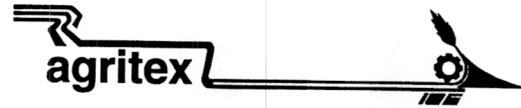




SILSOE RESEARCH INSTITUTE



## **Draught Power Performance and Production Management**

*(Optimising DAP for Cropping)*

REC'D NRIINT  
- 9 JUL 2001

Project R7352

**Evaluation of the 2000–2001 season spring  
ploughing and mechanical weeding trials  
by Focus Groups in Chivi and Masvingo**



IDG/01/14

ENGINEERING  
for  
Life

AN INSTITUTE SPONSORED BY THE BIOTECHNOLOGY AND BIOLOGICAL SCIENCES RESEARCH COUNCIL

# **Draught Power Performance and Production Management**

## **(Optimising DAP for Cropping)**

A synthesis of an evaluation of ploughing trials by six farmer-groups

***Tiri Koza<sup>1</sup>, Bertha Mudamburi<sup>1</sup>, Jim Ellis-Jones<sup>2</sup> and Dave O'Neill<sup>2</sup>***

*<sup>1</sup>AGRITEX, Institute of Agricultural Engineering, P O Box BW 330, Harare, Zimbabwe.  
Tel: +00263 4 860019 atesa@iae.icon.co.zw*

*<sup>2</sup> Silsoe Research Institute, Silsoe, Bedford MK 45 4HS, UK; Tel: +44 (0)1525 860000*

**IDG/01/14**

**Silsoe Research Institute, UK  
&  
Institute of Agricultural Engineering, Zimbabwe**

**Distribution:**

Agritex-IAE  
Agritex-Masvingo

CARE Zimbabwe  
DFID LPP  
ICRISAT  
NRI  
SRI  
UZ

Tiri Koza, Bertha Mudamburi, Ephraim Mbanje, Library  
CAEO Masvingo, DAEO Chivi, DAEO Masvingo, Mashingaidze, Madzore, LJ Mapfumo,  
Mudzingwa, O Moyo  
Masvingo Office, V Zvarevashe, Z Mutimusekwa, J Ruchaka  
Zimbabwe Office, Tim Smith, Wyn Richards, B Manyuchi  
Steve Twomlow  
Charlie Riches  
Jim Ellis-Jones, Dave O'Neill, Library  
Prof. S Mupeperekwi, Prof. Ken Giller, Prof. Ostin Chivinge, Aidan Senzanje, N Mhazo

## Farmer evaluation of the 2000–2001 season on-farm spring ploughing and mechanical weeding trials through Focus Groups in Chivi and Masvingo

### Introduction and purpose

The purpose of the evaluation exercise was to obtain feedback from members of the community with regard to implement trials that were conducted with selected households. The exercise was conducted in six project areas of Chivi and Masvingo districts, namely Mutange (communal area - CA), Nyimai (communal area - CA), Gari (communal area - CA), Chedenje (resettlement area - RA) Mushagashe (small-scale commercial area - SSCA) and Mushandike. The evaluations took place between 30 April and 10 May 2001.

### Objectives

Facilitators held discussions with farmers in order to obtain information on:

- which implements had been used in the testing programme and other tillage implements that farmers were evaluating;
- farmers' perceptions of the plough and cultivator testing;
- maintenance of implements;
- parts supply and supporting systems;
- a winter ploughing (WP) test programme.

### Activities

Focus group meetings were held at three sites namely Mushandike Irrigation Scheme, Mutange Dam and Nyimai Dam. Feedback was also obtained at Chedenje Dam (resettlement area), where three farmers were interviewed together; individual interviews were held with participating farmers from Gari and Mushagashe (see Table 1).

**Table 1: Farmer feedback meetings and individual interviews**

Place	Date	Collaborating farmers	Attendance	Attitude to WP
Mushandike (Irrigation scheme)	30.04.01	Mr Ngesi Mr Mashayanyika Mr Mabhande (absent)	13 men, 5 women	--
Matangi Dam (CA)	02.05.01	Mrs Chirove Mr Gwatinyanya Mr Chipato (absent)	1 man, 19 women	Positive
Nyimai Dam (CA)	03.05.01	Mr S Zhira Mrs Mutero Mr Pfumo	11 men, 10 women	Positive
Gari Dam (CA)	08.05.01	Mrs Mhaka Mr Makuve Mr Tazvigwira	Individual interviews	--
Chedenje Dam (RA)	09.05.01	Mr T Zhira Mr Maziva Mr Charuma	3 farmers interviewed together	Positive
Mushagashe (SSCA)	10.05.01	Mrs Machiri Mr Mapurisa Mr Nehowa	Individual interviews	Positive

### Implements tested

The single-furrow, standard mouldboard plough was tested before and after renovation in paired plots A and B. Mechanical weeding tests were conducted with two well-resourced farmers, one from Mushagashe and the other from Chedenje Dam.

