CHAPTER 4

ASSESSMENT OF THE CAPITAL RESOURCE BASE OF SMALLHOLDER FARMERS IN THE STUDY AREAS

4.1 Introduction

Availability and ownership of some of the basic farming resources such as land, DAP and implements have an influence on crop productivity at smallholder level. Implement use for basic tillage operations, such as ploughing and weeding, is closely related to the use of available DAP.

Quality of tillage is primarily determined by soil conditions, draught potential of available animals, whether draught animals are trained for the task, the harnessing system, the type and condition of the implement, and level of skill possessed by the operator using it. Tillage is classified as primary or secondary. Good tillage provides a favourable environment for seed germination, root growth, weed control, soil and moisture control and improved tilth (Richey, 1961). Implement condition varies from farmer to farmer and is influenced by a number of factors such as age, quality of manufacture, handling, availability of spares and farmer's knowledge and skills in their operation, repair and maintenance.

With the exception of planters, all locally made animal-drawn implements are sold without operating instructions from manufacturers. As discussed in Chapter 2, previous studies have largely ignored implement condition and field performance aspects but concentrated on livestock work performance, nutrition and management of draught animals, strategies for DAP use, DAP availability and ownership, distribution of DAP and implements, and utilisation of livestock for DAP in smallholder farming systems. Previous work related to animal-drawn implements and training needs for farmers in the use of implements was reported by Mudamburi (1989), Chatizwa and Khumalo, (*op cit*), Chatizwa and Ellis-Jones (*op cit*), Chatizwa and Koza (1998) and Mujuru

(1998). More recent work aimed at assessing the condition of implements owned by smallholder farmers in Zimbabwe was reported by Koza, Sibanda and Mashingaidze (2000) in Muzarabani district. This chapter contains findings from focus group discussions held with smallholder farming communities in Chivi and Masvingo districts between late October and early November 1999 as well as from a formal implement survey and cluster analyses to determine household assets.

4.2 Objectives

The main objective was to assess the capital resource base of smallholder farmers in the study areas with regard to use of DAP and animal-drawn implements.

Specific objectives were to investigate:

a) Availability, ownership and uses of DAP
b) Land ownership patterns and cropping systems and practices
c) Livestock management
d) Implement ownership and management: condition, sourcing, availability, implement setting, spares availability
e) Households' knowledge of implement use, repair and maintenance
f) Role of rural blacksmiths in providing implement repair services to farmers

4.3 Materials and methods

Focus group discussions were held with smallholder farmers between late October and early November in order to get an overview of the use of DAP and implements in the six study areas. A focus group meeting comprising farmers ranging between 20 and 48 in each community was convened. Different groups were made up of varying numbers of males and females from different resource categories. Information on availability and use of DAP, farming systems, livestock management, implement types owned, implement management and crop production was recorded

on data sheets (Appendix 3). A facilitator led the discussion by posing pre-set questions to a group of farmers. As expected, several responses from different farmers were given and were recorded on flip charts. Responses were discussed with the full participation of farmers until the group reached a consensus on a particular point. The final point agreed on was a record of farmers' perception in that group. The process was repeated for all questions. The same set of questions was posed to all farmer-groups. Responses from individual groups were synthesised to give an overall view of focus groups. Photographs of two focus group participants are shown in Figure 4.1.

Mutangi Dam-Chivi Communal area	Chedenje-Mukosi resettlement area

Figure 4.1: Households attending focus group meetings at two sites

Each group of farmers selected three households to participate in the implement testing trials. The households were selected according to the following criteria which were intended to broadly fit with a wealth ranking exercise that was recently undertaken in Masvingo province (Ellis-Jones, 1999; CARE, 1999), as described in Appendix 4:

Resource group (RG) 1 (good):	Farmer with a plough, cultivator and adequate DAP
RG 2 (average):	Farmer with a plough only and adequate DAP
RG 3 (poor):	Farmer with a plough only and inadequate DAP
RG 4 (very poor):	Farmer without a plough and no DAP

A cluster analysis was done to assess the capital (human, social, natural, physical, and financial) of each participating household and ensure resource categorisations that had been done by farmers during focus group discussions were correct. The cluster analysis was a method of looking closely at five different components that made up household resources i.e. the size and composition of household (human capital), whether household belongs to a club, farmer union or village committee (social capital), land ownership (natural capital), livestock, DAP and implements owned (physical capital) and sources of income (financial capital).

A survey questionnaire (Appendix 5), was designed in SNAP (Mercator, 1998). The questionnaire was administered to 100 households, in Mshagashe West small-scale farming area (ward 6), Mutangi (ward 7), Nyimai (ward 16), Mushandike irrigation scheme (villages 12, 13 and 14), and Chedenje resettlement area (villages 20, 21 and 22). The survey was conducted in a ward or village and 25 households were randomly selected to represent farmers in each study area.

The questionnaire had a set of numbered questions with variables. Variables were coded and values assigned before data entry. Responses to open-ended questions were manually analysed. An example of details of variables for Question 21, analysed in SNAP from the DAP implement survey questionnaire, is shown in Table 4.1. The condition of ploughs was analysed based on farmer resource groups or from total counts or percentages of responses using codes.

