	482	113	52	0	19	12	133	136	
	\bar{x}	127	133	487	705	410	166	70	1	12	4	48	146	
0.2	1951-56	98	149	351	685	327	116	8	0	0	0	0	131	1662
	1957-61	75	71	229	697	194	135	55	2	0	0	8	106	
	1962-62	104	96	144	394	467	78	46	0	0	9	98	120	
	\bar{x}	92	105	241	591	329	110	36	1	0	3	35	119	

Average monthly rainfall, 30yrs 194.6 170.1 473.9 879.0 534.0 175.2 84.0 31.7 11.4 13.5 99.5 208.2 2878.1
 a) Data for 1952 and 1965 are missing.

The table gives a rough estimate of rainfall reliability on monthly basis over the year. The measures were derived by ranking the data into groups of five years and the average figure for each month and for each rainfall probability was calculated. The probability levels indicated are the ones below which rainfall will be expected to fall in specified number of years. The probabilities merely show that rainfall will be less than levels shown in 8, 6, 4 and 2 years out of 10. The rainfall reliability is an important measure because for agricultural production farmers place importance on it.

Starting from late November or December the rain falls gently through February. The months receiving the heaviest rainfall are March, April and May. August September and October receive relatively insignificant rainfall.

Monthly rainfall averages give the rainfall profile for the area which, unless irrigation is used, is a good guide to the cropping calendar. The profile also shows up times of the year farmers are likely to be very busy on farms in the area, times when food and cash may be a problem and periods when rainfall reliability could be awkward for the farmers.

2.3 Soils, altitude, topography and natural vegetation

Recent information on soils in Kyela District is very limited. The Soil Science Research Department, UAC, is still carrying out the soil survey, in the District. In this respect extensive use of Tanzania, United Republic of, (1967) has been made.

Kyela District is a representative of low coastal areas with average altitude of 600m above sea level. The soils are clayey with imperfect drainage. They are of Ultisol order i.e. mineral soils having strong structural development, clay accumulation in the B horizon and with discontinuous iron pan (plinthite). The land has a gentle slope.

Most of the original vegetation has been replaced by cultivation such that the natural vegetation cannot be identified.

2.4. Population and settlement

The District had a population of 114,600 at the 1978 census (Daily News, 17th January, 1979). During the pre-survey interviews, in August 1980, the ward leaders of Kyela District indicated that each of the villages in their wards had around 300 households on average. Since villagisation in 1975 the population of the District has been concentrated into the registered villages. By the end of March 1979 the whole of Mbeya Region had 562 registered villages of which 432 had formed village governments (Daily News, 3rd May, 1979). During the pre-survey in August 1980, the problem of land scarcity was pointed out in most areas of the District.

Most of the population of the District is the Nyakyusa. Other tribes in the District include the Ndali, Kisi, Kinga and Ngoni. Social traditions, including eating habits are fairly homogenous throughout the District.

2.5 Communication

The private buses and those owned by the Tanzania Railways Corporation (TnC) provide road service from Mbeya (the Regional Headquarters) to Itungi Port, on Lake Nyasa. The road is bituminous. From this main road there is a network of non-bituminous feeder roads to various parts of the District thus giving access to the main centres of settlement.

Mbeya Town itself is easily accessible to other parts of the country by road and air. The TAZARA railway from Dar es Salaam to Kapiri Mposhi, Zambia also passes through Mbeya Town.

2.6 Markets

The major crops, i.e. paddy, maize, beans, groundnuts, cashewnuts and cocoa are sold through government established channels. The National Milling Corporation (NIC) is responsible for buying the cereals and legumes whereas the General Agricultural Products Export Corporation (GAPEX) buys cocoa and the Cashewnut Authority

of Tanzania (CATA) buys farmers' cashewnuts. Official prices for the main scheduled crops are announced prior to the buying season, the same prices apply nationwide. Table 2 - 2 shows the producer prices for the important crops in the District for the 1977/78 - 1981/82 seasons.

Although the official marketing channels exist, there are informal transactions between neighbours and people from outside the District. There are strong seasonal price variations in the unofficial markets.

Table 2 - 2. Kyela District: Producer prices for the main scheduled crops, 1977/78 - 1981/82.

Crop	1977/78	1978/79	1979/80	1980/81	1981/82
Shs per kg.....				
Paddy	1.20	1.20	1.50	1.75	2.30
Maize	0.85	0.85	1.00	1.00	1.50
Cassava -Makopa	0.60	0.65	0.65	0.65	0.70
-Udaga	0.50	0.50	0.50	0.50	0.50
Fingermillet	2.00	2.00	2.00	1.50	1.50
Groundnuts	4.00	4.00	4.00	4.20	4.80
Beans I	2.00-3.50	3.50	3.50	3.50	3.50
Beans II	1.75-2.75	2.75	2.75	2.75	2.75
Cashewnuts-SG	1.15	1.70	1.80	3.00	3.00
-UG	1.00	1.40	1.50	2.00	2.00

Sources: 1977/80 - 1980/81, Marketing Development Bureau, Ministry of Agriculture.

1981/82, The Daily News, 27th May, 1981.

