REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND RURAL DEVELOPMENT

FARM MANAGEMENT SURVEY OF THE OKAVANGO REGION

ANALYSIS REPORT I

November 1995 - June 1996

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DIRECTORATE OF PLANNING
WINDHOEK
March 1997

Farm Management Survey of the Kavango Region Namibia

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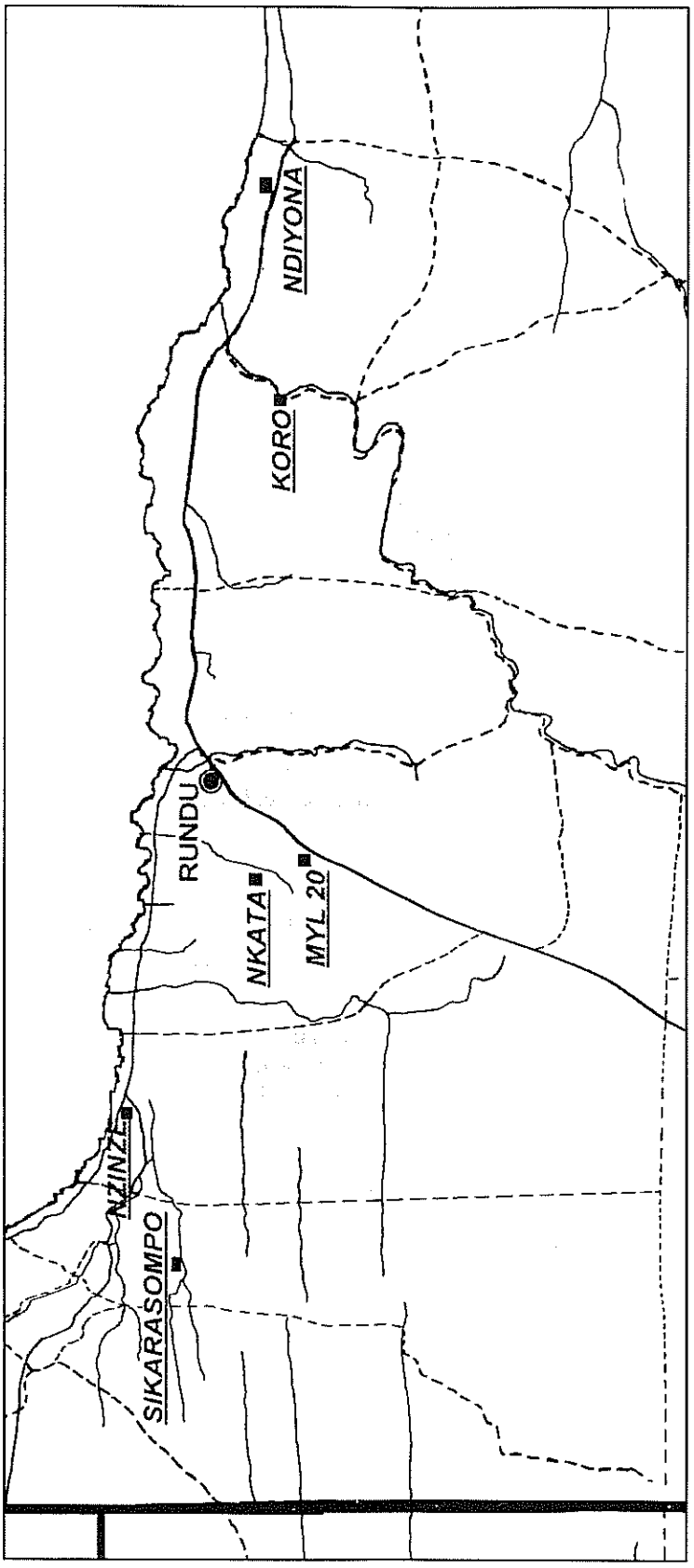


Acknowledgments

The implementation of this survey was made possible through a grant of counterpart funds from the European Union. These funds were used to field a team of enumerators and provide logistical support for the field work. For subsequent surveys these costs are being met from local funds. The European Union support provided invaluable priming resources for the initiation of this survey work, which is now an established activity of the Directorate of Planning. The EU also provided the services of a technical adviser in the initial stages of the survey. Additional technical support to the survey and equipment costs were provided by the British Overseas Development Administration. The ODA provided consultancy funds to set up the survey and the services of a technical adviser throughout the period of the survey.

Technical support was provided by Dr. A Low, Technical Adviser to the Monitoring and Evaluation Unit of the DP and by C. Daffin, Technical Adviser to the Statistics Unit of the DP. Head office staff involved in the project were, I. Botha from the Monitoring and Evaluation Unit of the DP and by Ms S. Loubser and Mr. L. Rukoro from the Statistics Unit of the DP. Field staff were Boun-Tieng Ly, G. Ndangoh, F. Chaka, L. Munene, G. Neumbo, T. Muranga, M. Haindonga, O K Shivute, R. Mupini, A. Hamutenya, M. Hashipara and A. Kapuka.

Introduction

Context and Purpose of the Farm Management Survey

This is the first farm management survey conducted in Namibia and covered a selection of villages in the Kavango region. A similar survey is being conducted in Caprivi covering the 1996/97 cropping season and it is expected that similar surveys will be carried out in all other Northern Communal Area regions over the next several years.

The purpose of the farm management surveys (FMS) is to provide quantitative data on the operation of farming units in the Northern Communal Areas, where no such data has previously been available except through ad hoc surveys. The results of the FMS should complement information from other research into communal area farming systems, which tend to be more qualitative in nature.

Being the first survey of this kind in Namibia, its implementation has been a learning process. Gaps and deficiencies have come to light during the collection, processing and analysis of the survey data. Nevertheless a detailed data set has been accumulated on farm household resource allocation and utilisation over the 1995/6 crop production season in six villages in Kavango.

This data set is available for those who want to use it to answer specific questions. It is fully documented and guidelines on how to analyse the information are available in the survey 'Technical Report'. Further detailed information on the conduct of the survey can be found in the survey document 'Survey Manuals'. The purpose of this report is to present a fairly comprehensive, but by no means exhaustive, analysis of the data. The report provides information that can be used directly for research or planning purposes. It also attempts to provide readers with a comprehension of the scope and detail of the data and stimulate the further use of the data set to meet specific needs.

Organisation of the Report

The report has 6 parts.

A Village and household characteristics
B Household non-crop welfare
C Resource utilisation in crop production
D Per hectare crop inputs and output
E Relationships between household characteristics, non-crop welfare and crop production
F Typical farm-household models

These parts provide information on different aspects of farm-household resource allocation and utilisation through one cropping season, which can be read and used independently. The parts are also linked. Parts E and F draw on information generated in the earlier parts to build quantified farm-household models, representing the situations for typical farm-household types in Kavango.

Although the report contains many tables and charts, these represent neither a comprehensive analysis of the data set, nor a standard way of presenting information from the data set. Readers may feel that the analyses presented in this report are not useful for their own specific purposes. That does not mean that the data set is similarly useless. Many different analyses can be done to examine household resource allocation and utilisation in different ways. Readers are encouraged to contact the Statistics sub-division of the Directorate of Planing for assistance in gaining access to the data and generating analyses that meet their own specific requirements.

Description of the Survey

The Farm Management Survey is a multi-visit survey. It was first conducted in the Kavango region with enumeration starting on the 13 November 1995 and ending on the 28 June 1996, covering most of the 1995/96 cropping season.

Preparation for the survey started in July 1995 with the design of the questionnaires and the development of training materials and manuals. The questionnaires were then tested in four villages in the Kavango region. The final draft of the questionnaires was developed at the end of August 1995.

The survey was designed as a series of formal questionnaires with clear coding procedures in order to collect quantitative information. The frequency of data collection varied for different questionnaires, the majority of which were completed every 14 days, some were completed at the start and end of the survey and others were completed just once

The following aspects of farm management were covered in the questionnaires:

- Information on the farm workers and their activities on and off-farm
- The use of Draft power (owned and/or hired)
- The non labour and non draft inputs on fields
- Field off-take
- Changes in livestock numbers and the consumption of livestock products
- The cash income and expenditure of a specific household
- A household census
- A household inventory of agricultural implements and household items
- Rainfall and Temperature data
- Information on their different fields
- Records of their regular activities and the prices paid for specific goods

The Kavango region was zoned into six areas based on the following factors:

- Distance from the river
- Location East, West, South
- Distance to a main road

Due to budget constraints, workload of the enumerators, and an expected high dropout rate it was decided to include a maximum of 30 households per village in the survey. The 1991 Population Census was used to compile a list of villages with a minimum of 40 households. The six surveyed villages were then chosen at random from this list, one from each zone. The villages are Nzinze, Sikarosompo, Nkata, Myl20, Ndiyona and Koro, Map 1.1 above.

After obtaining approval from the village authority to survey a specific village all households were listed in each village. From each of these lists thirty households were selected randomly for each village, 180 households in total. The sample was selected in such a way that the sampled proportion of male and female headed households reflected that of the whole village. However, due to household migration and differences in the definition of a household between this survey and the 1991 Population Census only 167 households were available for interview. By the end of the survey the number of households had dropped to 157, a total of only ten dropouts.

Twelve trainees attended a two week training course in November 1995. Out of these, formal contracts were signed with six enumerators, two supervisors and one data entry clerk. Enumerators were chosen who could speak the local language of the village in which they were going to work. Accommodation for the six enumerators was arranged in the different villages.

Supervision trips were done on a weekly basis by the supervisors who checked and collected the completed questionnaires. Head office staff also made supervisory trips once a month to check on both the supervisors and enumerators.

There were several problems with enumeration. A major problem was the high turn over of staff. This caused delays in the data collecting process as new people had to be recruited and trained. The enumerators also had difficulty settling into the different villages. This consequently delayed area measurements. Another problem to be dealt with was translating the farmer's units (i.e. heap) into standard units in order to record the amount of off take. Due to a lack of time, crop cutting for yield estimations, was done for just a small number of households.

The data were initially entered onto a computer in Rundu. However, data entry had to be completed in Windhoek because of a shortage of staff in Rundu. Data entry finished in August 1996. Data editing was done at the Directorate of Planning and completed in September 1996. Data analysis started in October 1996 and finished in January 1997. The first results were available in November 1996 and presented at a workshop on the 28 November 1996. The data are available in Dbase 5 files as well as in Microsoft Access files from the Directorate of Planning, Windhoek.

Further details about the survey and data structures can be found in the 'Technical Report' and 'Survey Manuals' document available from the Directorate of Planning, Windhoek.

Data Analysis Problems

In any survey problems occur in the collection and analysis of the data, this survey was no exception. However, due to the multi visit structure of this survey many problems could be corrected during subsequent visits, a luxury not available in most single visit surveys. Hence, due to this and the close supervision of the survey the quality of the data collected should be high. However, there were some known problems in the data collection and readers should note the following points when interpreting the results.

The survey covered an eight month period and not the more desirable twelve months. Hence some under enumeration on land preparation and harvest/post harvest work

will have occurred where this work was done before or after the survey period.

Questions were usually asked to the head of the household. Where the head was unsure about the activities of other members of the household enumerators were instructed to check with these people.

Livestock numbers reported by farmers were to be checked by the enumerator. However, it was not always possible to do this.

Cash income is under enumerated, especially for Nzinze where many households refused to state their income. It should also be noted that a more detailed breakdown of sources of income and expenditure is available than has been given in this report.

Enumerators failed to measure many fallow areas and hence fallow will be under estimated.

It should be noted that ploughing and planting are sometimes done at the same time and these two different activities may have been recorded as one, either ploughing or planting.

Enumerators were confused in the identification of certain crops, in particular identifying cow peas and beans.

Maize was harvested early, before the crop cutting was done and hence no estimates of production were obtained from the cuttings. Data were collected on numbers of pumpkins, melons etc harvested. However, no information on weight was collected and so the data are not used in this report.

Data were collected on prices (Questionnaire Q2) but due to confusion in the training some of these data are not reliable. Where possible other sources of data have been used to check or replace pricing data.

The amount of time spent fishing/hunting is under estimated as households refused to say if they were hunting.

Where a household dropped out before the end of the survey the data have been excluded from any analysis where including such data would lead to bias in the results. Similarly some results given in the report exclude visit one as this covered a longer recall period than the normal two weeks for other visits.

One field in Myl 20 (48 hectares) belonging to a household on the Farmer Support Programme has been excluded from part of the analysis.

Definitions

HOUSEHOLD

A household, comprises the farmer and other members of the household who form a consuming and producing unit and a social organisation. Households are often under the management of a single person, but can also operate collectively. Members normally sleep and eat together in the same place, share meals and divide household duties. Household members also share some goals, benefits and resources for which they are independent on some, and in conflict with others. In some cases household members even live a predominant part of their time away from the household, but when they return they assume full household status.

HOUSEHOLD HEAD

The head of the household is the person acknowledged in the household as the head by the other members. The head has primary authority and responsibility for household affairs and is the primary decision maker.

FIELD

A field is a contiguous area of land owned or rented by a farmer and bounded by a discernible perimeter which could be demarcated by paths, neighbouring fields, streams etc.

PLOT

A plot is a sub-division of a field containing a single crop or homogeneous mixture of crops. In most cases a plot will be defined by distinct differences in land use from the rest of the field in which it is positioned.

FALLOW

Fallow land is a piece of land which has been left idle by the farmer without any crops or labour inputs having been applied. area under fallow can be left open to grazing and can be assumed to be under the jurisdiction of the household for up to a period of five years.

VISIT

A visit covers a period of fourteen days and is the time taken to complete one interview with all households in a village. Hence the recall period for questionnaires completed each visit is no more than fourteen days. There were two exceptions to this rule; visit one where respondents were asked to recall for the previous four weeks; visit four where a recall period could be up to three weeks.

SESSION

Labour and draft inputs were measured as person sessions (usually just refereed to in the report as a session). A session represents either a morning or an afternoon and can be treated as one half of a days work. Where an activity is field related a session will include the time taken to get to the field. A session also relates to individuals. Hence 8 sessions spent ploughing a field could be one person working eight sessions or two people working for four sessions etc.

LABOUR DAY

Two sessions make up one labour day. The conversion from sessions to labour days is made by dividing the number of sessions worked by two.

Part A Village and Household Characteristics

A 1 Village Characteristics

Table A1.1 Village Locations and Seasonal Rainfall

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro
Riverside or inland	river	inland	inland	inland	river	inland
Beside main road	yes	no	no	yes	yes	no
Inland by Omuramba		yes	no	no		yes
Rainfall Nov-Jun 1995/6 in mm	250.5	382.8	303.0	326.0	229.0	282.0

A 1.1 Village Locations

The six villages were chosen to represent typical differences in location of villages in Kavango region. These differences are summarised in Table A1.1 above and the location of the villages is given in Map 1.1 above.

Two villages (Nzinze and Ndiyona) are both by the river and beside a main road. Another village is beside a main road but inland (Myl 20). Of the remaining three inland villages away from a main road, two are located near omurambas (dry river beds) and one is not.

A 1.2 Rainfall

Chart A1.2 shows the rainfall distribution for each village. Sikarasompo and Myl 20 had the best rainfall distribution and highest total rainfall. In the other villages the season did not effectively start until January.

Chart A1.3 compares the 1995/6 season with longer term averages for Rundu, Mashari and Tondoro. It can be seen that the 1995/6 season started later and ended earlier than average.

A 1.3 Field Characteristics

The average age of the nearly 500 fields measured and monitored in the survey, (Chart A1.4) was 7.1 years. Nzinze stood out as having the highest average field age. For most households the average age of their fields was between 0-5 years.

With over 90% of the area cropped being in fields where mahangu was reported as the main crop, the scope for crop rotation is limited. Mahangu has been the main crop in each of the last 5 years for 24% of fields. In Nzinze, with the highest average field age, nearly 50% of fields have been continuously cropped with mahangu over the last 5 years. As the other main crops are also grain crops (sorghum, maize), continuous grain cropping is the norm. Only 10% of fields have been fallow in any of the last 5 years. In Nzinze this figure is as high as 18%, but in Myl 20 it is as low as 4%.

In all but two villages over 50% of fields are described as sandy. Sikarasompo and Koro have an unusually high proportion of fields that were described as having clay soils. These villages are located beside omurambas, which may provide an explanation.