Table 4.1: Details of variables for a question analysed by SNAP

Name: Q21		**Label**: How do you describe the condition of your plough?	
Type: Question		**Response**: Multiple	**Codes**: 4
Text: How do you describe the condition of your plough?			
Code list			
Code	**Label**	**Values**	**Counts**
ER	Errors		
NA	Not asked		
NR	No reply		6
1	Good	1	30
2	Average	2	35
3	Poor	3	27
4	Very poor	4	2

Implements owned by fifty-three households, who participated in implement performance trials (Chapter 5), were inspected for faults, missing parts, improvised/modified parts, wear on soil-engaging parts, adjustments and settings used by the owner. Criteria for assessing condition of implements were based on the number of defective components on the different assemblies and missing parts. Each implement was assigned a code for its condition depending on defective parts. The implements were repaired and necessary replacements were made. Most ploughs that were in poor condition required the use of special tools like a cold chisel, hammer and hack saw to remove mechanically or rust-damaged nuts and bolts. The cost of individual implement parts replaced was noted and the total cost of repair was determined (Chapter 6). Photographs of each implement in its initial condition, during and after repair were taken.

4.4 Results

4.4.1 Characteristics of households

The mean size of households was eight. There was no significant difference between household sizes of different RGs. Farming was the main activity for income generation and food security. Up to 37% of farmers received remittances to supplement incomes for farm activities and 80% of these were well-resourced. Table 4.2 gives a summary of findings on assets that characterise households in terms of resource availability.

Table 4.2: Characteristics and resource availability of households (n=100)

	Well-resourced RG1	Average-resourced RG2	Poorly-resourced RG3	Very poorly-resourced RG4	Significance
% in each category	33%	32%	28%	7%	
Male Heads of Households	82%	81%	89%	86%	Nsd
HoH living at home	91%	97%	75%	100%	10%
Dominant age group	Over 55	46-55	46-55	36-45	5%
Master farmers (MF)	52%	44%	11%	14%	1%
Groups or Club membership	51%	61%	79%	86%	5%
Implement ownership	P-100%, C-100%	P-100%, C-23%	P-100%, C-3.6%	P-86%, C-0%	1%
Livestock ownership					1%
Cattle ownership (>8 cattle)	85%	41%	7%	100%	
Donkey ownership	22%	44%	30%	14%	5%
Goat ownership	47%	42%	43%	50%	10%
Average area cropped (ha)	12	4	3	2	
Always use fertiliser	60%	43%	26%	50%	5%
Use credit	28%	59%	39%	14%	5%
Main sources of income					Nsd
Crops	94%	97%	93%	100%	
Livestock	63%	47%	26%	0%	
Buying and selling	9%	13%	11%	-	
Wages	6%	7%	11%	14%	
Good plough condition	50%	30%	20%		Nsd
Good cultivator condition	16%	20%			Nsd
Average age of ploughs (years)	14	18	21		
Average age of cultivators	14	23			

HoH = Head of household, P = Plough, C = Cultivator, MF = A certified farmer trained by Arex (formally Agritex), a department under the Ministry of Agriculture and Rural Development, responsible for extending agricultural technologies to farmers, Nsd = no significant difference.

4.4.2 Cluster analysis of households

Classification of the 53 farmers who were nominated by focus groups to participate in the implement trials was undertaken based on the cluster analyses. The assets owned by the respective households are summarised in Appendix 6. Appendix 7 provides an illustration of a cluster analysis of one of the households. Most RG1s were in the small-scale commercial and resettlement farming areas. Households in Mushandike irrigation scheme, were mostly RG2s with most RG3s and RG4s coming from the communal farming areas. Figure 4.2 shows the number of households in each category based on cluster analyses.

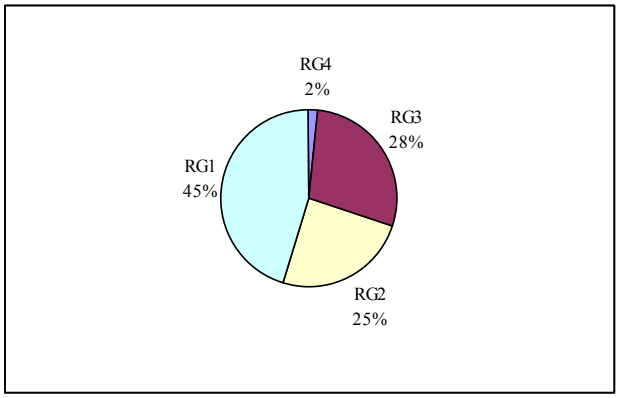

Figure 4.2: Categorisation of households by resource group

4.4.3 Availability and use of livestock

About 92% of households owned cattle and 47% owned donkeys. Households that owned both cattle and donkeys constituted 45% and 80% of these were well-resourced. Households without DAP (neither cattle nor donkeys) constituted 8% and belonged to the poorer RGs. An average of eleven cattle and two donkeys were owned per household. Households owned a mean of 4 cattle and 2 donkeys for draught. The cattle ownership ranged from no cattle owned by very poor (RG4) to a maximum of 45 cattle owned by best-resourced households (RG1s). Farmers attributed the shortage of DAP to the effects of the 1991-1992 season drought that seriously depleted the cattle herd.

About 10% of households in communal areas (Mutangi and Nyimai) owned four to seven cattle while about 40% of households, mostly from Chedenje and Mshagashe owned more than eight cattle. Results revealed a greater percentage of households (22%) from areas with better-resourced farmers (Chedenje, Mshagashe and Mushandike) owning donkeys than households (5%) in Mutangi and Nyimai communal areas.