3. FARMERS' OBJECTIVES, PRIORITIES AND RESOURCE ENDOWMENTS IN KYELA

3.1 Introduction

Small farmers have multiple objectives which are ranked as priorities:

- a) A reliable supply of basic foods.
- b) A desirable combination of foods.
- c) A supply of cash.
- d) Minimization of risk in farming.

The ranking varies depending particularly on the stage of development achieved.

Like the ranking of priorities the factors which limit agricultural production vary according to farmers' natural and economic circumstances. Uncertainties from four major sources bring farmers their management problems:

- a) Rainfall variation affecting output levels.
- b) Pest and disease incidence affecting output levels.
- c) Variable purchase price of foods affecting cash needs.
- d) Variable selling prices for cash crops affecting cash availability.

Farmers' objectives and priorities are reflected in what they do on their farms. They have to satisfy their priorities with the resources at their disposal. Thus in planning adaptive experimentation one has to keep farmers' priorities in mind. If such experimentation is to be relevant, it must result in improved management practices which can be implemented within the level of resources farmers are able and willing to invest.

3.2 The dominance of subsistence objectives in the Kyela farming

During the 1977/78 season 80% of the sampled farmers in Kyela received an annual cash income of not more than Shs 2,500. Their dominant priority was to have an adequate food supply for their families throughout the year. Within this dominant priority of a reliable food supply they showed preferences which are discussed below. Table 3 - 1 shows their preferences for staple foods.

Table 3 - 1. Kyala farmers: Preferences for staple foods (%).

Starch source	1st preference	2nd preference
No response	0	1
No preference	1	2
Rice	69	13
Maize	15	30
Bananas	10	34
Cassava	5	13
Sweet potatoes	0	7

When they were asked to express their first and second preferences for staple foods 82% had a first or second preference for rice and 45% and 44% a first and second preference for maize "Ugali" (stiff porridge) and cooked bananas respectively. Cassava and sweet potatoes were supplementary starch sources.

The preferred relishes were pumpkin, cassava, pea and bean leaves. Beans and peas were also important relishes.

As table 3 - 2 shows whereas cassava, bananas, rice and maize are the starchy staples grown by the majority of farmers in the area, beans, pigeon peas, groundnuts and bambaranuts are the main legumes.

Table 3 - 2. Kyala: The proportion of farmers growing the main foods

Food (starches)	Proportion growing	Food (relishes)	Proportion growing
	Percent		Percent
Cassava	97	Beans	66
Bananas	95	Pigeon peas	65
Rice	94	Groundnuts	53
Maize	86	Bambaranuts	52
Sweet potatoes	81		
Finger millet	42		

When farmers were asked to mention a year in which they last purchased the cereals because they had nothing in store for food the majority could not remember any year. 19% reported that they purchased rice between 1971 and 1978 during the months of February, March, April, May, July, August, September and December. 14% reported that they purchased other grains in 1971, 1972 and 1977 during the months of January, March, June - August and December. Based on this information it seems the majority of farmers produce enough cereals to meet their subsistence requirement.

Table 3 - 3 shows the availability of different foods in Kyela during the year.

Table 3 - 3. Kyela: The availability of different foods during the year.

Food	Readily available	Uncertain supply	Not available
Cassava	June-August	Sept. - May	
Bananas	April-January	February-March	-
Rice	May-August	September-April	-
Maize	April-June	July-August	Sept.-March
Sweet potatoes	June-January	February-May	-
Vegetables	May-June	January-April	July-Dec.

During the main survey 62% of the sample farmers reported using fresh cassava leaves throughout the year. The rest mainly used them between February and October. The majority of farmers (88%) did not pick and dry leaves for eating during the dry season.

The commonly purchased foods are rice, maize, beans and other relishes. Rice is usually purchased between September and May and maize between August and March. Beans and other relishes are bought throughout the year.

By December 1977 80% of the rice growers had finished rice from the previous year's harvest (1976/77) and 10% were still keeping some in store. By the same period 83% of the maize growers had

finished it and 13% were still keeping it in store, 85% of the farmers who grew beans during 1976/77 season had finished them by December 1977 and 10% had some in store during that time.

71% of the sample farmers started eating beans planted during the 1977/78 season between March and September 1978. 27% could not remember the month(s).

3.3 Cash incomes among Kyela farmers

From table 3 - 4 it can be noted that during 1977/78 season 80% of the sample farmers in Kyela did not receive an annual cash income of more than Shs 2,500. Whereas 5% of the sample did not get more than Shs 200 that year another 5% got between Shs 5,000 and 10,000.

Table 3-4 sample farmers in Kyela: Income levels during 1977/78

<u>Income level</u>		<u>Proportion of farmers</u>
	<u>Shs</u>	<u>Percent</u>
1	- 200	5
201	- 400	9
401	- 600	13
601	- 1000	13
1001	- 1500	20
1501	- 2500	20
2501	- 3500	10
3501	- 5000	5
5000	- 10000	5
<u>Total</u>		100

Source: Computer printout of survey data.

The major cash sources and approximate income levels of the surveyed farmers are shown in table 3 - 5. The table shows that the overall average reported cash income was shs 1,600 per farm, with an average of about shs 1,200 reported from on-farm sources - mainly sales of rice, beans, cocoa, milk and cows.

