

Strategic Research Needs Relating  
to Draught Animal Power:

A Diagnostic Study in Zimbabwe

July - August 1992

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Our special thanks go to Mr P Malusalila (Acting Chief of the Crop Production Branch, AGRITEX) who worked closely with us throughout our visit to Zimbabwe and shared with us his expertise and experience in agronomy. His untiring efforts ensured that our programme was well organised and ran smoothly, which we greatly appreciated. We are also particularly grateful to Miss P Huchu (Monitoring and Evaluation Section, AGRITEX) and Mr I Pompi (AGRITEX Provincial Office, Bindura) who accompanied us during part of the field work.

We record our appreciation for the time and interest given to us by the many farmers we met, many of whom are facing great difficulties this year because of the drought.

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## ABBREVIATIONS

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Organisations are based in Zimbabwe unless otherwise stated.

AEO	Agricultural Extension Officer.
AETC	Agricultural Engineering Training Centre.
AGRITEX	Department of Agricultural Technical and Extension Services.
CARD	Coordinated Agricultural and Rural Development Programme (GTZ-funded, based in Gutu).
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
COFRE	Committee for On-Farm Research and Extension.
CTVM	Centre for Tropical Veterinary Medicine, UK.
DAP	draught animal power.
DAEO	District Agricultural Extension Officer
DDF	District Development Fund.
DAWG	Draught Animal Working Group, ODA.
DRSS	Department of Research and Specialist Services.
DTC	Development Technology Centre , UZ.
DVS	Department of Veterinary Services.
FSRU	Farming Systems Research Unit, DRSS.
GoZ	Government of Zimbabwe.
IAE	Institute of Agricultural Engineering.
ILCA	International Livestock Centre for Africa (HQ at Addis Ababa)
ITDG	Intermediate Technology Development Group (NGO).
LSU	Livestock unit (in Zimbabwe, 1 LSU = 500 kg)
MLAWD	Ministry of Lands Agriculture and Water Development (formerly the Ministry of Lands, Agriculture and Rural Resettlement until 1992).
NGO	Non-governmental organisation.
NR	Natural Region (agroecological zone).
NRED	Natural Resources and Environment Department, ODA.
NRI	Natural Resources Institute, UK.
ODA	Overseas Development Administration, UK.
RNRRS	Renewable Natural Resources Research Strategy (ODA)
RTTCP	Regional Tsetse and Trypanosomiasis Control Programme for Malawi, Mozambique, Zambia and Zimbabwe (EC-funded, based in Harare).
SRI	Silsoe Research Institute, UK.
TOR	terms of reference
UZ	University of Zimbabwe.
VIDCO	Village Development Committee.

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## SUMMARY

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Introduction (section 1 of the main text)

This report presents the findings of a visit to Zimbabwe in July and August 1992 concerned with draught animal power (DAP). The objective was to identify and formulate appropriate areas of investigation for future funding under ODA's Livestock Production and Nutrition Programme by carrying out a diagnostic study of strategic research needs relating to draught animal power.

The study was carried out by staff from the Natural Resources Institute (J Barrett, team leader and economist); the Silsoe Research Institute (D O'Neill, agricultural engineer/ergonomist) and the Centre for Tropical Veterinary Medicine (R Anne Pearson, livestock production scientist). In Zimbabwe, counterpart staff and collaborative support were provided mainly from the Department of Agricultural Technical and Extension Services (AGRITEX) and the Department of Research and Specialist Services (DRSS).

The initial phase of the study was carried out mainly in Harare and involved detailed discussions with relevant organisations to:

- review past and present activities relevant to DAP.
- discover senior level perceptions of constraints and research priorities relating to DAP.

The subsequent phase of the mission involved meetings with officials and farmers in Masvingo, Midlands and Matabeleland North Provinces. Visits were made to Makoholi Experimental Station and Matopos Research Station.

In the final week of the visit a workshop was held at the AGRITEX Institute of Agricultural Engineering at Hatcliffe on 17 August. Almost 40 participants came together to discuss and debate the preliminary findings of the team.

The broad perspective (section 2)

There are some 800,000 families in the communal sector in Zimbabwe for whom mixed farming is the main economic activity. Arable plots are small, commonly in the order of two or three hectares. Many but not all farmers own cattle, for which the main economic roles are provision of draught power and milk for household consumption. In recent years the communal cattle herd has approached four million animals and stocking rates are approaching or exceeding carrying capacity. Meanwhile, shortage of DAP is widely recognised as one of the principal constraints to increased crop production in the communal lands.

The crop-livestock interaction is important in Zimbabwean farming systems. At a fundamental level, the problem is an imbalance between supply and demand for draught animal power.

From available reports and literature, and following discussions with senior staff in government institutions, the team concluded that the main research and extension emphasis to date has been upon improving dry season nutrition and in reducing the DAP requirements in tillage in Zimbabwe (section 3).

From discussions with field staff, farmers and other key informants, the following problems and prospects were identified in relation to various types of intervention which have been considered (section 4).

#### NUTRITION

Extensive nutrition: there is general interest in grazing schemes and much scope exists for research into both technical and socio-economic issues. However, this is not considered further in view of the non-specific relationship to DAP.

Intensive nutrition: the main area of farmer interest appears to be in use of crop residues (mainly maize stover) which are widely collected by farmers. Stover from small grains is used to a lesser extent, but use is increasing as feed shortage gets worse. Other novel residues are also being used. Farmers and extension workers are unclear of the best way to use such residues, and recognise the need for investigation in this area. Given the work that has been carried out in other parts of Africa (eg by ICRISAT) the team considered that most of the required work may be adaptive research. However, it would be worthwhile for NRI to carry out a literature review to examine the scope for useful strategic research in this area. A previous proposal prepared in collaboration between NRI and Matopos identified the need for a survey of current crop residue utilisation in Zimbabwe. The present team underlines the need for such a study, and this is included in the proposals below.

#### ANIMAL HEALTH

Apart from control of life-threatening diseases, the main farmer interest in relation to health of draught animals appears to be control of intestinal parasites. The proportion of farmers using deworming treatments appears small but significant. There may be scope for some research to investigate the optimum (cost-effective) use of anthelmintic drugs for strategic treatment of draught animals. ODA has indicated interest in assisting the DVS to establish a Veterinary Epidemiology and Economics Unit which, among other functions, will coordinate strategic studies of animal health and production. This may be an

appropriate framework for some research into deworming of draught animals. In this context, it would be useful to have more information on current farmer practices concerning deworming.

#### USE OF COWS AND DONKEYS

Using cows as draught animals: this was very variable among the farmer groups visited, with no obvious pattern. It was widely recognised that such use can lead to reduced fertility and reduced milk production. This is an area where some useful adaptive research could be carried out in Zimbabwe, probably at Makoholi. ILCA is already carrying out strategic research on this subject. Accordingly this should be a low priority for new ODA research.