Cattle and donkeys were the main types of livestock owned by smallholder farmers. The animals played an important role in the livelihoods of smallholder farmers. Cattle provided draught power,

milk, manure, meat and cash from hiring out for draught. Donkeys provided draught for tillage and transport and were used due to a shortage of cattle. Oxen were preferred for the provision of draught power, but due to shortage of oxen, cows, heifers and bulls were also used in draught teams. Goats, sheep and poultry were the other types of livestock owned in varying numbers by households.

Farmers expressed the view that 4 to 6 oxen and 4 to 5 donkeys were adequate or ideal for draught power needs of a household. Poor households overcame the DAP shortage problem through hiring out labour in exchange for draught power, borrowing and hiring animals or by engaging in *nhimbe* or *humwe* (reciprocal labour arrangement:-a farmer brews beer or a traditional non-alcoholic drink using millet flour and invites other farmers to plough or weed his field. Another farmer can make the same arrangement and other farmers go and assist with labour, either for ploughing, weeding or harvesting). Mixed draught teams comprising cattle and donkeys were used. Figure 4.3 shows a typical animal draught tillage systems found in Nyimai area of Chivi district.

Figure 4.3: A draught animal tillage system found in Nyimai-Chivi communal area
(Note: Yoked donkeys leading two cows)

Draught animals were mainly used for ploughing, cultivating and carting. A calendar showing the use of draught animals is shown in Table 4.3.

Table 4.3: Calendar for use of draught animals

	Months											
Use	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**
Ploughing	X	X	X					X	X			
Planting	X	X	X									
Cultivating		X	X	X								
Carting	X	X	X	X	X	X	X	X	X	X	X	X
Milk[1]		X	X	X	X							
Manure	X	X	X	X	X	X	X	X	X	X	X	X
Meat, hides, skins, lobola	No specified time and use is determined by household socio-cultural needs											

[1]Cows calve in October or November and provide milk for up to four months.

4.4.4 Land holding and crop production

The average size of cropped lands in Mushandike, Chedenje and Mshagashe were 1.5 ha, 5 ha and 8 ha respectively. Farm sizes in Mshagashe SSCFA ranged from 85 ha to 395 ha. The rest of farmers (63%), from Gari, Mutangi and Nyimai areas in Chivi communal areas owned arable land sizes that ranged between 2 and 8 ha. Seventy-three percent of these farmers owned lands ranging between 2 and 3 ha. Maize was the major crop grown in all areas. Maize yields ranged between 0.3 t to 0.5 t for RG 3 and 4 and for RG 1 and 2 they ranged between 3 t to 6 t per season. Most grain was retained for home consumption and the better-resourced farmers sold an average of about 2 t per season. Other important crops were cotton, groundnuts, bambara nuts and sorghum. In Mushandike, cotton, maize, wheat and beans were grown in rotation under irrigation. Horticultural crops such as, tomatoes, vegetables and paprika were also regarded important. Table 4.4 shows the main crops grown in the respective study areas.

Table 4.4: Crops grown in the six study areas

Gari CA	**Nyimai CA**	**Mushandike Irrigation Scheme**	**Mutangi CA**	**Chedenje RA**	**Mshagashe SSCA**
Maize	Maize	Maize	Maize	Maize	Maize
Cotton	Cotton	Cotton	Cotton	Cotton	Ground nuts
Ground nuts	Ground nuts	Beans	Ground nuts	Ground nuts	Bambara nuts
Bambara nuts	Bambara nuts	Wheat	Bambara nuts	Bambara nuts	Tobacco (oriental)
Sorghum	Sunflower	Tomatoes			
Sunflower	Sorghum	Leafy vegetables			
		Paprika			

Sweet potatoes, pearl and finger millet (*mhunga,* and *rapoko*, respectively) were other crops to which small portions of land were allocated. Gardening (*vlei* or small-scale irrigation) was an important activity performed by farmer-groups. Most farmers, both well and poor-resourced, used kraal manure when available, or compost to improve soil fertility. Farmers who afforded to buy fertilisers, applied commercially produced basal and top dressing fertilisers to their crops.

The majority of farmers did their land preparation after the first rains, and about 30% of farmers winter-ploughed. The number of households who indicated that they winter ploughed are as follows: April (36%), May (47%), June (38%), July (21%) and August (11%). Most households (64%) indicated that they ploughed deeper in winter, 28% ploughed to the same depth and 4% shallower in winter and the remaining households did not winter plough. Farmers practice third furrow planting, for maize (i.e. planting behind the plough on every third pass). For cotton, ploughing was followed by row marking and then seed was hand-planted.

Weeding was done at two to three weeks after crop emergence. In maize, at least 2 weedings were carried out between two and six weeks after crop emergence. In cotton at least 3 weeding operations were done in order to keep the crop weed-free for about eight to ten weeks after crop emergence. In Mushandike irrigation scheme, land preparation was done immediately after harvesting one crop in order to put in another crop. Chemical spraying for crop protection against pests in cotton was repeated depending on prevalence of pests. Harvesting of all crops was done manually. Some of the main constraints faced by smallholder farmers were high cost of seed, fertilisers and chemicals, inadequate rainfall, shortage of DAP, late rains, and inadequate arable land.

4.4.5 Livestock management

Grazing areas were limited and livestock freely grazed in communally owned grazing land. Due to reduced livestock numbers there was adequate grazing in Mushandike, Chedenje and Gwenyaya area of Nyimai. In Mshagashe, most farms had paddocks with adequate grazing. However, farmers elsewhere, expressed a view that grazing potential was reduced due to over-stocking, despite livestock losses during the 1991-1992 drought. New lands that were being opened for cultivation were taking up grazing areas.