Table 3 - 5. Sample families in Kyela: Sources of cash income during 1977/78

Cash source	Farmers deriving	Level of income in shs								Average a) for sellers	Average for sample	
		100	100-199	200-299	300-499	500-799	800-1199	1200-1599	≥1600			
		No:	Percent.....	No:	Percent.....						shs	shs
Crop sales:												
Rice	39	63	0	9	3	9	11	2	1	4	581	366
Beans	42	68	7	10	3	8	5	4	4	1	482	328
Cocoa	18	29	0	4	0	12	2	0	0	0	372	108
Groundnuts	18	29	6	8	1	3	0	0	0	0	164	48
Fruits/Veg.	1	2	0	1	0	0	0	0	0	0	750	15
Cashew nuts	4	6	1	1	1	1	0	0	0	0	213	13
Others	1	2	0	0	1	0	0	0	0	0	250	5
Livestock and products:												
Milk	31	50	9	11	3	6	2	0	0	0	211	106
Cows	25	40	11	7	5	0	0	0	1	1	234	94
Chickens/eggs	16	26	0	2	13	1	0	0	0	0	247	64
Pigs	10	16	2	6	1	1	0	0	0	0	165	26
Off farm sources:												
Family working	21	34	0	2	1	0	18	0	0	0	583	198
Casual labour	48	77	9	21	9	6	1	0	0	2	252	194
Other	8	13	1	2	4	0	0	0	1	0	344	28
Overall mean												1604
On farm sources												1184

a) In calculating the contribution of the listed items to the total annual family cash income those receiving less than Shs 100 were assumed to receive shs 50 and those receiving shs 1600 or more were assumed to receive shs 1000.

77% of the sample families were also receiving cash income from casual labour and 34% were receiving it from family members working away from their farms.

3.4 Land in Kyela farming

There is land scarcity in Kyela. All land is under continuous cultivation and crop rotation is not followed. About half of the farmers usually apply small quantities of fertilizers on their rice fields to maintain the soil fertility. Farm-yard manure is also used to some extent. A typical cultivated area per family during the survey was about 1.5ha, and about half of it was used for rice production.

Extrapolating from the 1978 census the population of Kyela District is estimated at 129,000 in 1982. The area of the District is about 770km² and therefore the population density is about 168 people per km².

According to 57% of the sample farmers it was difficult to get more rice land to cultivate. The rest said that they could get it by clearing new land and by renting at Shs 240 - 480 per ha (during the survey).

3.5 Labour in Kyela farming

The families provide most of the farm labour in the area. Family size averaged 6.9 persons among survey farmers with 3.4 of these being over 15 years old and so of working age.

The labour peaks were said to occur during November - February when the fields are cultivated, planted and the crops are weeded. The other busy months are May - July when harvesting of the crops is done. According to the majority of the respondents (73%) during the main survey rice is the main labour user.

Some hiring of labour is done and the communal work parties are common in the area especially during cultivation, weeding and harvesting. When farmers were asked to indicate the number of times they had people on their farms to help them during the busiest months of the 1977/78 season 65% said they were not helped at all, 19% 13%, 2% and 1% said they got help once, twice, thrice and four times respectively.

Table 3 - 6 shows the operations and number of times which 35% of the sample farmers got help from other people during the **busiest** months of the 1977/78 season.

Table 3 - 6. Kyela: The operations and number of times sample farmers get help during the 1977/78 season.

Operation	No. of times	Farmers	
		No.	Percent
Hoeing	1	8	36
	2	11	50
	3	3	14
Weeding	1	2	9
	2	3	14
	3	2	9
	4	2	9
Harvesting	1	1	4
	3	1	4
Other	4	1	4

3.6 Capital in Kyela farming

All families in Kyela had hand hoes for their farm work. 55% of the sample had neither oxen nor ploughs. 35% reported owning both and whereas 8% reported owning only oxen, for farm work, 2% reported owning ploughs only.

The purchases of resources for use on the farms by sample farmers in Kyela during the 1977/78 season are shown in table 3 - 7 and table 3 - 8 shows the working capital expenditure by income groups.

Table 3-7 Kyela: Purchases of resources by sample farmers during the 1977/78 season.

Item	Proportion of farmers	Average value per farmer	
		for purchasers	for whole sample
	PercentShs.....	
Basal fert.	45	153	69
Machinery	27	174	47
hired labour	26	167	43
Top dressing fert.	13	88	11
Rice seed	8	130	10
Insecticide	0	0	0

As table 3-8 shows nearly half (47%) of the the sample farmers did not spend more than shs 100 on the purchases of farm inputs during 1977/78 and 24% did not purchase them at all.

Table 3-8 Kyela: Working capital expenditure by income groups, 1977/78

Income level a)	Prop. of farmers within income level	Expenditure levels b) of farmers in sh								Total percent of farmers
		0	1-100	101-200	201-300	301-400	401-500	501-600	801-900 (600+)	
<u>Shs</u>	<u>Percent</u>	<u>Percent of farmers</u>								
1-200	5	2	2	0	2	0	0	0	0	6
201-400	9	2	2	2	0	0	3	0	0	9
401-600	13	5	8	2	0	0	0	0	0	15
601-1000	13	3	2	1	2	3	2	0	0	13
1001-1500	20	7	3	3	0	3	3	0	0	19
1501-2500	20	2	3	7	1	5	0	0	0	18
2501-3501	10	0	2	3	0	1	0	3	2	11
3501-5000	5	0	0	0	0	1	0	3	0	4
5001-10000	5	3	1	0	0	1	0	0	0	5
Total	100	24	23	18	5	14	8	6	2	100

a) The reported lowest income was shs 18 while the highest was shs 7060

b) The reported lowest expenditure was shs 0 while the highest was shs 812.

