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PLANNING AN ADAPTIVE EXPERIMENTAL PROGRAMME ON MAIZE FOR FARMERS OF THE UFIPA PLATEAU

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PREFACE

The present report is the result of a cooperation between CIMMYT'S Eastern African Economics Programme and Uyole Agricultural Centre, the Department of Agricultural Economics and Rural Sociology, Research.

This is the first comprehensive study at UAC which aims at designing a concrete experimental programme for a specified group of farmers. The suggested experiments are the outcome of diagnostic survey work of the farming system and farmers circumstances in Ufipa. The emphasis is on maize as an expanding crop and a future major resource user and thus a good vehicle in achieving a significant impact on the farming system as a whole.

INTRODUCTION

Traditional commodity or resource oriented agricultural research has ignored the fact that farmers produce several commodities, by the management of several resources, in an integrated farming system. Almost inevitably, because the small farmer has limited labour and capital, and in some areas limited land, the allocation of resources to one commodity implies a compromise in the management of other commodities and other resources. Such compromises allow farmers to satisfy their priorities despite resource limitations. Technically ideal production and conservation methods fail to accomodate management compromises which may be important to farmers in achieving their objectives, and farmers in return consider such methods as irrelevant to their needs and circumstances. Farming System Research, conducted by an economist in collaboration with technical scientists, identifies management compromises and allows the planning of experiments which complement farmers' priorities. Recommendations based on the results from experiments planned in this way are likely to be rapidly absorbed because they do not conflict with facets of existing management practice which are important to farmers. This report describes the Farming System of the Ufipa plateau, assesses the compromises in resource allocation and enterprise management made by Ufipa farmers, and sets out a maize research programme designed to be compatible with their priorities and resource endowments.

THE UFIPA FARMING SYSTEM

A good deal of farm economic survey work has been done on the Ufipa plateau. This report draws on the Southern Highlands Socio-Economic Survey (Uyole 1971) and the Ufipa survey (Uyole 1976). Fieldwork carried out in Ufipa in 1977 supplemented the information already available from these sources.

Products and end uses

The present farming system is based on finger millet and maize as main starch staples, beans supplemented by groundnuts as the main relish crops, and livestock. Sweet potatoes and cassava act as supplementary

starch sources. Beans, maize and finger millet surpluses are sold for cash supplemented by sale of animals by livestock owners. Average annual cash incomes are about Tsh 1,200 each and resource allocation is still dominated by subsistence objectives; the need for adequate food for the family, day in day out. Table 1. shows the calenders of plantings and harvests of the three major crops occupying over 90% of the total area cultivated (Uyole 1976). The calender is a guide to the commitment of land and labour by Ufipa farmers. There were 265 plantings of finger millet, 228 of beans and 192 of maize on the 119 farms studied in 1977. The 1976 Uyole survey showed finger millet occupying about 50% of the 3.59 hectares cultivated by the average household.

Table 1. Time of planting and harvesting of the major crops in %

Crop	Planting	Harvest	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Finger millet	-	+		8	30	50	11							
		+				2		1		5	76	13	4	
Beans	Early		1	26	18	6								
	Late					4	8	35	2					
		Leaf		2	21	25	11	14	25	4				
		Seed				4	21	21	6	2	39	6		
Maize	1st			27	24	8	2							2
	2nd+ 3rd		1	7	16	11	4							
		+				1			1		19	63	9	5

Two thirds of farmers preferred finger millet as a base for ugali, one third preferred maize. Finger millet is used extensively in brewing and is valued for its storing qualities. Poor storing is one of the major problems seen with maize. Bean leaves and seeds are eaten as the main dish with ugali. On the starch side of food production maize plantings begin immediately after the rains, 75% of planting is completed by the end of December, some planting continues into February. Finger millet plantings also begin in November but the majority are made after December, 61%. In general priority is given to maize from which green cobs can be taken relatively early to provide a change of diet and, where stores are exhausted, a new source of starch. Normally two crops of beans are planted and the calender shows up the complementarity in the availability of bean leaves

and bean seeds. The June harvest of the second bean planting and the use of new leaves in December from the first planting minimises the storage period between seasons. Some farmers store bean leaves as well as seeds. Sweet potatoes, harvested largely in June, are a convenience food used during the period when the women are in the field all the day harvesting the finger millet. Cassava is a famine crop eaten whenever the main starch sources are exhausted, this tends to be towards the new harvest period in the first half of the calendar year. Sales of crops, usually surpluses but sometimes enforced by a need for cash, are made from April onwards as the new crops are coming to harvest, but August to November is the dominant sales period.

