OPTIMISING DRAUGHT ANIMAL POWER FOR CROPPING

Proceedings of a Project Initiation Workshop
Harare, 14-15 September 1999

Edited by D H O’Neill
IDG/99/21
Preface

It is becoming increasingly recognised that the success of development aid research projects depends heavily on creating a beneficial situation for the stakeholders. Furthermore, if there is to be any meaningful and sustained impact, the major stakeholders will continue to pursue the initiative(s) generated by a project (research or development) after the project has run its course and its funding has ceased.

This volume presents the Proceedings of this highly participative Workshop, in which it can be seen how decisions on technical and logistic details of the project were reached. The Workshop Programme is given overleaf and the list of participants in Annex 1. Relevant current scientific information was presented as two Background Papers, which are reproduced as series of illustrations. The intention in doing this is to present facts only and, thereby help the audience (and readers) make their own inferences, rather than be led too far by the authors and their opinions.

Dave O’Neill
Silsoe

19th November 1999

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PROJECT INITIATION WORKSHOP (14-15 Sept 1999)
OPTIMISING DAP FOR CROPPING

Programme

Tuesday 14 September

Day - Setting the scene

9.00 Welcome and coffee
9.30 Opening address
9.45 Introduction to the Project and Stakeholders
10.30 Background I: The use of animal-drawn implements in Zimbabwe
11.15 Coffee
11.30 Background II: Innovative methods for soil improvement in semi-arid production systems

Lunch

Small group discussions (brainstorming)
1. Interventions for improved implement use
2. Adoptability of innovative methods
3. Availability of cattle and donkeys for alternative uses
4. Effects of innovative methods on livelihoods

15.30 Tea
16.00 Report back to plenary session

Drinks and snacks

Wednesday 15 September

Day 2 - Project implementation

8.15 Project structure and linkages
8.45 Small group discussions: Field activities
1. Location and farmers
2. Survey design
3. Field trials
4. Data collection and analysis

10.30 Coffee
10.45 Report back to plenary session
11.15 Small group discussions: Development and extension
1. Gender sensitivity
2. Role(s) of artisans and manufacturers
3. Format for “Best Practice Guidelines”
4. Dissemination - current methods and recommendations for uptake pathways for Project outputs

13.00 Lunch
14.00 Report back to plenary session
14.30 Project Activities - Incorporation of reports from groups
15.45 Tea
16.00 Presentation of agreed Project Plan
16.20 Closing address
16.30 Depart
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List of Participants
Opening Address

R Chitsiko, AGRITEX, Harare
(Summarised by D O’Neill)

Traditionally, farmers just “in-span and go” without giving much, if any, thought to whether they could improve their operation(s) through implement selection or adjustment, hitching and harnessing, timing etc. There are standard designs of plough, but there is no such thing as a standard draught animal. Consequently, not all DAP users have similar animals. Despite standard designs of ploughs, cultivators and other implements, they have to work in a wide variety of soil conditions and there is little, if any, guidance on optimal settings. The situation becomes even more complex if the needs of different crops are to be taken into account. What we need is a compendium of the physics of draught animal operations, with the ability to pin-point opportunities for optimisation. This is especially so where the supply of DAP is limited.

From his experience, Mr Chitsiko recommended the following as areas for fruitful research.

- How, and on what scientific bases and principles, should animals be selected?
  - species?
  - breed?
  - size?
  - age?
  - etc

- How can implements be matched to soil types and conditions and to (where appropriate) crop types?

- What are the key features of implement design and use which interact with farmers?

The process of optimisation must address the performance of the animals, implements and farmers (both separately and in combination), and in the context of the quality and efficiency of the work output. Our farmers will achieve their best only when the interfaces and interactions between the essential components of tillage operations are properly understood.
Workshop Day 1

Setting the Scene

Introduction to the Project and the Workshop

D O'Neill, Silsoe Research Institute, UK

The project is entitled Draught Power Performance and Production Management but is usually referred to by its abbreviated title Optimising DAP for Cropping. It is funded by the Livestock Production Programme by the UK Department for International Development (DFID). It involves collaboration between AGRITEX (particularly the Institute of Agricultural Engineering at Hatcliffe), the University of Zimbabwe and Silsoe Research Institute, who are managing the project. Other informal collaboration is anticipated, indeed is encouraged, with the organisations (particularly CARE Zimbabwe) which are represented at this Workshop.

The Goal and Purpose of the project are as follows:\(^2\)

**Goal**
Performance of livestock (including draught animals) in semi-arid crop / livestock and livestock production systems improved.

**Purpose**
Develop and promote strategies for the allocation and management of on-farm and locally available resources in order to optimise livestock production and improve their contribution to the crop / livestock farming system.

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\(^2\) As stipulated by the Livestock Production Programme (LPP).
Output 1
Best Practice Guidelines in implement use (setting, maintenance and harnessing), based on current knowledge, will be developed by appropriate stakeholders.

Output 2
The appropriateness of current DAP use in maize and cotton systems will be defined in terms of management of existing resource utilisation (animals, implements and labour) on yields and profitability.
The potential for resource utilisation in innovative crop production methods (eg green manures, use of dung, crop residues) will be quantified.

Output 3
The findings of the research will be promoted and disseminated by stakeholders.

With these requirements in mind, the two background papers have been prepared and are intended to generate debate of relevance to the project. After the background papers you will divide into four groups to think laterally about issues of concern to the project and then report back to a plenary session. The formation of these groups will not be controlled - you will be able to join whichever discussion group interests you most.
Background Paper I

The Use of Animal-Drawn Implements in Zimbabwe

J Ellis-Jones¹ and I Chatizwa²

¹ Silsoe Research Institute, Silsoe, UK
² Institute of Agricultural Engineering, Harare

(Summarised by D O'Neill)

The authors structured their presentation around five issues relevant to draught animal use and key to the development of the project. These are:

- factors affecting DAP productivity
- the uses of DAP
- the users of draught power
- constraints faced by the users
- research and development.