4. FARM MANAGEMENT IN THE KYELA STUDY AREA

4.1 Introduction

Farm Management is the decisions a farmer takes in allocating his scarce resources to production enterprises in order to satisfy his priorities. Such management is itself a resource. In this chapter the management of farms in Kyela is discussed and an attempt is made to evaluate the influence of farmers' priorities, circumstances and resource endowments on the cropping patterns to understand why farms are managed the way they are.

4.2 The enterprise pattern

The approximate hectareage figures for the main crops grown in Kyela during the 1977/78 season are shown in table 4-1.

Table 4-1 Kyela: Approximate areas of the major crops, 1977/78.

Crop	Percent growing	Ha per grower	Average ha per sample
Rice	94	0.67	0.63
Maize	86	0.45	0.39
Beans	66	0.45	0.30
Cassava	97	0.25	0.24
Sweet potatoes	81	0.20	0.16
Groundnuts	53	0.20	0.11

The majority of the farmers (92%) were growing rice on pure stand. A few mixed it with other crops, such as maize and groundnuts. 30% of the maize plantings were reported as pure and the rest were mixed with beans, groundnuts, rice and pumpkins. Over 70% of the bean, cassava and sweet potato plantings were reported as pure. Only 44% of the farmers were growing groundnuts on pure stands. In addition to the crop enterprises 94% of surveyed farmers kept cattle and a very small minority of these about 2% kept sheep and goats. 47% of the surveyed farmers kept pigs.

A number of farmers made several plantings of the major crops. Table 4-2 shows the proportion of farmers making these plantings.

Table 4-2. Kyela: Multiple plantings of the major crops, 1977/78

Crop	Percent of farmers making plantings		
	1	2	3
Cassava	34	55	52(old crop)
Rice	50	56	37
Maize	60	29	-
Sweet potatoes	66	15	-
Beans	3	61	-
Groundnuts	44	15	-

4.3 The crop calendar

Table 4-3 shows the detailed crop calendar for the major crops in the Kyela farming system. It shows plantings, use from the field and harvests by ten-day intervals over the year, November to October. The concentration of planting occurs between December and February and that of harvesting occurs between May and July. The table further shows the early usage of both cassava and maize.

Table 4-3. Kyela: Crop Calendar - Establishment and Usage

Crop	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
	E M L	E M L	E M L	E M L	E M L	E M L	E M L	E M L	E M L	E M L	E M L	E M L
Cassava												
87 plantings	2	4 2	4 3	2 4	5 5 4	6 6	8 3 5	3 3 3	4 6 3	1		1
31 used from field	1	1	1 2	6 2	6 1	2	3	4	1		1	
25 harvested		1	2	2	1 1	1	1 1	1 1	4 1	1	2 2	3
Rice												
89 plantings	2 1	18 9	261 8	131 7	2						1	
25 used from field					1		1 9 3	8 1	2			
86 harvested						1	11 17	23 16	13 5			
Maize												
55 plantings	6 1 5	101 1	9	4		4 1	5 3	2 1 1	1			
35 used from field			2	3 1 2	9 2	3 2	1 2		1 1	1 3		2
50 harvested	1			1 2	4 5	11 6	3 2	1		1 5	4	1
Sweet potatoes												
50 plantings	1	1	2	13 3	8 2 3	7 1	2	1 2	3	1		
30 used from field		2		1	1	1 2	3 1	2 3	4 6	1 1	1	1
30 harvested	1	1	1	1	1	2	1 1		5 4	6 4	1	1
Beans												
40 plantings		1	1		1 1	7 2	12 4	7	3	1		
25 used from field	1		1				1	2	11 4	4		1
33 harvested			1	1		2	1		3 4	9 6	1 2	1 2
Groundnuts												
56 plantings	5 1 3	5 3	7 1	2		1	3 1	2		1 1		
19 used from field	1			1 1	5 3	3 2	1	2				
34 harvested	1			2 1	3 5	7 4	2 1	2	1 1	2 1		1
Total plantings	13212	38314	494 9	341 14	16 7 8	25 1 9	303 13	15 4 6	7 7 6	3 0 2	0 1 0	0 0 1
Total used from field	2 0 1	3 0 0	2 0 4	11 1 5	22 0 6	9 0 7	17 0 7	18 0 4	19 0 11	6 0 4	1 0 1	4 0 0
Total harvested	1 0 2	2 0 0	2 0 2	6 0 4	9 0 11	230 11	10 23	21 18	26 0 15	180 17	7 0 5	1 0 8

Table 4-4 sets out more closely the concentration of planting during the year. As it shows, maize and, to a lesser extent, groundnuts receive initial priority at the start of the rains in November with rice taking over in early December through to the end of February. The planting of sweet potatoes increases in importance in early February but by early March gives way to cassava. The bean plantings mainly take place in May and early June.