During the dry season, crop stover was fed to livestock as a supplement. Tick problems were experienced in all areas mainly due to irregular dipping of cattle as well as the increasing cost of dipping (dipping cost increased from Z$3 to Z$10 per animal as from January 2000).

Training of draught animals was considered a man's task and young men usually acquired skills in the use of DAP from older members in the family or from neighbours. There was a general lack of knowledge in the use of appropriate harnessing of draught animals, especially donkeys. Yokes, which are designed for use with cattle, were commonly used to harness donkeys. Donkey harnesses were not easily available and farmers lacked skills for making donkey harnesses.

4.4.6 Implement ownership and uses

All households, except those in RG4, owned a plough. The age of ploughs ranged from fairly new to over 60 years old. The most common plough was the Zimplow VS standard single-furrow plough, owned by 86% of households. Other ploughs were BSP Inkunzi Silver Medal, (4%), Victoria (6%), Ransomes (2%) and Safin (2%). Victoria, Ransomes and Safin ploughs were the oldest plough makes owned and their ages ranged between 45 and 65 years. The general condition of ploughs owned was poor, 62% of ploughs were in poor condition, 30% were average and only

8% were in good condition. Some well-resourced households (10%) owned 2 to 3 ploughs, cultivators, harrows and ox carts. Ownership of planters, ridgers and rippers was rare with only two households from Mushandike owning a planter and a ripper each. Thirty-two percent of households did not own ox-carts, the majority of them (70%) being resource-poor. Cultivators were owned by the well-resourced households (RG1 and 2) only. About 39% of respondents owned cultivators and distribution was very uneven across the study areas as follows, Mshagashe (84%), Chedenje (33%), Nyimai (24%), Mushandike (13%) and Mutangi (10%). Most households (85%) owned BS41 five-tyne model and the rest owned BS221 model cultivators. Table 4.5 shows identified implements and their uses.

Table 4.5: Common implements owned and their uses

Implement	Uses
Plough	Ploughing, weeding, marking planting lines, loosening kraal manure
Cultivator	Weeding, marking planting lines (e.g. for beans), ridging
Harrow	Clod breaking, seed covering, crust breaking, soil loosening, moisture conservation, pre-weeding operation in rapoko, thinning rapoko, removal of trashy weeds
Scotch cart	Transport

4.4.7 Problems with implements

Farmer-groups expressed diverse problems and experiences with implements. The common problems encountered are shown in Table 4.6.

Table 4.6: Problems with implements

Implement	Problem(s)
Plough	Heavy for animals, cannot adjust, weak materials/parts, inadequate inversion, inadequate penetration, parts not durable, high cost, cannot repair, incompatibility of some spares
Cultivator	Width adjusting mechanism fails, weak materials/parts, cannot be used on the ridge, high cost
Harrow	Heavy for animals, weak materials/parts (e.g. spikes deform easily), some harrows are light in construction
Scotch cart	Poor manufacturing quality, poor quality of wheel bearings, high cost
Planter	Seed and fertiliser metering systems do not function properly, seed crack

Farmers perceived the high cost of implements and spares as a constraint because some could not afford new implements (e.g. a plough cost Z$2 500 to Z$3 000 and a cultivator, between Z$3 200 and Z$4 000 in November 1999). One tonne of maize was selling locally for about Z$3 600.

4.4.8 Condition of ploughs

Well-resourced households owned ploughs that were in better condition than poorer households (Figure 4.4). The average plough was 19 years old although some operational ploughs were over 60 years old (Table 4.7).

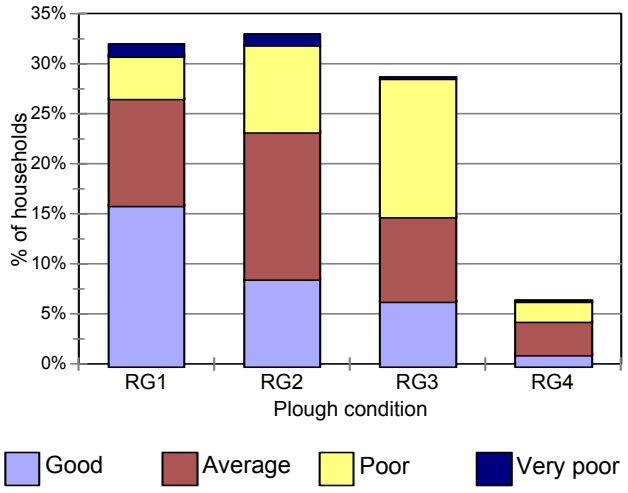

Figure 4.4: Plough condition according to household category

Table 4.7: Average age of ploughs

	RG1	RG2	RG3	RG4	Overall
Average year purchased	1987	1983	1985	1975	1984
Oldest	1945	1960	1960	1940	1940
Newest	2001	1999	2001	1997	2001
Average age (years)	14	18	16	26	19

4.4.9 Condition of individual plough parts

Most households described plough parts other than those actually removed as being in average condition. An analysis of the condition of individual parts on the different ploughs indicated that,

15% of the ploughs were good, 22% were average, 60% were poor and 3% were in very poor condition. Parts in poorest condition included landsides, mouldboards, shares, axles, wheel arms and wheels. The main parts in good condition were beams, stays and handles (Table 4.8). The details of implement parts are shown in Appendix 8.

The main parts removed were the hake (regulator), drawbar assembly, adjusting bar holder with set-screw, and u-clamp assembly. Other parts which were removed included stays, wheels and axles. About 34% of households did not have plough spanners that were normally supplied with a new plough. Households with ploughs that had missing drawbar assemblies were, Nyimai (81%), Mutangi (60%), Chedenje (46%), Mshagashe (40%) and Mushandike (39%).