This summary provides a brief narrative of the key points. It accompanies and connects the continuous sequence of detailed figures and tables covering these issues, and included below.

The major factors affecting draught animal productivity, and their interactions, are shown in figure 1. The factors are arranged in columns such that the major factors that can be more easily influenced through research and development are to be found to the right of the factors that are harder to influence.

In communal areas, the main economic benefit of owning, or having access to, cattle and donkeys has been found to be their draught output (figure 2), despite a wide range of problems associated with the uptake of DAP (figure 3). There is considerable heterogeneity between rural households, particularly when it comes to draught animal ownership, as is shown by the survey results given in figure 4. Categorising households in this way facilitates the correct targeting of information and, by specifically identifying those households without access to DAP, helps ensure that their needs are not overlooked. The response to a question on what exactly is meant by “adequate DAP” was: “A span that, in the farmers’ perception, can do a reasonable ploughing job”.

Patterns of ownership of livestock and equipment, again from Muvirimi’s (1997) study, are shown in figures 5 to 8. Households that do not own adequate DAP pay for access in a variety of ways, as shown in figure 9. The column total exceeds 100% because some households use more than one of these options. Some trends observed in analyses of rural households are shown in figure 10.

Most households own a plough and are likely to use it for more than just ploughing: figure 11 shows how various DAP implements, often purchased using off-farm income, might be used by communal farmers. Nevertheless, there are severe constraints on implement use (the principal ones are shown in figure 12) which are not ameliorated by deficiencies in the supporting mechanisms and infrastructure (see figures 13 and 14 respectively). The main needs for improving
References

“...... farmers should aim to increase maize production from current levels of between 1.5 and 2 million tonnes to 2.5 million tonnes, which should peak at 3.1 million tonnes a year during the next five years......”
Factors affecting the Productivity of DAP

- **Factors hard to influence**
  - Geological factors (soils, topography)
  - Climatic factors (rainfall, temperature)

- **Factors easy to influence**
  - Farming systems, crop and livestock practices
  - Access to technology, credit and extension

- **Biophysical factors**
  - Soil productivity, nutrient availability
  - Biological and hydrological processes

- **Social, cultural and economic factors**
  - Household economy, food security
  - Access to markets, labor

### Estimate of Economic Output of Communal Area: Cattle and Donkeys

<table>
<thead>
<tr>
<th></th>
<th>% of Total Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CATTLE</td>
</tr>
<tr>
<td>LSE</td>
<td></td>
</tr>
<tr>
<td>Draught</td>
<td>63.6</td>
</tr>
<tr>
<td>Milk</td>
<td>13.6</td>
</tr>
<tr>
<td>Mure</td>
<td>8.5</td>
</tr>
<tr>
<td>Local slaughter</td>
<td>57</td>
</tr>
<tr>
<td>Sold outside local area</td>
<td>47</td>
</tr>
<tr>
<td>Hard growth</td>
<td>10.4</td>
</tr>
<tr>
<td>Social value</td>
<td>(7)</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>100</td>
</tr>
</tbody>
</table>

Source: (a) Barrett (1992), (b) Estimate through discussion with farmers
PROBLEMS ASSOCIATED WITH PROMOTING ADOPTION OF DAP

- Cost of animals and implements
- Profitability of cropping
- Supply of animals
- Competing demands for livestock products
- Selection and training of animals
- Nutrition
- Health
- Lack of suitable implements
- Increasing manual operations (esp. for women)
- Poor image of DAP among opinion formers
- Preference for tractors

FARMER RECOMMENDATION DOMAINS

RURAL HOUSEHOLDS

<table>
<thead>
<tr>
<th>NO ANIMALS OWNED</th>
<th>ANIMAL OWNERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INADEQUATE DAP</td>
</tr>
<tr>
<td>No access to DAP</td>
<td>Donkeys only</td>
</tr>
<tr>
<td>7%</td>
<td>10%</td>
</tr>
<tr>
<td>Some access to DAP</td>
<td>Donkeys and cattle</td>
</tr>
<tr>
<td>30%</td>
<td>2%</td>
</tr>
</tbody>
</table>

37% 16% 47%

% Households owning or having access to DAP (n=248)

Source: Muvirimi, 1997
Figure: Livestock ownership (range owned by % households)

Figure: % households owning no livestock
### Percentage of farmers owning equipment in semi-arid Zimbabwe

<table>
<thead>
<tr>
<th>Implement</th>
<th>Nil</th>
<th>At least one</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ploughs</td>
<td>9</td>
<td>91</td>
</tr>
<tr>
<td>Carts</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Cultivators</td>
<td>69</td>
<td>31</td>
</tr>
<tr>
<td>Ridgers</td>
<td>98</td>
<td>2</td>
</tr>
<tr>
<td>Harrow</td>
<td>71</td>
<td>9</td>
</tr>
</tbody>
</table>

Source: Muvirimi, 1997

### Percentage of households owning or borrowing animal implements

<table>
<thead>
<tr>
<th>Implement</th>
<th>Owned</th>
<th>Borrowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ox plough</td>
<td>81%</td>
<td>15%</td>
</tr>
<tr>
<td>Ox cultivator</td>
<td>18%</td>
<td>14%</td>
</tr>
<tr>
<td>Ridger</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Harrows</td>
<td>19%</td>
<td>19%</td>
</tr>
<tr>
<td>Ox planter</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Scotch cart</td>
<td>35%</td>
<td>44%</td>
</tr>
</tbody>
</table>
Means of recompense and % of households using each

<table>
<thead>
<tr>
<th>Type</th>
<th>% households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nhimbe</td>
<td>19</td>
</tr>
<tr>
<td>Cash</td>
<td>61</td>
</tr>
<tr>
<td>Food</td>
<td>9</td>
</tr>
<tr>
<td>Beer</td>
<td>1</td>
</tr>
<tr>
<td>Kinship sharing</td>
<td>17</td>
</tr>
<tr>
<td>Exchange/barter</td>
<td>10</td>
</tr>
</tbody>
</table>