Using donkeys as draught animals: in all of the areas visited in Natural Regions IV and V, it was felt that donkeys are of increasing importance as sources of animal draught for farming. The donkey is widely preferred for pulling carts and other transport purposes, and in some areas is used to a significant extent for ploughing and cultivation. In the semi-arid areas, donkeys are important as reserve sources of DAP for those years in which the cattle are too weak to plough. There was widespread recognition that in the past donkeys have been undervalued and given insufficient attention by government institutions across the board. Very little is known and there seems to be substantial scope for strategic and adaptive research in relation to donkeys as draught animals.

#### IMPLEMENTS AND TILLAGE PRACTICES

Implements: various design and manufacturing deficiencies are recognised among the implements currently available to communal farmers in Zimbabwe. Improved designs for some implements are being developed or tested. The general constraint is that farmers have limited cash and appear disinterested to invest in very expensive equipment that is used for a very short period each year. Most of the research that can be envisaged in this area is adaptive. A general theme which emerged was that most of the implements are inappropriate for the small local breed of cattle, and even more so for the donkey. There are no implements generally available which are specifically designed for use by donkeys. A study to systematically evaluate the suitability of locally available implements seems justified.

Modified tillage practices: there has been widespread success in promoting the practice of winter ploughing as a means of alleviating DAP constraints. Reduced tillage methods have not been widely adopted, perhaps because of transfer of the labour bottleneck from ploughing to weeding. Other tillage practices which are being promoted for soil and water conservation (such as ridging) are actually aggravating the demand for DAP, and this may be a reason for limited farmer uptake. Some farming systems

investigation of the DAP implications of modified tillage techniques appears worthwhile.

Scope for ODA-funded strategic research on DAP (section 5)

Taking into account ODA policy objectives, scope for developmental impact, UK comparative advantage, and an emphasis upon strategic as opposed to adaptive research requirements, the following opportunities for NRED-funded research relating to DAP are identified:

**A. Identification and characterisation of recommendation domains for research and extension relating to DAP**

National planning of extension and research programmes relating to DAP requires more systematic collection and evaluation of a wide range of information. This would include current practices and opportunities for intervention in relation to the utilisation of crop residues, inter-household draught transactions, tillage practices, use of donkeys and cows, gender issues, health care practices and so forth. No methodology has been developed or tested for the assembly and evaluation of such information in a coordinated way, centring upon the theme of draught animals. This leads to the concept of identifying and characterising the recommendation domains for appropriate interventions and related research needs.

The development of such an approach would firstly enable better planning of appropriate extension programmes for specific situations and should lead to better justification for and planning of research projects. In particular, sites for on-farm trials of specific interventions may be selected more effectively, leading to more efficient use of government resources and higher farmer adoption rates.

**B. Improved crop production by better use of donkeys and cattle of limited draught capability**

The objective would be to improve crop production in semi-arid areas where draught power, particularly for soil and water management operations, is an effective constraint, by promoting the wider and more effective use of animals of limited draught capability, in particular donkeys and weaker cattle. More specifically, the project aims to provide research and extension organisations with basic information and practical techniques required for the design and evaluation of appropriate extension messages and adaptive research projects relevant to animals of limited draught capability.

The project activities would include to characterise the donkey as a draught animal in semi-arid mixed farming systems. This would include examining the relationships between work, nutrition and health. The project would also involve assessing the draught characteristics of various implements and practices and determining possible modifications to reduce their draught requirements.

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## SECTION 1: INTRODUCTION

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### 1.1 Background to the visit

The Overseas Development Administration (ODA) supports strategic research relating to renewable natural resources under the auspices of various programmes funded through its Natural Resources and Environment Department (NRED). Strategic research relating to draught animal power (DAP) is included within the NRED-funded Livestock Production and Nutrition Programme managed by the Natural Resources Institute (NRI). This research is carried out by the Centre for Tropical Veterinary Medicine (CTVM) in Edinburgh and the Silsoe Research Institute (SRI) in Bedfordshire as well as by NRI.

Since 1990 ODA has placed increasing emphasis on the need to coordinate the research activities of the various institutions. A Draught Animal Working Group (DAWG) was set up in 1991 comprising representatives from NRI, CTVM and SRI. DAWG was requested to put together a comprehensive research strategy for NRED-funded research on DAP, consistent with ODA's objectives as set out in the Renewable Natural Resources Research Strategy (RNRRS).

Initial desk study and UK discussions resulted in the preparation of a background paper for DAWG (Okali and Scott, 1992) which set out the issues relevant to development of a research strategy. The document emphasised ODA's concerns to address the needs of the poor and of women. Okali and Scott (1992) considered that the range of technical interventions available for promoting the extent of use and the effectiveness of DAP was already well documented. They underlined the need to adopt a farming systems perspective in assessing the priorities for research.

At a subsequent DAWG meeting it was agreed that the next step should be a diagnostic case study to be carried out by a multidisciplinary team comprising representatives from CTVM, SRI and NRI. Budgetary constraints dictated a relatively short field trip in one country only. It was agreed to select a country in Sub-Saharan Africa rather than the Asian sub-continent. It was also agreed to focus on a country where the use of DAP is relatively well established, recognising that problems and prospects for research in such a situation are likely to differ significantly from those in countries where DAP has not yet been widely adopted. Because of these choices, the results of the case study would have limited transferability to other locations. Accepting this limitation, the study would still have substantial relevance in much of sub-Saharan Africa. It was also considered as a milestone and valuable exercise in itself to get the various

DAP research organisations working closely together in such a study.

Zimbabwe was identified as a candidate country for the diagnostic study. Smallholder mixed farming is the basic land use throughout Zimbabwe's Communal Lands. Provision of draught power is the main economic role of cattle in these areas (Barrett, 1992). Shortage of DAP has frequently been identified as one of the main constraints to increased crop production in Zimbabwe. ODA is currently supporting a wide range of agricultural research programmes in Zimbabwe, some of which already involve NRI and SRI.

Mr Petros Nyathi (Assistant Director, Livestock and Pastures Division) of the Department of Research and Specialist Services (DRSS) of Zimbabwe's Ministry of Lands, Agriculture and Water Development (MLAWD) visited the UK in May 1992 for discussion of the proposed study. A few weeks later Mr D O'Neill of SRI briefly visited Zimbabwe and held further discussions with Mr E Shumba (Assistant Director, Crop Division). Subsequently DRSS warmly welcomed the proposed study and agreed to assist in its organisation and conduct.

#### Terms of Reference

Terms of Reference (TOR) for the visit were as follow

- 1 To become familiar with past and on-going research relevant to draught animals in southern Africa.
2. To study available documentation on local farming systems including agronomic practices and use of draught animals in communal farming areas in NRS III, IV and V.
3. To establish contact with and discuss issues relevant to draught animal power with appropriate individuals and organisations.
4. To determine constraints on crop production associated with the use of draught animals by interviewing farmers and key informants to be agreed in (3).
5. To integrate the findings of activities (1) to (4) and present these findings to representatives of relevant organisations at a workshop. The aim of the workshop will be to discuss and identify research options and their associated problems and prospects.
6. To investigate the potential for links between possible research initiatives and on-going ODA supported research programmes.
7. To address institutional issues relevant to the implementation of possible research initiatives.