Chart A1.2 Rainfall by visit

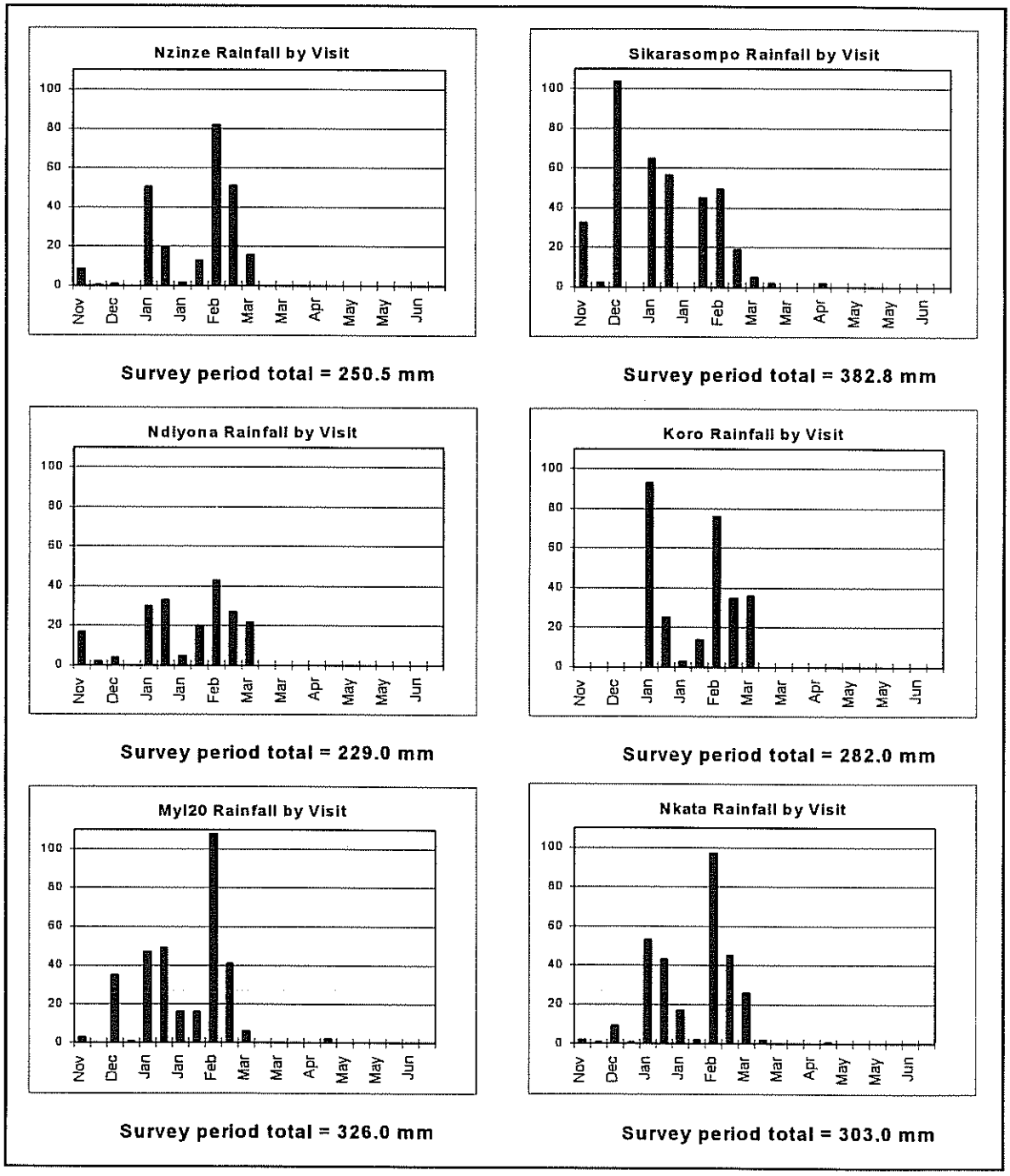
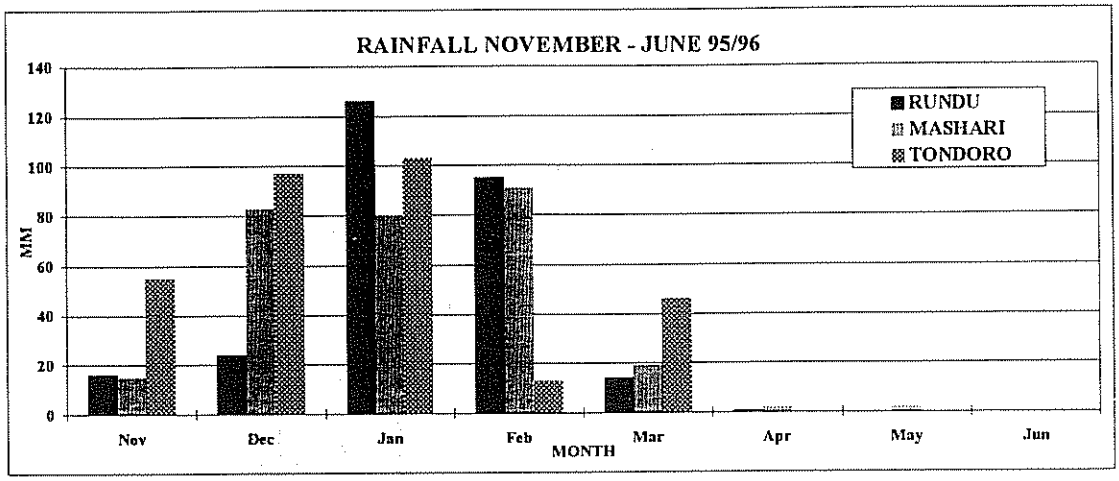
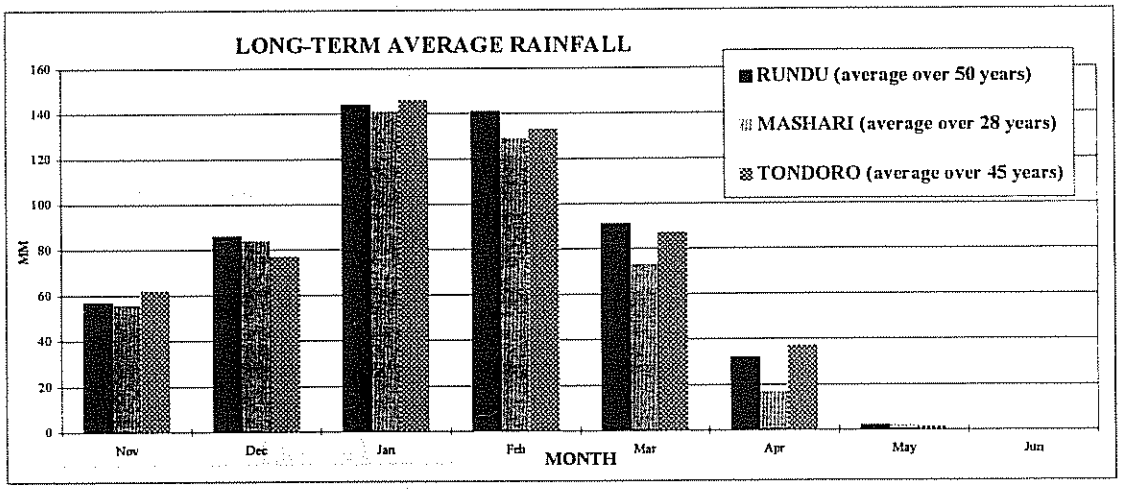


Chart A1.3 Long-term average rainfall





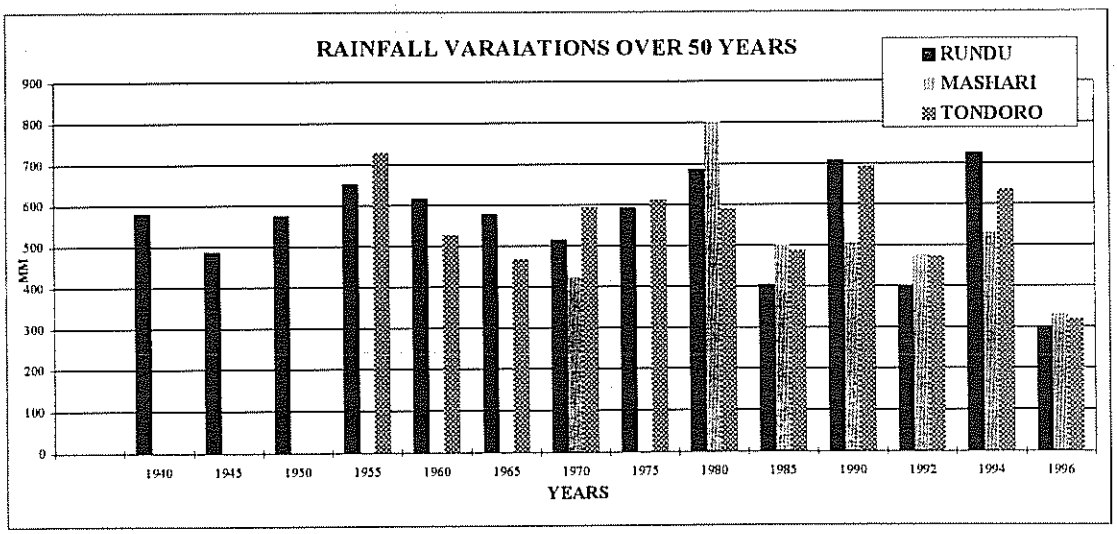
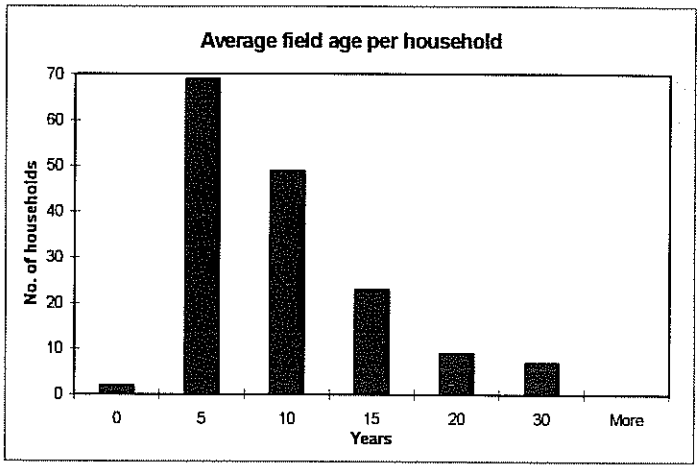


Chart A1.4 Field characteristics

Average age of fields by village

	Nzinze	Sikaras ompo	Nkata	Myl 20	Ndyiona	Koro	Total
Age in years	13.2	8.1	4.1	6.7	7.8	4.2	7.1

Class	Frequency
0	2
1-5	69
6-10	49
11-15	23
16-20	9
21-30	7
More than 30	0
	159



Field cropping histories by village

	Nzinze	Sikaras ompo	Nkata	Myl 20	Ndyiona	Koro	Total
No of fields	61	79	59	80	100	104	483
Mahangu all years since 1991	30	31	7	7	30	13	118
% mahangu all years since 91	49%	39%	12%	9%	30%	13%	24%
Fallow any year since 1991	11	7	8	3	16	4	49
% fallow any year since 1991	18%	9%	14%	4%	16%	4%	10%

Percent of fields with different soil types by village

	Nzinze	Sikaras ompo	Nkata	Myl 20	Ndyiona	Koro	Total
Sandy	78%	54%	53%	83%	47%	23%	64%
Loamy	16%	7%	47%	17%	49%	54%	40%
Clay	5%	37%	0%	0%	4%	23%	14%
Clay/sand	0%	2%	0%	0%	0%	0%	0%
Grand Total	55	59	57	78	79	92	420

A 2 Household Characteristics

A 2.1 Household Composition and Workforce

Average household size is 9.3 persons, Chart A2.1. Nkata and Sikarasompo villages have low average household sizes (6-8) compared with the other villages, which have 10 or more persons per household on average.

Household members can be divided into producers (between 15 and 59 years of age) and dependents (children under 15 and older fold above 59 years). The average number of producers per household is 4.7, with 60% of households having between 3 and 6 producers. Households with more dependents than producers are less common (42%) than those with the same number or fewer dependents than producers (58%).

Households use more labourers than their productive members in field activities. Additional labourers are brought in from outside the household either in the form of work groups or as individuals. The average number of workers used by households on field activities excluding work groups is 10. The average size of workgroups is 6. In Sikarasompo village the size of workgroups is twice the average and in Koro the number of workers used in groups is relatively low.

A 2.2 Employment of Household Members

The most common occupation after farming is teaching and then employment by NGO or cooperatives, Table A2.2. NGO employment is particularly high in Nzinze and this is due to the employment opportunities offered by the nearby NDC scheme at Musese. The number of persons earning wages is relatively high in Nzinze where 74% of households have at least one wage earner. In the other villages about one third of households have one or more wage earners.

A 2.3 Age of Household Members and Dependency Ratios

The age structures of the village populations are similar. Chart A2.3 shows that the highest proportions of village populations are in the 0-19 age groups. In most villages the lowest numbers are in the 40-50 age groups.

A 2.4 Ownership of Assets

Major types of assets owned by households will include livestock, cultivation equipment and transport equipment, Chart A2.4.

In the survey villages ownership of assets is quite skewed, with a large proportion of households owning none of the livestock or equipment categories examined. 44% of households own no cattle and only 13% own 30 or more. The ownership of goats is even more skewed, with 59% not owning any and only 7% of households having 30 or more goats. Poultry are more commonly owned. Only 29% of households do not have chickens and 39% own flocks of between 6-20 birds (Chart A2.4).

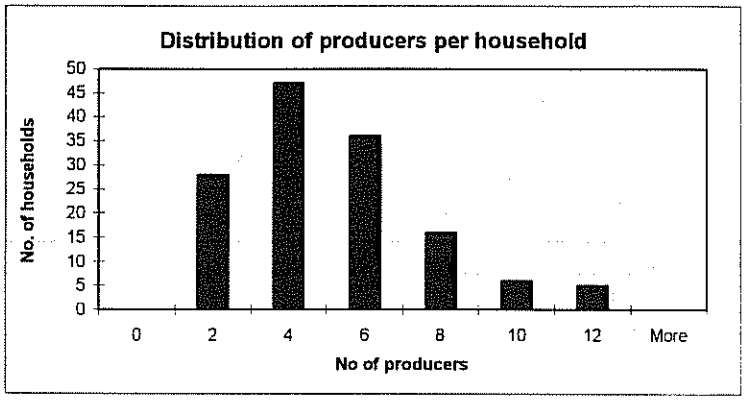
Half the households own no item of cultivation equipment (plough, harrow, planter) and 53% do not own any item of traditional transport (sledge, cart).

Chart A2.1 Household composition and workforce

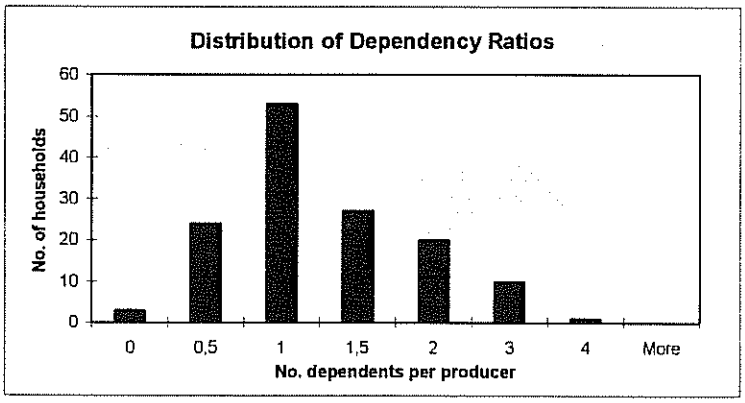
Household Composition

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndyiona	Koro	Total
Household size	10.1	8.3	6.2	10.0	10.1	10.4	9.3
Average No. of hld producers	5.8	4.1	2.9	5.1	4.2	5.5	4.7
Average No. of dependents	4.3	4.3	3.5	4.9	4.6	3.5	4.2
Average dependency ratio (dependents per producer)	0.9	1.3	1.3	1.2	1.2	0.9	1.1

Class	Frequency
0	0
1-2	28
3-4	47
5-6	36
7-8	16
9-10	6
11-12	5
More	0
	138



Class	Frequency
0	3
0.1-0.5	24
0.6-1	53
1.1-1.5	27
1.6-2	20
2.1-3	10
3.1-4	1
More	0
	138



Workers used in field activities

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndyiona	Koro	Total
Number of workers used not in groups	219.0	311.0	155.0	374.0	218.0	391.0	1668.0
Average no. workers not in groups	7.3	11.5	6.7	12.5	7.3	14.5	9.9
No. workers used in groups	172.0	322.0	124.0	138.0	250.0	29.0	1035.0
Average no. workers in groups	5.7	11.9	5.4	4.6	8.3	1.0	6.2

Table A2.2 Employment of household members

Number of persons by sex, main occupation and village

		VILLAGE						
SEX	OCCUPATION	Nzinze	Sikaraso mpo	Nkata	Myi20	Ndiyona	Koro	Grand Total
Male	None/farmer	54	67	37	94	65	54	371
	Teacher	6	1	1	3	3	2	16
	Police	0	0	0	1	0	0	1
	Plumber	0	0	0	0	0	1	1
	Carpenter	0	0	0	2	0	0	2
	Driver	0	1	0	0	0	0	1
	NGO/Co-op	12	2	1	0	0	0	15
	Labourer	2	0	3	3	0	0	8
	Cattle herder (paid)	0	0	0	0	2	4	6
	Student	82	38	21	58	57	67	323
	Other	2	5	2	3	10	19	41
Male Total		158	114	65	164	137	147	785
Female	None/farmer	69	67	47	91	94	81	449
	Teacher	3	0	1	0	2	0	6
	Student	51	30	24	43	56	40	244
	Other	8	3	2	1	9	25	48
Female Total		131	100	74	135	161	146	747