### Plough testing and farmer perceptions

At each location during spring ploughing, the project team tested 3 farmers' mouldboard ploughs in their condition as found and using farmers' settings in Plot "A". The renovated ploughs were tested in Plot "B". During weeding tests, plot A was weeded using a cultivator in its usual condition and plot B was weeded after renovating the cultivator. The feedback from the farmers was generally positive in terms of tillage practice, crop (maize and cotton) growth and weed control. The main points reported

by the farmers are summarised in Tables 2 and 3. More detailed information is given in Annexes 1 to 6.

The average cost of renovating the ploughs was Z\$1229 and the average cost of renovating the cultivators was Z\$489 (see Annex 7). This is equivalent to 41% of the cost of a new plough.

**Table 2: Farmers' opinions on the advantages and disadvantages of renovating mouldboard ploughs**

Advantages		Disadvantages	
Tillage	Crop	Tillage	Crop
Better and uniform inversion/weed burial	Better establishment and stand	Higher draught forces	
Deeper and wider furrows	Less wilting during the drought spell		
Increased moisture retention	Stronger and healthier plants		
Less weed growth	Faster growth		
Easier plough handling and control	Bigger cobs and better yield expected		

A potentially significant disadvantage was the higher draught force requirement of the renovated ploughs. However, previous findings have shown that these higher draught forces were still within the animals' pulling capability. Another inevitable disadvantage would be the increasing cost of buying spare parts. Although farmers are aware of the high cost of spares, this point was raised by only one farmer, (Mr Nehowa from Mushagashe). The refurbishment costs were covered by the project for the collaborating farmers.

**Table 3: Farmers' opinions on the advantages and disadvantages of renovating cultivators**

Advantages	Disadvantages
Better depth of cut More effective weed control Less weed growth Easier implement handling and control	

#### Maintenance of implements

Spares are obtained from a variety of sources. These include local general dealers/shops, large hardware shops (e.g. N Richards) and other shops in Masvingo such as Masvingo Farm Supplies, Farm and City, Enjay Sales and OK (a large chain store) and at Chivi and Ngundu business centres.

Worn plough parts are used until they are broken: only when work stops are they replaced. Some of the common problems that farmers experience when they want to repair or maintain implements, as noted in the previous (1999-2000) evaluation, are:

- long distance to shops;
- cost of spares is high and some local shops over-price spares;
- some parts are not available in local shops;
- farmers have limited funds to stock spares as they give more priority to capital assets;
- some parts are out of stock at the time when farmers get cash from early crop sales in May/June.

During the on-farm tests and the evaluation exercise, farmers were given advice on some important aspects of how to maintain implements. Some of the hints were:

- timely replacement of worn parts;
- frequent checks and tightening of loose bolts and nuts;
- repairing broken parts to avoid work stoppages;
- oiling or greasing soil-engaging parts of the plough bottom (share, mouldboard and landside) during off-season when the implements are not in use, to prevent rust;
- cleaning of implements after use;
- proper transportation of implement to and from fields;
- proper storage of implements during off-season.

Rural blacksmiths play an important part in repairing and maintaining implements. With the exception of the frog, they repair and fabricate most plough spares at a negotiable cost. Some of their products are of inferior quality and standard due to poor workmanship. This gives problems when farmers try to fit spares such as landsides or shares to modified plough components.

#### Implement setting

Skills in implement use and setting are passed mainly from father to son. Some farmers acquired knowledge in implement setting through the Agritex Master Farmer Training programme. Few farmers hold Master Farmers certificates and only those who had participated in the trials felt confident in explaining how to properly set a plough. Correct setting of the plough cannot be achieved without the drawbar hitch assembly and farmers adjust depth of cut using the wheel.