8. To prepare a report on the visit which, if appropriate, shall include a draft project proposal to be presented to DAWG and sent to DRSS for distribution in Zimbabwe within one month of return.

#### Composition of the team

UK-based members of the team were:

- John C Barrett (Team leader and agricultural economist)  
Worked with the Department of Veterinary Services in Harare 1987-1991. Currently Head of Resource Assessment and Planning in NRI's Economics, Social and Statistics Department.
- David O'Neill (Agricultural engineer)  
Senior member of SRI's Overseas Division with wide experience of the application of draught animal power.
- R Anne Pearson (Livestock Production Scientist)  
Research Fellow at CTVM with extensive experience in draught animal management and nutrition.

It was recognised that agronomy was an important discipline to be covered by the team. In view of the considerable in-country expertise in this area, it was agreed to include a Zimbabwean agronomist in the team. This was:

- Percy Malusalila (Agronomist)  
Principal Crop Production Specialist and Acting Head of the Crop Production Branch in the Department of Agricultural and Technical Extension Services (AGRITEX), MLAWD.

For short periods when Mr Malusalila was not available to work with the team he was deputised on one occasion by Ms Prisca Huchu of the Monitoring and Evaluation Section of AGRITEX, and on another occasion by Mr Ishmael Pompei, Principal Crop Production Specialist for Mashonaland Central Province.

Mr P Nyathi (DRSS) acted as principal co-ordinator while the team were in Zimbabwe. Other people who provided material assistance to the study are acknowledged at the front of the report.

#### 1.4 Conduct of the study

Preparation for the visit included assembly of relevant literature and reports which are included in the bibliography at Appendix 1 along with additional material identified subsequently.

The visit to Zimbabwe took place between 21 July and 20 August 1992. A list of persons and organisations contacted is provided as Appendix 2. The itinerary is given in Appendix 3.

The diagnostic element of the study centred upon synthesis and interpretation of existing information, views and experience rather than upon collection of new primary data at the farm level. The farmer participation and farming systems elements in the study lay in exposing the key issues and research priorities perceived by national institutions to the critical discussion of farmers (and other key informants such as extension workers) in their own environment, in a range of differing circumstances.

The initial phase of the study (TORs 1 to 3) was carried out mainly in Harare and involved detailed discussions with relevant organisations to:

- review past and present activities relevant to DAP (see Appendix 4); and
- discover senior level perceptions of constraints and research priorities relating to DAP.

The subsequent phase of the visit involved meetings with officials and farmers at a Provincial level (see Appendices 5 to 7). Most of this phase was spent in Masvingo Province which includes the DRSS Chiredzi Research Station which is strongly supported by ODA, and the DRSS Makoholi Experimental Station where most of the DAP research in Zimbabwe has been carried out. Shorter periods were also spent in Midlands Province, where cotton is an important crop; and in Matabeleland North Province, where the DRSS Matopos Research Station has a mandate to study livestock production in semi-arid areas.

In the final week of the visit a workshop was held in Harare to discuss and debate the preliminary findings of the team with all interested parties (see Appendix 8). Final meetings were held to follow up possible opportunities for future collaboration with UK organisations. An interim report was completed before departure from Zimbabwe.

### 1.5 Approach to the study

Given the limited period of the visit, which had to include report preparation in addition to extensive background reading and a full programme of meetings and field work, the report is of necessity an overview. Descriptive findings and background information are largely confined to appendices while the main text of the report discusses the central issues and sets out research options for consideration by DAWG.

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## SECTION 2: THE BROAD PERSPECTIVE

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### 2.1 Zimbabwe in the context of southern Africa

Draught animal power is used for cultivation and transport throughout southern Africa. Animal traction is a well established technology in some areas, particularly where disease has not restricted the keeping of cattle and markets for cash crops are fairly well established. In other areas farmers have had little experience or opportunity to use draught animals in the past. Such farmers have carried out land preparation and cultivation by hand. Promotion of animal traction in these areas is seen as a way of greatly improving the quality of life of the farmers and their families. In Zambia, for instance, in the eastern and southern regions draught animals have been used for several generations and about 90% of smallholder farmers use them. However in the northern and central regions of Zambia few farmers use animal traction and it is regarded as a new but slowly increasing technology (Francis, 1988; Mwenya, 1991; Starkey, Dibbits and Mwenya, 1991).

Over recent years most of the governments in southern Africa have come to recognise the importance of draught animals as a source of power on smallholder farms. Draught animal power research and development issues now have a higher profile in agricultural development planning than in the past. Tractors are no longer regarded as the only answer to farm power requirements. In Tanzania for example *'the agricultural policy is to assist farmers in shifting from hand hoeing to a more productive mode using draught animals'* (Jumbe, undated). In Tanzania, Kenya and Zambia national networks have been set up to promote collaboration between projects concerned with draught animal issues.

Animal traction projects exist throughout much of southern Africa to promote the use of animal power. The Mbeya Oxenisation Project in Tanzania is a good example of such a project, set up in 1987 to *'promote smallholder agricultural development in Mbeya region through the development, production, marketing and extension of animal traction technology appropriate to smallholder farming systems'* (Jumbe, undated). The project collaborates with the extension branch of the Ministry of Agriculture and Livestock Development, the cooperatives and private enterprise to increase the use and understanding of draught animals for crop production and transport.

Research is being carried out very often within or alongside such projects financed by Governments, NGOs and outside donors. Relevant references to draught animal research and development in southern Africa are listed in the bibliography at Appendix 1. Issues being addressed include those of

nutrition, management and health of the animals, implements, wider uses of draught animals, cart design and methods to improve the transfer of technologies to the farmers.

*Animal Traction Network for Southern and Eastern Africa (ATNESA)*

This network was established in 1990. A workshop was held in Lusaka, Zambia in January 1992 with the theme of 'improving animal traction technology'. The main emphasis of the network is on information exchange between members and the network has an informal and hence flexible structure. Network activities proposed for 1992/93 (Starkey, 1992) included to organise formal or informal national animal traction networks in the regions, to collate regional information on animal traction, to facilitate the holding of small regional workshops on women and animal traction (held in Mbeya, Tanzania in June 1992), animal-drawn transport (in Zimbabwe in January 1993), use of donkeys (no progress yet) and tillage implements (planned for Tanzania in late 1992). The network provides a means of improving communication between animal traction programmes in the eastern and southern regions.

*International Livestock Centre for Africa (ILCA)*

ILCA has a regional office in Harare. One of its functions is to provide a link between regional scientists and those scientists working at ILCA. ILCA has a strong programme of research on animal traction. Their current research includes studies on draught cows and the nutrition and management of draught animals in semi-arid areas (ILCA, 1990). Exchange of information and experiences would be useful in strengthening a livestock and pasture component of a draught animal power research programme in Zimbabwe.