The dominant crop of the system remains finger millet. It stores for years and is highly valued for making both beer and ugali. Maize tends to be eaten first after the new harvest to minimise storage losses, and the finger millet is dried and stored.

Ufipa farmers will rarely admit to having run out of finger millet, it is a slur on their management. Farmers will admit to taking finger millet as payment for casual labour. Often old finger millet is sold out of store when it is clear that the new crop will come through. At bad times the amount of beer being brewed is reduced to eke out supplies for food. The Uyole 1976 Ufipa survey showed 50% of farmers reported using 25% of their finger millet crop for beer and 20% reported using 75%.

Resource management

Land management is critical to the success of the finger millet crop. Table 2. taken from the Uyole Ufipa survey, 1976, shows only one instance, out of 64 fields of finger millet studied, of the crop being grown three times in succession.

Table 2. Finger-millet - Land use histories on 64 fields

Year 1	2	3	4	5	6	7	Frequency
Fm	Idle						11
Fm	B	Idle					10
Fm	Fm	Idle					9
B	Fm	Fm	Idle				9
Fm	Fm	B	Idle				7
B	Fm	B	M	B	Fm	Idle	6
B	Fm	Idle					4
M	B	Fm	Idle				2
B	Fm	Fm	M	Idle			2
Fm	Fm	B	M	Idle			2
Fm	Fm	Fm	Idle				1
B	B	Fm	Idle				1
						Total	64

Fm = Finger-millet; B = Beans; M = Maize

Farmers reported extremely poor yields of finger millet during a third season. After the 1st year crop, the admixture of maize increased and was said by some to be dominant in a third year crop. Traditionally, fallow land is 'moulded' in the February/March, the grass inverted in mounds and a late bean crop planted. The mounds are spread after start of the new rains in November and finger millet planted on the land. Land use and indeed the traditional farming system evolve around the need for new land for the finger millet crop and shifting cultivation has been the result.

Labour use is strongly differentiated between men and women for a number of operations. Weeding is predominantly womens work, as is harvesting finger millet and planting groundnuts. Men clear new land, thresh finger Millet and herd animals. Domestic work is also shared, with the men responsible for firewood and the women for water. The crop calendars in table I. show the busy periods as November to January and in June. This is borne out both by farmers responses as to the busiest month of the year, and the incidence at which they reported hiring supplementary resources. These responses are set out in Table 3.

Table 3. The incidence of busy periods and resource hire in percent

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Busiest month		9	15	11	5			2	42	9	4	2
Labour hirings		9	18	10	14	10	5		21	8		5
Ox hirings	4	28	24	8	8	8			12			

Sixty percent of farmers reported hiring labour, 51% of all hirings were for land preparation, 27% for harvesting and 22% for weeding, threshing and other operations. Some 60% of farmers reported owning work oxen and ploughs in the 1977 study. This compares to 4% in the 1971 study and 40% in the 1976 study. Thirty farmers that is 25% hired oxen, all for land preparation, mainly in the October/March period. In total, some 85% of farmers surveyed used oxen for cultivation. Ufipa farmers have two clear peak labour periods, one in land preparation concentrating in the November/December period and a second in June at the finger millet, maize and bean harvests.

Sixty-nine percent of farmers reported purchasing cash inputs, they spent an average Shs. 203 each, about 17% of average income. Seventy-one percent of capital outlay was for resources to supplement family labour at peak periods, hired labour and hired oxen. Only 18% of capital spending was for fertilisers and insecticides, with an additional 11% for seeds, mainly finger millet and beans from traditional sources.

Evolution of the system and development constraints

The Ufipa farming system is in a rapid state of evolution precipitated by the increasing of oxen and the official policy of villagisation implemented in 1973. These two factors have had a major and compounded impact on the basis of the traditional farming system.