Table 4.8: % of households reporting condition of individual plough parts and main parts removed

Plough parts	Good	Average	Poor	Removed
Share	24	39	35	2
Mouldboard	18	41	41	-
Hake (regulator)	21	23	6	50
Wheel	23	43	26	8
Axle	21	43	29	7
Wheel arms	29	39	27	5
Landside	22	29	48	1
Frog	32	49	16	3
Adjusting bar holder with set screw	18	28	5	49
U-clamp assembly	20	48	13	19
Left handle	37	51	11	1
Right handle	36	54	9	1
Drawbar assembly	23	26	3	48
Stays	39	43	5	13
King bolt	40	44	14	2
Plough beam	56	43	1	-
Plough spanner	49	15	1	35

4.4.10 Ownership, age and condition of cultivators

About 39% of households owned a cultivator. The condition of cultivators for the respective resource groups is shown in Figure 4.5. The average age of cultivators was 15 years and the oldest cultivator in operation was over 50 years old (Table 4.9).

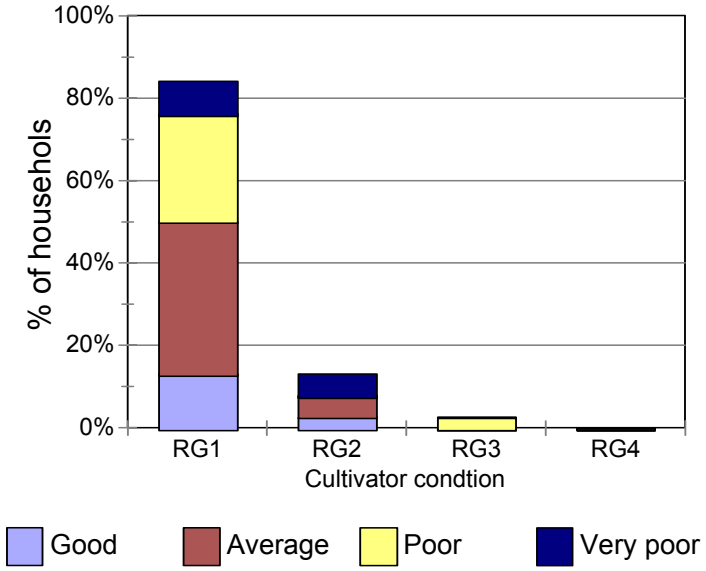

Figure 4.5: Cultivator condition according to resource category

Table 4.9: Average age of cultivators

	RG1	RG2	RG3	RG4	Overall
Average year purchased	1987	1978	0	0	1986
Oldest	1950	1962	0	0	1950
Newest	2000	1991	0	0	2000
Average age (years)	14	23	0	0	15

As with the plough, most cultivator parts were reported as being in average condition. Most cultivators had lost their sturdiness, framework robustness and stability as a result of loose or missing nuts and bolts as well as bent beams. Parts in poor condition included tynes, wheel assemblies and width adjusting mechanisms (Table 4.10).

Table 4.10: % of households reporting on condition of individual cultivator parts

Cultivator parts	Good	Average	Poor	Removed
Lever adjusting assembly	22	53	25	0
Handle bar	34	60	6	0
Rack for adjusting lever	18	53	29	0
Beam and draw bar	39	53	8	0
Expanding beam	24	62	14	0
Wheel axle	14	38	34	14
Wheel	11	42	28	19
Wheel arms	28	47	14	11
Swivel plates	17	53	24	6
Universal share arms	37	43	20	0
Tynes (3")	15	32	44	9
Hiller tynes	17	39	22	22
Sweep or duck foot tynes	18	29	47	6
Link arm top	27	59	14	0
Link arm bottom	28	56	13	3
Sliding bracket	32	47	15	6

4.4.11 Implement parts replacement intervals

The most regularly replaced plough part was the share with 39% of households replacing this at least three times a year. Shares, wheels, axles and landsides were replaced at least once a year. Wheel arms and mouldboards were less frequently replaced. Handles, beams, frogs and stays were rarely replaced on ploughs (Table 4.11). Most parts on the cultivator including tynes were rarely replaced (Table 4.12).

Table 4.11: % of households reporting frequency of plough parts replacement

Plough parts	More than Three times/year	Once Or twice/year	Once every two years	Once every three years	Rarely
Share	39	55	4	2	0
Mouldboard	1	6	18	12	63
Hake (regulator)	-	1	1	3	95
Wheel	16	54	6	13	11
Axle	14	54	5	12	15
Wheel arms	1	14	27	12	46
Landside	8	47	15	7	23
Frog	1	2	2	7	88
Adjusting bar holder	-	7	3	1	89
U-clamp assembly	-	9	7	8	76
Left handle	-	2	1	-	97
Right handle	-	1	1	1	97
Drawbar assembly	-	-	-	3	97
Stays	-	1	-	3	96
King bolt	5	12	4	5	74
Plough beam	-	2	-	-	98