**The key issues in Zimbabwe**

Zimbabwe is one of the countries in southern Africa where the use of draught animals is widespread and long-established in much of the country outside tsetse-infested areas.

There are some 800,000 families in the communal sector in Zimbabwe for whom mixed farming is the main economic activity. Arable plots are small, commonly in the order of two or three hectares. Many but not all farmers own cattle, for which the main economic roles are provision of draught power, manure and milk for household consumption. In recent years the communal cattle herd has approached four million animals and stocking rates are approaching or exceeding carrying capacity. The current drought may reduce the cattle herd to nearer three million. Meanwhile, shortage of draught animal power is widely recognised as one of the principal constraints to increased crop production in the communal lands (Zinyama, 1988; Barrett, 1992).

Many authors have identified the importance of the crop-livestock interaction in Zimbabwean farming systems (Steele,

1981; Sandford, 1982; Shumba, 1984; GTZ, 1986; Avila, 1987; Steinfeld, 1988; Cousins, 1989; Scoones, 1990; Barrett, 1992). Ownership or access to draught animals correlates strongly with the amount of crop produced by the household. Increased yields are in part due to increased area cultivated and partly due to improvement in yields per unit of area, often due to more timely ploughing and planting (eg Shumba, 1984).

Other authors have described the animal power problem in Zimbabwe in some detail (eg Elliot, 1989; Tembo, 1989). At a fundamental level, the problem is an imbalance between supply and demand for draught animal power, which results in reduced crop production.

The scope for intervention to ameliorate the DAP constraint is summarised in Figure 1, which broadly separates factors measures to increase the supply of draught animal power from those which affect demand. These include:

### 2.2.1 Factors to increase DAP supply

#### NUTRITION

- \* extensive nutrition (not specific to draught animals):
  - grazing schemes.
  - veld reinforcement.
  - veld rehabilitation.
- \* intensive nutrition:
  - fodder legumes on fallows.
  - fodder legumes as intercrops.
  - planting of browse species on bunds or in lots.
  - improved use of crop residues.
  - use of commercial feeds (concentrates).

#### HEALTH

- \* strategic treatment of draught animals (eg deworming).

#### HERD MANAGEMENT

- \* increase offtake of unproductive animals.

#### USE OF ALTERNATIVE ANIMALS

- \* cows.
- \* donkeys.

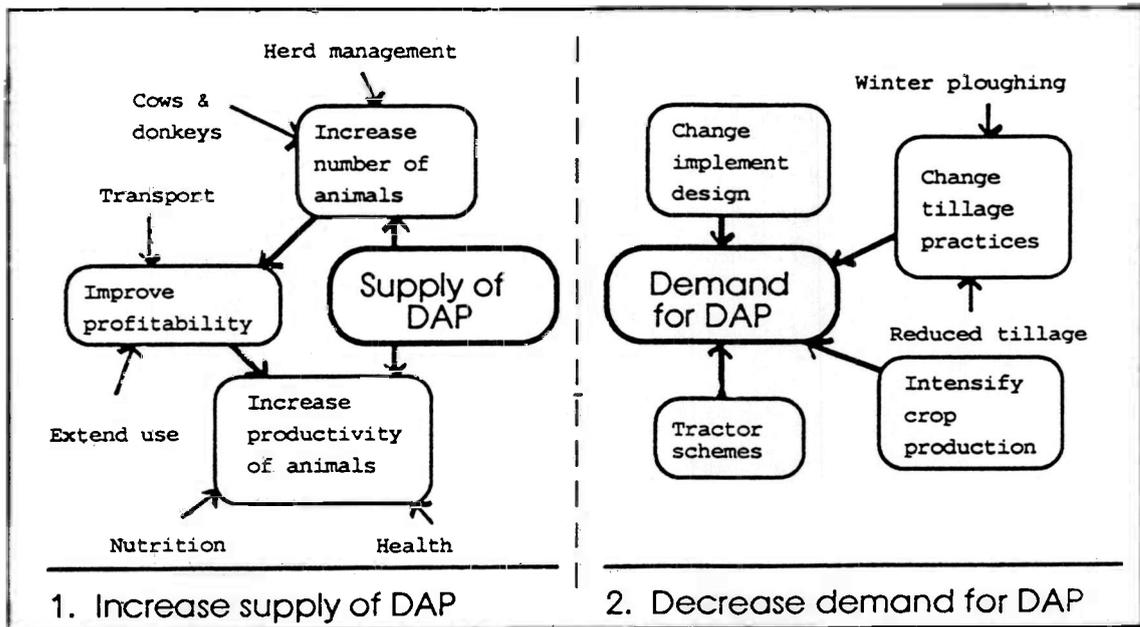


Figure 1: Opportunities to alleviate draught animal power shortage

#### IMPROVE DAP PROFITABILITY

- \* promote new uses of draught animals.
- \* promote inter-household draught transactions.

#### 2.2.2 Measures to reduce DAP demand

##### IMPROVE IMPLEMENT DESIGN

- \* reduce the draught requirement of implements.
- \* design implements which are more effective.

##### CHANGE TILLAGE PRACTICES

- \* develop and promote winter tillage systems.
- \* develop and promote reduced tillage systems.

##### INTENSIFY CROP PRODUCTION

- \* enable households to meet food needs from smaller areas cultivated (eg small-scale irrigation, vegetable gardens).

##### TRACTOR SCHEMES

- \* promote and support the use of tractors in situations where this is feasible and appropriate.

### 2.2.3 DAP implications of soil and water management

The above measures are all concerned with reducing draught animal constraints in the communal lands. It is important to be equally aware of other development initiatives which may aggravate the draught animal power shortage: in particular, the promotion of soil and water conservation. The construction and maintenance of contour bunds and other conservation work increase the demand for farm power. The adoption of tillage techniques such as tied ridging also increases the demand for DAP. On the other hand, certain minimum tillage practices, combined with water-harvesting techniques can reduce energy demand. It is important that the DAP implications of soil and water management measures are understood and are taken into account in the design of soil and water management projects.

### 2.3 Discussion

It was easy to compile a list of possible interventions which affect the DAP constraint: the more challenging task is to decide which of these measures have the greatest prospect of widespread impact. At present Zimbabwe does not have an agricultural mechanisation strategy that might set out how limited research funds should be allocated between the various potential areas of investigation. The concern of the present team was to establish where there is a need for strategic rather than adaptive (country-specific) research, and to assess which of such strategic research opportunities are appropriate for ODA/NRED funding. The remainder of this report considers such issues.

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## SECTION 3: RESEARCH OPPORTUNITIES AND PRIORITIES AS PERCEIVED BY CENTRAL INSTITUTIONS

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### 3.1 Introduction

The research priorities perceived by central institutions are reflected by their past and present projects and programmes, which are examined in this section. More detailed background information is provided in Appendix 4.