#### **Winter ploughing**

From the previous season's evaluation, farmers indicated that they practise winter ploughing in order to:

- conserve moisture;
- loosen soil;
- deep rooting for the next crop;
- destroy pests;
- improve soil fertility by burying weeds and trash;
- facilitate early planting (particularly those without adequate DAP).

#### **Winter ploughing test programme**

Owing to the uncertainty on availability of fuel, exact dates for winter ploughing could not be set. However, it is intended to conduct a winter ploughing programme in early June 2001. Three farmers will be selected using their access to animals and implements as the main criteria.

#### **Conclusions**

The main conclusions are as follows.

- The plough is the most important tillage implement used by all resource categories of farmers.
- The ownership and use of a cultivator is restricted to the well-resourced farmers (i.e RGs 1 and 2).
- Farmers can improve productivity through implement renovation.
- Removal of drawbar hitch assemblies is common and makes it difficult to make the necessary adjustments on the plough.
- Shares, landslides and wheel assemblies are replaced most frequently on ploughs while tynes and sweeps are replaced most frequently on cultivators.
- Proper maintenance of both ploughs and cultivators is lacking among farmers due to various reasons.
- Blacksmiths play an important role in servicing and fabricating plough spares but workmanship is poor and there are no standardised specifications of spares and repairs.
- High cost of implements and spares is a constraint on improved implement use.
- Farmers require training in DAP utilisation as well as a reliable and affordable implement and spares supply mechanism.

The average cost of plough renovation was 41% the cost of a new plough and equivalent to 223 kg of maize.

#### **Acknowledgements**

The work being reported is a collaborative effort of R & D agencies in Zimbabwe and UK and farmers in Masvingo and Chivi districts. We would like to acknowledge the following people for their input:

Chivi and Masvingo farmers:	Households from Gari, Nyimai, Mutangi, Chedenje Mushagashe, and Mushmanike
CARE:	V Zvarevashe, Z Mutimusekwa, J Ruchaka
UZ:	Aidan Senzanje, Norman Mhazo
Agritex-Masvingo Province:	N Pambirei, O Chaibva, J Mazodze, P Mashingaidze, Madzore, LJ Mapfumo, Mudzingwa, O Moyo

*This work is funded by the Government of Zimbabwe (GoZ) and the UK Department for International Development's (DFID) Livestock Production Programme, Project R7352. The views expressed in this report are not necessarily those of the GoZ or DFID.*

Mushandike Irrigation Scheme- 30 April 2001

Composition of farmers: 18 farmers (13 men, 5 women)

Facilitators: Tiri Koza, Bertha Mudamburi and LJ Mapfumo

### Implements tested

The following renovations were made to the mouldboard ploughs in the spring ploughing tests.

**Table A1.1: Parts replaced on participating farmers' ploughs**

Farmer	Part replaced	Cost (Harare/Masvingo prices) Z\$
Mr Mabhandi (RG1)	Landside and bolts	180
	Share and bolts	180
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Clamp	105
	Kingbolt	13
	C2 bolts	34
	<b>Total</b>	<b>886</b>
Mr Ngesi (RG2)	Landside and bolts	180
	Share and bolts	180
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	<b>Total</b>	<b>734</b>
Mr Mashayanyika (RG3)	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	U piece and set screw	115
	Wheel	160
	Wheel axle	48
	<b>Total</b>	<b>918</b>

### Farmer experiences and perceptions

After renovation the following observations were made by the farmers.

- Ploughing was more efficient through better soil inversion and a wider cut (old method left unploughed portions of the furrow).
- There was increased load on animals (higher draught).
- Without all the adjustment parts in place, the plough is difficult to set.
- Better implement control enables animals to move in a straight path.
- Less weed infestation but no marked differences in weeding effort.
- Faster crop growth, earlier cotton ball development and maturity.
- Better yields predicted in the B plots, however, excessive rains could have caused nutrient leaching.

### Maintenance of implements

Typically, routine maintenance should include:

- Replacement of worn out parts
- Oiling and greasing
- Cleaning the plough after use
- Storage at end of season

However parts are replaced only when broken and work has had to actually stop. Spares are sourced from local general dealers at Mushandike business centre and from Masvingo.