No of people age 15 and over by Wage Earner and Village

	Nzinze	Sikaraso mpo	Nkata	Myi20	Ndiyona	Koro
Total no. wage earners	25	5	9	14	10	8
No of hhlds reporting	23	21	20	27	25	23
HHlds with wage earners	17	8	8	8	8	6
% hhlds with wage earners	74%	38%	40%	30%	32%	26%

Chart A2.3 Age distribution

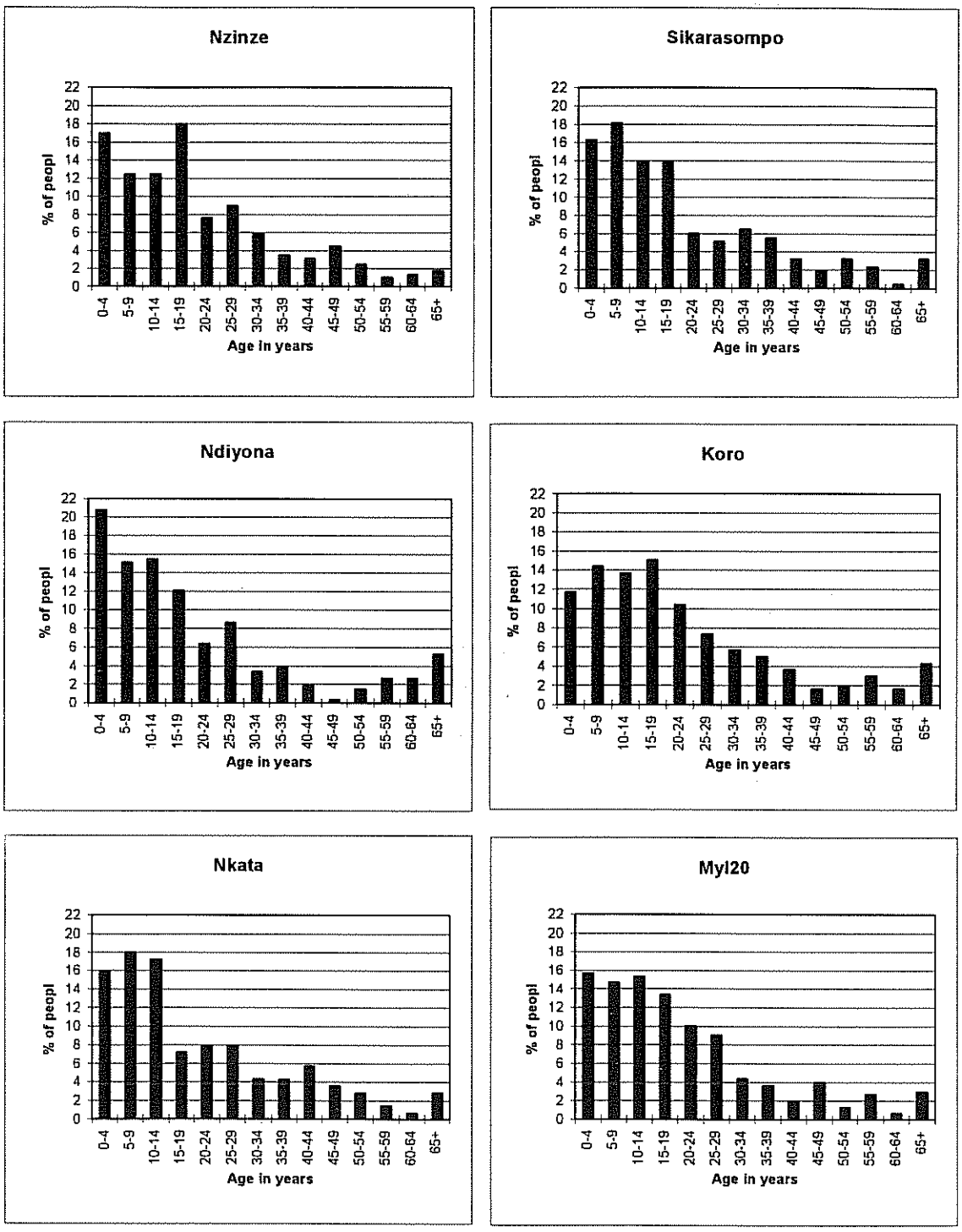
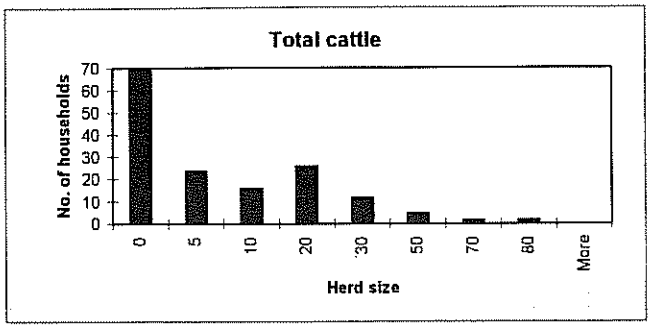
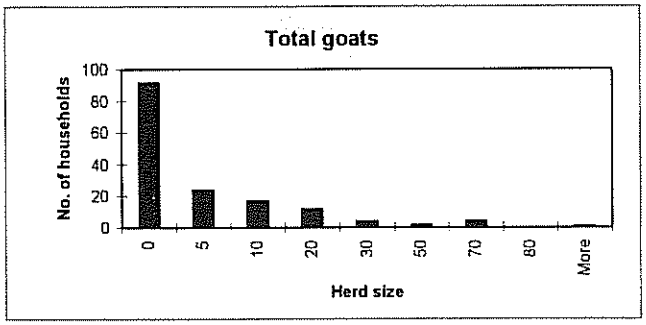


Chart A2.4 Ownership of assets

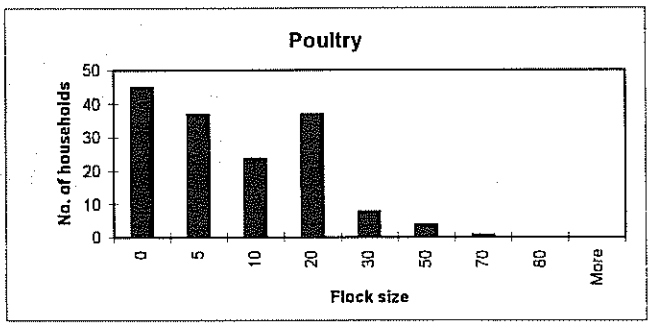
Class	Frequency
0	69
1-5	24
6-10	16
11-20	26
21-30	12
31-50	5
51-70	2
71-80	2
More than	0
	156



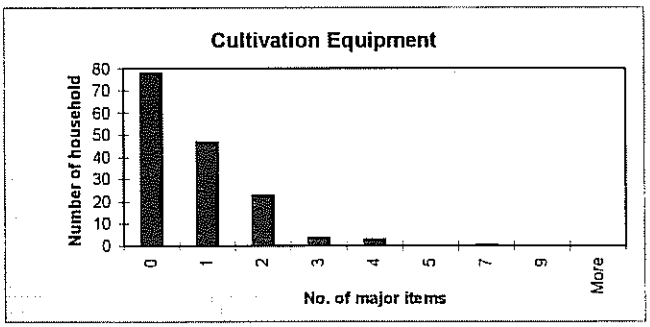
Class	Frequency
0	92
1-5	24
6-10	17
11-20	12
21-30	4
31-50	2
51-70	4
71-80	0
More than	1
	156



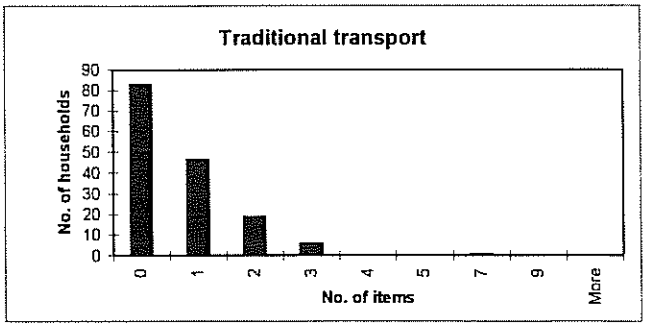
Class	Frequency
0	45
1-5	37
6-10	24
11-20	37
21-30	8
31-50	4
51-70	1
71-80	0
More than	0
	156



Class	Frequency
0	78
1	47
2	23
3	4
4	3
5	0
6-7	1
8-9	0
More than	0
	156



Class	Frequency
0	83
1	47
2	19
3	6
4	0
5	0
6-7	1
8-9	0
More than	0
	156



A 3 Summary of Village and Household Characteristics

The survey villages differ in respect of location, average ages of fields cultivated and proportion of fields with sandy soils. However there is little apparent pattern to these differences. For example Nzinze, one of the two riverside villages, has the highest average field age and a comparatively high proportion of sandy fields. Ndiyona, the other riverside village has a comparatively low proportion of fields with sandy soils and the average age of fields is lower than one of the inland villages.

There are some differences between villages in household characteristics. Nkata has comparatively small average household size and workforce (producers within the household and workers from outside). Nzinze and Ndiyona stand out as having both the largest number of wage earners and the largest proportion of households having one or more wage earners.

Some general features of households, common across villages, are:

a) dependents are about as numerous as producers for most households

b) a high proportion of households do not own livestock or cultivation or transport equipment

c) household workforces are boosted by bringing in labour from outside the household as individuals or in the form of workgroups.

This initial examination of village and household characteristics suggests that, for many parameters, variations between households within villages are greater than variations between villages.

Part B Household Non-crop Welfare Status

For rural households in Kavango, cash and livestock are the main sources of livelihood outside of cropping and hunting and gathering. Households will measure their welfare through a season before crop production in relation to their net gains from the production and use of cash and livestock.

First will be levels of cash income obtained from various sources, sales of beer, handicrafts, pensions, remittances and wages. Against this will be the cash expenditures households need to make to exist through the season. The balance of cash incomes and expenditures can then be treated as the first element of a household's non-crop welfare

The second element of non-crop welfare will be derived from livestock production. Again this has consumption and income elements. Households can expect to increase the value of their livestock holdings through a season, unless deaths and slaughters are greater than births and other gains (purchases, gifts). Welfare gained from livestock can then be measured in terms of net changes in the value of livestock. However welfare gains also come from the consumption of livestock products and the value of this own consumption must also be included in the welfare measure.

In this section we will build up a profile of household welfare from sources other than crop production, which will include:

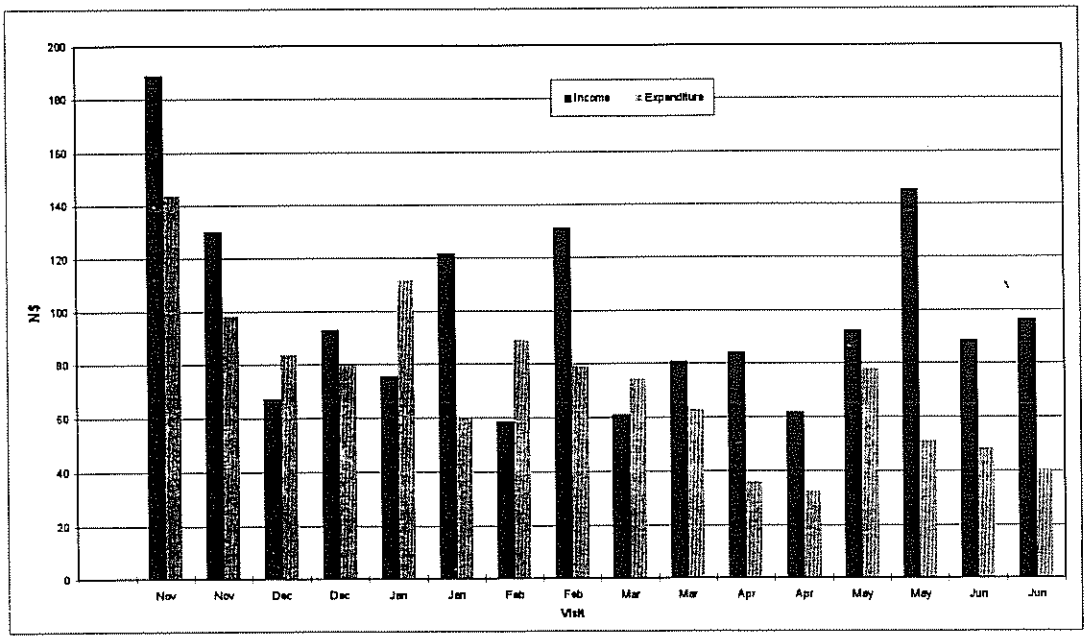
1. Cash income and expenditure

2. Welfare gained from livestock

2.1 Changes in value of stock
2.2 Value of own consumption of livestock products

For each of these welfare elements we will look at distributions by source, by season, by village and by household.

Chart B1.1 Income and expenditure - average per household (N$ per 2 week period)



B 1 Cash Income and Expenditure

Over the 8 month period of the survey from November to June, cash expenditure averaged over all households in the survey was N$1,188. Of this 64% was spent on food, 21% on services, which included school fees as well as hiring of power sources (Table B1.2).

Table B1.3 shows the distribution across villages. In two villages, Nzinze and Nkata, cash transactions were low compared with the other villages. This is a surprising result since, as seen in section A2.2, Nzinze had the highest number of wage earners and highest number of households with one or more wage earners. This is abnormally due to under estimation of cashincome from earnings in Nzinze as a number of farmers refused to divulge this information.

Chart B1.1 shows that while there was no clear pattern of income through the period, expenditures seemed to fall in the second half of the period (March to June). This is likely to be due to on-farm food sources being more plentiful at the end of the rainy season.

Average cash income over the period was higher than expenditure (N$1,577). 54% of this income came from the sales of produce (crops, livestock products, beer) and 40% came from non-farm earnings (pensions, remittances, wages).

Table B1.2 Expenditure/income average over all households (N$ per 2 week period)

	VISIT									
	Nov	Nov	Dec	Dec	Jan	Jan	Feb	Feb	Mar	Mar
Expenditure										
- food	88	64	56	62	34	64	42	56	50	57
- capital	20	14	8	17	6	6	4	5	2	7
- services	24	12	7	24	39	11	14	21	14	10
- loans	10	17	3	5	1	1	5	3	2	1
Income										
- credit	8	4	0	1	2	0	1	2	2	1
- services	3	3	2	2	5	4	4	4	1	4
- earnings	38	77	37	38	28	40	13	79	43	33
- sales	128	38	23	51	39	73	39	46	15	42
All expenditure	142	107	74	108	80	82	66	86	67	76
All income	177	122	62	92	74	118	57	130	61	81

	Apr	Apr	May	May	Jun	Jun	Total of 8 months	% of all exp/inc
Expenditure								
- food	44	27	23	26	25	18	737	64%
- capital	4	3	5	6	10	7	125	11%
- services	5	6	15	15	20	9	246	21%
- loans	0	0	1	3	0	0	53	5%
Income								
- credit	1	1	2	3	4	0	32	2%
- services	1	0	3	8	6	4	55	4%
- earnings	12	15	49	67	17	41	627	41%
- sales	70	44	39	69	62	52	832	54%
All expenditure	53	37	44	51	56	34	1,161	
All income	84	61	93	146	89	97	1,545	

Table B1.3 Cash income and expenditure by village

	Nzinze		Sikarasompo		Nkata		Myl20		Ndiyona		Koro	
Expenditure												
- Food	99	71%	177	63%	99	66%	187	60%	226	64%	40	56%
- Capital	7	5%	19	7%	17	12%	56	18%	22	6%	13	18%
- Services	26	19%	81	29%	28	19%	42	13%	97	27%	13	18%
- Lloans	7	5%	3	1%	5	3%	25	8%	9	3%	6	8%
Income												
- Credit	6	6%	11	2%	2	4%	9	2%	6	1%	2	1%
- Sservices	8	9%	4	1%	4	6%	11	3%	12	2%	17	8%
- Earnings	21	22%	239	50%	27	45%	209	47%	141	28%	110	53%
- Sales	58	62%	226	47%	27	45%	213	48%	345	68%	77	37%
All expenditure	139		280		149		310		354		71	
All income	94		481		60		443		505		206	

The distributions of the major income sources across households (earnings and sales) are skewed as expected, with the majority of households receiving zero or up to N$250 from either source during the period. Expenditure on food is less skewed, with most households spending between N$250 and N$1,000 on food (Chart B1.4). Most households (60%) recorded cash income/expenditure balances of +/- N$500 (Chart B1.5). More households had cash surpluses than cash deficits.

B 2 Own Consumption of Livestock Products

B 2.1 Consumption of Own Cattle Products (*milk excluded*)

The proportion of households consuming own cattle products in any two week period was very small and sparsely distributed over the season (Chart B2.1). Even in Sikarasompo, which had the largest average cattle herd size (19), only 8% of households consumed own cattle products over the survey period and that was in one two week period only.

B 2.2 Consumption of Own Goat Products

Chart B2.2 indicates that consumption of own goat products is both more common (up to 20% of households consuming in a two week period) and more regularly distributed through the season than for cattle. Again Sikarasompo and Koro, with the highest average goat herds, have the highest levels of consumption.