The traditional grass moulds of the Wafipa are a green manuring system which, together with shifting cultivation and long fallow periods, give the highly fertile clean weed environment required for good crops of finger millet. The moulding practice itself evolved in place of a Chitemene system, probably in response to the loss of forests due to the dominance of iron making for which the Wafipa are famous. Oxenisation has largely superseded the moulding system and villagisation has raised the local population density to a level which precludes effective fallowing by shifting cultivation. Wafipa have been able to maintain finger millet

production by cultivating larger areas by ox-plough and by repeated cultivation to pre-empt severe weed problems. The Uyole 1976 report noted however that finger millet yields and total production were highest in the only village without oxen, growing relatively small areas. Villagisation has effectively tripled the local population density and reduced the feasible period of fallow from 10 to 3 years. Evidence from Research in Zambia shows that without high levels of fertilizer and intensive cultivation and weeding, finger millet yields will be low. Alternative management systems are possible but are both capital and labour intensive and there are high opportunity costs on both these resources which presently limit the income earning posibilities of Ufipa farmers. Labour productivity, in particular, is likely to be low relative to other crops.

The evolutionary pressures of ox-cultivation and villagisation have destroyed the basis of traditional finger millet management. Alternative management methods have high costs and, as has happened widely throughout East and Central Africa, it can be forecast that finger millet will decline in importance in the Ufipa farming system. Added factors hastening its demise are the arduous work in grinding the flour at home, and the narrowness of the market for it as a cash crop, in making traditional beer specially in Kilimanjaro. Factors which will hold it in the system are its storing quality - it can be reliably conserved - and local preferences for finger millet beer.

As in most areas, and because the climate of Ufipa is favourable, it is likely to be superseded by maize which has many production advantages; it has a wide market, expanding as the urban areas grow and thus is a good 'dual' crop for both cash and food. It is less labour intensive giving a higher return in food or cash per unit of labour required for either weeding or harvest. Maize is not as vulnerable as finger millet to the effect of manures and fertilizers on weeding requirements. Finally, machine grinding of maize is admirably suited to the village settlement pattern now dominant, removing the burden of grinding in the household. It does, of course, have a serious storage problem.

Maize has long featured as a minor crop in the Ufipa farming system. The evidence suggests that its importance has increased at the last ten years. Thirty-two percent of farmers now prefer maize as a base for ugali and 51% of farmers reported it had only been brought into the household as a regular food over the last ten years (47% reported it had been used for ten years or longer). Sixty-nine percent of farmers reported they were planting more now than five years ago. It is always a key decision in assessing development opportunities in a farming system, to decide whether to reinforce or to reverse system trends. If reversing trends is

to be attempted, that is moving contrary to prevailing economic forces, there needs to be a very strong case for it and very clear means of implementation. In Ufipa farming no strong case exist for attempting to preserve finger millet. Development opportunities lie in providing maize as a substitute starch with higher productivity to limiting resources and better long term cash earning opportunities. Resource constraints - rapidly degraded land, labour bottlenecks and capital scarcity (as well as lack of knowledge of alternative management and technology and poor requisite supply)- dominate the management strategies of Wafipa farmers. Uncertainty of rainfall plays some part in that of late plantings many fall victim to an early finish to the rains in March. Many farmers, in making late plantings, see this as an acceptable risk. The vulnerability of beans to insect pests is another major source of risk. Scarce capital is utilised to hire oxen and labour to relieve the labour peaks in two periods, November - January when land is prepared and planted to finger millet, maize and beans, and June - July, when the finger millet is harvested and threshed and maize and beans are also being harvested. This second peak is largely caused by the labour intensive method of harvesting finger millet. As the crop declines so will the importance of this peak. The decline of finger millet will leave the November - January peak as the dominant constraint on farmers' income. The key issue in the development of farming in Ufipa will be the management of resources and enterprises over this period. Development strategy should be to seek innovations in management which take pressure off labour and capital committment during this period, and which allow prolonged use of the land area under farmers' control. Possible management innovations which may contribute to this strategy include:

1. Back end or winter cultivation to ease land preparation pressures after the start of the new rains. Ubuldingi leaves a tradition of winter preparation which could well be developed.

2. The use of herbicides in minimum tillage techniques, subject to constraints on availability and alternative uses.

3. Planting methods with low labour requirements and crop arrangement in the field conducive to weeding by oxen.

4. The use of manure and perhaps artificial fertilizers to prolong the use of cleared land, reducing the frequency of labour intensive work in opening new land and improving yield levels.