Composition of farmers: 20 farmers (1 man, 19 women)

Facilitators: Tiri Koza, Bertha Mudamburi and Madzore

### Implements tested

The following renovations were made to the mouldboard ploughs in the spring ploughing tests.

Table A2.1: Parts replaced on participating farmers' ploughs

Farmer	Part replaced	Cost (Harare/Masvingo prices) Z\$
Mr Chipato (RG1)	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	U piece and set screw	115
	Drawbar hitch assembly	409
	Drawbar bolt	20
	Kingbolt	13
	C2 bolts	17
	Stay bolt	12
	Clamp	105
	<b>Total</b>	<b>1286</b>
Mrs Chirove (RG2)	Landside and bolts	180
	Share and bolts	180
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	<b>Total</b>	<b>734</b>
Mr Gwatinyanya (RG3) <sup>1</sup>	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	U piece and set screw	115
	Drawbar hitch assembly	409
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Frog	417
	Clamp	105
	Kingbolt	13
	C2 bolts	34
	Mouldboard	598
	<b>Total</b>	<b>2660</b>

<sup>1</sup>Plough in the worst condition during spring ploughing tests in the 2000/01 season.

### Farmer experiences and perceptions

Farmers regularly removed some parts, because the plough was regarded as too heavy for the animals. After renovation the following observations were made by the farmers, Mrs Chirove and Mr Gwatinyanya.

- Ploughing was more efficient through better soil inversion and greater width of cut.
  - Without all the adjustment parts on the plough, the plough is difficult to set.
  - Quality of ploughing was better.
  - Moisture retention of the soil was improved due to increased depth.
  - Plough was easy to handle for the operator.
  - Crop germination and growth (health) were better.
  - Less weed infestation.
- ◆ Farmers appreciated the skills acquired on plough setting and adjustments.

- ◆ Mr Gwatinyanya had learnt how to correctly link the front chain to the rear yoke–clamp when using 4 animals (cattle).

#### **Parts that are removed**

Parts that farmers often remove even when the plough is brand new include the drawbar hitch assembly, U piece and set-screw (adjustable bar holder) and regulator hake. Depth is regulated using the wheel assembly instead of making adjustments on the regulator hake. It was explained that this results in faster wear of the wheel axle and hub.

#### **Maintenance of implements**

Typically, routine maintenance should include:

- Replacement of worn out parts
- Oiling and greasing
- Cleaning the plough after use
- Storage at end of season.

Spares are sourced from Chivi, ZFU offices, N Richards Hardware, Mapuvire General Dealers. Farmers often travel by bus but, if no cash is available, they walk a 40km round trip. Local blacksmiths can fabricate most parts except the frog. However, parts are replaced only when broken and work has actually stopped.

#### **Programme for winter ploughing tests**

Tests are to be conducted in June 2001 but exact dates could not be confirmed due to fuel shortage.

Nyimai Dam - 03 May 2000

Composition of farmers: 21 people (11 men, 10 women)

Facilitators: Tiri Koza and Bertha Mudamburi

### Implements tested

The following renovations were made to the mouldboard ploughs in the spring ploughing tests.

**Table A3.1: Parts replaced on participating farmers' ploughs**

Farmer	Part replaced	Cost (Harare/Masvingo prices) Z\$
Mr S Zhira (RG1)	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	U piece and set screw	115
	Drawbar hitch assembly	409
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Kingbolt	13
	C2 bolts	17
	Drawbar bolt	20
	<b>Total</b>	<b>1543</b>
	Mr Mutero (RG2)	Landside and bolts
Share and bolts		180
Regulator hake and bolts		235
U piece and set screw		115
Drawbar hitch assembly		409
Wheel		160
Wheel axle		48
Wheel arms		166
Frog		417
Clamp		105
Kingbolt		13
C2 bolts		17
<b>Total</b>		<b>2045</b>
Mr N Pfumo (RG3)	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	U piece and set screw	115
	Drawbar hitch assembly	409
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Frog	417
	Clamp	105
	C2 bolts	17
	<b>Total</b>	<b>2032</b>

### Farmer experiences with trials

Observations made by the farmers are included below.

- Some areas were left unploughed in the A plot where the farmer-set plough that was cutting shallow.
- In plot B (with the renovated plough), ploughing was uniform and burial of trash was better.
- The plough cut deeper in the B plots.
- The load was greater for animals in Plot B as they had already completed Plot A (Mrs Mutero used 2 donkeys on the front yoke).