B 2.3 Consumption of Own Poultry Products

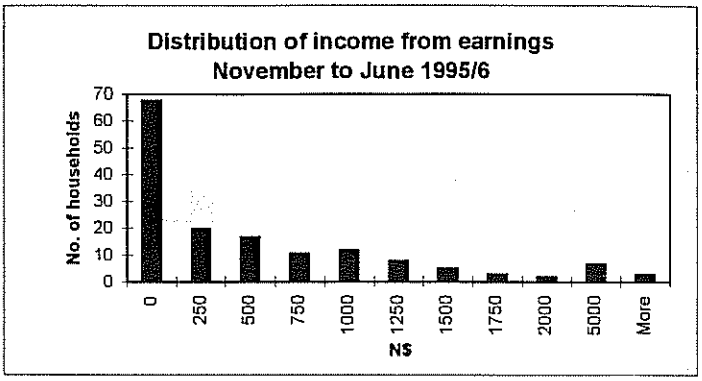
Chart B2.3 indicates that consumption of own poultry products is both more common (up to 50% of households consuming in a two week period) than either goats or cattle. Myl 20 had much lower consumption of own poultry products recorded than other villages and has the lowest average flock size (4) compared with other villages with average flock sizes of 6-15.

B 2.4 Consumption of Own Milk Products

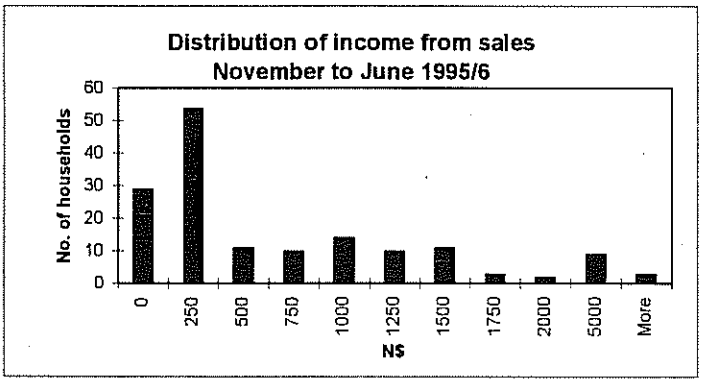
Chart B2.4 indicates that consumption of own milk products is only significant in two villages (Sikarasompo and Koro). These villages have average cattle herd sizes of 10 or more, while average herd size in all other villages is less than 10.

Chart B1.4 Income distribution

Class	Frequency
0	68
1-250	20
251-500	17
501-750	11
751-1000	12
1001-1250	8
1251-1500	5
1501-1750	3
1751-2000	2
2001-5000	7
More than 5000	3
	156



Class	Frequency
0	29
1-250	54
251-500	11
501-750	10
751-1000	14
1001-1250	10
1251-1500	11
1501-1750	3
1751-2000	2
2001-5000	9
More than 5000	3
	156



Class	Frequency
0	3
1-250	51
251-500	22
501-750	24
751-1000	18
1001-1250	12
1251-1500	9
1501-1750	5
1751-2000	2
2001-5000	8
More than 5000	2
	156

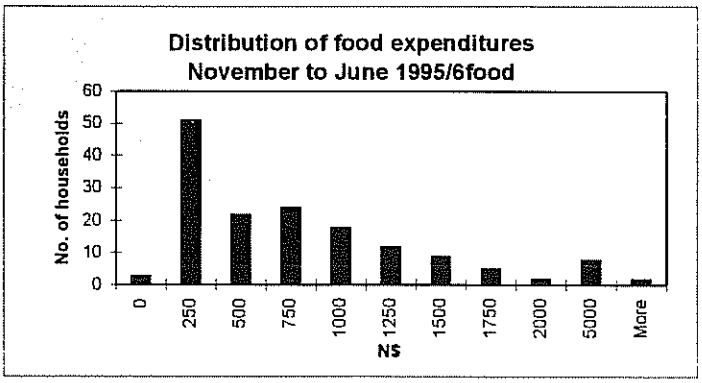
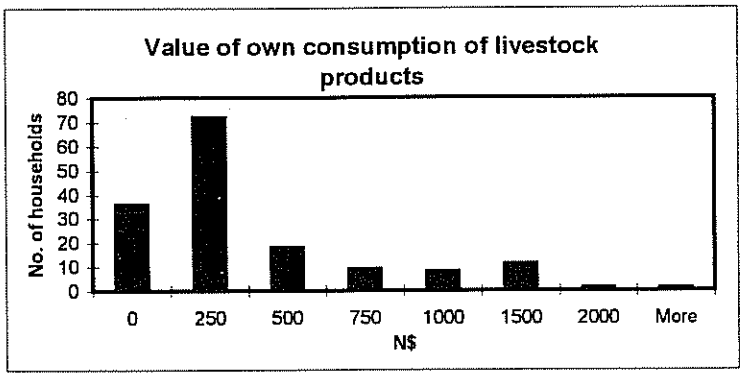
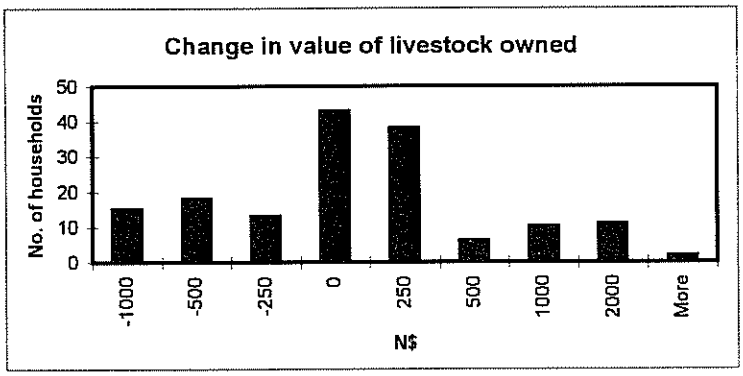


Chart B1.5 Non-crop welfare gains over survey period

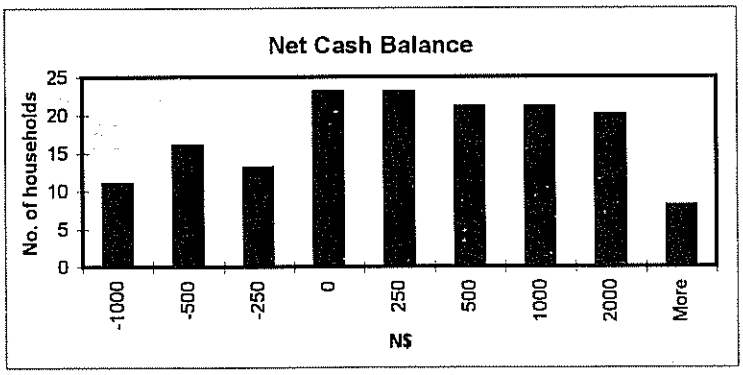
Class	Frequency
0	36
1-250	72
251-500	18
501-750	9
751-1000	8
1001-1500	11
1501-2000	1
More than	1
	156



Class	Frequency
-1000	15
-500	18
-250	13
-249-0	43
1-250	38
251-500	6
501-1000	10
1000-2000	11
More than	2
	156



Class	Frequency
-1000	11
-500	16
-250	13
-249-0	23
1-250	23
251-500	21
501-1000	21
1000-2000	20
More than	8
	156



Class	Frequency
-1000	14
-500	10
-250	17
-249-0	18
1-250	24
251-500	16
501-1000	22
1000-2000	19
More than	16
	156