5. Improving storage methods to reduce the influence of the timing of food supplies on resource allocation.

6. Selection and promotion of varieties of maize, beans, finger millet and groundnuts with maturity periods of greater complementarity, allowing a better spread of resource use in land preparation, planting and weeding.

Accepting the prognostication that maize will replace finger millet as the basic starch staple in the area implies that it will become the major resource user. It is thus a good vehicle for manipulating the whole system to improve productivity. The rest of the report focuses on planning an adaptive experimental programme for maize, with some recommendation on other crops, which given positive responses, will provide recommendations to give higher labour productivity and improved incomes to Ufipa farmers.

PRESENT AND FUTURE MAIZE MANAGEMENT IN THE UFIPA FARMING SYSTEM

Although only 32% of farmers reported a preference for ugali made of maize, all farmers reported eating maize as ugali at one time of the year or another. The Uyole 1976 survey (field work during 1975) gives maize 16% of the cropped area, an average of .565 ha per farm, the 1971 survey showed a rather higher proportion. In addition maize was found as a second crop, often at low levels of density, in most finger millet fields. Seventy five percent of farmers reported a cash income from maize sales averaging shs 338. Even now it is the most important cash source to Ufipa households contributing 26% of total reported cash income, compared to 24% from sales of finger millet. Husbandry details are for the observations made on pure maize fields or maize intercropped with groundnuts, the most relevant to future maize research.

Location and place in the rotation

The rotation of the Wafipa system still revolves around the need for newly cleared, fertile and weed free land for producing finger millet. Maize is usually planted with the finger millet, at low density in the first year on new land but increasing in density and sometimes described as dominant on land being used for the third time for finger millet. Farmers often choose low lying land for pure maize plantings to give the crop the chance of residual moisture.

Land preparation

Most of the maize fields are prepared by ox-plough. Of 97 plantings of maize studied in more detail mainly in pure stands but some mixed with groundnuts, 83% were prepared by ox-ploughs into a flat seedbed, 10% were ridged by hand and 3% prepared flat, by hand hoes. Only one pass with oxen and plough is normally made. Where maize is interplanted with finger millet, again ox-ploughed flat planted seed beds predominate but two or three passes with the ox-plough are common to aid weed control and give a fine seed bed. Land preparation by oxen for pure planted maize is largely done at the start of the rains. Part of the land planted by finger millet in December/January, with maize as intercrop is cultivated at the backend of the previous season, in March, April or May, with a final ploughing once the new rains have started .

Varieties and seed

The pre-survey identified three local varieties of maize

a. Mofat: With large flat grains and only 1 cob per plant, it takes about 4 months to mature and is preferred by farmers.

b. Kalimwa: Is a short plant with small cobs and grains, it also has a short maturity period and is preferred [illegible] for eating fresh. It is the shortest term variety known by local farmers, when asked what variety they would plant if delayed until February over 80% named Kalimwa.

c. Namesa: Has a mixed colour of grains, red and black as well as white. Farmers feel it to be more resistant to weevils in store.

These are known by many of the survey farmers most of whom also reported experience of improved seeds. However only 11% of the surveyed farmers reported purchasing seeds in the 1977/78 season. In selecting their own seed farmers mentioned several criteria as being particularly valued:

White grains	104	Damage free	84
Large cobs	93	Large grains	46
Early maturing	90		

Planting

One hundred and seventeen farmers, 98% of those surveyed, had planted maize, 64% of these made more than one planting of the total of 192 maize plantings

reported 59% were pure stands and 41% in mixed. This compared to 60% mixed stands in 1970. Maize plantings were spread over the period September to February with November 32%, December 39% and January 18% predominant.

Row planting (45%) and Broadcasting (52%) were the dominant methods of planting maize. No measurements of spacing or population density were made in the field. Those planting in rows commonly placed two seeds per hole.

Thinning and weeding

Fourteen percent of farmers reported thinning their crop to one(10%) or two (4%) plants per hole. 17% of farmers did not report weeding, 39% reported one weeding and 43% reported two. Of those reporting weeding 4% reported 1st weeding one week after planting, 17% two weeks, 35% three weeks and 41% four weeks or more.

Use of fertilizers and insecticides

A minority of farmers used cow manure (24%) and fertilizers (25%). The artificial fertilizer was mainly Nitrogen, only 3% used a basal dressing. Those farmers purchasing fertilizer spent an average of Shs. 90.00 each. No information was obtained on the levels of fertilizer use or the timing of applications. Thirty one farmers (26%) used insecticide for the protection of maize in store. Only 3 farmers reported having used insecticide in the field.