Table 4.12: Frequency of replacement of cultivator parts

Cultivator parts	More than three times/year	Once or twice/year	Once every two years	Less than once Every three years	Rarely
Lever adjusting assembly	0	0	0	0	100
Handle bar	0	0	0	0	100
Rack for adjusting lever	0	0	0	0	100
Beam and draw bar	0	0	0	0	100
Expanding beam	0	0	0	0	100
Wheel axle	0	18	9	9	64
Wheel	0	15	15	9	61
Wheel arms	0	3	3	3	91
Swivel plates	0	0	0	3	97
Universal share arms	0	0	3	3	94
Tynes (3")	0	26	17	6	51
Hiller tynes	0	8	8	4	80
Sweep tynes	0	18	18	3	61
Link arm top	0	0	0	6	94
Link arm bottom	0	0	0	3	97
Sliding bracket	0	0	0	3	97

4.4.12 Sourcing of plough and cultivator parts and repairs

Eighty percent of households purchased plough spares from Masvingo city, 18% purchased from local stores and 2% of households got assistance from local blacksmiths. Plough parts most commonly obtained from local stores were wheels, axles, wheel arms, shares and landsides. Parts repaired by local blacksmiths included handles, landsides, shares, and mouldboards, with most repairs taking less than one day to fix. Cultivator parts sourced from local stores or repaired by blacksmiths included wheel arms, axle, wheel and tynes.

Depending on where farmers were located in the study areas, implements and spares were sourced from retail shops in local village business centres, at Ngundu, Chivi Business Centre and Masvingo City. The nearest and the furthest service points were 15 km (Gari to Ngundu) and 115 km (Chedenje to Masvingo), respectively. Most farmers preferred to source spares from Masvingo City unless a fault occurred during work and one had to buy from the nearest local shop. Table 4.13 shows the nearest places from where implements and spares were sourced by households from respective areas.

Table 4.13: Places from where households source implements and spares

District	Study areas	Source of implements and spares (distance in kilometres between study area and source)
Chivi	Gari	Ngundu (20), Masvingo (115)
	Mutangi	Chivi (15), Masvingo (90)
	Nyimai	Chivi (20), Masvingo (45)
Masvingo	Chedenje	Rarangwe (4), Zengeya (10), Ngundu (25), Masvingo (120)
	Mshagashe	Masvingo (35)
	Mushandike	Masvingo (30)

4.4.13 Sources of knowledge on implement use

Households obtained their knowledge on the use of the plough from various sources. The most frequently stated being Arex (60%), other household member (30%), their father (25%) or other farmers (11%). Most farmers controlled the depth of ploughing using the wheel (70%), or the depth regulator (30%). Width was controlled by the regulator hake (61%), other (31%) or widening the frog (8%).

Of those who owned cultivators, 45% gained their knowledge on cultivators from Arex, 35% from their fathers and 20% from another family member. About 76% used the wheel for depth control, and 21% did not control depth of cultivation at all. Most households (97%) used the lever for width control and 3% of households owned cultivators with no control mechanisms.

4.4.14 Renovation of implements

Fifty-three ploughs and two cultivators owned by households who participated in the implement trials were renovated during the comparative performance trials (Chapter 5.1). Only two out of a possible six cultivators were evaluated in the 2000-2001 spring season. Distribution of renovated ploughs by age categories is shown in Figure 4.6.

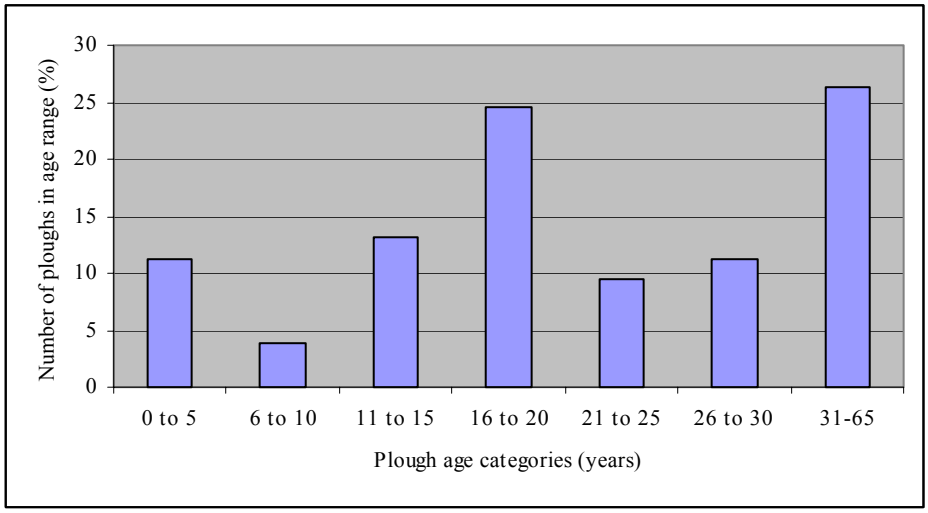

Figure 4.6: Categorisation of renovated ploughs by age

All implements had at least a defect that required repair work, adjustment or modification. The most frequently replaced plough parts were wheel assemblies, shares, landsides, and drawbar hitch assemblies. Parts that were replaced on cultivators included 250-mm sweeps and reversible 75-mm tynes. Plough parts that were frequently replaced and the mean number of households who replaced each part are shown in Figure 4.7. Plough parts that were replaced for the different households are given in Table 4.14. Examples of some defects found on implements are in Appendix 9.