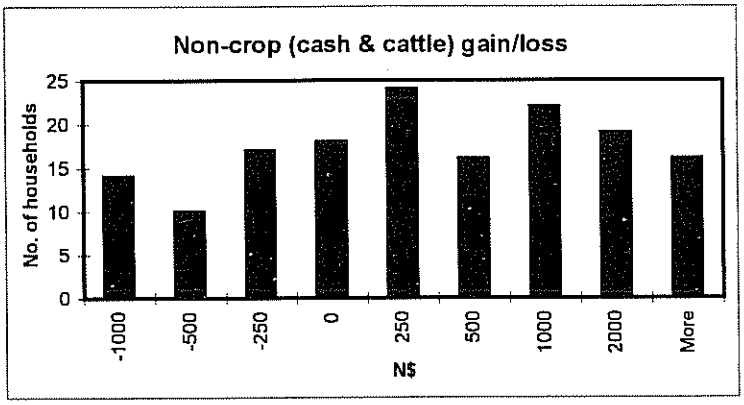


Chart B2.1 % of households consuming own cattle

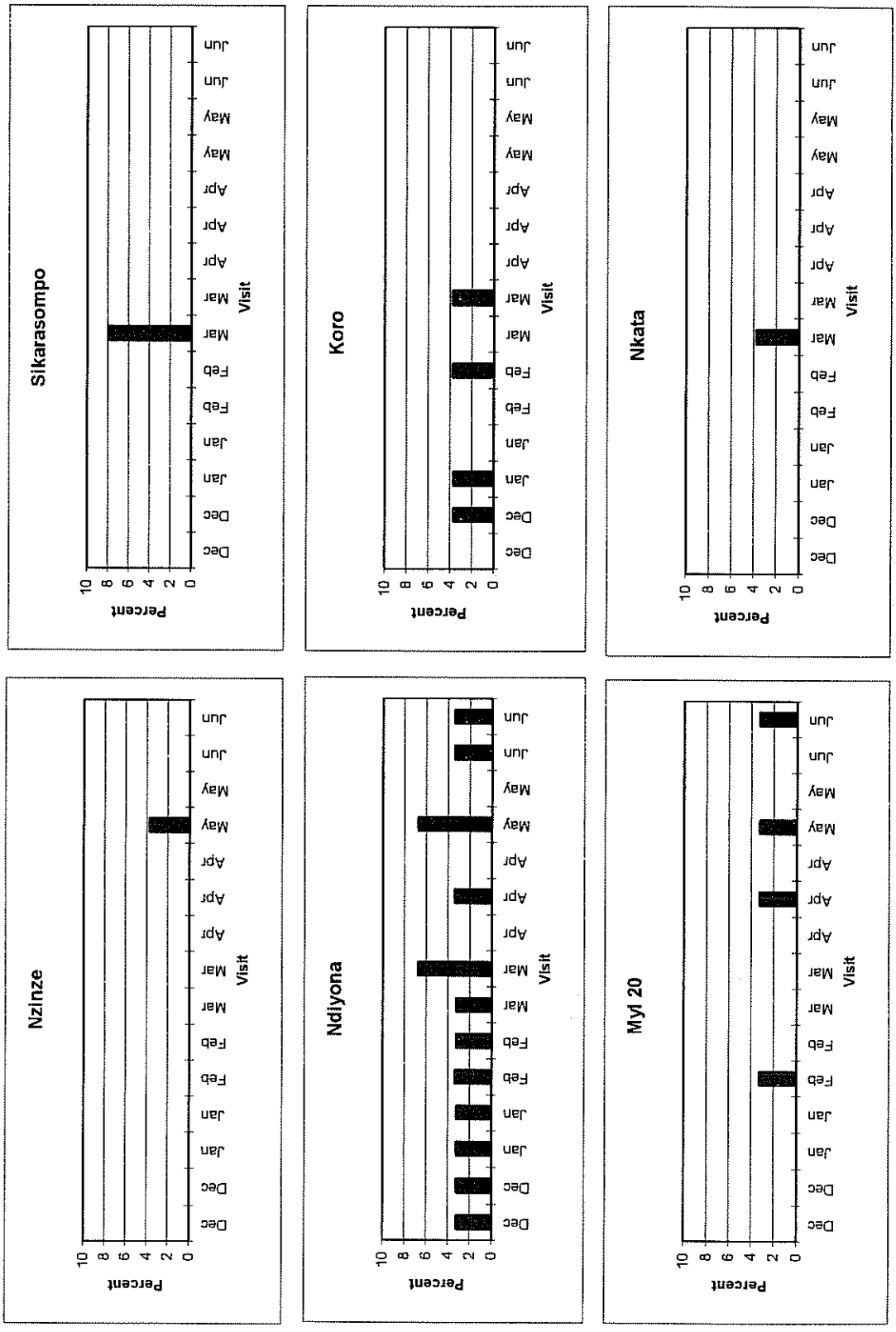


Chart B2.2 % of households consuming own goats

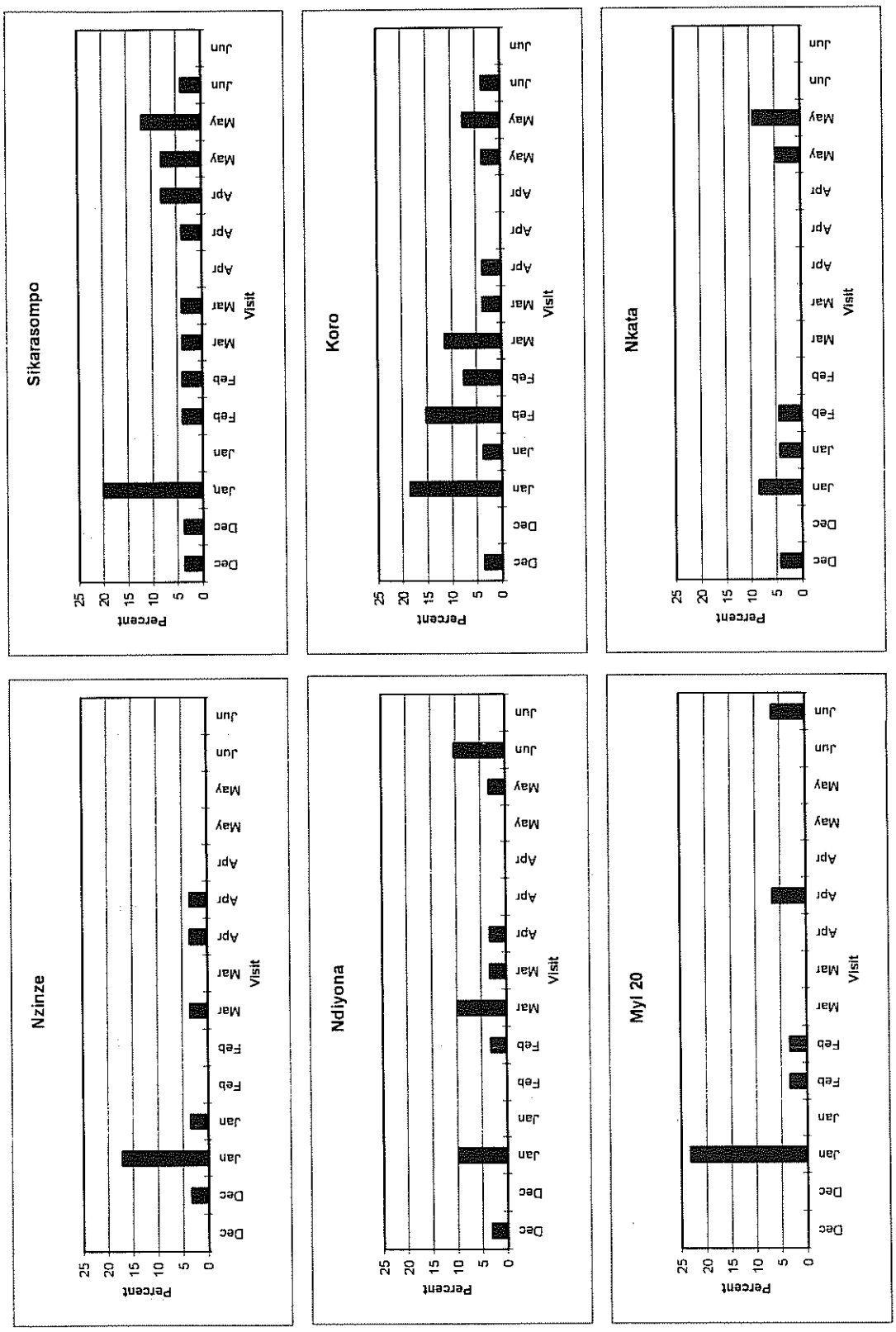


Chart B2.3 % of households consuming own poultry

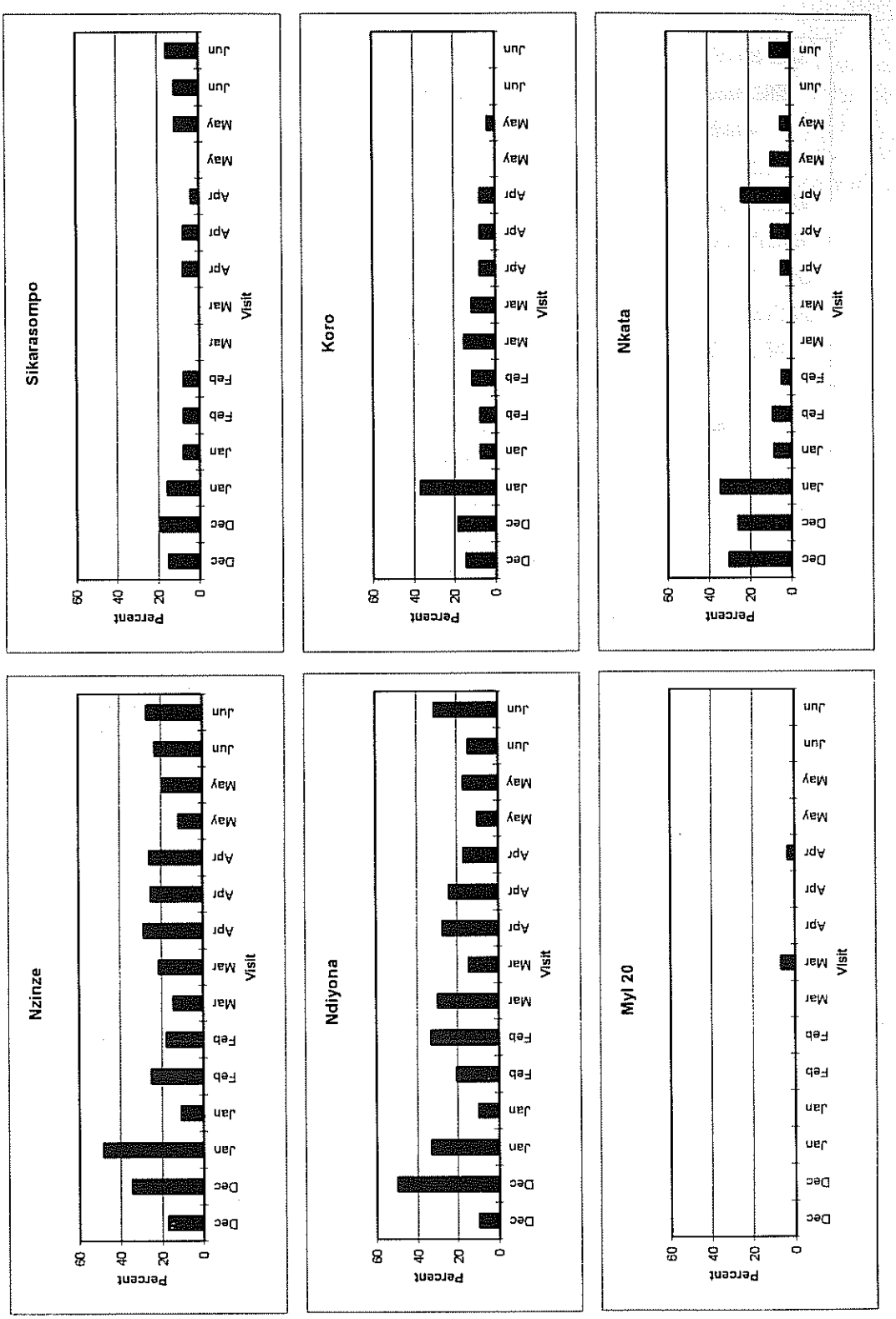
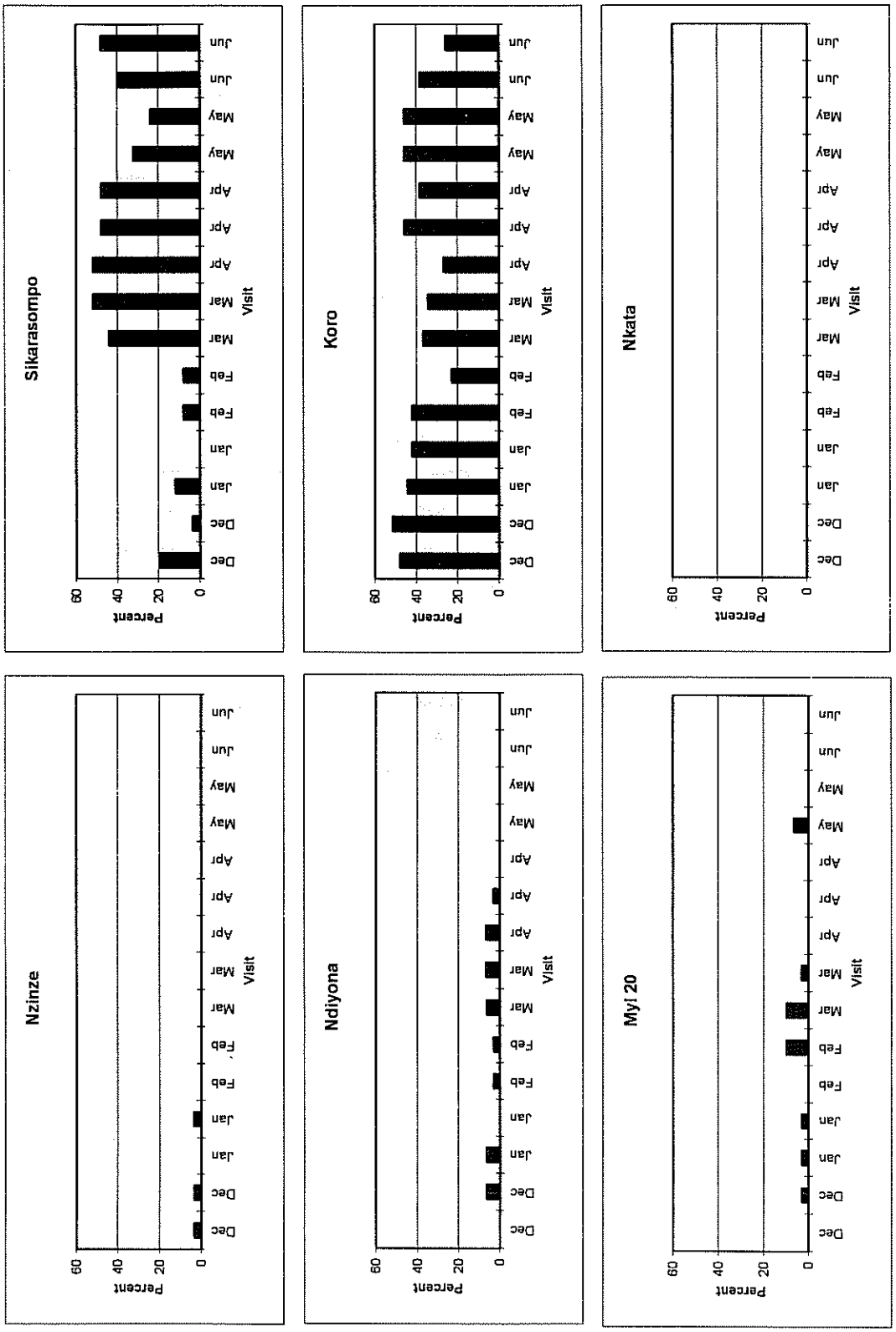


Chart B2.4 % of households consuming own milk products



B 3 Changes in Livestock Numbers

Changes in livestock numbers over time will contribute to increases and decreases in household wealth. These changes in livestock numbers can be expected to vary across the season. Through a season households will experience net gains or losses.

B 3.1 Seasonal Changes in Livestock Numbers

Chart B3.1 shows that, for cattle, goats and poultry, losses due to other reasons than death were highest in December-January. This probably reflects increased slaughters of livestock products for own consumption as well as sale in the Christmas holiday period. For all livestock types, births are the dominant source of increases in numbers.

B 4 Summary of Non-crop Welfare Gains

B 4.1 Net Cash Balance

A significant number of households (40%) have negative net cash balances. Another group (28%) has a positive cash balance of up to N$500. A third group (31%) has positive cash balances of greater than N$500.

B 4.2 Value of Livestock Welfare Gains

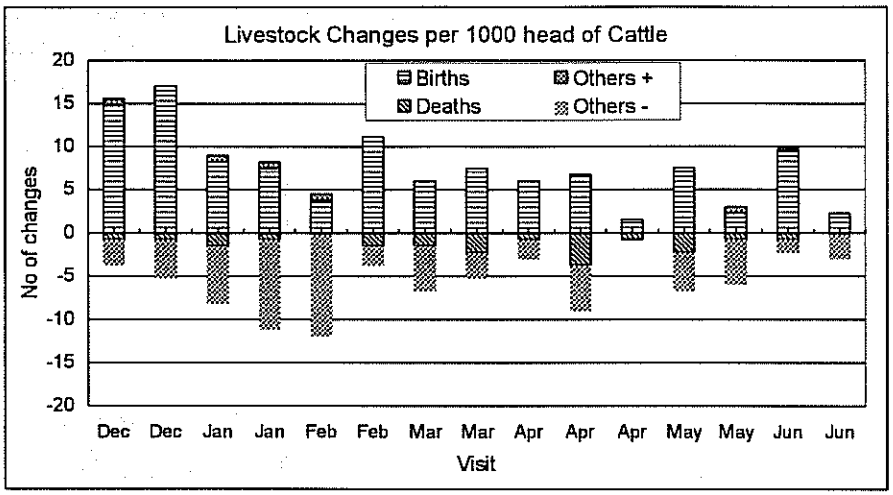
For most households (46%) the gain from consumption of livestock products is valued at N$1-250, see Chart B1.3 above. For the majority of households (52%) the change in value of stock is between N$-249 and N$250. For many households the gain from consumption will be combined with a slight loss of value in stock.

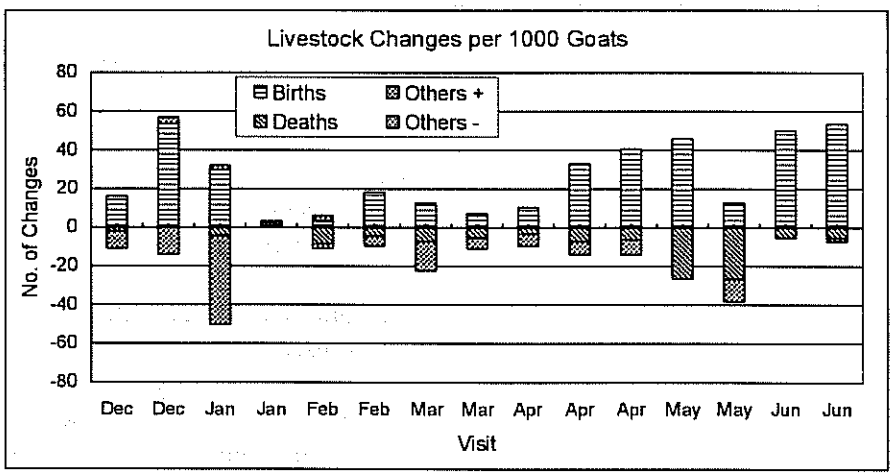
B 4.3 Non-crop (cash & cattle) Welfare Gain/loss

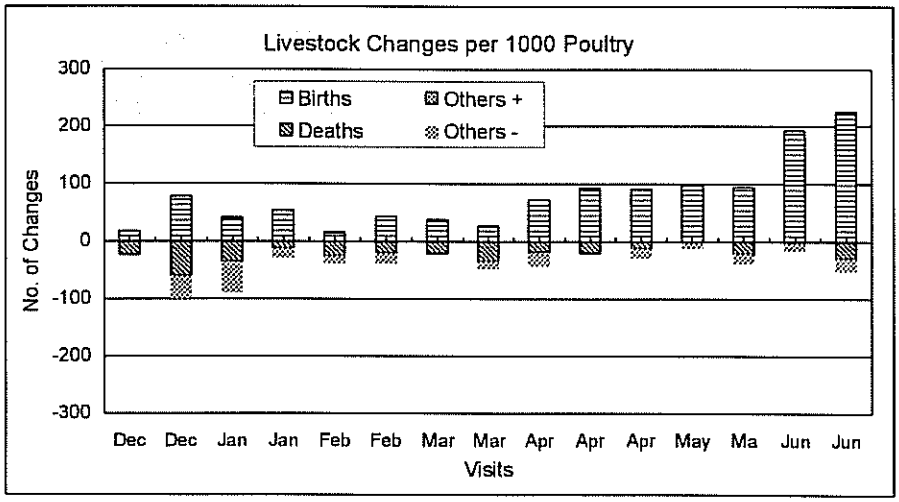
When livestock welfare gains are combined with net cash balances 38% of households suffer net welfare losses through the season. Welfare gains of up to N$500 are made by 26% of households and gains above N$500 are made by 37% of the survey households.

The sum of cash and cattle welfare gains will be used as one indicator of household welfare in the comparative analyses of section E. However, as there is some concern about underestimation of the gains from wage employment, especially for households in Nzinze, other welfare measures will also be used to differentiate between better off and less well off households.

Chart B3.1 Changes in livestock numbers







Part C Crop Production

C 1 Crop Areas

Many of the fields are planted in mixtures of crops. In this survey a main crop was allocated to each field/plot and any additional crops grown on the fields were noted as secondary crops. No attempt was made to allocate areas to each of the crops in a mixture.

Table C1.1 shows the proportion of fields which had different crops growing on them. Overall 93% of fields were planted with mahangu. The next most commonly planted crop was maize (31% of fields with maize). The other crops planted on more than 15% of fields were: pumpkins, sorghum, melon and beans.

Table C1.1 Cultivated fields by type of crop growing

Number of cultivated fields by type of crop growing

	Village						
Crop	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	All
Millet	47	39	41	66	60	76	329
Sorghum	3	21	8	7	22	36	97
Maize	19	21	14	20	17	20	111
Cowpeas	1	0	0	5	0	0	6
Beans	16	5	27	5	8	7	68
Groundnuts	0	2	2	5	1	1	11
Pumkins	9	27	23	3	13	32	107
Melons	18	31	6	9	16	15	95
Sugar cane	5	0	1	1	1	0	8
Spinach	0	4	0	4	1	3	12
Number of fields	48	41	44	69	69	83	354

Percentage of cultivated fields by type of crop growing

	Village						
Crop	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	All
Millet	97.92	95.12	93.18	95.65	86.96	91.57	92.94
Sorghum	6.25	51.22	18.18	10.14	31.88	43.37	27.40
Maize	39.58	51.22	31.82	28.99	24.64	24.10	31.36
Cowpeas	2.08	0.00	0.00	7.25	0.00	0.00	1.69
Beans	33.33	12.20	61.36	7.25	11.59	8.43	19.21
Groundnuts	0.00	4.88	4.55	7.25	1.45	1.20	3.11
Pumkins	18.75	65.85	52.27	4.35	18.84	38.55	30.23
Melons	37.50	75.61	13.64	13.04	23.19	18.07	26.84
Sugar cane	10.42	0.00	2.27	1.45	1.45	0.00	2.26
Spinach	0.00	9.76	0.00	5.80	1.45	3.61	3.39
Number of fields	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Most fields are planted with a mixture of one or more of these most common crops. Two thirds of plots had more than one crop planted on them (Table C1.2). Taking the major crops only (mahangu, maize, pumpkins, sorghum, melons and beans), 36% of plots had just one of these major crops planted on them. The rest were planted with a mixture of one or more of these main crops.

Crop area information is available only in relation to the main crop on a field, or a section of a field where this was measured as a separate plot. Table C1.3 provides an analysis of main crop areas grown by village and for the total sample of households.

Mahangu is the dominant crop. All households planted some mahangu, 20% planted maize and 8% planted sorghum. Only 7% of farmers reported having fallow fields. These are fields farmers are not using now but expect to do so in the future. They do not include areas that have been abandoned completely.

The average area planted to mahangu as the major crop is quite large, averaging 6.15 hectares per grower. This large average area excludes one area of 48 hectares of improved mahangu planted by one farmer as part of the NDC farmers support programme.

Improved mahangu was planted by at least 19% of farmers. Some farmers were not able to distinguish between traditional and improved mahangu on some of their fields. Improved mahangu was planted on about 11% of crop area, while traditional or unspecified mahangu was planted on 82% of crop area. The crop taking up the next highest area was maize (2.7% of cropped area).