- Crop emerged earlier in the B plot, better and faster growth was noted.
  - The plants in Plot B were healthier and stronger.
  - Less weeds were in B plot due to deeper ploughing and the better soil inversion that controlled weeds.
  - Crop in the B plots resisted moisture stress during the long dry spell in January 2000.
  - Mrs Mutero expected a better yield in the B plot.
- ◆ Farmers realised that there was increased moisture for crop growth in plots that had been ploughed deeper than the usual practice.
  - ◆ Mr Pfumo told other farmers what he had learnt specifically on the function of the drawbar hitch assembly, correct plough setting and maintenance.

#### **Parts that are removed**

Parts that farmers often remove even when the plough is brand new include the drawbar hitch assembly, U piece and set-screw (adjustable bar holder) and regulator hake. Depth is regulated using the wheel assembly instead of the regulator hake. It was explained that this results in faster ware of the wheel axle and hub. Spares are sourced from local store some 2km away and also in Chivi and Masvingo.

#### **Maintenance of implements**

Typically, routine maintenance should include:

- Replacement of worn out parts
- Oiling and greasing
- Cleaning the plough after use
- Storage at end of season.

#### **Programme for winter ploughing tests**

Tests are to be conducted in June 2001 but exact dates could not be confirmed due to fuel shortage.

Gari Dam: - 08 May 2001

Composition of farmers: Individual farmers

Facilitator: Tiri Koza

Implements tested

The following renovations were made to the mouldboard ploughs in the spring ploughing tests.

Table A4.1: Parts replaced on participating farmers' ploughs

Farmer	Part replaced	Cost (Harare/Masvingo prices) Z\$
Mrs Mhaka (RG1)	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	U piece and set screw	115
	Drawbar hitch assembly	409
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Frog	417
	Clamp	105
	Kingbolt	13
	C2 bolt	17
	<b>Total</b>	<b>2045</b>
Mrs Makuve (RG2)	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	U piece and set screw	115
	Drawbar hitch assembly	409
	Wheel axle	48
	Wheel arms	166
	<b>Total</b>	<b>1333</b>
Mr Tazvigwira (RG3)	Landside and bolts	180
	Share and bolts	180
	Regulator hake and bolts	235
	Drawbar hitch assembly	409
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Frog	417
	<b>Total</b>	<b>1795</b>

### Farmer experiences and perceptions

#### Mrs Mhaka (Trainee Master Farmer)

After ploughing the two trial plots, rows were marked and seed (cotton) was placed in the furrows. Initially the drawbar hitch assembly, regulator hake, adjustable bar holder and beam-mouldboard stay were missing. Most components were worn and the plough was out of alignment as handles were off-centre and beam-handle stays were bent.

- Ploughing depth on plot A was shallower than on plot B.
- Operator found the renovated plough easier to control.
- Crop emergence in plot B was better. Plot A had more gaps in-row.
- Plants in the B plot were healthier and the stand was better than in A plot.
- Plot A had more weeds than plot B.
- During the dry spell, plants in plot B showed less signs of moisture stress.
- Early cotton ball development and ball-splits were noticed in plot B. Yield is expected to be more from plot B.

#### Lessons learnt:

- ◆ Correct plough setting
- ◆ Easier control of the plough following repair and adjustments

### Mrs Makuve

Maize was hand-planted in furrows marked after ploughing the two plots. Before renovations, the drawbar hitch assembly, regulator hake, adjustable bar holder and handle-mouldboard stay were missing on the plough.

- After repairing the plough, depth of ploughing increased and inversion was better.
- Plot A had more weeds than plot B.
- Better germination was noticed in plot B and plot A had to be gap-filled.
- Crop growth and health were generally similar in the two plots.
- Towards tasselling stage, the plant developed 3-4 ears/plant in the two plots. The extra ears were removed to leave one cob per plant.
- A portion of plot A at the starting headland had plants that showed moisture stress during the dry spell.
- Plots were weeded late with hoes. A weed called *bise* in Shona (red flowers and green stem) affected the crop in plot B.

The two sons who ploughed were away from home and Mrs Makuve could not comment on handling and control of the plough after repairing and setting.

### Mr Tazvigwira

Before renovations, the drawbar hitch assembly, regulator hake, and adjustable bar holder were missing on the plough. Maize was hand planted after row marking.