Significant trends

- Older HoHs have more assets
- The more cattle owned, the larger the area cultivated
- The more livestock owned, the less implements are borrowed
- The more cattle owned, the higher the incomes from dryland, irrigation and livestock but not wages, pensions or remittances
- Households who have been farming longer in the area have accumulated more assets
- Those households in receipt of food aid are more likely to borrow equipment
- Households with less livestock are less likely to have latrines at home
### Alternative use of DAP Implements

<table>
<thead>
<tr>
<th>Implement</th>
<th>Main or intended use</th>
<th>Other uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plough</td>
<td>Ploughing</td>
<td>Weeding, furrow marking, planting, ridging</td>
</tr>
<tr>
<td>Cultivator</td>
<td>Weeding</td>
<td>Planting, furrow making, weeding/planting</td>
</tr>
<tr>
<td>Harrow</td>
<td>Clod breaking</td>
<td>Seed covering, stover clearing, soil cap breaking</td>
</tr>
<tr>
<td>Ripper</td>
<td>Plough pan breaking</td>
<td>Planting, furrow making</td>
</tr>
<tr>
<td>Ridger</td>
<td>Ridge making</td>
<td>Weeding during re-ridging</td>
</tr>
</tbody>
</table>

### Constraints to DAP Implement Use

- Limited knowledge/training for extension staff and farmers
- Poor awareness of implement design
- Poor condition of existing implements
- Inadequate maintenance (and maintenance facilities)
- Poor access to spare parts
Supporting Infrastructure

<table>
<thead>
<tr>
<th>Formal sector</th>
<th>Wholesalers</th>
<th>Retailers</th>
<th>Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>(ZimPlow)</td>
<td></td>
<td>(Rural stores)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Informal sector</th>
<th>Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Rural artisans)</td>
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Inadequate supporting mechanisms

- Lack of credit facilities
- Lack of farmers awareness of tillage and implement options
- Poor farmer representation at equipment supply level
- Lack of an efficient agent network in rural areas (cost, risk, logistics)
- Lack of rural artisans workshops (capital, materials etc.)
- Weak links between farmer, researcher, extension, formal and informal distribution networks.
Lessons learnt

- Lack of innovative implement design specific to local needs
- Limited incentive for formal sector to diversify the product range
- Inadequate distribution and after sales network (lack of incentives)
- High tooling costs/limited market (?) for new implements

OPPORTUNITIES FOR INCREASING PRODUCTIVITY

- Increasing the supply of DAP
  - Using existing animals more effectively
  - Greater use of donkeys
  - Encouraging DAP contractors
  - Increasing carrying capacity

- Reducing the demand for draught animals
  - Reduced tillage systems
  - Innovative implements
Improving implement utilisation:

For farmers
- Training on DAP animal selection and training
- Training on implement use and maintenance, *(including assessment of impact of training)*
- Improving access to appropriate implements
- Access to credit *(where use is profitable)*

For manufacturers - policies/incentives for
- Improving back up and distribution services
- Improving linkages with farmers and rural artisans
- Ensuring implements take into consideration user needs *(inc. women, children, small animals)*
- Encouraging support for rural artisans *(training, material acquisition, credit)*
Discussion

(Charles Sadzamara) - Do you have any plans to investigate the effect of soil fertility (e.g., uses of animal manure)?

(Steve Twomlow) - This will be covered in the next presentation.

(Clopas Rukuni) - Farmers are not knowledgeable about their implements; what are the effects of stripping off the assemblies?

(Aidan Senzanje) - Obtaining the data is part of the project.
Innovative ideas and technologies from a variety of sources including farmers, extensionists, researchers and other stakeholders are needed. Simultaneously, the organisation of innovation, in terms of services provided by different players (security of land tenure, inputs, credit, marketing, processing etc), needs to be taken into account. Ultimately the end users have to integrate these factors and innovations into their individual farming and livelihood strategies. If sustainable agriculture at the smallholder level is to be achieved in southern Africa and, for that matter, throughout the developing regions of the world, research and extension has to take account of this complexity.

Recent work in Zimbabwe has shown that the majority of smallholder farmers rely heavily on draught animal power (DAP) and mouldboard ploughs for primary tillage and crop establishment. Seed is planted by hand into a furrow made by the plough and covered during the next pass, ensuring the maize germinates into a relatively weed-free seedbed (Third Furrow Planting - TFP). Unfortunately, farmers face the problem that the peak demand for DAP coincides with the period that animals are in their weakest condition at the end of the dry season (Shumba et al., 1992). Farmers recognise the need for weed control to remove weeds and allow enhanced capture of rainfall. Weed management is a key component of conservation tillage (Norton, 1987; Riches et al., 1997) and with weeding accounting for up to 60% of pre-harvest labour input for maize production (MLARR, 1992), considerable strain is placed on household supplied labour, particularly women. This could be reduced through more appropriate use of the cultivator or plough.
The availability of labour, DAP (to both men and women) together with well maintained and correctly used implements are key resources that determine the area planted, timeliness of operations, efficient utilization of other resources and, hence, the productivity and sustainability of the cropping system (Shumba et al., 1992; Ellis-Jones & Mudhara, 1997; Chatizwa, et al., 1998). The heterogeneity of household resource availability has been well established (Ellis-Jones and Mudhara, 1995; Scoones, 1995) and it is clear that farmers should have a range of technology options from which to select, based on individual socioeconomic and biophysical conditions. Research work over three seasons has provided opportunities for technology development with farmers in Zimuto Communal Farming Area and the adjacent Mshagashe Small Scale Commercial Farming Area to evaluate alternative crop establishment and weed control systems across a soil catena. This participatory approach to technology development has ensured that farmers have remained central to identifying, testing and evaluating the technology options (Twomlow et al., 1998; Ellis-Jones et al., 1998). The conclusions that can be drawn from this research are:

- Farmers have a deep understanding of the interrelationships between the factors which need to be considered in achieving acceptable maize yields.

Farmers are willing to make a number of trade-offs to achieve timely planting, crop stands and acceptable levels of weeding.