Table C1.2 Percentage of plots by crops growing

Percentage of plots by number of crops growing

	VILLAGE						
Number of crops	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Grand Total
0	7.55	5.36	10.20	1.30	1.35	3.26	4.24
1	30.19	5.36	24.49	44.16	48.65	35.87	33.42
2	20.75	10.71	36.73	32.47	31.08	23.91	26.18
3	18.87	23.21	14.29	15.58	8.11	22.83	17.21
4	16.98	14.29	10.20	5.19	6.76	9.78	9.98
5	3.77	25.00	2.04	0.00	4.05	3.26	5.74
6	1.89	14.29	2.04	0.00	0.00	1.09	2.74
7	0.00	1.79	0.00	1.30	0.00	0.00	0.50
Grand Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Percentage of plots by number of major crops growing

	VILLAGE						
Number of main crops	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Grand Total
1	32.65	5.66	27.27	48.68	49.32	40.45	36.46
2	24.49	11.32	43.18	38.16	32.88	22.47	28.65
3	22.45	24.53	13.64	10.53	8.22	23.60	16.93
4	18.37	18.87	13.64	1.32	6.85	8.99	10.16
5	2.04	30.19	2.27	1.32	2.74	3.37	6.25
6	0.00	9.43	0.00	0.00	0.00	1.12	1.56
Grand Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table C1.3 Households Growing And Average Areas Of Main Crop

NO OF GROWERS

	Nzinzi	Sikarasomp	Nkata	Myl 20	Ndiyona	Koro	TOTAL
No of households	26	24	21	29	29	26	155

NO OF GROWERS OF MAJOR CROPS

	Nzinze	Sikarasomp	Nkata	Myl 20	Ndiyona	Koro	TOTAL
Mahangu trad	24	18	13	16	13	22	106
Mahangu imp	2	2	5	9	9	2	29
Mahangu unknown	6	9	7	18	9	5	54
Sorghum improved	0	0	1	0	1	0	2
Sorghum unknown	0	1	0	1	2	7	11
Maize	2	5	3	7	7	7	31
Cowpeas	0	0		1			1
Fallow	3	0	4	1	1	2	11
Not known	0	1	0	0	0	0	1

AVERAGE AREA OVER ALL HOUSEHOLDS

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Total
Mahangu trad	3.40	6.11	1.40	3.23	1.97	4.40	3.42
Mahangu imp	0.06	0.20	0.42	2.17	1.17	0.06	0.73
Mahangu unknown	0.53	3.08	0.86	3.96	2.38	0.78	2.00
Mahangu	**4.00**	**9.38**	**2.69**	**9.37**	**5.52**	**5.24**	**6.15**
Sorghum improved	0.00	0.00	0.04	0.00	0.01	0.00	0.01
Sorghum unknown	0.00	0.03	0.00	0.13	0.08	0.58	0.14
Maize	0.07	0.17	0.19	0.21	0.18	0.25	0.18
Cowpeas	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Fallow	0.15	0.00	0.60	0.12	0.07	0.15	0.17
Not known	0.00	0.02	0.00	0.00	0.00	0.00	0.08
TOTAL	4.22	9.60	3.52	9.85	5.86	6.22	6.65

AVERAGE AREA PER GROWER

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Total
Mahangu trad	3.69	8.14	2.26	5.86	4.39	5.20	4.92
Mahangu imp	0.83	2.34	1.78	7.00	3.78	0.82	2.76
Mahangu unknown	2.29	8.21	2.59	6.39	7.68	4.03	5.20
Sorghum improved			0.74		0.31		0.53
Sorghum unknown		0.75		3.72	1.18	2.16	1.95
Maize	0.88	0.81	1.36	0.89	0.73	0.95	0.94
Cowpeas				0.46			0.46
Fallow	1.32		3.15	3.60	2.08	1.93	2.42
Not known		0.45					0.45

PROPORTION OF CROP AREA IN MAIN CROPS

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Total
Mahangu trad	80.7%	63.6%	39.8%	32.8%	33.6%	70.7%	51.4%
Mahangu imp	1.5%	2.0%	12.1%	22.1%	20.0%	1.0%	11.0%
Mahangu unknown	12.5%	32.1%	24.6%	40.2%	40.7%	12.5%	30.1%
Mahangu	**94.8%**	**97.7%**	**76.4%**	**95.1%**	**94.2%**	**84.2%**	**92.5%**
Sorghum improved	0.0%	0.0%	1.0%	0.0%	0.2%	0.0%	0.1%
Sorghum unknown	0.0%	0.3%	0.0%	1.3%	1.4%	9.3%	2.1%
Sorghum	**0.0%**	**0.3%**	**1.0%**	**1.3%**	**1.6%**	**9.3%**	**2.2%**
Maize	1.6%	1.8%	5.5%	2.2%	3.0%	4.1%	2.7%
Cowpeas	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%
Fallow	3.6%	0.0%	17.1%	1.3%	1.2%	2.4%	2.5%
Not known	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%

The average areas planted per grower was higher for sorghum (2 ha) than for maize (0.9 ha). However, since maize was grown by more farmers, the area under maize was higher than for sorghum.

The major differences noted between villages are the number of farmers growing improved mahangu and maize and the number growing sorghum as the main crops. In Myl 20 and Ndiyona both improved Mahangu and maize were more commonly grown as main crops than in other villages. In Koro there was more sorghum as well as maize grown as main crops than in other villages. In these villages there was less mixed cropping of the main crops than in the other three villages (Table C1.2 above).

Sikarasompo, reports relatively high levels of mixed cropping, with less than 6% of plots planted to a single crop and 39% with 5 or more major crops.

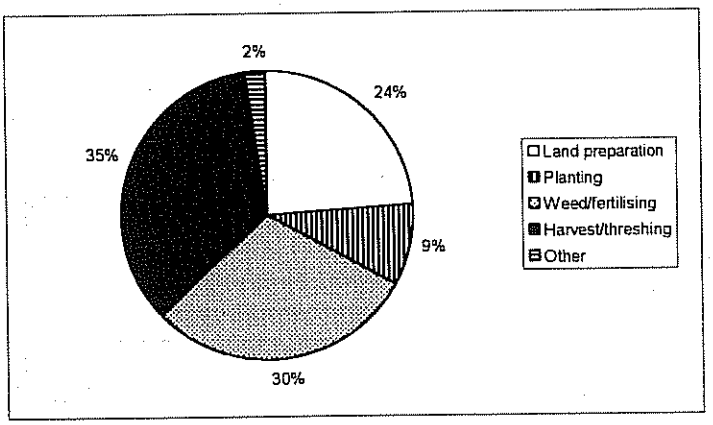
C 2 Labour Field Inputs by Households

Time spent on field and other activities is measured in sessions. One session is half a day: a morning period or an afternoon period. If the whole day was spent in an activity by one person, this is counted as two person sessions. A morning spent in an activity by two persons is also counted as two person sessions.

C 2.1 Labour Inputs by Type of Labour

Over the whole sample 47,598.5 sessions were spent on field activities, see Table C2.2 below. This gives an average of 305 sessions per household (or 153 person days).

Chart C2.1 Labour inputs to fields



A breakdown of these sessions by type of labour indicates that 77% of the time spent on field activities was by household members; 56% of sessions were undertaken by females; and children less than 15 years of age provided only 6% of the time spent on field activities.

C 2.2 Labour Inputs by Activity

Table C2.3 gives the total number of sessions spent on field activities which are summarized in Chart C2.1. It should be noted that ploughing and planting are sometimes done at the same time and these two different activities may have been recorded as one, either ploughing or planting. Chart C2.4 below summarizes the time spent by different population groups on the major field activities.

Planting activities are mainly done by female household members. For row planting 84% is done by household members and 83% by females. For broadcasting 83% is done by household members and 88% by females. For replanting 94% is done by household members and 91% by females.

Virtually no fertilisation takes place so this category essentially represents weeding only. 30% of sessions are spent on weeding

Table C2.2 Labour field inputs by type of worker and activity

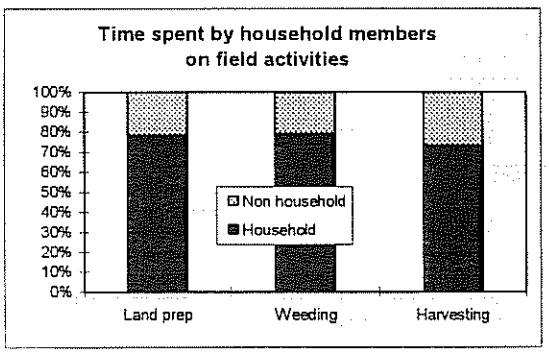
Number of sessions in field activities by type of worker

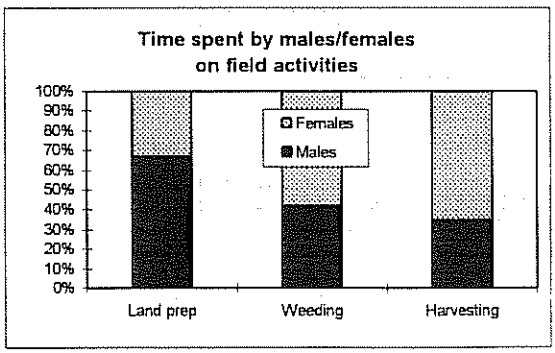
	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro	All
Total field sessions	7135	11918	2920	11138.5	6649	7838	47598.5
HH member	93%	68%	78%	81%	55%	93%	77%
Non hh member	7%	32%	22%	19%	45%	7%	23%
Male	47%	45%	35%	44%	39%	44%	44%
Female	53%	55%	65%	56%	61%	56%	56%
Child <15 yrs	7%	8%	4%	6%	5%	5%	6%
Adult	93%	92%	96%	94%	95%	95%	94%

Number of sessions by field activity

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro	All
Total number of sessions	7,135.0	11,918.0	2,920.0	11,138.5	6,649.0	7,838.0	47,598.5
Land prep	23%	16%	33%	26%	29%	24%	24%
Row planting	5%	1%	0%	0%	8%	7%	3%
Broadcasting	2%	4%	12%	11%	3%	1%	5%
Replanting	0%	2%	1%	0%	0%	2%	1%
Weed/fert	34%	32%	34%	25%	26%	29%	30%
Harvest/thresh	35%	43%	18%	35%	33%	32%	35%
Other - no draft	0%	0%	0%	0%	0%	2%	0%
Other - draft	0%	2%	2%	1%	1%	4%	2%

Chart C2.3 Time spent by different population groupings on field activities





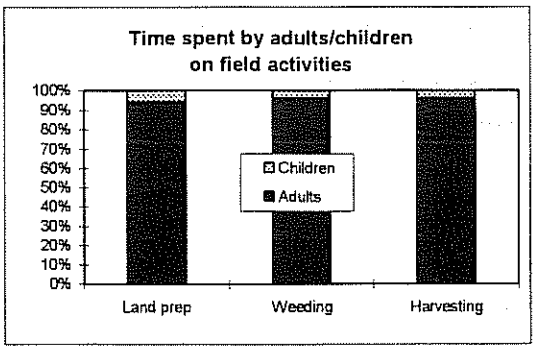


Table C2.4 Labour inputs by activity and worker type

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro
Total land preparation	1,647.0	1,917.5	974.5	2,947.5	1,935.5	1,860.0
HH member	87%	86%	67%	82%	52%	89%
Non hh member	13%	14%	33%	18%	48%	11%
Male	71%	66%	63%	76%	61%	59%
Female	29%	34%	37%	24%	39%	41%
Child <15 yrs	7%	13%	6%	10%	4%	5%
Adult	93%	87%	94%	90%	96%	95%

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro
Total row planting	381.0	102.0	3.0	51.0	516.0	512.0
HH member	99%	90%	100%	90%	62%	94%
Non hh member	1%	10%	0%	10%	38%	6%
Male	6%	38%	0%	22%	17%	20%
Female	94%	62%	100%	78%	83%	80%
Child <15 yrs	9%	11%	0%	10%	7%	5%
Adult	91%	89%	100%	90%	93%	95%

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro
Total broadcasting	117.0	447.0	349.5	1,274.5	187.5	115.0
HH member	74%	83%	75%	86%	78%	98%
Non hh member	26%	17%	25%	14%	22%	2%
Male	24%	14%	2%	9%	27%	24%
Female	76%	86%	98%	91%	73%	76%
Child <15 yrs	10%	9%	2%	3%	10%	13%
Adult	90%	91%	98%	97%	90%	87%

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro
Total replanting	13.0	197.0	26.0	46.0	0.0	137.0
HH member	100%	98%	88%	67%		98%
Non hh member	0%	2%	12%	33%		2%
Male	0%	3%	0%	33%		12%
Female	100%	97%	100%	67%		88%
Child <15 yrs	0%	23%	0%	0%		10%
Adult	100%	77%	100%	100%		90%

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro
Total weeding/fert	2,446.0	3,848.5	987.0	2,745.5	1,749.0	2,279.0
HH member	95%	75%	85%	75%	54%	92%
Non hh member	5%	25%	15%	25%	46%	8%
Male	43%	43%	33%	42%	35%	46%
Female	57%	57%	67%	58%	65%	54%
Child <15 yrs	6%	5%	0%	3%	6%	3%
Adult	94%	95%	100%	97%	94%	97%

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro
Total harvest/thresh	2,530.0	5,172.0	536.0	3,943.5	2,195.0	2,504.5
HH member	94%	52%	89%	81%	54%	97%
Non hh member	6%	48%	11%	19%	46%	3%
Male	43%	42%	9%	31%	28%	31%
Female	57%	58%	91%	69%	72%	69%
Child <15 yrs	7%	5%	4%	7%	3%	5%
Adult	93%	95%	96%	93%	97%	95%

C 3 Draft Power and Equipment Use for Land Preparation

The analysis of draft power use is restricted to that for land preparation, since draft power is almost never used for any other crop production activity.

C 3.1 Methods of Land Preparation

Over all villages 91% of the area cultivated was prepared using oxen. Only 5% of the area was prepared by hand. However a large proportion of the area (68%) was prepared using a combination of hand and oxen draft, see Table C3.1.

In only two villages were tractors used for land preparation (Nzinze and Ndiyona) and then only by less than 15% of households and for 7% and 14% of the crop area. The tractor ploughing information excludes the area of 48 hectares planted under the NDC Farmer Support Programme by one farmer.

While 20% of households use hand hoeing to prepare some of their land, this only covers 5% of the area prepared.

C 3.2 Type and Number of Equipment Used for Oxen Ploughing

The single furrow plough is the dominant equipment used.

Just over half of the area planted was ploughed with a single plough, 11% of the area was prepared with two ploughs. The remaining 36% of the area was prepared using more than 2 ploughs or a combination of different numbers of ploughs at different times on a field, see Table C3.2.

C 3.3 Ownership of Equipment and Oxen for Ploughing

On 65% of the area ploughed, own oxen and own equipment were used. On 17% of the area ploughed oxen were borrowed and on 14% of the area the equipment was owned by relatives, see Table C3.3.

The percent of households that had land prepared with own oxen and equipment (53%) is less then the area ploughed with own oxen and equipment. This indicates that where own oxen and equipment are used, larger areas are ploughed, than when oxen and equipment is hired or borrowed.

In Ndiyona hired oxen and equipment were used on a comparatively high proportion of area ploughed compared with the other villages. Also one third of households in Ndiyona hired oxen and equipment for ploughing, compared to 10% or less in other villages.

Table C3.1 Methods of land preparation

Percent of area prepared using different land preparation methods

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Total
Method of Preparation							
Hand	3%	0%	9%	6%	7%	8%	5%
Oxen	90%	100%	91%	94%	79%	92%	91%
Alone	43%	26%	18%	27%	14%	11%	23%
With hand	46%	74%	73%	67%	65%	81%	68%
Tractor	7%	0%	0%	0%	14%	0%	3%
Alone	1%	0%	0%	0%	10%	0%	2%
With other	6%	0%	0%	0%	4%	0%	1%

Percent of households using different land preparation methods

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Total
Method of Preparation							
Hand	8%	0%	33%	24%	31%	21%	20%
Oxen							
Alone	62%	50%	38%	28%	48%	29%	42%
With hand	65%	100%	86%	97%	69%	100%	86%
Tractor	12%	0%	0%	0%	14%	0%	5%
Alone	4%	0%	0%	0%	7%	0%	2%
With other	8%	0%	0%	0%	7%	0%	3%

Table C3.2 Number of equipment used for oxen ploughing

Number of ploughs used for ox cultivation - % of area

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	All
Number of ploughs							
One only	66%	47%	56%	35%	55%	81%	53%
Two	26%	0%	5%	22%	7%	0%	11%
More than 2	8%	53%	39%	43%	39%	18%	36%

Table C3.3 Ownership of equipment and oxen for ploughing

Ownership of equipment used with oxen for ploughing and village - percent of area

	Nzinze	Sikarasompo	Nkata	Mylo20	Ndiyona	Koro	All
Ownership of equipment							
None	1%	1%	0%	0%	0%	0%	0%
Owned	68%	82%	39%	79%	38%	52%	65%
Co-owned	0%	0%	0%	0%	7%	2%	1%
Relative	23%	2%	29%	13%	4%	31%	14%
Hired	1%	1%	4%	0%	19%	0%	3%
Mixed	7%	13%	28%	8%	32%	15%	15%

Ownership of equipment used with oxen for ploughing and village-percent of household

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	All
Ownership of equipment							
None	4%	4%	0%	0%	0%	0%	1%
Owned	46%	79%	29%	69%	41%	43%	52%
Co-owned	0%	0%	0%	0%	10%	7%	3%
Relative	46%	8%	43%	34%	10%	36%	29%
Hired	4%	4%	10%	0%	31%	0%	8%
Mixed	8%	25%	29%	17%	31%	29%	23%

Ownership of oxen used for ploughing - percent of area

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Total
Ownership of oxen							
Owned	66%	71%	37%	79%	52%	54%	65%
Hired	1%	0%	6%	0%	19%	0%	4%
Borrowed	23%	12%	35%	15%	5%	31%	17%
Hire or Borrow	0%	4%	0%	1%	8%	2%	3%
Combination	10%	13%	22%	6%	15%	13%	11%

Ownership of oxen used for ploughing - percent of households

	Nzinze	Sikarasompo	Nkata	Myl20	Ndiyona	Koro	Total
Ownership of oxen							
Owned	46%	67%	29%	67%	48%	54%	53%
Hired	4%	0%	10%	0%	34%	0%	8%
Borrowed	46%	21%	48%	33%	14%	42%	33%
Hire or Borrow	0%	13%	0%	7%	7%	12%	6%
Combination	15%	25%	24%	10%	10%	35%	19%

C 4 Seed Use and Source of Supply

Seed was the main material crop input. Only two households applied fertiliser and only one reported using pesticides. Over 90% of the seed used is mahangu.