Table 4-4. Kyela: Farmers' planting sequence and priorities

Crop	Nov.		Dec.		Jan.		Feb.		Mar.		Apr.		May		June		July		Aug.		Sept.		Oct.		Total													
	E	M	L	E	M	L	E	M	L	E	M	L	E	M	L	E	M	L	E	M	L	E	M	L	E	M	L	No.	%									
Number of plantings by ten-day periods.....																																					
Rice	2	-	1	18	-	9	26	1	8	13	1	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	89	25						
Cassava	-	-	2	4	2	-	4	3	-	2	-	4	5	5	4	6	-	6	8	3	5	3	3	3	4	6	3	1	-	-	87	24						
Maize	6	1	5	10	1	1	9	-	-	4	-	-	-	-	-	4	1	-	5	-	3	2	1	1	-	1	-	-	-	-	55	15						
Sweetpotatoes	-	-	1	-	-	1	2	-	-	13	-	3	8	2	3	7	-	1	2	-	2	1	-	2	-	-	3	1	-	-	50	14						
Beans	-	-	-	1	-	-	1	-	-	-	-	-	1	-	1	7	-	2	12	-	4	7	-	-	3	-	-	-	-	1	40	11						
Groundnuts	5	1	3	5	-	3	7	-	1	2	-	-	-	-	-	1	-	-	3	-	1	2	-	-	-	-	-	1	-	1	36	10						
Total	13	2	12	38	3	14	49	4	9	34	1	14	16	7	8	25	1	9	30	3	13	15	4	6	7	7	6	3	0	2	0	1	0	0	0	1	357	99
Percent of monthly totals.....																																					
Rice	1	-	-	5	-	2	7	-	2	4	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Cassava	-	-	1	1	1	-	1	1	-	1	1	1	2	-	2	2	1	1	1	1	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-		
Maize	2	-	1	3	-	-	2	-	-	1	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Sweet potatoes	-	-	-	-	-	-	1	-	-	4	-	1	2	1	1	2	-	1	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-		
Beans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	3	-	1	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-		
Groundnuts	1	-	1	1	-	1	2	-	-	1	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

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4.4 Farm Management and resource limitations in Kyela

Land and labour are the basic resources of the Kyela farming system. Capital is used to off set deficiencies in either land, as in the purchase of fertilizers, or labour, as with hired/purchased oxen and ploughs or hired machinery. As there is land scarcity in Kyela following is not easy and so the only way to maintain the soil fertility is the use of manure and artificial fertilizers. Despite the increasing need of using fertilizers only 60% of the surveyed farmers used it during the 1977/78.

4.5 The soil fertility maintenance

The use of fertilizers, mostly TSP and SA, is becoming common in Kyela. The usual rate is 2.5 bags of 50kg per ha broadcasted with rice seed at planting and the same amount of SA applied later during the growing season. During 1977/78 season 76% of the farmers did not use animal manure on their fields. The following table shows the crops on which the sample farmers used animal manure that season.

Table 4-5. Kyela: Use of animal manure on different crops, 1977/78

Crops	Percent of farmers
Bananas, maize, cocoa	16
Beans and maize	3
Cocoa only	3
Rice only	8

4.6 The seasonal labour supply

In Kyela the labour peaks occur during November to February when the major crops in the system are being established. The other months of heavy activity are May to July when harvesting takes place. During the labour peaks few farmers hire casual labourers. During the survey the cost of hiring labour was shs 10 for weeding 50m² of the cropped area. Where communal work parties are common for ploughing and harrowing few farmers hire tractors and or oxen for the same operations. In 1977/78 the cost of ploughing 1 ha of land with a tractor was shs 180 and that of ploughing the same area

with an ox-plough was about shs 150. 73% of the farmers reported rice as the main labour user.

4.7 Compromises in Management due to seasonal labour shortage

The following are the management strategies followed by Kyela farmers to help them alleviate seasonal labour constraints.

1. Spreading the planting effort

The plantings of maize, rice and groundnuts are mainly done between November and February, those of sweet potatoes between February and March and those of cassava and beans in April and May.

2. Use of capital to alleviate labour bottleneck in land preparation

This takes three forms: use of oxen and ploughs, the hire of machinery and the hire of labour.

35% of the farmers surveyed reported owning oxen and ploughs a further 10% reported owning either of the two. 96% of those who owned oxen used them for farm work and 33% of ox owners hired them out to other farmer in the area. 27% of the farmers surveyed reported hiring ox-ploughs and 3% hired tractors. Only 35% hired labour, mainly 1 - 2 times per year but some hired up to 4 times. The following table shows the number of times labour was hired for different farm operations during the 1977/78 season.

Table 4-6. Labour hiring in Kyela: Number of times and farm operations for which it was hired during 1977/78

Operation	Number of times	Percent of hirers
Land preparation	1	36
	2	50
	3	14
Weeding	1	9
	2	14
	3	9
	4	9
Harvesting	1	4
	3	4
Other	4	5

Table 4-6 shows that all the 35% farmers who hired labour during the season did so during land preparation, 41% of them during weeding, 8% during harvesting and 5% hired it for other farm activities.

3. Dry season cultivation

Most farmers plough their fields during the dry season and this is one way to alleviate labour bottleneck in land preparation.