- After repairing the plough, load on the animals (donkeys) increased and speed of operation was slower.
- Depth of ploughing increased and inversion was better in plot B.
- Initially the plough left unploughed portions in the furrows and these were eliminated after the plough was repaired and set correctly.
- Due to poor soil moisture conditions at planting, germination was poor and both plots were gap-filled.
- Heath and crop stand was better in the B plot.
- Since there was no close monitoring of weed infestation no marked differences were noticed.
- Crop in plot B was more tolerant to drought and the crop produced bigger cobs than in plot A.

Lessons learnt:

- ◆ Deeper ploughing is good for the crops and the usual shallow ploughing, *kupara* (scraping) is not good.
- ◆ Not to remove plough parts.
- ◆ To ensure plough is maintained and not to give the responsibility of the ploughing to children.
- ◆ Easier control of the plough after repairs were done and plough correctly set.

### **Parts that are removed**

Parts that farmers often remove even when the plough is brand new include the drawbar hitch assembly, U piece and set-screw (adjustable bar holder) and regulator hake. Depth is regulated using the wheel assembly instead of making adjustments on the regulator hake.

### **Maintenance of plough**

Typically, routine maintenance should include:

- Replacement of worn out parts
- Oiling and greasing
- Cleaning the plough after use
- Storage at end of season.

### **Programme for winter ploughing tests**

Tests are to be conducted in June 2001 but exact dates could not be confirmed due to fuel shortage.

Chedenje Dam: - 09 May 2001

Composition of farmers: 3 participating farmers (all men) interviewed together

Facilitators: Tiri Koza, Mudzingwa

#### Implements tested

The following renovations were made to the mouldboard ploughs in the spring ploughing tests.

**TableA5.1:** Parts replaced on participating farmers' ploughs

Farmer	Part replaced	Cost (Harare/Masvingo prices) ZS
Mr T Zhira (RG1)	Landside and bolts	180
	Mouldboard bolts	35
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Clamp	105
	<b>Total</b>	<b>694</b>
Mr Maziva (RG2)	Landside and bolts	180
	Share and bolts	180
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Clamp	105
	<b>Total</b>	<b>839</b>
Mr Charuma (RG3)	Landside and bolts	180
	Share and bolts	180
	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Frog	417
	Clamp	105
	Kingbolt	13
	Stay bolt	12
<b>Total</b>	<b>1281</b>	

**TableA5.2:** Parts replaced on Mr Zhira's BS41 cultivator

Part replaced	Cost (Masvingo prices) ZS
Sweep	237
Sweep bolt	10
<b>Total</b>	<b>247</b>

#### Farmer experiences and perceptions

All the trial plots were visited and discussions were held with each farmer explaining field activities and observations made during the season.

#### Mr Charuma

Maize was hand-planted after row-marking. Plots were weeded three times using hoes. Before renovation, the plough had the following modified parts: frog, handles, handle-grips, wheel assembly (arms, axle, wheel), clamp, landside, and mouldboard. The plots were harvested and the crop was stooked on two separate frames in the field.

- Better penetration, and burial of weeds was noted after repairing the plough.
- In plot, B the plough was easy to handle.
- Less weeds emerged in plot B. After harvest, a visual assessment showed that plot A had more weeds.

- Bigger maize cobs were from plot B (a sample from both plots was taken and assessed visually).
- Crop stand and health in plot B was better than in plot A.

#### Mr Maziva

Maize was hand-planted after row-marking. Plots were weeded twice using hoes. Before renovation, the plough had the following modified parts: regulator bar holder, wheel, wheel arms, landside, and mouldboard. A local artisan in the village and another one at Ngundu did the modifications. A new pair of handles was fitted. The farmer experienced problems with monkeys. The crop had not been harvested at the time of visit.

- After repairing the plough, depth of ploughing increased and inversion was better.
- Better burial of weeds was noted after repairing the plough.
- The plough was easy to handle and control after repairs were done.
- Less weeds emerged in plot B. A visual assessment showed that plot A had more weeds.
- Plot B had a taller crop. During the dry spell the crop in plot B was not seriously affected.
- Crop stand and health in plot B were better than in plot A.