For all villages over 70% of farmers used their own retained seed on at least some of their planted area. Also in all villages 7% or more of households obtain seed for some of their planted area from other farmers.

C 4.1 Seed Source

The main source of seed is from own retained harvest, except for Ndiyona, where most of the seed used came from the extension service, Table C4.1. Other villages have different secondary sources. NDC is the main secondary source for Nzinze and Myl 20. Nzinze will be getting seed from the NDC project at Musese, while for Myl 20 one farmer, who planted a large area of mahangu, is a member of the NDC Farmer Support Programme. The main secondary source for Sikarasompo was store/cooperative. For Nkata and Koro an NGO was the major secondary source.

C 4.2 Seed Type

Overall 68% of seed planted is of local type, 29% is improved, Table C4.1. Ndiyona is unusual in that more improved seed is used than local. In Sikarasompo, Nkata and Myl 20 one quarter or more of seed used is of improved type. In Nkata 20% of the seed applied to a single field is a mixture of local and improved.

In all villages over 20% of farmers are using improved seed. Over the survey as a whole one third of farmers use improved seed on at least some of their cropped area.

Table C4.1 Seed use and source of supply

Seed source - percent of amount (Kgs)

	Nzinze	Sikaraso mpo	Nkata	Myl 20	Ndiyona	Koro	All
SOURCE							
Unknown	0%	1%	1%	0%	0%	0%	0%
Own retained from previous season	72%	47%	48%	66%	45%	86%	63%
Relative	9%	5%	0%	3%	0%	0%	3%
Other farmer	2%	16%	6%	5%	2%	3%	5%
NGO	0%	1%	16%	6%	5%	10%	5%
Extension programme	0%	6%	0%	0%	46%	0%	10%
Store/coop	0%	24%	5%	5%	1%	0%	6%
NDC	17%	0%	0%	13%	0%	1%	6%
Other	0%	0%	24%	1%	0%	0%	1%

Seed source - percent of households

	Nzinze	Sikaraso mpo	Nkata	Myl 20	Ndiyona	Koro	All
SOURCE							
Unknown	0%	4%	5%	3%	0%	4%	3%
Own retained from previous season	73%	71%	81%	90%	79%	100%	83%
Relative	27%	17%	0%	13%	3%	0%	10%
Other farmer	12%	54%	14%	23%	7%	15%	21%
NGO	0%	8%	33%	33%	14%	42%	22%
Extension programme	0%	17%	0%	3%	62%	0%	15%
Store/coop	0%	50%	14%	30%	7%	0%	17%
NDC	38%	0%	0%	13%	0%	4%	10%
Other	0%	4%	38%	3%	0%	4%	7%

Seed type - percent of amount (Kgs)

	Nzinze	Sikaraso	Nkata	Myl20	Ndiyona	Koro	All
Type of seed							
Local	88%	77%	51%	56%	42%	89%	68%
Improved	12%	23%	28%	39%	56%	10%	29%
Local + improved	0%	0%	21%	6%	2%	0%	3%

Seed type - percent of households

	Nzinze	Sikaraso	Nkata	Myl20	Ndiyona	Koro	All
Type of seed							
Local	76%	69%	49%	47%	51%	68%	59%
Improved	21%	31%	34%	39%	42%	29%	34%
Local + improved	3%	0%	17%	14%	7%	3%	8%

Part D Per Hectare Crop Inputs and Output

Since 92% of the area planted has mahangu as the main crop, the per hectare labour input analysis is essentially related to mahangu production, either as a single crop or grown in association with other crops.

D 1 Person Sessions per Hectare

Labour and draft inputs were measured as sessions. A session represents either a morning or an afternoon and can be treated as one half of a days work. Therefor two sessions make up one labour day. The conversion from sessions to labouur days is made by dividing the number of sessions worked by two. Thus, over all plots, the average number of sessions worked per hectare was 61, which is equivalent to 30.5 labour days.

However not all activities were undertaken on all fields. Table D1.1 indicates that essentially the activities of ox ploughing, planting, weeding and harvesting/threshing were done on all fields (allowing for less than 10% non reporting). However hand clearing was only done on 60% of fields and hand hoeing only on 30% of fields.

The per hectare labour inputs are therefore presented in Table D1.1 for four different field situations: where land clearing and or hoeing is done, compared to when one or the other of these is not done. The data shows that the labour inputs per hectare for crop production in Kavango range from 43.2 days/ha (with land clearing and hand hoeing) to 31 days without hand clearing or hand hoeing.

Weeding and harvesting activities require the most labour input per hectare, followed by hand clearing and hand hoeing.

Table D1.1 Per hectare labour inputs to crop production

Per hectare labour inputs by activity				
	% of fields	No. of sessions	90% confidence intervals	
ACTIVITY				
Land clearing	57	12.8	14.0	11.6
Land preparation				
by handhoe	28	11.5	13.2	9.8
by oxplough	91	8.6	9.2	8.0
Planting	94	7.7	8.3	7.1
Weeding	100	23.3	24.8	21.8
Harvest/threshing	94	22.4	24.1	20.6

Total sessions labour input per hectare		
	Sessions	Days equivalent
With land clearing - with hand hoeing	86.3	43.2
With land clearing - without hand hoeing	74.8	37.4
Without land clearing - with hand hoeing	73.5	36.8
Without land clearing - without hand hoeing	62.0	31.0

D 2 Seed Inputs per Hectare

The only significant non labour/draft input used was seed. This can be broken down into local and improved seed:

	Kg/ha	90% confidence interval
Local	4.9	5.7 - 4.1
Improved	3.5	4.0 - 3.0

These data suggest that local seed is applied at a slightly higher rate than improved seed.

D 3 Yield per Hectare

Yields were estimated in two ways. First farmers were asked to estimate the amount of threshed grain obtained from their fields. Second a small number of crop cuttings was done in selected fields.

The data collection on yields was not complete. In the end farmer estimated yield information was only obtained for 203 out of the 354 fields which were measured and monitored through the season. Crop cutting was only completed for 22 fields.

Where fields had more than one crop farmers estimated the amounts of specific grain types obtained from the field. Two thirds of fields had more than one of the main crops growing on them. The yields from these fields represent the amounts of specific grain from the whole field, not just the proportion of the field containing the specific crop.

Farmers reports of yields will tend to represent yields of specific crops when grown in association with other crops. They will not represent yields under pure cropping. The crop cutting estimates on the other hand will represent yields under pure cropping. For this reason, among others, crop cutting yield estimates will be expected to be higher than farmer estimates.

The results of the farmer estimates of yield for mahangu are given in Chart D3.1. The overall average yield was 120.2 kg/ha. At a village level the yields ranged from 94kg/ha (Myl 20) to 151 kg/ha (Sikarasompo). There is, as expected, a considerable variation in yields per plot within villages.

When compared with the crop cutting yields, the farmer estimates are very low. Overall crop cutting estimates indicate an average yield of 300kg/ha (more than twice farmer estimates). However the ordering of average yields per village is consistent between the two estimates:

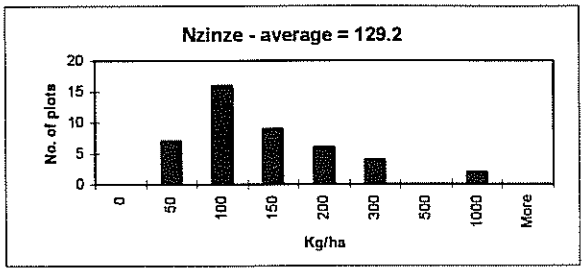
Sikarasompo	= 1
Nzinze	= 2
Nkata	= 3
Ndiyona/Myl 20	= 4

For sorghum only 14 observations are available (Charts D3.2, D3.3). Both farmer estimates and crop cutting indicate huge variations in yields per plot (4-78 kg/ha for farmer estimates), (8-320 kg/ha for crop cutting).

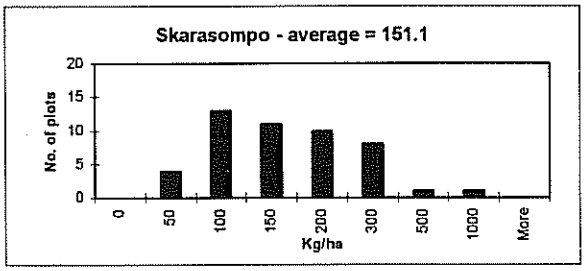
The 7 maize observations also show very low and very variable yields (Chart D3.2). No crop cutting estimates are available.

Chart D3.1 Farmer estimates of yields per plot for mahangu

Class	Frequency
0	0
1-50	7
51-100	16
101-150	9
151-200	6
201-300	4
301-500	0
501-1000	2
More	0
	44



Class	Frequency
0	0
1-50	4
51-100	13
101-150	11
151-200	10
201-300	8
301-500	1
501-1000	1
More	0
	48



Class	Frequency
0	0
1-50	10
51-100	6
101-150	5
151-200	0
201-300	0
301-500	1
501-1000	1
More	0
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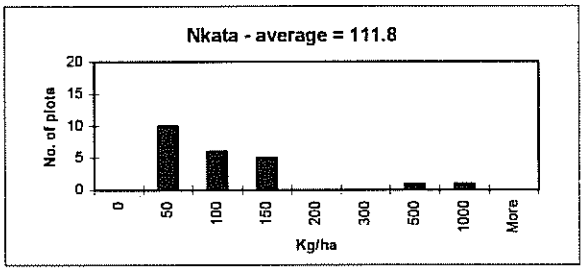

Class	Frequency
0	0
1-50	16
51-100	17
101-150	7
151-200	2
201-300	2
301-500	2
501-1000	0
More	0
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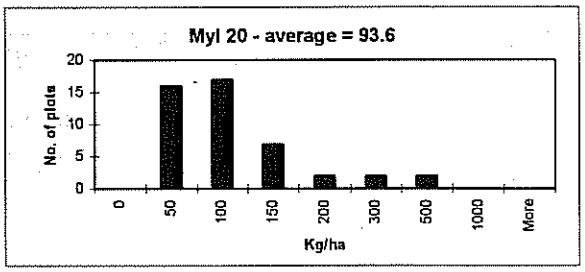

Class	Frequency
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51-100	6
101-150	4
151-200	1
201-300	0
301-500	3
501-1000	0
More	0
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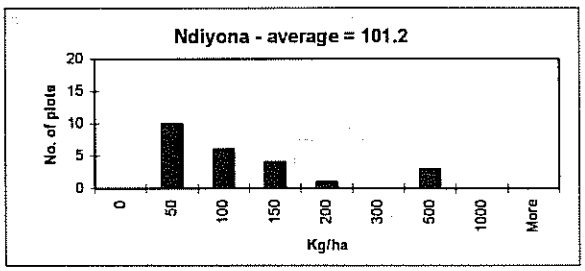


Class	Frequency
0	0
1-50	47
51-100	58
101-150	36
151-200	19
201-300	14
301-500	7
501-1000	4
More	0
	185

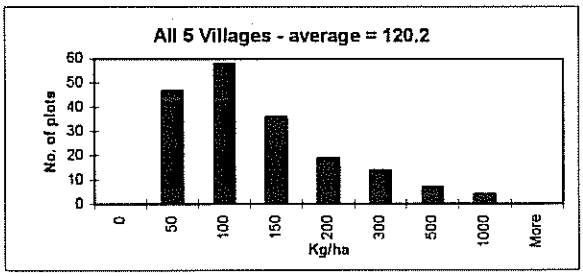
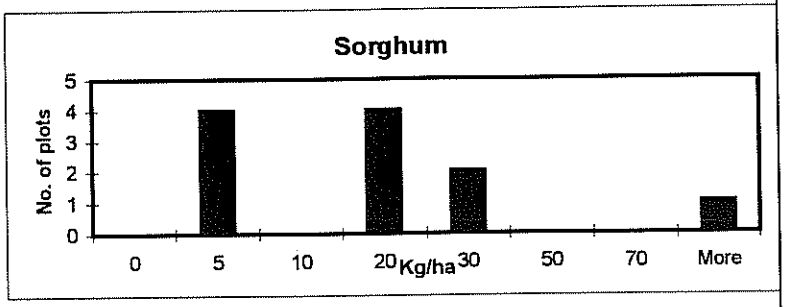


Chart D3.2 Farmer estimates of yields per plot for sorghum and maize

Class	Frequency
0	0
1-5	4
6-10	0
11-20	4
21-30	2
31-50	0
51-70	0
More	1
	11

Class	Frequency
0	0
1-20	2
21-40	0
41-80	1
81-100	1
101-120	2
121-150	0
More	1
	7



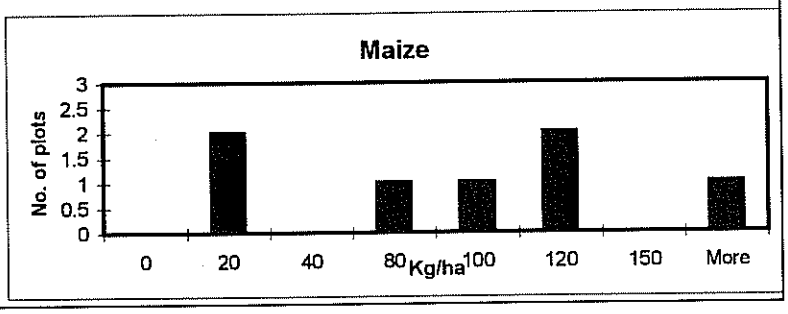
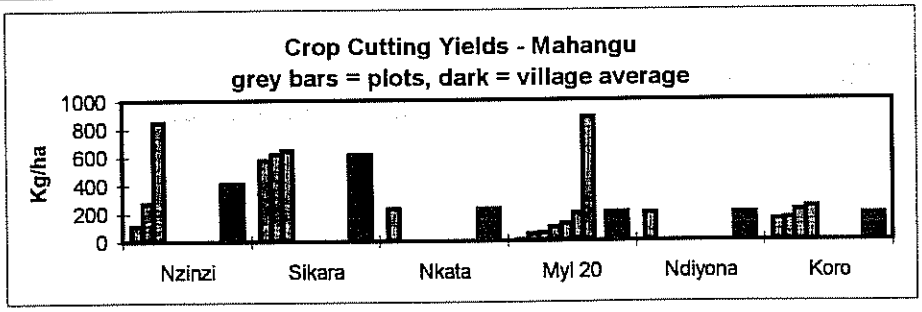


Chart D3.3 Crop cutting yield estimates for mahangu and sorghum (kg/ha)

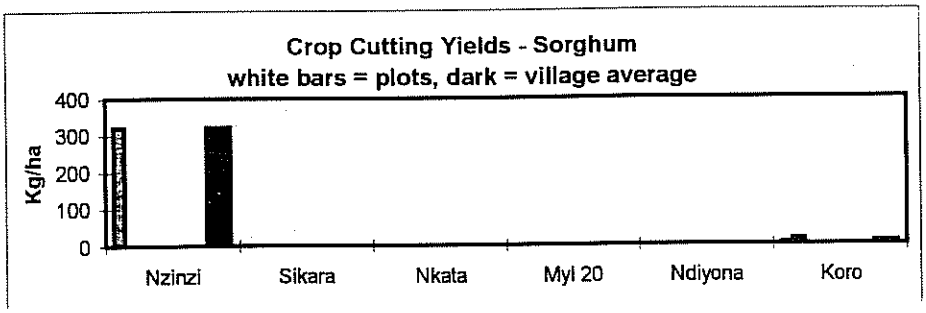
Average Millet Yields (Kg/ha) from crop cuttings

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro	All
Kg/ha	410	615	230	203	200	193	300



Average Sorghum Yields (Kg/h) from crop cuttings

	Nzinze	Sikarasompo	Nkata	Myl 20	Ndiyona	Koro	All
Kg/ha	320					8	112



Part E Relationships between Household Characteristics, Production Capacity and Performance

E 1 Factors Influencing Area Cropped

In Parts A , B and C we have seen a significant variation between households and villages in both characteristics (household size, ownership of assets), non-crop income and crop production. Although there are differences between villages, there appears to be no clear pattern in relation to village location or field characteristics.

Examination of the data suggests that cattle ownership is a major factor influencing crop production, at least in terms of area cultivated. An initial multiple regression analysis of factors thought to be most likely to influence a household's crop area gave the following results.

Household crop area =
-5.8 + .19**cattle* + .88**equipment*
+ .68**producers* + .48**consumers*
+ .02**mm rainfall*

These variables were all statistically significant at the 90% level and explained 49% of the variation in crop area between households. The variable that contributed most to explaining household crop area variation was *cattle* (number of cattle owned by the household). The second strongest explanatory variable was *producers* (the number of adults aged 15-59 in the household).

E 2 Relationships between Cattle Numbers and Other Variables

In Chart A2.4 the distribution of cattle ownership is shown. No cattle are owned by 44% of households, 26% own between 1 and 10 head and 30% own over 10 head of cattle. These ownership categories are used to examine relationship between cattle ownership and other variables.