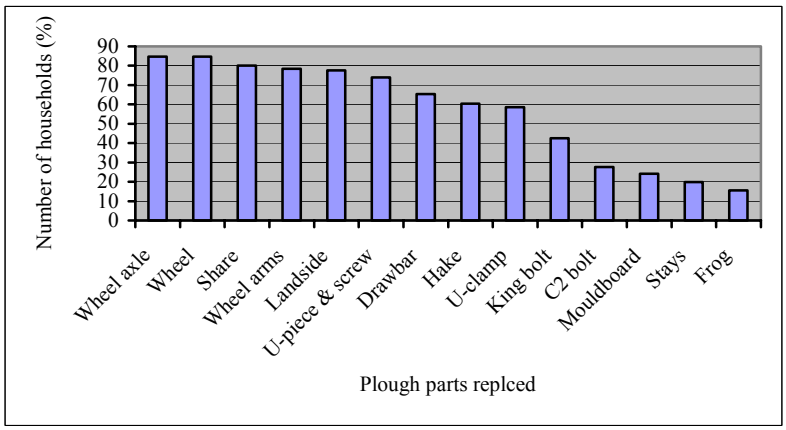

Figure 4.7: Number of households and respective parts replaced on ploughs

Ploughs with missing drawbars constituted 70% of the sample. Ploughs with complete drawbar hitch assemblies were largely owned by well and average-resourced households (70%), mostly from Chedenje, Mushagashe and Mushandike areas. Plough beams and handles were generally in good condition and did not require replacement or repair. Figure 4.8 shows condition of a plough before and after renovation and Figure 4.9 shows a cultivator in poor condition before renovation.

Table 4.14: Plough parts repaired for the different household resource groups

	Household category		
Plough part	**Well-resourced (%)**	**Average-resourced (%)**	**Poorly-resourced (%)**
Share	79	100	75
Mouldboard	5	36	19
Hake regulator	53	93	81
Wheel	79	93	88
Axle	79	93	88
Wheel arms	68	86	81
Landside	79	79	94
Frog	11	14	31
U-piece and set screw	58	79	88
U clamp and assembly	68	57	75
Left handle	0	0	0
Right handle	0	0	0
Hitch assembly	47	86	63
Stay beams	5	14	19
King bolt	47	21	63
Plough beam	0	0	0

Details of frequency of plough part replacement for the different seasons are shown in Appendix 10. The mean plough mass before and after renovation was 33.6 kg (ranging from 22.4 to 39.2 kg) and 37.8 kg (ranging from 33.5 to 41.8 kg), respectively. Ploughs weighed 4.2 kg (12.5%) more after repair.

a) A plough before renovation: Mutangi-20.05.00	b) A plough after renovation: Mutangi-20.05.00

Figure 4.8: Condition of a plough before and after renovation

A boy holds a cultivator before it was renovated. (Note: Missing wheel and arm assembly): Mshagashe-11.01.01

Figure 4.9: Condition of a cultivator before renovation

4.5 Discussion

Results showed that, as expected, well-resourced households were less constrained in terms of accessing labour, DAP and implements for cropping activities than the average and resource-poor households. Well-resourced households were from the small-scale commercial and resettlement areas while poorer households were from Chivi communal areas where land was generally inadequate, grazing was poor, soils were predominantly sandy and the area received lowest rainfall. Households in Mushandike were largely in the average category and had more potential for generating household income all year round from irrigated crops than farmers from other areas even though arable and grazing lands were limited.

Land ownership in Mushandike, Chedenje, and Mshagashe followed distinct patterns in terms of size of areas that were determined by type of settlement and farming sector, regardless of RGs. Communal farmers from Chivi had inadequate arable lands. In Mshagashe, farms were not being fully utilised and some farms were sub-divided among family members but sharing grazing areas.

Most households relied mostly on cropping for family income generation and food security. Maize was important for home consumption and for local sales, especially for better-resourced farmers who produced surplus grain. Cotton was an important crop grown in all areas except in Mshagashe where the incidence of cold weather before cotton balls split and water-logging were limiting factors.

Farmers in Chivi communal area used little or no basal fertilisers due to high costs of inputs and they believed that fertilisers were unsuitable in sandy soils and cause burning effect on crops during drought spells. The use of kraal manure was common among all categories of households but its use dependent on cattle ownership. Since well-resourced farmers had larger arable lands as well as

access to DAP than average and poorer farmers, they had the capacity to cultivate larger areas. They hired labour from poorer households mainly for weeding and harvesting. Poor households would get DAP, grain/food or cash in return.

As expected, shortage of DAP was most severe among resource-poor households who lacked finance to rebuild animal herds. Ownership of cattle was closely related to household capital. Resource-poor households relied on making arrangements for hiring, sharing or exchanging labour for DAP similar to findings by Ellis-Jones (1999) and Zindi (1999). The shortage of DAP among poorer households suggest that they were more likely to delay land preparation and consequently achieve lower yields than better-resourced households due to DAP shortage.

Due to shortage of oxen, farmers used, cows, bulls and heifers to form draught teams. Both cattle and donkeys provided draught but cattle were considered more valuable than donkeys as they were used for socio-cultural and socio-economic functions, while donkeys only provide draught (Ellis-Jones, 1997). Donkeys were spanned together with cattle using yoke harnessing systems even though farmers were aware that appropriate donkey harnesses should be used. Cattle yokes are inappropriate for harnessing donkeys because they cause discomfort and injuries. Donkeys do not exert their forces from withers as cattle do, but from the breast (Jones, 1997). Thus, useful draught energy can be wasted through inappropriate harnessing of donkeys.

Ploughs and cultivators that were up to 65 years old were still in use. Results show that, poorly-resourced households, owned older ploughs than other better-resourced households. Basing on the dominant age group of resource-poor farmers (36 to 45 years), very old ploughs were most likely inherited from parents. Older plough designs presented compatibility problems with some spares (e.g. landsides) due to changes in design of newer ploughs. Farmers complained of weak materials

used in the manufacture of some implement parts such as hitch assemblies and shares. This meant that farmers would need to frequently replace implement parts but due to high cost of spares, repair and maintenance of implements was not usually done timeously and farmers tended to improvise repairs.