5. FARM MANAGEMENT AND HAZARD AVOIDANCE IN KYELA

5.1 Introduction

In agricultural production farmers face uncertainty of weather, pests and diseases, and the level of both input and output prices. These factors are variable and unknown to the farmer when he makes decisions. They provide an element of risk to farmer decision making. Risk may have important effects on farmer's decision making. For example, although a farmer may not be able to predict rainfall he is aware of the degree of variability and therefore takes actions such as planting a crop at several dates to avoid the risk of low rainfall at a particular period in a crop cycle.

Small farmers must manage their farms differently from large and medium scale farmers because whereas the latter can absorb the bad year, for the former, because the effect of such a year is to reduce production below their subsistence needs and therefore jeopardises the very survival of their families. Similarly, small farmers are uncertain of the result of innovation, and will only take small steps away from their present management practices. In this chapter an attempt is made to identify the uncertainties faced by local farmers in Kyela and the management strategies they use to avoid the hazards these imply.

5.2 Hazards in Kyela farming

When the sample farmers were asked to mention the worst season for farming in recent years, answers ranged from 1962 to 1978. Asked what problems the bad seasons brought 80% mentioned acute shortage of food before the new harvest. The main hazard reported by 60% of the sample was too much rain and floods. In fact in April 1979 a total of 10,472 families with a total of 61,461 people in Kyela were hit by floods which left over 2,000 families home less and without food. About 17,780ha of food and cash crops, worth shs 23 million were destroyed (Daily News 7th June, 1979). 1963 was another year which floods caused serious damage in the area (Daily News, 6th June, 1979).

When they were asked how the 1977/78 season was in terms of the farming hazards, 44% responded that it was good, 36% responded it was bad, 18% average and 2% did not respond. The reason given by those who responded it was a bad season was too much rain and floods.

As table 5-1 shows 58% and above of the sample farmers in Kyela were aware of the listed problems in farming.

Table 5 - 1. Kyela farming: The incidence of observed problems.

Problem	Response							Every season	Aware of problem
	No response	No problem	77/78	76/77	75/76	74/75	Not recent		
..... <u>Percent of farmers</u>									
Floods	14	26	26	10	8	3	13	0	60
Heavy rains during harvesting	13	19	32	15	5	2	15	0	69
Early finish of rains	24	15	8	24	11	5	12	0	60
Delayed rains	26	18	23	10	10	5	10	0	58
Damaged rice roots	26	10	14	16	13	3	18	0	64
Damaged rice leaves	13	11	8	10	21	10	27	0	76
Birds eating rice	32	6	22	8	5	6	18	2	61

Table 5-2 sets out the answers of the respondents when they were asked the crops on which losses due to pests and diseases were most serious. As shown, rice, bananas and maize were mostly the affected crops.

Table 5-2. Kyela farming: Crops on which losses due to pests and diseases were most serious, 1977/78

Response	Ranking	
	First	Second
	<u>Percent of farmers</u>	
No response	3	3
Only few losses	11	18
Rice	42	18
Maize	13	19
Bananas	26	18
Beans	0	11
Cassava	0	3
Groundnuts	0	3
Cocoa	5	6

Table 5-3 summarizes the answers of the sample farmers when they were asked to mention pests and diseases causing serious attacks on crops in their area. As the table shows, according to them, Panama disease of bananas is the most serious one.

Table 5-3 Kyela: The incidence of crop pests and diseases

Response	Ranking		Total
	First	Second	
	<u>Percent of farmers</u>		
No response	23	37	60
Panama disease	23	10	33
"Kajubili"	24	8	32
Army worm "Mbuluwulu"	6	12	18
Birds	11	0	11
"Lifilifiki"	0	10	10

During the presurvey the respondents identified the common pests and diseases in the area as summarized in table 5-4.

Table 5-4. Kyela: The common crop pests and diseases

Crop	Pests/Diseases	Frequency	Local control	Other control measures
Bananas	Weevil	High	Uproot affected plants	None
	Panama	High		
	Nematodes	High		
Paddy	"Kajubili"	High	None	None
	"Mbuluwulu"	Occasional	None	None
	Moles	High	None	None
	Moth larvae	High	None	None
Cassava	Mosaic	High	None	None
	Moles	High	None	None
	Hollow heart	High	None	None
Cocoa	Caspias			
Cashewnuts	Larvae			

5.3 Hazard management in Kyela farming

As shown in table 5-4 the farmers in the area do not have the control measures against pests and diseases attacking most crops.

The following are the major management strategies used to insure against the effects of uncertainty arising from rainfall variability:

1. Use of cassava and sweet potatoes as insurance crops

Cassava and sweet potatoes are basically insurance crops. They are mostly eaten when rice and maize are scarce.

2. Multiple plantings of the major crops

Over 50% of the sample made double plantings of rice, cassava and beans during the 1977/78 season. 29%, 15% and 15% made double plantings of maize, sweet potatoes and groundnuts respectively during that season.

3. Use of leaves for relish

The leaves of cassava, sweet potatoes, pumpkins and beans are used to supplement other relish supplies. During the survey 65% of the sample farmers reported using bean leaves fresh early in the new season and 15% of them dried them for use in the dry season. The majority (70%) of the bean leaf users reported picking them between 1 and 3 weeks after plant germination. 1-3 leaves per plant are picked and the plants may be picked up to 6 times. When asked their opinion on the effects of bean leaf picking on the final crop 27% had no idea, 65% said it increased the final yield and 8% said it decreased it.