E 2.1 Cattle and Household Characteristics

Households with no cattle have more dependents than producers among their household members, Table E2.1 below. Households with larger herds tend to have larger numbers of producers, but the number of dependents is not very different for households of different cattle owning groups. The number of workers utilised by households is higher for the larger cattle owning groups.

Table E2.1 Household composition by cattle ownership

	Cattle ownership group			
	No cattle	1-10 head	Over 10 head	All
No. of households	68	40	47	155
% of households	43.9	25.8	30.3	100
Average no. of dependents in household	4.0	4.4	4.6	4.2
Average no. of producers in household	3.8	5.1	5.6	4.7
Average dependency ratio	1.3	1.0	1.0	1.1
Average No. of non group workers	7.8	10.6	13.8	9.9

E 2.2 Cattle and Non-crop Welfare

Households with no cattle have smaller balances of cash income over expenditure, Table E2.2 bellow. They also consume lower values of their own livestock products. Thus the value of their non-crop welfare gains is less than small herd owners and much less than large herd owners. In addition households with larger cattle herds tend to have more wage earners among their members.

Table E2.2 Household wealth measures by cattle ownership

	Cattle ownership group			
	No cattle	1-10 head	Over 10 head	All
Cash income/exp balance (N$)	358	436	440	384
Consumption of livestock products (N$)	91	248	595	285
Non-crop welfare gains (N$)	363	644	890	588
No. of wage earners	0.5	0.6	0.9	0.6

E 2.3 Cattle Ownership and Crop Production

Table E2.3 Main crop production by cattle ownership

	Cattle ownership group		
	No cattle	1-10 head	Over 10 head
Hectares cultivated			
Mahangu traditional	3.0	5.3	9.6
Mahangu improved	1.2	1.4	0.6
Sorghum		0.2	0.2
Maize		0.1	0.2
Total	4.2	7.0	10.6
Average no. cultivation equipment owned	0.1	0.9	1.7

The extent of crop area cultivated is strongly related to cattle ownership, Table E2.3 above. Households owning medium and large herds also tend to grow small areas of sorghum and maize as main crops. Not surprisingly there also appears to be a relationship between herd size and ownership of cultivation equipment.

E 3 Per Hectare Inputs and Output by Cattle Ownership

Table E3.1 Per hectare labour days by cattle ownership

	Cattle ownership group		
	No cattle	**1-10 head**	**Over 10 head**
Clearing by hand	7.0	6.0	7.5
Hand hoeing	7.0	4.5	5.5
Ox ploughing	4.5	4.5	4.0
Planting	4.5	4.0	3.5
Weeding	15.0	9.5	10.5
Harvesting	16.5	10.5	8.0

The average inputs per hectare on fields where the activity was done is not very different between cattle owning groups, except for weeding and harvesting, where significant differences exist between the group owning no cattle and the two cattle owning groups, Table E3.1 above.

Table E3.2 Proportion of sessions supplied by non-household members by cattle ownership

	Cattle ownership group		
	No cattle	**1-10 head**	**Over 10 head**
Ox ploughing	49%	18%	15%
Planting	22%	12%	13%
Weeding	17%	9%	25%
Harvesting	37%	12%	24%

Clearing and hoeing by hand have been left out of Table E3.2 above, since less non-household labour was used for these activities on less than 7% of fields. These activities can be regarded as being essentially household member tasks. For the other activities 18% or more of fields have non-household member work input.

For non cattle owners a high proportion of sessions for ox ploughing and harvesting are supplied by non-household members. Obviously the non-household input for ox ploughing is related to the need to borrow or hire oxen and equipment for ploughing and much of the time people come with the oxen.

The large herd owners have need for non-household labour for weeding and harvesting. This is presumably related to the larger areas cultivated by these households.

E 4 Per Hectare Grain Yield Estimates by Cattle Owner

Table E4.1 Grain yields - farmer estimates and recorded off-takes kg/ha

	Farmer estimate	Recorded off-take
Millet - traditional	117	106
Millet - improved	161	304
Sorghum	87	99
Maize	90	152
All fields	119	125

Only one third of fields recorded a single grain crop. From most fields off-take consisted or one or more grain types, together with beans, pumpkins, melons. Grain yields were therefore accumulated for each field. The grain yields are reported by main crop on the field but may include other grains as well. Both farmer estimates of total yields from fields and recorded off-takes through the year are presented. They provide very similar results.

Table E4.1 above presents grain yields from fields with designated main crops. There are so few observations for all but the millet traditional fields that the average yields indicated are not significantly different from each other. For the purpose of the models developed in the next section, an average grain yield of 120kg/ha for all types of fields will be used.

Part F Farm-household models.

As a summary of the farm management information presented in the previous sections, a number of representative farm models are quantified in this final section. The farm models focus on crop production, but also include part of non-crop gains from cash balances and livestock transactions, which have been summarised as non-crop welfare gains in section B.

F1 Model 1 No cattle

The first model is based on information for households holding no livestock. Two variants are examined. Variant one is where all oxen used for ploughing are borrowed. Variant two is where for half the area oxen are hired, and for the remainder they are borrowed. For these groups it is assumed that no clearing of new fields is done, but that hand hoeing is undertaken for 15% of fields.

Crop area data are from Table E2.3. Labour data are taken from Tables E3.1 and E3.2. Oxen hiring costs are as reported by Keyler "Economies of the Pearl Millet Subsector in Northern Namibia ICRISAT 1995: Page 46". A nominal price is included for the cost of non-household labour. Some of this comes from work groups, for which beer has to be made, others come from individuals who may or may not get paid, but will incur a reciprocal arrangement of some kind. Non-household labour of these types is assumed to have an opportunity cost of N$1 per day.

The budgets are presented in Table F1.1. The calculations are explained, using the no hiring variant. Gross value of production (N$1,008) is the quantity of grain produced (total grain area times the per hectare grain yield) multiplied by the price of grain. Since virtually all the grain produced is consumed, the price used is the price households would have to pay to purchase grain in the village. From data on grain purchases among the survey households this is estimated at N$2 per kg.

Labour inputs are split between household and non-household on the basis of the data in Table E3.2. The proportion of per hectare labour input supplied by non-household labour is multiplied by the total crop area to give non-household labour inputs for ox-ploughing, planting, weeding and harvesting. A nominal charge of N$1 per day is used to represent the cost of non-household labour, as explained above. This gives a non-household labour cost of N$49.8.

Seed costs (N$36) are based on the average seed rate of 4kg/ha and the assumption that that farmers purchase seed to plant the area under improved varieties every second year. The rest of the seed is retained own production, which otherwise would have been consumed. Improved seed is priced at N$3 per kg, while retained seed is given the same price as own consumed grain (N$2/kg).

The value of production net of cash/kind costs (N$922.2) is the gross value of grain production less costs of non-household labour and of seed. This represents the net return to the household labour inputs used for cultivation of the total grain area. Since this net return is obtained through the input of 124.7 household labour days, we calculate the net return per household labour day as 922.2/124.7 = N$7.4 per labour day supplied by household members.

Over the cropping period, households obtained gains from cash balances and livestock transactions (N$363). This is added to the budget to provide an indication of the combined net gain from these sources as well as crop production over the cropping season (N$1,285.2).

The budgets in Table F1.1 indicate that in the 1995/6 year households with no cattle may typically have achieved returns to their own field labour of N$7.4 per day, *if they did not have to hire oxen for ploughing,* and were able to depend on neighbours to borrow the required oxen draught power. However if oxen had to be hired for half the area planted, these households would have made achieved a return of only N$ 0.4 per field labour day on their cropping operations. When oxen are hired the combined gain from cash, livestock and crops is reduced from N$ 1,285 to N$ 411.6 over the cropping season.

Table F1.1 Farm model type 1 - No cattle owned

	No hiring		Hire ox plough for 50% area	
	UNITS	N$	UNITS	N$
CROP AREA				
Mahangu - traditional	3.0		3.0	
Mahangu - improved	1.2		1.2	
GROSS VALUE OF PRODUCTION		**1,008.0**		**1,008.0**
Yield kg/ha	120.0		120.0	
Price N$/kg	2.0		2.0	
NON HOUSEHOLD LABOUR @ N$1 per day (N$)	**1.0**	**49.8**	**1.0**	**49.8**
Oxploughing (49%) (days)	9.3		9.3	
Planting (22%) (days)	4.2		4.2	
Weeding (17%) (days)	10.7		10.7	
Harvesting (37%) (days)	25.6		25.6	
SEED COSTS @4Kg/ha		**36.0**		**36.0**
- Own retained	2.0	28.8		28.8
- Purchased 50% of improved area	3.0	7.2		7.2
OXEN HIRE FOR PLOUGHING		**0.0**		**873.6**
N$/ha	416.0		416.0	
VALUE OF PRODUCTION NET OF CASH/KIND COSTS		**922.2**		**48.6**
HOUSEHOLD LABOUR INPUTS (days)	**124.7**		**124.7**	
Hand hoeing (15% of fields)	4.4		4.4	
Oxploughing (51%)	9.6		9.6	
Planting (78%)	14.7		14.7	
Weeding (83%)	52.3		52.3	
Harvesting (63%)	43.7		43.7	
VALUE OF PRODUCTION NET OF CASH/KIND COSTS PER HOUSEHOLD LABOUR DAY (N$/day)		**7.4**		**0.4**
Cash balance and value of gains from livestock		363.0		363.0
NET CASH, LIVESTOCK & CROP GAINS (Nov-Jun) N$		**1,285.2**		**411.6**

F2 Model 2 1-10 head of cattle

For households with 1-10 head of cattle, two variants are again assumed: one where oxen are hired to plough half the land and the other where no oxen are hired. Similar assumptions about the amount of new land opened up are made as for model type 1.

Again hiring oxen dramatically reduces both returns from field labour inputs and combined gains from cash, livestock and crops over the growing season, see Table F1.2.

Table F1.2 Farm model type 2 - 1-10 cattle owned

	No hiring		Hire ox plough for 50% area	
	UNITS	N$	UNITS	N$
CROP AREA				
Mahangu - traditional	5.3		5.3	
Mahangu - improved	1.4		1.4	
Sorghum	0.2		0.2	
Maize	0.1		0.1	
GROSS VALUE OF PRODUCTION		**1,680.0**		**1,680.0**
Yield kg/ha	120.0		120.0	
Price N$/kg	2.0		2.0	
NON HOUSEHOLD LABOUR @ N$1 per day (N$)	**1.0**	**23.8**	**1.0**	**23.8**
Oxploughing (18%) (days)	5.7		5.7	
Planting (12%) (days)	3.4		3.4	
Weeding (9%) (days)	6.0		6.0	
Harvesting (12%) (days)	8.8		8.8	
OXEN HIRE FOR PLOUGHING		**0.0**		**1,456.0**
N$/ha	416.0		416.0	
SEED COSTS @4Kg/ha		**58.8**		**58.8**
- Own retained	2.0	50.4		50.4
- Purchased 50% of improved area	3.0	8.4		8.4
VALUE OF PRODUCTION NET OF CASH/KIND COSTS		**1,597.4**		**141.4**
HOUSEHOLD LABOUR INPUTS (days)	**169.9**		**169.9**	
Hand hoeing (15% of fields)	4.7		4.7	
Oxploughing (72%)	22.7		22.7	
Planting (88%)	24.6		24.6	
Weeding (91%)	60.5		60.5	
Harvesting (78%)	57.3		57.3	
VALUE OF PRODUCTION NET OF CASH/KIND COSTS PER HOUSEHOLD LABOUR DAY (N$/day)		**9.4**		**0.8**
Cash balance and value of gains from livestock		644.0		644.0
NET CASH, LIVESTOCK AND CROP GAINS (Nov-Jun) N$		**2,241.4**		**785.4**

F3 Model 3 More than 10 head of cattle

For model three the two variations depend on whether new land is opened up or not. For the first variant it is assumed that no new land is opened up and therefore no land clearing is needed. In the second variant it is assumed that 25% of the area cropped is newly opened or needs clearing.

Since oxen are not hired for either variant, the difference in returns to household labour are not great. Where land needs to be opened up returns fall to N$ 10.2 per day compared with N$ 11.1 per day when land clearing is not needed..

Cash balances and livestock gains for these households are substantial and result in a combined net cash, livestock and crop gain of N$3,288.6 over the cropping period for both variants.

Table F1.3 Farm model type 3 - Over 10 cattle owned

	No new land cleared		Clearing needed on 25% of area	
	UNITS	N$	UNITS	N$
CROP AREA				
Mahangu - traditional	9.6		9.6	
Mahangu - improved	0.6		0.6	
Sorghum	0.2		0.2	
Maize	0.2		0.2	
GROSS VALUE OF PRODUCTION		**2,544.0**		**2,544.0**
Yield kg/ha	120.0		120.0	
Price N$/kg	2.0		2.0	
NON HOUSEHOLD LABOUR @ N$1 per day (N$)	**1.0**	**59.4**	**1.0**	**59.4**
Oxploughing (15%) (days)	6.4		6.4	
Planting (13%) (days)	4.8		4.8	
Weeding (25%) (days)	27.8		27.8	
Harvesting (24%) (days)	20.4		20.4	
OXEN HIRE FOR PLOUGHING		**0.0**		**0.0**
N$/ha	416.0		416.0	
SEED COSTS @4Kg/ha		**86.0**		**86.0**
- own retained	2.0	82.4		82.4
- purchased 50% of improved area	3.0	3.6		3.6
VALUE OF PRODUCTION NET OF CASH/KIND COSTS		**2,398.6**		**2,398.6**
HOUSEHOLD LABOUR INPUTS (days)	**216.2**		**236.1**	
Hand clearing (25% of fields)	0.0		19.9	
Oxploughing (85%)	36.0		36.0	
Planting (87%)	32.3		32.3	
Weeding (75%)	83.5		83.5	
Harvesting (76%)	64.4		64.4	
VALUE OF PRODUCTION NET OF CASH/KIND COSTS PER HOUSEHOLD LABOUR DAY (N$/day)		**11.1**		**10.2**
Cash balances and value of gains from livestock		890.0		890.0
NET CASH, LIVESTOCK AND CROP GAINS (Nov-Jun) N$		**3,288.6**		**3,288.6**

F4 Conclusion

The main conclusion from this analysis is that household labour is by far the most important resource put into crop production in Kavango. The next most important resource is oxen power. Access to oxen power critically influences both the scale of production possible and the value of the net returns to crop production.

Efforts to improve crop productivity should focus on measures to increase the efficiency with which the major resources of labour and oxen power are used. This can be achieved directly by reducing the time taken to complete tasks (e.g. weeding with cultivators). Or it can be achieved indirectly, through complementary inputs (seed, fertiliser), which increase yields per unit of labour/power.

In the past research and extension effort has concentrated on the latter option. Given the highly variable production environment in Kavango, farmers are likely to prefer the less risky option of reducing labour/power requirements over input increasing technologies. More emphasis should therefore be paid to the design and dissemination of practices and equipment that increases the efficiency of labour/power use (e.g. row planting and cultivator weeding).

Ownership of cattle is significantly correlated with gains from crop production. Households owning larger herds have higher values of crop production as they are able to plant larger areas. Despite growing larger areas they do not have much higher costs for employing non-household labour and are less likely to incur the major cost of hiring oxen for ploughing. Thus differences in net value of crop production between those owning no cattle and hiring ploughing services and between those not having to hire are even more marked than gross values of production.

Cattle owning households spend more household labour time in the field, as they grow larger areas and have larger workforces. Despite this the crop returns per day of household labour time remains higher for cattle owning households.

These advantages of cattle owning households are reinforced by the higher non-crop gains they enjoy from cash balances and consumption of own livestock products. Household with larger cattle herds have higher combined net cash, livestock and crop gains per household member.

Despite the very low yields obtained on average (120kg/ha), crop production is an important contributer to welfare in Kavango. Our estimates indicate that it accounts for 75-78% of the combined gains from cash balances, livestock and crops, see Table F2.1. This only accounts for grain yield and additional benefits come from legumes and pumpkins etc. Against this are the values of gains not recorded: hunting and gathering, value of firewood, water and housing, etc. However, compared to the net value of cash and livestock gains, crop production seems to be more important in a moderate rainfall year like 1995/6.

The comparative gain from crops compared with cash balances and livestock do not differ across cattle ownership types. This is because crop gains increase proportionally with gains from livestock and cash as herd size increases.

Obviously cattle ownership is critical to improved welfare. It allows greater welfare from both crop and livestock production. Those without cattle are at a serious disadvantage and those who have to hire oxen to plough are in an even more critical situation. Measures to enable more households to gain access to their own cattle will have a significant impact on household welfare in Kavango.

Table F2.1 Welfare by cattle ownership

WELFARE INDICATORS	No cattle	1-10 head	Over 10 head
Gross value of crop production (GVCP) N$	1,008	1,680	2,544
GVCP net of cash/kind costs (NVCP) N$	922	1,597	2,399
NVCP per household labour day N$/day	7.4	9.4	11.1
Combined net cash, livestock and crop gains (Nov-Jun) N$	1,285	2,241	3,289
Average number of household members	7.8	9.5	10.2
Combined net cash, livestock and crop gains per member (N$/head)	165	238	322
Proportion of net cash, livestock and crop gains from crop production	78%	75%	77%

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