Much of the past livestock research carried out in Zimbabwe has concentrated on addressing topics relevant to the commercial farming sector. It is only since independence that there has been a shift in research resources to consider the problems facing farmers in the Communal Lands, where draught animal power has an important role. Hence specific research on draught animal power in Zimbabwe is a relatively recent undertaking, although it has long been recognised that animal traction is an important function of cattle in the communal lands (e.g. Danckwerts, 1974).

Most of the technical research relating specifically to draught animal power has been undertaken by scientists working at the DRSS Makoholi Experimental Station, at the Institute of Agricultural Engineering (IAE), Hatcliffe, which falls within AGRITEX, and at the University of Zimbabwe.

### 3.2 Research relating to the supply of DAP

Research relating to animal productivity has focused largely on addressing nutrient supply, both for livestock generally in the communal lands (through extensive range studies) and for draught animals specifically (through studies of strategic supplementation using crop residues and concentrates).

Current research at Makoholi centres on the use of alternatives to draught oxen. Donkeys have been compared with oxen in on-station 'performance tests' and the effect of work on productivity of cows is under investigation. At Matopos a study of the grazing behaviour of local donkeys marks the start of a programme to study the role of the donkey in local farming systems. Other livestock research by DRSS while not directed specifically at draught animals does have relevance as it aims to improve the nutrition and husbandry of communal land livestock. Further information on all these projects is given in Appendix 4.

Close contact is maintained between DRSS and AGRITEX in determining research needs. This has been formalised through a Committee for On-farm Research and Extension (COFRE) set up six years ago and reviewed recently (Shumba, Waddington and Navarro, 1990). Projects have tended to address the problems

of the small-scale commercial farmers, who are able to make use of inputs such as feed supplements, improved seeds, fertilisers and herbicides, rather than those of the poorer farmers in the communal lands, many of whom are more concerned with risk management than maximising production. Recent on-farm projects include evaluation of the use of stover and protein blocks as winter feed for draught cattle. Other AGRITEX projects have involved feasibility studies of grazing schemes, veld reinforcement techniques, fodder intensification, agroforestry and storage of crop residues.

The main constraint to on-farm research is seen as finance. For example the 1989/90 report of the Livestock and Pastures Subcommittee of COFRE noted that few livestock and pasture projects were being submitted and that most were coming from AGRITEX with only two out of 20 from DRSS. DRSS gave budgetary problems and shortage of supervision as constraints. The subcommittee felt there was *'a need for more information on how donkeys fit into the farming systems and especially their use to provide draught'* (COFRE, 1989).

#### *On-station facilities for draught animal research*

Makoholi has excellent facilities for on-station draught animal research with spacious animal holding pens, 14 functional metabolism stalls, other individual animal holding pens for monitoring food and water intake, plenty of land for working, a cattle weighscale, smaller weighing scales and a drying oven. Laboratory facilities for sample analysis are lacking. Samples for feedstuff analysis can be sent to Matopos, but there is currently a backlog of samples awaiting analysis in their laboratories.

Matopos Research Station too has excellent facilities, laboratories and staff qualified to carry out livestock research. They have a small group of resident donkeys as well as crossbred cattle which could be used for draught animal research studies.

Training courses in animal traction are offered by the Agricultural Engineering Training Centre at IAE, Hatcliffe. Details are given in Appendix 9.

#### *The Department of Veterinary Services (DVS)*

The DVS emphasises the importance of draught animal power in the communal farming sector. Field and research programmes are in general directed at the potentially epidemic, life threatening diseases in Zimbabwe which are not specific to draught animals. Research into better diagnostic methods, vaccine production, disease control programmes and epidemiology have left little scope within the budget for attention to tactical interventions relating to livestock production, such as strategic deworming. Nevertheless DVS recognises the importance of considering the impact of diseases on livestock productivity, particularly now that the cost recovery of veterinary services is planned.

The Regional Tsetse and Trypanosomiasis Control Programme (RTTCP) is currently investigating strategic control of trypanosomiasis in draught cattle for the working season (Connor, 1992).

Plans are in-hand to establish and strengthen a Veterinary Epidemiology and Economics Unit within the DVS headquarters which might receive bilateral aid support from ODA. Such a unit would be an excellent base from which to investigate the relationships between work and disease and the impact, and economics, of tactical veterinary interventions not just in draught animals but in beef and milk animals too.

### 3.3 Research relating to the application of DAP

Whereas research into the characteristics of the power source has been the general responsibility of DRSS, the application of draught animal power (DAP) has been investigated mainly by AGRITEX. The majority of such projects have been based at the IAE, often in collaboration with the other organisations at the Hatcliffe site (see Appendix 4 and Table A10.4).

The role of the IAE is to provide agricultural engineering research, testing, development, training and extension services to meet the agricultural engineering needs of the agricultural and associated sectors within Zimbabwe. Communal farmers are currently the priority target group.

The DAP activities at the IAE are undertaken in the context of the overall farm power situation and so exist alongside projects concerned with human labour and tractor power. The principal aim underlying these projects is the control of soil erosion and run-off and so the emphasis of the DAP projects towards soil and water management would be expected.

Other Zimbabwean organisations have been involved to a lesser extent in research into the application of DAP. These include the DRSS, most prominently, and the University of Zimbabwe. Provincial AGRITEX offices have also been involved with the application of DAP through programmes such as the GTZ-funded Coordinated Agricultural and Rural Development (CARD) project in Gutu District (see Appendix 4). COFRE exists to provide an active interchange of information between research and extension. Thus a reasonably good level of communication is achieved between the groups involved.

The DRSS with its responsibilities for (i) livestock and pastures research and (ii) crops research (the Institute of Agronomy - now incorporating the Farming Systems Research Unit) is interested in both work output from the livestock performance point of view and also the application of DAP to crop production. The crops research programme includes an ODA-funded project, being undertaken by the Silsoe Research Institute, to research innovative techniques for tillage, weed control and soil management. This project is complementary to the GTZ/AGRITEX Con-till project in the Soil and Water Conservation Branch. A recent review of the ODA project (Ellis-Jones and Riches, 1992) has recommended that

greater attention be paid to the DAP (and human labour) aspects.

Other DRSS activities relating to the application of DAP have recently included a farmer survey by the Chiredzi Research Station (Brown and Kamba, 1992) or have fallen within the remit of the FSRU. These have included, in the past, some widely accepted work on crop-livestock interactions (eg Shumba, 1984 and 1985; Avila, 1984) and now major surveys by the FSRU in Chivi and Mangwende (eg see Chikura, 1992). Subjects of interest to the FSRU include farmer decision-making and the use of a ripper tine in collaboration with CIMMYT (this is different from the ripper tine developed in the Con-till project).

At the University of Zimbabwe a strong initiative in the Department of Soil Science and Agricultural Engineering to set up a multi-disciplinary DAP research team was reported by Tembo (1989), but it appears that interest was not sustained. The Development Technology Centre (DTC) at the University has a passing interest in DAP; DTC may encourage research but does not actively pursue it.

#### Other relevant activities

The Intermediate Technology Development Group (ITDG) has undertaken a series of surveys on rural transport, which has included the use of animal draught for pulling carts, but not for pulling tillage implements.