#### Mr T Zhira

Cotton was hand-planted after row-marking. Plots were hand-weeded first and weeded twice with a cultivator. Before renovation, the plough had the following modified parts: regulator bar holder, wheel, wheel arms, landside, and mouldboard. Two stays (beam-mouldboard and handle-mouldboard) were missing. Mr Zhira does the modifications himself.

- After repairing the plough, depth of ploughing increased.
- Better soil inversion and burial of weeds was noted after repairing the plough.
- The plough was easy to handle and control after repairs and setting.
- Less weeds had emerged in plot B before weeding. A visual assessment at the time of visit showed that both plots were weed-free.
- Plot B had a taller and healthier crop in the early growth stages.
- Crop stand and health in plot B were better than in plot A. Cotton in plot B developed more balls and it is likely to yield more than plot A.

#### **Weeding test:**

Mr Zhira had used his BS41 cultivator for one season only (it was in very good condition). Loose bolts on the slide bracket assembly and a broken wheel were the only faults noted before the test. A new sweep was fitted and no adjustments were made to vary depth or width of cut.

- Depth and width of cut were similar in the two plots.
- Plot B had less weeds from the previous ploughing operation.
- Both plots were weeded once more after the weeding tests.

A visual assessment of the plots showed that the trial plots were weed-free. Cotton balls were beginning to split and the first picking was to be done in the following two weeks.

#### **Parts that are removed**

Parts that farmers often remove even when the plough is brand new include the drawbar hitch assembly, U piece and set-screw (adjustable bar holder) and regulator hake. Depth is regulated using the wheel assembly instead of making adjustments on the regulator hake.

#### **Maintenance of plough**

Typically, routine maintenance should include:

- Replacement of worn out parts
- Oiling and greasing
- Cleaning the plough after use
- Storage at end of season.

However, parts are replaced only when broken and work has actually stopped.

#### **Programme for winter ploughing tests**

Tests are to be conducted in June 2001 but exact dates could not be confirmed due to fuel shortage.

Mushagashe West: - 10 May 2001

Composition of farmers: Individual farmers

Facilitator: Tiri Koza

### Implements tested

The following renovations were made to the mouldboard ploughs in the spring ploughing tests.

**Table A6.1: Parts replaced on participating farmers' ploughs**

Farmer	Part replaced	Cost (Harare/Masvingo prices) Z\$
Mrs Machiri (RG1)	Wheel	160
	Wheel axle	48
	Wheel arms	166
	Cup head bolt C2	17
	Kingbolt	13
	<b>Total</b>	<b>404</b>
Mr Mapurisa (RG2)	Regulator hake and bolts	235
	U piece and set screw	115
	Cup head bolt C2	17
	Kingbolt	13
	<b>Total</b>	<b>380</b>
Mr Nehowa (RG3)	Landside and bolts	180
	U piece and set screw	115
	Wheel	160
	Wheel axle	48
	<b>Total</b>	<b>503</b>

**Table A6.2: Parts replaced on Mrs Machiri's cultivator**

Part replaced	Cost (Masvingo prices) Z\$
2 x Tines 9(@\$113 ea.)	226
Sweep	237
Wheel	160
Wheel axle	48
5 tyne and 1 sweep bolt	60
<b>Total</b>	<b>731</b>

### Farmer experiences and perceptions

#### Mrs Machiri

Maize was hand-planted following row-marking. Plots were hand-weeded once. The farmer experienced problems with stray cattle that repeatedly destroyed the crop in the trial plots. The plough was in good condition with no missing components.

- After renovating and setting the plough, depth of ploughing increased.
- Better soil inversion and burial of weeds was noted after repairing the plough.
- The plough was easy to handle and control after setting.
- Crop stand and health in plot B was better than in plot A.
- Crop was frequently destroyed by stray cattle and no yield is expected.
- Trial plots were wrongly sited as they were targeted by stray cattle.

#### Weeding test:

Mrs Machiri's cultivator (BS221) was bought about 15 years ago and it was in very poor condition. A number of faults were noted on the adjusting lever, wheel assemblies and swivel plates. There were some missing parts that included the right side handle-link arm stay, bushes for the expansion beams, two front tines. Loose bolts were tightened.

- Plot B had less weeds after renovations on the cultivator.
- Both plots were weeded once after the tests.
- Depth of cut in plot B increased slightly.
- Repaired cultivator was more effective in weed control.