4. Early planting of crops

Farmers concentrate their plantings during the early rains so that plants get enough moisture during their growing.

6. TRENDS AND DEVELOPMENT OPPORTUNITIES IN THE FARMING SYSTEM IN KYELA

6.1 Introduction

Before any improvement on the current farming systems is made it is important to know first how they evolved over the recent past and what are the current trends. Plans which interrupt or seek to reverse trends are working against forces presently motivating farmers and therefore need to be carefully prepared. In this chapter trends and development opportunities in the Kyela farming system are discussed.

6.2 Trends in the Kyela farming system

In the survey farmers were asked if they were producing more or less rice, maize, sweet potatoes, cassava, groundnuts and bambaranuts than ten years ago. They were also asked if they were keeping more or less cattle than five years ago. Their answers are summarized in table 6-1.

Table 6-1. Kyela: Trends in the production of the main crops and ownership of cattle.

Enterprise	Responses of farmers				
	More	same	Less	No information	Never grew/had
Percent of farmers.....				
Rice	58	15	16	11	0
Maize	26	23	29	19	3
Sweet potatoes	34	27	24	15	0
Cassava	53	26	16	5	0
Groundnuts	13	16	34	34	3
Bambaranuts	19	21	25	31	5
Cattle	35	9	56	0	0

a) The crop comparison was made between 1968 and 1978 and that of cattle between 1973 and 1978.

The table shows that farmers were growing more rice, sweet potatoes and cassava than ten years before the survey was done. The common reasons for growing more were: need for more food and cash as the family size was increasing, more use of oxen for farm work and increased labour force. Another reason for growing more sweet potatoes and cassava was their usefulness as famine crops.

The main reasons for growing less maize, groundnuts and barbaranuts were: labour constraint drought more preference for rice, exhausted soil, many crop failures, land scarcity and pest and disease problems.

Since the proportion of farmers who were growing less maize was about the same as that of those who were growing more one cannot safely conclude that maize production is declining in the area because of increased rice hectarage. Moreover the two crops do not compete much for land because whereas rice is mainly grown in lower flooded areas, maize is grown on higher lying land.

The main reasons for keeping less cattle were: some died, some were used to pay dowries, slaughtered for home use and others were sold.

Table 6-2 compares the ownership of oxen in 1972 and 1978. As shown in 1978 a greater proportion of farmers was owning oxen than in 1972 but the total number of oxen was less in 1978 than in 1972. Those who reported having less oxen in 1978 gave the following reasons: Some died some were sold, some were used to pay dowries and others were slaughtered.

Table 6-2. Kyela: Ownership of oxen by sample farmers during 1972 and 1978.

Number of oxen	1972	1978
	Percent of farmers	
0	68	56
1	2	5
2	15	34
3	2	2
4	8	2
5	2	0
6	3	2
7	0	0
8	2	0

In both years the majority of farmers had two oxen and were using them for farm work.

Of the main crops rice is the only one which the majority of farmers grow on flat seedbed which is normally less labour intensive to prepare by hand than ridges but it gives poorer water and weed management. The use of ox-ploughs and tractors (by very few farmers) encourages flat seedbed preparation even for other crops.

6.3 Strategies for relieving the November - February labour bottleneck

The following are the possible strategies for relieving the November - February labour peak:

1. More use of oxen and ploughs
2. Dry season cultivation or back end cultivation to reduce land preparation pressures after the start of the new rains.
3. Planting methods with low labour requirements and crop arrangement in the field conducive to weeding by oxen.
4. Selection of crop varieties to improve the complementarity in labour requirement for establishment and weeding.

6.4 New cash crops

Although cocoa, cashewnuts and cardamoms are not included in the list of the main crops in Kyela, they are becoming important there. Research and Development Programmes in these crops and rice as the major food and cash crop as well as the major resource user in the system seem appropriate.

7. RICE MANAGEMENT AND ITS IMPROVEMENT IN KYELA

7.1 Introduction

This section of the report forms the basis for planning an adaptive research programme on rice for small farmers in Kyela the main components of rice management are treated under the following headings:

- 1) Present practice
- 2) The reasons for the present practice
- 3) The possibilities for improving on the present practice.

7.2 Land preparation and planting

1. Present practices

Soon after harvest in the month of July/August, when the land is still moist, the soil is ploughed after cleaning the last year's straw. This first cultivation is known in the area as "KUKATUA" and it is done with a hoc, ox-drawn plough or a tractor with a disc harrow.

The second cultivation, known as "KUVURUGA", is done in the November and December when the rains have started. Most farmers use ox-drawn ploughs for this operation.

Planting is done soon after the second ploughing and farmers consider March as the latest month of planting. Some farmers purposely delay the second ploughing up to February to let the weeds grow and then destroy them during ploughing.

Seeds to be planted are selected while the previous crop is in the field. During selection characteristics of the variety are taken into account and seeds of different varieties are kept separately. The important rice varieties in the area are shown in table 7-1. Kilombero Variety is grown by most farmers.