Storage

Farmers indicated that maize stored very badly compared to finger millet. Weevils were seen as the most important local pest, government varieties were reported as particularly prone to storage damage. Seventy five percent of farmers thought it feasible to keep maize in store between 5 and 8 months.

This summarizes the available information on the present management of maize on the Ufipa Plateau. The next section evaluates how the priorities of Ufipa farmers, their resource limitations and the way they handle hazards (including rainfall uncertainty, losses from insects and unreliable retail supply) influence their present management practices on maize.

The uncertainty of a reliable, cheap supply of starch through the market, due to the underdevelopment of the infrastructure and distributive services, creates a priority for subsistence production on Ufipa farms.

Three existing facets of food supply management influence resource allocation decisions on maize.

1. Should the supply of dry finger millet to be held over for brewing be low, the seasons maize plantings, with green cobs available a month before the millet harvest, become an important supplement to eke out supplies of dry millet. Fresh millet is not a good base for beer and dry millet is carried over from one season to the next to allow brewing to continue.

2. Farmers who anticipate a shortage of starch grains will plant maize on dambo edges in September or October, utilising the high water table resulting from residual moisture to produce a very early maize crop.

3. When the finger millet harvest is complete the dry maize is picked and consumption switches to maize to minimise its period of storage and exposure to weevils. Millet is eaten again when the dry maize is finished.

As has been described November to January is a period of labour scarcity in Ufipa farming. Farmers spend cash to hire both labour and ploughs to increase their cultivated area at this time. Management of maize over this period reflects the scarcity of farmer resources.

1. Ox-ploughing can only begin after the rain has softened the ground. Maize planting stretches from November into February. Twenty five percent of plantings are made after the end of December.

2. Planting techniques - broadcasting (51%) and dropping the seeds into the plough furrows (44%) - require very little labour. Planting is done rapidly consistent with the pressure on labour at this period.

3. With the establishment of finger millet becoming an increasing priority in late December and early January low levels of weeding are found on the maize plantings. Fifty one percent of plantings were weeded either once or not at all and 76% of first weedings were done more than three weeks after planting.

These are compromises made in the management of maize due to the scarcity of capital and labour during this period. All these factors reduce maize yield potential, and the response to the use of manure and fertiliser. Twenty four percent of farmers are using cow manure, out of 71% owning cattle and 61% keeping their cattle in the area. Historically, bomn

manure is not a method of maintaining fertility, though the incentives for manure utilisation are likely to increase now when traditional shifting and moulding practices are breaking down. Twenty five percent of farmers reported purchasing fertilisers, largely top dressing for their maize. Purchased inputs must compete with the hire of labour and ox-ploughs for the limited capital available to farmers.

Anticipating maize as a future major crop in a system based on the use of oxen for draught offers a major extension opportunity. The Wafipa are presently exploring maize as a crop of increasing importance, and, similarly, exploring oxen as substitute for hoes in land preparation. They are at a stage when relevant guidence could make a major impact on the farming of the area. The present compromises in the management of maize could become more acute as larger areas are cultivated. Improved maize management will be feasible if the system is manipulated to reduce the impact of the November - January bottleneck. The present harvesting bottleneck is June and July is caused by the intensive requirements for picking and threshing finger millet. As finger millet fades and maize increases its lower harvesting labour requirement will reduce the importance of the June-July labour peak and the November - January peak will become more crucial to expansion of the system. Some approaches to alleviating the November - January bottleneck were outlined on page 6. These are now elaborated with maize as the target crop to derive a programme of adaptive experiments designed to allow expansion of the Wafipa system and increased income for Ufipa farmers.

From experience elsewhere with maize it can be expected that more timely planting, methods of planting which give a good stand and more and timely weeding will give higher yields and the more profitable use of purchased fertilisers. An experimental programme for maize will aim towards these goals while making compromises in the light of the circumstances of Ufipa farmers.

AN ADAPTIVE RESEARCH PROGRAMME FOR UFIPA FARMERS

An appropriate adaptive research programme with emphasis on improving maize management on Ufipa farms has three major thrusts. Many of the sub-programmes outlined assume that livestock will play a major role as a source of power and a means of fertility maintenance. It is important to emphasise that the aim is to improve on present management, thus controls in most of the experimental work should [illegible] present practice in order to observe the response to treatments being tested.