Tractors can alleviate the DAP demand. A French aid project was set up to determine the conditions for the successful introduction of tractor mechanisation in the communal lands in particular (Fousse, 1989; Wirbel, 1989). Promising results were reported where there were good rainfalls, but tractors were regarded by farmers primarily as substitutes for oxen, rather than offering additional options. Hire services from the District Development Fund (DDF) are currently suffering from a lack of co-ordination and from under-funding, leading to inefficient utilisation of a depleted fleet of tractors.

The manufacturers of animal-drawn implements naturally express interest in improving their products but apparently have no budgets for research and development (e.g. see Dube, 1989).

#### Discussion

While there is research activity in Zimbabwe in most topics areas affecting the supply of and demand for DAP, the overall emphasis seems to be upon **animal nutrition and reduced tillage farming methods**. Thus these areas are perceived by the team to be the research priorities of central institutions.

In general a close relationship between research and extension is evident at the project level, especially in government departments. This is reflected by the level of

recent and regular activity of COFRE. Diagnostic surveys are a long-established feature of planning research and extension in Zimbabwe.

On the other hand, there is no clearly defined overall strategic plan of research, such as has been developed for example by ODA (the Renewable Natural Resources Research Strategy). This situation may change in the near future, through implementation of an Agricultural Services Project to be implemented by the Government of Zimbabwe under the auspices of a World Bank loan. A previous plan to develop a mechanisation strategy in 1990 was abandoned because of lack of government support. (J. Morris, personal communication).

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## SECTION 4: RESEARCH OPPORTUNITIES PERCEIVED BY FIELD STAFF AND FARMERS

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### Introduction

An agenda of DAP research options in Zimbabwe was readily established following the team's review of the research projects being carried out by central institutions and following discussions with senior staff in these institutions.

Unless they have extensive experience, particularly in the field, researchers often lack a broad vision of the needs of rural farmers. This is where field workers have a very useful background, being able to see the relative merits and degree of likely farmer interest in different types of intervention, and in different circumstances.

The next stage was therefore to talk to government field staff and farmers about the problems and prospects associated with the various interventions relating to DAP that had been identified. The findings from such discussions and meetings are summarised in this section, and presented in more detail in Appendices 5 to 7. Relevant background data on the areas visited are presented in tables and figures in Appendix 10.

### Perspectives of field staff

#### 4.2.1 Masvingo Province

More time was spent in Masvingo Province than in other areas outside Harare and accordingly more emphasis must be placed upon findings in this area.

Meetings were held with all of the senior staff in the Provincial Headquarters offices in Masvingo. The team was invited to sit in on a Provincial meeting at which all of the District Agricultural Extension Officers were present. All of the officers completed a short questionnaire (reproduced with results in Appendix 5) which was intended partly to familiarise the team with local practices and partly to focus subsequent discussion on relevant issues.

Discussions were also held with AGRITEX staff at District offices in the areas where field work was carried out, including Chivi, Gutu and Bikita.

The team was invited to sit in at a meeting of all the extension workers in Gutu district, who were assembled for a management course. Information and views were collected using a questionnaire, the results of which are presented in Appendix 6. This was followed by a lively discussion of

problems and prospects associated with different measures to reduce draught animal shortage.

The remainder of this sub-section is the team's synthesis of the general views of field-level staff.

#### *Nutrition and health*

The main area of present farmer interest is in the use of crop residues, which are already widely collected and stored at the homestead for winter feeding of cattle, especially draught animals and dairy animals. The main interest is in maize stover. However, as a result of increasing grazing shortages farmers are looking at ways to reduce storage losses and are looking at less traditional residues such as those from small grains and vegetable gardens. There is a potential conflict between the use of such residues for feed versus manuring: either through direct ploughing into the field, or by use as bedding in the cattle kraals. Field staff felt that more information was needed concerning the nutritional and storage characteristics of stover from different crop varieties.

Grazing schemes were also considered to be of some interest to farmers. However, this interest is frequently based on reducing herding labour rather than in improving veld condition and livestock productivity, which are the usual objectives of government extension staff. Because of the cost, farmers are interested usually only where an outside agency provides financial support to provide fencing.

At present measures to produce fodder crops are not widely of interest to farmers, partly because their production competes for scarce land and labour required in production of food crops. Also the benefits of such measures are questionable; in a good year there is likely to be sufficient grazing for animals. Furthermore, various problems are associated with production of fodder crops. For example, where fodder legumes are sown on fallow fields such areas traditionally become communal grazing land after the food crops are harvested. Unless some community agreement is reached to alter traditional land tenure arrangements, farmers are likely to be interested only where fodder crops can be harvested for storage at the homestead.

Farmers are not widely interested in spending money to improve animal condition, through the purchase of commercial concentrates or drugs (eg for deworming). However, there is a small but growing proportion of farmers who have a more commercial attitude to their cattle and who purchase some inputs.

### *Use of alternative draught animals*

There was a consensus that donkeys are becoming increasingly important as a source of DAP for field work, including both ploughing and weeding, particularly in the more arid parts of Zimbabwe which are a priority for ODA support. While they are not as large or therefore as powerful as cattle, donkeys are more hardy and are still able to plough in bad years when cattle are too weak. Their use in transport is already widely accepted. Views were expressed that donkeys are easier to handle and survive droughts better than oxen. Field staff thought that more attention should be given to donkeys as draught animals in both research and extension programmes, in particular in relation to proper harnessing and development of appropriate implements with a reduced draught requirement. This is considered further in section 5.3.

Views on the use of cows as draught animals differed widely among field staff, in relation to both current extent of use and also whether such use was increasing or decreasing. The overall impression was that cows were less important than donkeys as a potential additional source of draught animal power, but this conclusion should be viewed cautiously: it was clear that many field staff had an underlying conviction that cows should not be used as draught animals.

### *Implements and tillage practices*

The problem of implements was characterised more as a inadequate availability rather than poor design (this conflicts to some extent with findings of farmer meetings) except in the case of the ridger and planter. The ridger was considered to be too heavy, and the planter simply does not work very well.

Winter ploughing has been widely adopted and is considered a success story in Zimbabwe. Use is generally increasing, where farmers have access to draught animals and implements.

Reduced tillage has not been widely adopted, despite much government promotion. This is mainly because of increased problems of weeding compared with conventional ploughing.

#### 4.2.2 Midlands Province

Meetings held with field staff in Gweru (over two days) were less numerous than in Masvingo Province. These meetings added weight but did not extend the above findings. However, useful insights were provided by Mr Mupeta (Provincial AEO) who had previously carried out research on draught animal power at Makoholi under the auspices of an MSc project (see Appendix 4.3).

Mr Mupeta emphasised that the problem in Zimbabwe is not one of shortage of draught animals, but rather of their poor condition. Indeed, at a national level it can be calculated that each draught animal has to plough in the order of only

one hectare per year (ie four or five ha per span of four animals). This would be easily feasible if animals were in good condition and those farmers who have many animals would make them available for use by farmers who do not own cattle. Indeed, it would be better to try to reduce the size of the cattle herd and have fewer animals in good condition than the present situation of keeping many animals too weak to plough.