On all soils, planting into a furrow created with a ripper tine (RIP) or a plough (OPFP - open plough furrow planting) makes the best use of both available draught animals and labour, and they produced the best maize yields. Both methods are better than the traditional farmer practice of TFP (third furrow planting).

Hand hoe weeding is better than both the ox-cultivator and ox-plough. The poor performance of the draught animal weeding methods is largely due to the poor condition of the farmers' implements and their lack of knowledge about their efficient use. This includes both men and women farmers.

Households with greater access to DAP and labour seem prepared to accept that earlier weeding will be needed following planting into rip lines or OPFP, if this consistently allows more timely planting and results in a good crop stand.

- Those households with low DAP and low labour availability (mainly female-headed households) are less willing to accept the trade-off and see TFP as less risky and a method of saving both DAP and labour.
References


1. Schematic cropping calendar for semi-arid Zimbabwe

2. Meteorological drought index - based on 30 year rainfall records from Makoholi
3. Annual soil loss (kg/ha) observed for 4 tillage treatments at Makoholi from 1988 to 1994
5. Seasonal fluctuations in soil water content (mm) for a sandy loam (Sanyati) in response to flat and tied ridge cultivation for the 1993/94 season when ridges were tied late.

6. A comparison of labour requirements for farmers with different resources to carry out land preparation, weeding and ridging.
7. The crop production system - as seen by researcher in the past

8. Crop production and its position within a systems context
9. Impact of weeds on the soil water regimes that develop under a maize crop grown on Makoholi sand.

10. Water use efficiency (WUE, kg/mm) in response to time and frequency of weeding on a Makoholi sand.
12. Interactions between primary land preparation and crop establishment technique on maize
13. Interaction between primary land preparation and crop establishment technique on labour requirements

14. Maize grain yield per hour worked (kg/ha)
15. The interaction between 4 different conservation tillage and frequency of weeding 1995

16. The interaction between 4 different conservation tillage and frequency of weeding 1996
18. Farming operation by different farmer categories in Mshagashe and Zimuto
CROP ESTABLISHMENT TREATMENTS

- TFP - the farmer practice of third furrow planting, dropping seed into the plough furrow to be subsequently covered by the next pass of the plough compared with:
- RIP - Planting into a 0.2 to 0.3 m deep rip line created by a commercially available ripper tine mounted on a standard plough beam, and subsequently covered with a hand hoe.
- OPFP - Open plough furrow planting, seed planted into furrows opened with a single pass of a plough at the desired inter-row spacing, on previously ploughed land, and subsequently covered with a hand hoe.

19. Crop establishment treatments tested over 4 seasons in Mshagashe and Zimuto

WEEDING METHODS

- OCHH - an ox-drawn cultivator with crop rows subsequently weeded by hand-hoe if necessary.
- OPHH - a plough (0.25 m cut/width) with the mouldboard left in place, with crop rows subsequently weeded by hand-hoe if necessary. The ridges formed at weeding with the mouldboard plough were crossed tied at two to three m intervals (using hand hoes) to prevent water movement.

20. Weeding tested over seasons in Mshagashe and Zimuto
22. Seed cotton yield response averaged over 5 farms/soil types during the 1990/91 season in Sanyati
### Characteristics of ISWC and introduced technologies

<table>
<thead>
<tr>
<th>Indigenous technologies</th>
<th>Introduced technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Integration of soil fertility enhancing, soil moisture and soil conserving techniques</td>
<td>- Often specific to a single requirement</td>
</tr>
<tr>
<td>- Integral component of land management and cropping systems</td>
<td>- New management techniques may be required</td>
</tr>
<tr>
<td>- Limited loss of land</td>
<td>- Up to 20% of land area lost for cropping</td>
</tr>
<tr>
<td>- Flexible</td>
<td>- Inflexible</td>
</tr>
<tr>
<td>- Low cost using existing materials and tools</td>
<td>- Higher cost, additional tools</td>
</tr>
<tr>
<td>- Provide an immediate payback</td>
<td>- Often require an initial investment, annual maintenance with indeterminate benefits occurring over a long period</td>
</tr>
<tr>
<td>- Can be labour intensive with gender specific activities, but flexibility allows use of labour at off-peak periods</td>
<td>- Usually labour intensive with demand coinciding with existing labour peaks</td>
</tr>
</tbody>
</table>

23. Characteristics of indigenous soil and water conservation technologies and introduced techniques
Discussion

(Aidan Senzanje) - Are some farmers too poor to be helped?
(Mrs Madishona) - We first of all must define what we mean by a farmer

This led to wide-ranging discussion, not all of which needed recording. Some relevant points that emerged were:

• everyone in the rural community must be a farmer
• some people may till the land to retain tenure even if they do not wish to grow a crop
• there are people with land (ie “farms”) who prefer paid employment elsewhere
• some people with land simply rent it out for grazing.
Small Group Discussions I

Issues of Concern to the Project

Issue 1 Interventions for improved implement use
Issue 2 Adoptability of innovative methods
Issue 3 Availability of cattle and donkeys for alternative uses
Issue 4 Effects of innovative methods on livelihoods

Group Reports

Issue 1 Interventions for improved implement use

(Rapporteur: Norman Mhazo)

1 Reasons for low levels of knowledge and skills on DAP and proper implement use

- problems with dissemination methods
- problems with training methods
- no systematic back-up support (management)
- ineffective training programmes (selection, follow-up, resources)
- no extension service offered by dealers and manufacturers

2 Approaches to improve implement use

- ploughing competitions; specific demonstrations; classes
- farm machinery demonstration centre
- provide systematic back-up support for trainers and trainees
  - mobile training unit
  - practice, assignments
  - mass media
- dealers and manufacturers to provide extension support for their products
- researchers to provide clear benefits (yield, income) from improved implement use
- educational system to include agricultural implement use in their curricula.