A. Easing the labour bottleneck; November - January

Most important to the long - term development of the Ufipa farming system is an adaptive research programme designed to ease the labour bottleneck during crop establishment over the November to January period. Easing this bottleneck will reduce the compromises farmers are obliged to make in times of planting, method of planting and the timing and frequency of weeding. It will have an indirect effect of reducing cash commitments to the hire of labour, freeing cash for the purchase of [illegible] and [illegible] to improve yields. Three sub-programmes are outlined.

1. Testing crop arrangement and spacing alternatives in maize to allow effective ox-weeding and minimising increased labour requirements while improving yields. As well as conventional row treatments experience in Zambia, where many farming system are in a similar stage of evolution as the Ufipa system, suggests 'check rows' approach. With check rows 3 or 4 seeds are planted in holes at the corner of 90 cm squares allowing access by ox-weeder in both directions.

2. Testing of ploughing, hand and herbicide weeding combinations for their effects on maize yields and on the level and timing of cash and labour requirements. An important component in these trials will be winter ploughing at the back end of the rains in March, April and perhaps early May. The long and very dry season in Ufipa from May to October can ensure a good weed kill from timely winter ploughing allowing timely planting at the start of the rains in November. One pre-requisite for winter ploughing is an area of fallow land available to farmers as crops are still standing in the fields at this time. Winter ploughing seems a logical successor to the moulding system formerly dominant in the area. It is particularly valuable with the check row method of planting as only one hoe mark is needed as a planting hole by such a method.

3. Variety selection to improve the complementarity in labour requirement for establishment and weeding. Maize plantings are being spread over a two month period from mid November to mid January. Finger millet varieties are of a maturity period which requires establishment in late December. Better overall performance may be possible from varieties better adapted to the maturity period available, if these are feasible at this latitude and altitude.

a. Compare improved maize varieties of different maturity periods over a range of planting times. Early planting gives some 160 - 170 days of moisture (including an estimated 20 days of residual moisture). Late planting gives some 120 - 130 days of moisture. Selections of maize varieties should be compared to find the yield cross over points with later and later planting times as basis for recommending different varieties for early and late planting. If varieties have widely different growth habits stand density should be included as an experimental variable in the comparison.

b. Select a short-term (95 - 110 day) finger millet for planting in the second half of January. Selection should be against local preferred varieties Nameka, Kawulunge and the short term variety Katila. Supplementary criteria will be easy germination and resistance to head blast. Comparison should be made under local management practice and cover December and late planting dates.

B. Fertility maintenance trials to prolong the use of cleared land

Cleared land in Ufipa is rapidly degraded, though the rate of degration is likely to be slower under maize. Farmers have access to limited amounts of manure and have small amounts of cash to spend on artificial fertilizers. Long term and short term programmes are important.

a. Over the long term a programme should examine the way manure, most farmers will have only 3-5 tons per year available, and levels of artificial fertilizers to a value of about shs 150 - 200 per year can best be used to maintain soil fertility.

b. Over the immediate short-term two items should be researched.

i. Economic levels of fertilizer application on maize under present management practices, particularly the range of planting times being followed, the methods of planting being followed and the levels of weeding being achieved.

ii. The best use of 3-5 tons of cattle manure and of shs 150-200 of fertilizer in terms of the years under cultivation since the land was opened.

C. To improve the reliability of maize storage

If the storage of maize can be made more reliable it will be more acceptable as a substitute for finger millet. The two research aspects outlined below could usefully be supplemented by the planned introduction of hammermills in local villages, to encourage the easy processing of home produced maize.

a. Supplementary selection criteria for programme A3a would be hardness in the kernel and good husk cover to minimise the infection of cobs in the field.

b. Traditional storage should be examined in detail with a view to making simple improvements designed to enhance the effectiveness of the use of insecticides in controlling storage pests.

This concludes the objective of the study the design of an adaptive research programme aimed at improving Ufipa farmers incomes and based on a diagnosis of their existing circumstances. The emphasis is on experiments on maize as an expanding crop and a future major resource user in the system. Given other analyses the survey data could provide a similar perspective on beans as crop which is likely to remain important in the system. The diagnpsis indicates that detailed work on finger millet is not justfied as the crop has a limited future in the system.