This perspective is very important, and points to the need both to try to organise cattle owners groups to control livestock numbers more effectively, and also to emphasise research and development aimed at improving livestock nutrition. It also underlines the importance of promoting inter-household transactions in draught power, so that the currently available animals are used to full effect. The problems with and prospects for such an initiative are only poorly understood at present. Scope for investigation in this area is considered further in section 5.2.

#### 4.3 Findings from farmers meetings

A total of seven group meetings were held with some 200 farmers in the Districts of Gutu, Chivi, Bikita, Lower Gweru and Ntabazinduna. Two meetings with individual farmers were held in Chivi District. The findings from these meetings are presented in more detail in Appendix 7.

One of the reasons for these meetings was to help the team attune to farmer level perspectives on DAP constraints and opportunities. This was an essential learning exercise on the part of the team rather than original research. While the team had requested that a representative cross-section of each community be represented at these meetings, those attending were selected firstly by the local Extension Worker and secondly by self-selection (ie the better motivated farmers were likely to attend). Accordingly some of the information about the general farming system presented in Appendix 7 (particularly the quantitative data) must be treated with caution.

Apart from team orientation, the second (and more important) objective of these farmer meetings was to solicit views on the problems and prospects for the possible DAP interventions which had been discussed with central institutions and government field staff.

In general farmers echoed the views of field staff, which reflects the close and effective relationship of such staff with the farmers with whom they work.

Some useful additional information was collected. In particular, it was clear that different villages had very different views on the scope for different types of intervention, reflecting a wide range of site-specific circumstances. Among these, agro-ecology was an important factor. In lower rainfall areas there was interest in the use of donkeys, but not everywhere: for example in lower Gutu donkeys were hardly kept at all because of difficulties with

straying of donkeys and the serious problem of attacks by hyenas in this area. In higher rainfall areas there tends to be a higher interest in approaches such as fodder cropping. Interest in modified tillage practices varied according to rainfall pattern and soil characteristics. Population density and the relative constraints upon grazing and arable land often affected farmer interest in different interventions.

This heterogeneity in farmer circumstances has very substantial implications for the design of appropriate agricultural extension programmes, and the related adaptive research projects which back up such extension work. This issue is considered further in section 5.2.

Farmers in several locations reported problems with the local design of plough, and often expressed a desire for tillage implements for animals of limited draught capability (small local breeds of cattle; weak cattle; cows; donkeys) which are more suitable than those currently available in Zimbabwe (see section 5.3).

Overall, it was concluded that the average farmer is not very interested in measures which will significantly increase the demand upon land, labour or cash. Changes to tillage practices which would alleviate such demands are likely to be of considerable interest. Measures to improve animal nutrition are likely to be of widespread interest if they do not involve cash outlay or increase labour demand at times of existing peak demand. This suggests that improvement in crop residue utilisation could be an area of potential farmer interest and is taken up in section 5.2.

While smallholder farmers in Zimbabwe are driven mainly by risk management rather than profit maximisation, there is a small but emerging group of communal farmers who are becoming more commercial in their attitude to crop and livestock production. This group is likely to become more significant in number and influence in the future, and may merit a focus of research and extension assistance if such assistance is to be directed where impact is most likely to be achieved. This point is taken up in section 5.2.

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## SECTION 5: CONCLUSIONS AND RECOMMENDATIONS

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### 5.1 Priorities for research and extension in Zimbabwe

In identifying the options for DAP research which might be funded by ODA under the NRED Livestock Programme, the team differentiated between Zimbabwe-specific adaptive research and strategic research which would be of more widespread application. For example the research needed into relationships between animal nutrition and health, draught performance and other aspects of productivity is wide ranging but much of the work required in Zimbabwe is adaptive in nature. This is true also of much of the work needed into relationships between tillage practices and draught animal requirements.

Thus the two research projects proposed below at 5.2 and 5.2 do not reflect the overall research priorities in Zimbabwe, but specifically the strategic research needs appropriate for ODA/NRED funding. Thus, the research options have been identified with a particular emphasis on ODA's policy objectives, which include the needs of poor people and of women in particular. Emphasis was also placed upon development needs in semi-arid areas. Consideration was given to whether the institutional framework exists for transferring the findings of research into effective extension programmes and, if appropriate, development projects. Consideration was also given to the comparative advantage of the UK to support research in the proposed areas, and whether other donors or international research centres are already actively working in such areas.

#### 5.1.1 The areas of potential intervention

##### *Nutrition*

While improvement in animal nutrition appears to be an important area for research and extension in Zimbabwe, there may be only limited scope for strategic research appropriate for NRED funding.

Range management, herd management, grazing schemes and other issues relating to extensive nutrition are all in need of investigation, but such issues are not sufficiently specific to draught animals to warrant further consideration here.

In relation to intensive nutrition, many farmers are already using most of the crop residues which are readily available and are unlikely to be interested in using purchased supplements. Organisations such as ICRISAT are already working on improved use of crop residues and most of the research needed in Zimbabwe is probably adaptive in nature. There is probably scope for some limited work in this area,

but more systematic survey information on current practices and constraints in a range of different locations would be required before an appropriate line of scientific investigation can be proposed.

The ordinary communal farmer in semi-arid parts of Zimbabwe does not appear very interested in fodder legumes, as fallow crops, fodder banks, intercrops or relay crops. Given the wealth of existing information and past research which has had such limited impact, further strategic scientific research does not appear warranted without a much better appreciation of the farmer's perspective on this type of intervention.

#### *Animal health*

The same arguments apply in relation to animal health: the basic problems and the required interventions are in principle understood, but the development of specific recommendations appropriate to particular locations will require a better understanding of site-specific circumstances, and how these vary from place to place and from year to year.

#### *Alternative draught animals*

There is much scope for research and extension into the use of draught animals alternative to the ox, including donkeys, cows and immature cattle of both sexes. The main scope appears to relate to donkeys and cows. Since the use of cows for draught purposes is already being investigated by ILCA, this does not appear to be an appropriate area for a new initiative by ODA. On the other hand, donkeys are not being adequately studied by any other organisation, and the UK has a strong comparative advantage for developing research into equines. This advantage lies largely in the experience of staff at CTVM, although NRI has also been involved in surveys of donkey production and utilisation in tsetse-affected parts of southern Africa (Munn, 1991). Accordingly, research into donkeys has been proposed (see section 5.3).

#### *Implements and tillage practices*

There is considerable need for research relating to tillage implements and practices, but most of the required research is adaptive. Existing techniques and implements need to be modified to meet the needs of specific local circumstances.