Discussion

(Jim Ellis-Jones) - Do farmers see the problem (eg using a dilapidated plough) as we see it?
(Mrs Mandishona) - The feedback that ZFU gets is that problems are more to do with a lack of draught animals than with poor equipment.
(Pitiel Mujuru) - Farmers need step-by-step demonstrations and are very appreciative of them.
(Clopas Rukuni) - Where do colleges get DAP teachers from?
- No real answer.
(Pitiel Mujuru) - The problems are also attributable to poor attitudes, low interest and low motivation.
Workshop Day 1  
Setting the Scene

Issue 2  
Adoptability of innovative methods  
(Rapporteur: Joanne Mhunduru)

Areas for intervention
Scirp conservation  
Fertility management  
Water conservation  
Weed management  
DAP - animal breeding, implements, ergonomics

Promoters of adoptability
Need for change  
Potential benefits - efficiency, labour saving, cost-effective, improved yields / standard of living
Lack of alternative  
Market driven  
Good participation / collaboration - sense of ownership  
Good dissemination / communications  
Changes in political and socio-economic conditions  
Competition  
Education  
Environment

Inhibitors of adoptability
Social / political instability  
Lack of understanding  
Inappropriate approach (eg too top-down)  
Culture (gender) and superstition  
Lack of resources  
Inappropriate technology / targeting (eg re gender)  
Tenure systems  
Infra-structural support  
Lack of credit (advantages should be explained to lenders)  
Lack of long-term financial support (eg donors’ short projects)  
Inflexible recommendations (no recognition of farmer adaptation)  
Long-term vs short-term benefits  
Lack of follow-up  
Risk  
Attitudes  
HIV/AIDS

No discussion
### Issue 3  Availability of cattle and donkeys for alternative uses

(Rapporteur: Samson Khumalo)

#### 1 Current uses

<table>
<thead>
<tr>
<th>Use</th>
<th>Cattle</th>
<th>Donkeys</th>
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<tbody>
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</table>

#### 2 Potential uses

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<td>✓</td>
<td></td>
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<tr>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Breeding / genetic conservation</td>
<td>✓</td>
<td>0</td>
</tr>
<tr>
<td>Recreation and sport</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
3 Constraints on potential uses

- Appropriate equipment - design and cost
- Opportunity and time (for animals and people)
- Knowledge
- Training (people and animals)
- Feeding (animals)
- Government policy
- Value of products
- Shortage of DAP

No discussion

Issue 4 Effects of innovative DAP practices on livelihoods

(Mrs Gova)

Livelihoods = means of living
Practices = use of implements
Areas of intervention = tillage methods
crop establishment
manure / fertiliser application
weeding
harvesting
transport

1 Direct beneficiaries
- Farmers / families
- Rural blacksmiths
- Contractors (hiring out animals and implements)
- Manufacturers and traders

2 Benefits to farmers (livestock owners / non-owners)
- Increased yield
- Time and labour saving
- DAP saving
- Increased income

3 Benefits to the community
- Offer labour for hire
- Income generation

4 Benefits to blacksmiths
- Demand for services
- Income generation
### Workshop Day 1

**Setting the Scene**

#### 5 Benefits to contractors
- increased income

#### 6 Benefits to traders
- increased sales
- higher stock turn-over

#### 7 Benefits to manufacturers
- increased sales

#### 8 How to promote

<table>
<thead>
<tr>
<th>To farmers:</th>
<th>training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>demonstrations</td>
</tr>
<tr>
<td></td>
<td>competitions</td>
</tr>
<tr>
<td></td>
<td>beneficiary participation</td>
</tr>
<tr>
<td></td>
<td>affordability</td>
</tr>
<tr>
<td></td>
<td>social acceptability</td>
</tr>
<tr>
<td>To blacksmiths:</td>
<td>training for skills</td>
</tr>
<tr>
<td></td>
<td>access to capital and materials</td>
</tr>
<tr>
<td></td>
<td>marketing</td>
</tr>
<tr>
<td></td>
<td>entrepreneurship skills</td>
</tr>
<tr>
<td>To contractors:</td>
<td>encourage informal linkages</td>
</tr>
<tr>
<td></td>
<td>entrepreneurship training</td>
</tr>
<tr>
<td></td>
<td>training to use animals and implements properly</td>
</tr>
<tr>
<td>To traders:</td>
<td>commission</td>
</tr>
<tr>
<td></td>
<td>support mechanisms</td>
</tr>
<tr>
<td></td>
<td>entrepreneurship training</td>
</tr>
<tr>
<td>To manufacturers:</td>
<td>policies in place</td>
</tr>
</tbody>
</table>

#### 9 Disadvantages
- high cost
- availability
- lack of capital
- competition
- social unacceptability
- non-tangible benefits
General Discussion

(Steve Twomlow) - If there were very little DAP available, should we still pursue the proposed project?
(Mrs Mandishona) - Yes, there is still a need to address the shortage of DAP.
(Charles Dhewa) - Farmers will always complain. Sometimes it should not be taken too seriously.
(Vurayai Zvarevashe) - The aim of this project is to get more efficient use of DAP.
(Aidan Senzanje) - We must respect the farmers’ views. There is a shortage of DAP.
(Jim Ellis-Jones) - The importance of communal grazing must not be overlooked. It is free but it carries a high economic cost. Feeding has to be made more efficient.
(Clopas Rukuni) - There appears to be a lack of information on the costs of crop inputs where DAP is used.
(Steve Twomlow) - Do we have any reliable figures on the DAP resource in Zimbabwe and the perceptions of farmers?
(Jim Ellis-Jones) - There are sufficient animals in Zimbabwe but the problems are distribution and inefficient management and use.
Project Structure and Linkages

D O’Neill and S Twomlow
Silsoe Research Institute

The linkages between other local organisations and projects with similar objectives were outlined (see Table 1) as a means of identifying possible locations for field work.