Findings indicate that most ploughs and cultivators were poorly maintained and were used with some parts seriously worn out or missing/removed. Results suggest that the poor condition of implements is attributable to the old age of implements, poor access to spares by farmers, high cost of spares and lack of proper spanners. Poor maintenance of implements can be attributed to farmers' lack of knowledge in correct implement setting, use and maintenance. Most households, including those with Master Farmer training, did not know the functions of some of the important implement parts.

Most farmers did not keep stock of spares except for a few nuts and bolts and they did not have policies for implement replacement. The frequency of replacing parts depends on area ploughed each season rather than elapsed time. Wear rates for soil engaging parts given by the IAE (1986b) for sandy soils are as follows: share (2 ha), wheel (10 ha), landside (15 ha) mouldboard (40 ha). Results showed that replacement of mouldboard and shares agreed with recommendations by the IAE but differed on wheel and landside replacement. Most farmers were replacing wheels and landsides more frequently than expected given the size of lands ploughed by most farmers. The high frequency of replacing wheels and landsides was related to farmers' habit of using the wheel to set ploughing depth in the absence of hitch assembly.

Poor condition and knowledge of use and maintenance of ploughs and cultivators can lead to increased demand for draught animal power (DAP) putting additional strain on both animals and

operators. It is also likely to have an impact on crop productivity as a result of poor land preparation (shallow ploughing, poor soil inversion, increased weeding burden and poor crop establishment). Weeding with cultivators that are in poor condition after poor land preparation is also likely to result in mechanical damage, made worse by poor maintenance and setting and crop rows being rarely straight.

Although some implement spares were sourced from local stores, households preferred to source most spares from Masvingo City where supply was reliable and they could compare prices. Farmers could also buy other farm inputs in one trip. Few blacksmiths provided repair services to farmers and were able to make a limited number of implement spares. They also renovated shares, landsides and patched up mouldboards and mended broken handles. Repair service provided by blacksmiths was usually affordable and payment could be made in kind. However some households expressed concern on the quality of the workmanship of blacksmiths. This problem was raised by focus groups during trial evaluations (Koza, Ellis-Jones and O'Neill, 2000; Koza, Mudamburi, Ellis-Jones and O'Neill, 2001). Some of the repairs or fabrication done by blacksmiths did not conform to standard specifications and this gave compatibility problems when a farmer purchased genuine replacement parts.

Some of the constraints faced by households were long distances to local shops, poor access to spares, high cost of spares, non-availability of spares in local shops and some spares were not stocked at the time when households got cash from early crop sales in May/June. Most local shops stocked spares towards the beginning of the ploughing season, in October/November and by that time the cost of spares will have increased.

Since the majority of farmers were not formally trained in the use of DAP and animal-drawn implements, the absence of implement operating instructions was a possible contributing factor to improper use and poor maintenance of implements by smallholder farmers. Farmers lacked knowledge in correct implement setting. Most farmers, particularly the poor-resourced, had not received Master Farmer training that is offered by Arex through AEWs. This showed that there was a need to strengthen training of farmers in correct and efficient use of animal-drawn implements.

4.6 Conclusion

Shortage of DAP, poorly maintained implements, lack of knowledge in correct implement use and setting, high cost and poor access to spares, limited grazing, inadequate arable land, inadequate cattle dipping facilities, inappropriate donkey harnessing were some of the constraints that were identified in the study. These factors contribute to low agricultural productivity that threaten the food security situation of smallholder farmers.

Cropping was an important source of income for all resources groups with livestock contributing more to income of better-resourced households. Maize and cotton were important crops among other crops grown. Poorer households produced food for home consumption with very little or no surplus for sale due to limited resources.

About a third of smallholder farmers were resource-poor with limited access to basic resources for crop production. The shortage of DAP, poor access to spares and implements were major constraints mostly affecting the poorer farmers. Improved access to implements and spares can be achieved through empowering rural blacksmiths so that they can offer manufacturing and repair services to farmers in the local communities.

Most households owned at least a plough and only the well-resourced farmers owned other implements including cultivators and harrows. Some very old implements were in use and poorest-resourced households owned older implements which were often in a worse condition than implements owned by better-resourced households. The hypothesis that well-resourced households own implements in better condition than resource-poor farmers can be accepted.

Most farmers, including those with Master Farmer training, did not know the functions of some of the important implement parts. Although knowledge on the use of DAP and implements was mostly acquired through Arex and informal means, there was lack of knowledge and skills in implement use and maintenance that contributed to the poor condition of implements. The hypothesis that farmers are able to correctly set, operate and maintain implements can be rejected based on results from this study. The escalating cost of implements and spares was a constraint that inhibited timely repair and maintenance of implements by smallholder farmers.

Communal farmers had inadequate grazing and arable land. In order to achieve meaningful production in communal areas, there is need to reduce the pressure on land due to land being opened up for cultivation resulting in reduced grazing and arable land.

Constraints in training and extension on DAP technology utilisation were identified. There is need to review the Arex Master Farmer training programme. A more practical oriented approach that may include ploughing competitions and field demonstrations could improve the effectiveness of training. Training of farmers in the correct use and maintenance of DAP implements, with emphasis on the importance and functions of parts that are usually removed, remains a high priority to increase both livestock and crop productivity at smallholder level.