Table 7-1 Kyela: Important rice varieties and their characteristics a)

Variety	Characteristics
Kilombero	High yielding, early maturing (takes 4 months), drought resistant has very good taste, competes well with weeds
Mwasungu	Low yielding, takes 5-6 months to mature, second in taste, it increases much in volume when cooked.
Faya	Takes 5-6 months to mature, has good taste (third in taste), competes well with weeds.
Mwanguru	Tall, grows well in upland soils, drought resistant, early maturing but it has not good taste.

a) Based on farmers' response.

In addition to the main varieties shown, in table 7-1 there are other varieties which are less common. These are: Sindano, Supa, Kikarata, Kalulu, Mapiko, Mbomela, Mpokanjara, Dujeni and Kigoma.

Paddy fields are normally planted in several consecutive days and seeds are broadcasted and covered by light harrowing with a hoe, ox-drawn harrow or a tractor harrow. The crop is grown in a pure stand.

About half of the farmers use small amount of fertilizers during planting. During 1977/78 the average amount of money per farm spent on fertilizers was shs 80 for the whole sample. They broadcast, with seeds, 2.5 - 5.0 bags, of 50kg, of TSP and some of them apply 2.5 bags of 50kg of S.A. per ha later when the crop is well established. Table 7-2 shows levels of application of basal and top dressing fertilizers in the area.

Table 7-2. Sample farms: Levels of application of basal and top dressing fertilizers, 1977/78

Type of fertilizer	Bags, of 50kg, applied per ha					
	0	<.1	1-3	3-4	4-5	>5
Percent of farmers who applied....					
Basal applied TSP	4	0	48	0	32	16
Basal applied S.A	95	0	5	0	0	0
Top dressed S.A.	84	0	8	0	8	0

2. Reasons for the present land preparation and planting practices

The first cultivation is done immediately after harvesting the previous year's crop because during that time the soil is still moist and easier to plough.

Planting is done as soon as the second ploughing is completed to avoid the crop damage by floods before it is well established.

3. Improving on present practices of land preparation and planting

Possible improvement strategies to boost rice production in Kyela include: increased use of ox ploughs for land preparation, the departure from the traditional method of paddy growing and the increased use of fertilizers or manure.

The land hoe still features prominently in the district's rice farms. To ease the labour bottleneck during land preparation it should be replaced by an ox-plough.

If seedlings were raised in nurseries and later transplanted in fields using proper spacing the amount of seeds used would have been minimized and it would have been easier to apply manure or fertilizers. The traditional method of planting rice is not effective during floods because the farms become immersed in water and when seeds are broadcasted they easily rot. During the survey 82% of the rice growers had never tried transplanting. When their opinion was sought on transplanting of rice they gave the answers as summarized in table 7-5.

Table 7-3. Rice growers: Opinion on transplanting rice

Response	Percent of farmers
Too laborious	58
Not used to it	19
No comment	8
Transplanted rice does not yield more	7
Transplanted rice yields more	5
Water is not enough for transplanting	3

7.3 Weeding

1. Present practice

A great proportion of farmers, 75% weed their paddy only once when it is between 15 and 30cm high and they complete the operation by the time the crop is 90cm high.

During the survey when the farmers were asked to mention the most difficult operation and the second most difficult one in rice production, weeding got the highest score followed by land preparation, as shown in table 7-4.

Table 7-4. Sample farms: The difficult operations in rice production.

Operation	First difficult	Second difficult	Total
 <u>Percent of farmers</u>		
Weeding	79	11	90
Land preparation	16	39	55
Harvesting	2	20	22
Others	2	25	27

They said weeding was the most difficult operation because it was done by hand and there were a lot of weeds. Only 32% of the sample farmers reported thinning their paddy during weeding.

2. Reasons for the present practice

62% of the farmers who were weeding their paddy only once thought they could not increase the production of their crop by increasing the

number of weedings. They considered only one weeding enough since their fields were flooded after that weeding and it was difficult for weeds to grow in water that may be up to a knee high in the advanced rainy season. The remaining 38% of the farmers said they did not weed their paddy more than once because of labour constraint.

3. Improvement on weeding

The use of herbicides may be an alternative approach to weeding by hand. The labour requirement in the operation. Most farmers, 93%, would like to use herbicides, the rest were afraid of the high cost of the chemical and the possible damage it might cause to the crop.

7.4 Field pest control

1. Present practice

The respondents mentioned two main pests of rice. One of them attacks the roots and plants die. The local name for the pest is "Kajubili". The other one eats the leaves of young plants and no control measure is used to combat both of them.

2. Reasons for the present practice

Possible reasons why farmers do not use any control measures against the mentioned pests are: either they are not aware of any measure or they are not convinced of the value of treatment.

3. Possibility for improvement

An entomologist should visit the area, identify the pests and recommend possible measures to control them.

7.5 Harvesting, threshing and storage

Harvesting of rice takes place between May and July. It is during this time when seed selection for the next season is also done. Harvesting is done by cutting the paddy in sheaves, using sickles, heaping them in the field and beating them with sticks. The straw is either burnt or incorporated into the soil during ploughing for the next season.

After threshing the produce is either stored in bags or in storage structures called "Vihenge". The seeds are well dried and different varieties are stored separately.

No chemicals are applied to control storage pests while the produce is in store.

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