Table 1 Organisations offering possible field work collaboration

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Location(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARE</td>
<td></td>
</tr>
<tr>
<td>IES (Institute of Environmental Studies)</td>
<td>Romwe Mutang</td>
</tr>
<tr>
<td>ICRISAT</td>
<td>Chiredze Gwanda Tsholotoho Zishavane</td>
</tr>
<tr>
<td>IFAD</td>
<td></td>
</tr>
<tr>
<td>CTC / COTCO</td>
<td></td>
</tr>
<tr>
<td>OCCZIM</td>
<td></td>
</tr>
<tr>
<td>Narrative Summary</td>
<td>Objectively Verifiable Indicator</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Goal</strong></td>
<td>Performance of livestock (including draught animals) in semi-arid crop/livestock and livestock production systems improved.</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Develop and promote strategies for the allocation and management of on-farm and locally available resources in order to optimize livestock production and improve their contribution to the crop/livestock farming system.</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>1. Best Practice Guidelines in implement use (setting, maintenance &amp; harnessing) based on current knowledge will be developed by appropriate stakeholders.  &lt;br&gt;2. The appropriateness of current DAP use utilization in maize and coton systems will be defined in terms of management of existing resource utilisation (particularly animals, implements and labour) on yields and profitability. The potential for resource utilisation in innovative crop production methods (green manures, animal manures, crop residues) will be quantified.  &lt;br&gt;3. The findings of the research will be promoted and disseminated by stakeholders.</td>
</tr>
<tr>
<td>Narrative Summary</td>
<td>Objectively Verifiable Indicator</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>Performance of livestock (including draught animals) in semi-arid crop/livestock and livestock production systems improved.</td>
<td>By 2005 in two nominated target countries where primary demand exists: - area cultivated per livestock unit increased by 15% - total crop yields in areas cultivated by livestock increased by 10%</td>
</tr>
</tbody>
</table>

**Activities**

1.1 Preliminary workshop with all stakeholders, to identify and agree the roles of the main collaborating institutions.

1.2 An assessment of the efficiency of use of DAP implements will be made with existing farmer groups (with and without previous training) a. surveys, b. farmers and c. scientists' diagnostic evaluations.

1.3 An assessment will be made of current dissemination methods for DAP/implement use identifying strengths and weaknesses in order to build on the strengths.

1.4 An assessment will be made of current institutions' (traders, artisans, manufacturers) ability to support farmers' repair and maintenance needs.

1.5 An assessment will be made of the social and economic implications of promoting DAP technologies.

1.6 Participatory development of best practice guidelines for farmers on correct implement use and setting.

2.1 Innovative crop production methods likely to be disseminated by crop production scientists will be identified.

2.2 DAP requirements (power and implements) for these innovative crop methods will be assessed.

2.3 The implications of innovative technologies for farmers' adoptability based on farmers' current resources will be assessed.

3.1 The best practice guidelines produced in Activity 1.5 will be made available for dissemination by appropriate stakeholders (ZFU, AGRITEX, commercial companies).

3.2 The research findings will be promoted through an end of project workshop and publications.


1.2 Surveys and diagnostic evaluations completed by Dec 2000.

1.3 Literature survey, survey and discussions with stakeholders compiled into a report April 2000.

1.4 & 1.5 Literature survey, survey and discussions with stakeholders compiled into a report October 2000.


2.1 Innovative practices confirmed by Jan 2000.

2.2 DAP requirements reported by March 2001.

2.3 Implications for farmers reported by Dec 2001.


3.2 Final project Workshop Proceedings available by Jun 2002.
Workshop Day 2  
Project Implementation

Small Group Discussions II

Field Activities

<table>
<thead>
<tr>
<th>Group</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>Location and farmers</td>
</tr>
<tr>
<td>Group 2</td>
<td>Survey design</td>
</tr>
<tr>
<td>Group 3</td>
<td>Field trials</td>
</tr>
<tr>
<td>Group 4</td>
<td>Data collection and analysis</td>
</tr>
</tbody>
</table>

Group Reports

Group 1  
Location and farmers  
(Vurayai Zvarevashe)

Major criteria

Group 1's decisions are summarised in the Table on the next page

Discussion

(Norman Mhazo) - Should any irrigation schemes be included?  
It had been previously agreed not to.

(Mrs Mandishona) - What are the Districts in Masvingo?  
There are several to choose from. These can not be confirmed until more detailed discussions are held with the collaborators.
<table>
<thead>
<tr>
<th>Area</th>
<th>Resettlement farmers</th>
<th>Small-scale commercial farmers</th>
<th>Communal farmers</th>
<th>Farmer groups</th>
<th>Crops</th>
<th>Back-up services</th>
<th>RANK</th>
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<td>✓</td>
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<td>DRC IC Agronomy</td>
<td>Agric Mech</td>
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<td></td>
<td>OCCZIM UZ</td>
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<td>Mat. S &amp; N Gwanda</td>
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<td>Tsholothso IV, V</td>
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<td>OCCZIM Filabusi</td>
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<td>DR &amp; SS</td>
<td>Maize, sorghum</td>
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<td>OCCZIM</td>
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<tr>
<td>Mash E Mtoko IV, V</td>
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<tr>
<td>Mash W Sanyati,</td>
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<td>✓</td>
<td>✓</td>
<td>DR &amp; SS</td>
<td>Big 12</td>
<td>Agric Mech</td>
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<tr>
<td>Nembudziya IV</td>
<td></td>
<td>CTC</td>
<td></td>
<td>OCCZIM UZ</td>
<td>Cotton, maize, small grains</td>
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</table>
Workshop Day 2

Group 2

Survey design

(Pitiel Mujuru)

1. Information required

1.1 Socio-economic / Wealth ranking

Household Assets

- livestock: availability, distribution, accessibility
  implements:
  landholding: grazing, arable
- crops and livestock
- cattle and donkeys
- on-farm, off-farm
- on use of DAP

1.2
2 Methodology

Formal survey - questionnaire(s)
Informal survey - focussed group discussions
In-depth interviews with key informants

<table>
<thead>
<tr>
<th>Who</th>
<th>When</th>
<th>With whom / what</th>
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<td>ZFU</td>
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<tr>
<td>SILSOE</td>
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</tbody>
</table>

No discussion

Group 3 Field Trials and Demonstrations

(Ephraim Mbanje)

1 Indicator(s)

Yield

2 Parameters

Animals size, type, performance, condition
Implements - state/condition, type, weight, draught, efficiency, setting
Labour - operations, gender, work rates, work load(s), training
Soil - type, physical characteristics, moisture, field conditions

3 Trial set-up

Paired plots - farmer managed
Compare innovations, labour, yields etc
Trained and untrained groups
Exchange visits
4 Demonstrations

Field days

Discussion

(Norman Mhazo) - Add work rate to indicators

(Pitiel Mujuru) - Using yield as an indicator could be problematic

(Pitiel Mujuru) - What parameters are involved in assessing optimisation? That depends on the farmers and what resources they have

Group 4 Data collection and analysis

(by / from: extension officers, ZFU, NGOs, local leaders)

A General

1 Environment

2 Farmers

Number and size of households; arable land area; grazing land area; numbers of animals (cattle, donkeys, small stock) grazing in that area; types of diseases.

3 Cropping

4 Livestock
Workshop Day 2

Project Implementation

B From Individual Farmers

1 Household

Name; age; sex; household head; number of household members and their activities; sources of income; area of arable land; level of draught animal training and experience.

2 Crops and livestock

Yields; herd composition; sources of draught power; cropping calendar.

3 Draught implements

C Analysis

- characterise farmers according to implements
- relate percent of farmers with DAP and implements to yield income
- relate arable land to draught and number of implements (to assess adequacy)
- level of training of draught animals
- use of appropriate computer packages

D Resources

- questionnaire
- transport
- stationery
- enumerators (personnel)
- duration to be determined by number of farmers to be visited

No discussion
Small Group Discussions III

Development and Extension

Group Reports

Group 1  Gender issues

1 Household compositions
- male / female headed
- avoid biassed approach

2 Animals
- ownership
- management
- training
- decision-making / selection of animals: milking, draught, bull / ox
- disposal / acquisition of livestock
- labour where there is no DAP

3 Implements and field operations
- ploughing - male / female balance
- repair and maintenance
- effect(s) of new technologies: eg ripper on weeding, a female role
- artisans - generally male: is this a problem?

4 Trials and demonstrations
Workshop Day 2

Group 2

Role of artisans and manufacturers

(Ivan Chatizwa)

1. Survey
   - incorporate artisans into the survey (number, skills, products etc)
   - elicit information on farmer-artisan relationships

2. Activities of artisans
   - repairing DAP implements
   - modification of implements
   - fabricate parts (shares, m-boards, tines etc)

3. Activities of manufacturers (in addition to 2 above)
   - manufacture implements and parts
   - develop new designs
   - develop prototype models

4. Communication
   Artisan to:
   - farmer - strong
   - dealer - weak
   - manufacturer - minimal

   Farmer to:
   - artisan - strong
   - dealer - strong
   - manufacturer - very weak

   Dealer to:
   - farmer - strong
   - artisan - weak
   - manufacturer - strong

   Manufacturers' linkages evident from the above.

5. Potential roles for artisans (researchable?)
   - diagnose farmers' implement problems from the condition of their implements
   - train farmers in implement operation and maintenance
Group 3 Format for “Best Practice Guidelines”
(Charles Sadzamare)

1 Targets

2 Methodology

3 Criteria for farmers
- user-friendly manual on setting, operation and maintenance of farm implements
- guidelines on organising ploughing competitions and demonstrations
- guidelines on training animals and handlers
- guidelines on training the trainer

4 Criteria for extension agents
- revised and fortified materials supporting what is prepared for the farmers
- guidelines on how to develop training materials

5 Criteria for artisans

6 Criteria for dealers and retailers
- posters
- manuals
- stock lists

7 Criteria for manufacturers
- encourage local manufacturers to supply their equipment with user-friendly manuals

Discussion
In discussion it was noted how important it is to think about the problems of getting information out and disseminated by an increasingly stretched Extension Service.
### Workshop Day 2

#### Project Implementation

**Group 4 Dissemination - current methods and recommendations for project outputs**  
(Edward Nengomasha)

<table>
<thead>
<tr>
<th>Current Activities</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| Field days and demonstrations| Increase frequency  
                               | Decrease “non-associated” activities  
                               | Improve farmer participation  
                               | Greater practical content    |
| Training programmes          | Include DAP knowledge and skills in syllabi (2nd and tertiary)  
                               | Prioritise resource allocation towards DAP issues  
                               | Increase coverage of farm machinery training (AGRITEX)  
                               | Encourage farmer-farmer information exchange  
                               | Farmer Field Schools / Groups  
                               | Encourage PEAs and PTDs        |
| Ploughing contests           |                                                                                  |
| Pamphlets / magazines / mass media | Increase production and distribution  
                               | Encourage DAP video clips                                                                 |
| DAP management               | Improve selection, handling, training  
                               | Encourage preferential husbandry practices for DAP                                     |

### Discussion

*(Steve Twomlow)* - AGRITEX courses should provide training in **how to train** farmers (ie training of trainers) as well as in passing on the basic farming skills.
Incorporation of Group Reports

J Ellis-Jones and D O'Neill
Silsoe Research Institute

The purpose of this Workshop session was to agree the project Activities which would be undertaken to deliver the project Outputs and assign primary responsibilities.

Output 1 ("Best Practice Guidelines")
- Collect and collate existing material.
- Assess target beneficiaries' views on "Best Practice Guidelines".
- For rural artisans, manufacturers and retailers - survey and identify needs.

Output 2 as given in the Logframe was subdivided into 2A and 2B

Output 2A (Appropriateness of current DAP use)
- Finalise locations for (i) survey and (ii) trials and demonstrations.
- Finalise survey details - (i) formal and (ii) informal.
- Run trials (i) on-farm, (ii) on-station, researchers collecting key data.

Output 2B (Potential innovations)
- Conduct on-station trials of innovative practices (1999-2000 season):
  - Domboshawa and Hatcliffe
  - Matopos (possibly)
- Identify potential innovations relating to:
  - animals (including mixed spans)
  - implements (tines, light ploughs)
  - crop management

It was agreed that all on-farm trials for the 1999-2000 season will be conducted in Masvingo Province.

Mrs Mandishona reminded us of the need to maintain farmer awareness of these activities and receive comments and feedback as appropriate.

Output 3 (Promotion and dissemination)
- Assessment of dissemination methods.
- Farmer field days in Masvingo.
- Farmer Workshop(s) after 1999-2000 trials.
- Quarterly newsletter to all stakeholders.
- Other promotional events.

Experimental designs for both on-farm and on-station trials are to be prepared by SJT in association with the local researchers and ratified by a biometrician. As these Proceedings go to press, the experimental designs have already been completed and are available in the project Working Document No. 1 at Annexes 2 and 3.

Cover crop trials to be conducted on-station (including Matopos).

Closing Address

Mrs Epiphania Violet Mandishona
(Summarised by D O'Neill)

In a short address, Mrs Mandishona was very appreciative of this DFill initiative to assist Zimbabwe's smallholder farmers, and commended the project team for attaching such importance to the farmers' perspectives, in tackling the proposed research. However, she warned, it can be easy to do this at the outset but not so easy to maintain the farmer involvement in the project from beginning to end. Certainly the farmers engaged in the field trials will be involved throughout but it is important that their neighbours are kept informed of any developments also.

There has been a good participation in this Workshop but, for various reasons, about half the identified stakeholders were unable to attend. The Workshop proceedings should be sent to all identified stakeholders, not just those attending.

Finally, we should be aware that farmers are often ahead of scientists and researchers, but farmers still need informed and appropriate advice to enable them to make their own decisions on how to optimise their practices. This project must, therefore, establish true collaboration between the farming and scientific communities.
## List of Participants

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<tr>
<th>No.</th>
<th>Name</th>
<th>Position</th>
<th>Institution</th>
<th>Address</th>
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<tbody>
<tr>
<td>1</td>
<td>Steve Twomlow</td>
<td>Soil &amp; Water Engineer.</td>
<td>Silsoe Research Institute</td>
<td>West Park, Silsoe, Bedford MK45 4HS, UK.</td>
</tr>
<tr>
<td></td>
<td>Joanne Mhunduru</td>
<td>CPHP/LPP Prog. Co-ord. (Zim)</td>
<td>DRSS/NRI</td>
<td>Tel: 00 44 1525 860000 Fax: 862140</td>
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<td></td>
<td>Box CY350, Causeway, Harare.</td>
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<td>Fax: 700339</td>
</tr>
<tr>
<td>2</td>
<td>Charles Dhewa</td>
<td>Information Officer</td>
<td>Zimbabwe Farmers Union</td>
<td>Box BW 330 Borrowdale, Harare.</td>
</tr>
<tr>
<td></td>
<td>BasilioBunu Chikwanda</td>
<td>DAP Training Officer</td>
<td>Institute of Agricultural Engineering</td>
<td>Tel: 860019, 860055 Fax: 860009, 860136</td>
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<tr>
<td>3</td>
<td>Jairus Magumise</td>
<td>DAP Training Officer</td>
<td>Institute of Agricultural Engineering</td>
<td>Box BE 1739 Borrowdale, Harare.</td>
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<td>OCCZIM-HQ</td>
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<td>Joy Chidavaenzi</td>
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<td>Institute of Agricultural Engineering</td>
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<td>Dennis Chiwodza</td>
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<td>Charles Sadzamare</td>
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<td>Institute of Agricultural Engineering</td>
<td>Box BW 330 Borrowdale, Harare.</td>
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<td>Samuel Khumalo</td>
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<td>7</td>
<td>Edward Nengomasha</td>
<td>Principal Research Officer</td>
<td>Maitopos Research Station</td>
<td>P Bag K 5137, Bulawayo.</td>
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<td>Vuraiy Zvarevashe</td>
<td>Agronomist</td>
<td>CARE-Zimbabwe</td>
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<td>Jim Ellis-Jones</td>
<td>Socio-Economist</td>
<td>Silsoe Research Institute</td>
<td>Box 264, Masvingo</td>
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<td>Clopas Rukuni</td>
<td>Farm Machinery Training Officer</td>
<td>Institute of Agricultural Engineering</td>
<td>Box 354, Masvingo</td>
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<td>Pitiel Mujuru</td>
<td>Mechanisation Specialist</td>
<td>Agritex</td>
<td>University of Zimbabwe, Box MP 167,</td>
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<td>Irvine Chizawa</td>
<td>Higher Eng Technician</td>
<td>Institute of Agricultural Engineering</td>
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<td>Development Tech Centre</td>
<td>Box 3755 Harare</td>
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<td>Ephraim Mhando</td>
<td>Research Engineer</td>
<td>Institute of Agricultural Engineering</td>
<td>Box FY539, Causeway, Harare.</td>
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<td>Box 3755 Harare</td>
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<td>15</td>
<td>Epiphania Violet Mandishona</td>
<td>Chief Educ. &amp; Training Officer</td>
<td>Agritex</td>
<td>University of Zimbabwe, Box MP 167,</td>
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<td>Majorie Gova</td>
<td>Senior Horticulturist/Agronomist</td>
<td>Maitopos Research Station</td>
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<td>20</td>
<td>Aidan Senzange</td>
<td>Lecturer</td>
<td>University of Zimbabwe</td>
<td>Care Research Institute, Box 3755 Harare</td>
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<tr>
<td>21</td>
<td>Tirivangani Koza</td>
<td>Assistant Chief Engineer</td>
<td>Institute of Agricultural Engineering</td>
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<tr>
<td>22</td>
<td>David H O'Neill</td>
<td>Project leader/Farm Power Specialist</td>
<td>Silsoe Research Institute</td>
<td>West Park, Silsoe, Bedford MK45 4HS, UK.</td>
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