The one area where a strategic (ie generalised) need was identified concerned the widespread demand for implements suitable for animals of reduced draught capability - firstly donkeys but also for cows and otherwise weak oxen (eg as a result of drought). It was also suggested but not confirmed that communal cattle in Zimbabwe are today significantly smaller than in the past: perhaps because larger animals have been selected out of the herd during episodic droughts or for commercial offtake for beef production; or perhaps increasingly stunted because of poorer nutrition and greater

stress. The overall message was that available implements are not suited to the weak animals currently owned by farmers.

#### *Inter-household draught animal transactions*

The team had concluded that while there was little scope for persuading the average farmer to intensify the production of his draught animals, there exists a small group of more entrepreneurial for whom the hiring out of their draught animals provides a regular income. It was considered that targeting such a group for specific extension advice would promote the local availability of draught animal power (discussed in more detail in Appendix 8). If the extension service would be prepared to organise and assist contract ploughing groups, it would be worthwhile to develop a more ambitious programme of strategic research aimed at such groups.

However, there is comparatively little known about existing practices relating to inter-household transactions in draught power, much of which takes place on a non-cash basis: eg on a reciprocal labour basis or through family obligation. More systematic information on present practices is required before implementing major changes to current research and extension programmes (see section 5.2).

#### 5.1.2 Development of the proposed research projects

The findings of the team as set out in the earlier sections of this report were presented to a workshop held in Harare on 17 August, along with a preliminary list of four proposed areas of strategic research:

- \* evaluation of the role of the donkey as a draught animal;
- \* evaluation of animal drawn implements with respect to reduced draught power;
- \* the health and nutrition of oxen used for contract ploughing; and
- \* identification and characterisation of recommendation domains for research and extension relating to DAP.

The majority of government staff in headquarters and provincial offices who had been involved in the study attended and participated actively in the workshop, as summarised in Appendix 8.

In the days between the workshop and the team's departure from Zimbabwe, further discussions were held with the Zimbabwean institutions with whom future possible NRED-funded DAP projects might be implemented. On the basis of the workshop and subsequent discussions with relevant organisations in Harare, the four projects presented at the workshop were subsequently revised to comprise three proposals (the last two were combined). The three proposals

corresponded to the three counterpart organisations who would be involved (DRSS, IAE and AGRITEX, respectively) in closely related but largely discrete pieces of work.

A draught report incorporating the three proposals was presented to a meeting of DAWG in London on 7 October 1992. The main outcome of that meeting was to reformulate the three proposals as two proposals for strategic research projects which ODA could fund and carry out in collaboration with Zimbabwean institutions. These proposals are set out below. This does not preclude the possibility that the proposed research could be carried out elsewhere in southern Africa, if more appropriate.

The first project (outlined in section 5.2), comprises components closely relating to the second project (outlined in section 5.3), including systematic diagnostic surveys relating to donkey ownership, implement ownership, tillage practices and so on. If the first project does not take place before or at the same time as the second project, it would be appropriate to transfer the appropriate components from the second to the first project.

## 5.2 Identification and characterisation of recommendation domains for research and extension relating to DAP

### *Objectives:*

To improve the design and implementation of research and extension programmes relating to draught animals and their use in smallholder mixed farming systems in southern Africa

### *Background:*

The scope for interventions to reduce the problem of draught animal shortage in agropastoral farming systems covers a wide range of measures relating to animal nutrition, animal health, changes in tillage practices, promotion of donkeys and cows, promotion of contract ploughing and other options. The potential impact of the different interventions varies considerably from one location to another, reflecting a complex of factors including rainfall pattern, soil type, land pressure, off-farm income levels, off-farm employment rates and other socio-cultural and economic factors.

A diagnostic approach to identify research and extension needs specifically relating to draught animals would need to be interdisciplinary beyond the normal extent of farming systems research in Zimbabwe. The proposed project would attempt to develop such an approach. This would involve identifying and characterising distinct *recommendation domains* relating to DAP: ie target beneficiary groups with particular research and extension needs. Such domains may be of a geographical nature: for example, certain tillage techniques would be recommended in certain districts. The domains could also represent social groups: for example there may be specific problems and associated extension programmes

needed for women farmers, or for farmers engaged in contract ploughing.

*Benefits:*

Government resources in southern Africa should be allocated to research and development would be targeted more effectively. ODA's strategic research programme relating to draught animal power would have a much firmer basis for future direction.

*Project activities:*

- \* To review and evaluate existing data held by AGRITEX potentially relevant to the characterisation of DAP recommendation domains in a selected pilot area (proposed to be Masvingo Province).
- \* To carry out rapid appraisal diagnostic studies at selected sites in the pilot area in order to delineate preliminary recommendation domains and to explore the range of issues discussed in the present report.
- \* To organise, supervise and evaluate a short questionnaire survey to be administered at sample locations throughout the pilot zone, to obtain systematic quantitative information on the relevant issues.
- \* To organise, supervise and evaluate longitudinal monitoring studies to be carried out at a small number of carefully selected sites.
- \* In collaboration with AGRITEX and DRSS, identify appropriate research projects and/or on-farm trials in association with the recommendation domains which have been identified and characterised.
- \* Where appropriate, supervise and evaluate on-farm trials which have been planned and implemented under the auspices of the project.

*Inputs:*

To be discussed with NRED programme managers, possibly including not only Livestock Production but also Animal Health; Agronomy and Cropping Systems; Agricultural Engineering; Socioeconomics; Livestock Protection. And to be defined with further liaison with the proposed Zimbabwean counterpart organisations.

*Output:*

A tested methodology for improved planning and appraisal of research and extension activities relevant to draught animal production and use in southern Africa. Output would be disseminated as official reports, journal publications, and through workshops.

### 5.3 Improved crop production by better use of donkeys cattle of limited draught capability

#### *Wider objectives:*

To provide research and extension organisations with basic information and practical techniques required to develop appropriate adaptive research projects and extension messages. This information will be used to provide advice to poor farmers to increase the effective use of donkeys and small/weak cattle in semi-arid areas where insufficient draught power is an effective constraint to crop production and crop marketing.

#### *Specific objectives:*

- 1 To test and/or develop simple methods which farmers can use to estimate weight and body condition and hence feed requirements and draught potential of donkeys in Zimbabwe.
2. To provide basic information on the work capacity, feed requirements and responses to management inputs (feeding, health care, working practices) of donkeys in smallholder mixed farming systems in sub-Saharan Africa
3. To identify and/or develop tillage implements and practices that are suitable for donkeys and cattle of limited draught capability.

#### *Background:*

In many parts of southern Africa, shortage of draught animal power is a constraint to increased crop production and thus a constraint to household food and income security. In semi-arid areas, for poorer households without access to oxen (including many women-headed households) and for a large number of ordinary farmers in years of drought, the use of donkeys and cattle of limited draught capability represents the only alternative to hand tillage. There is some evidence that the proportion of donkeys and cows used for draught is increasing in sub-Saharan Africa relative to the use of oxen. In addition, donkey numbers and their use as draught animals have increased in recent decades in southern Africa.

In developing strategies to alleviate the shortage of draught power for cultivation the options include firstly to extend the use of animals to include younger animals, cows and donkeys as well as adult oxen. As the evidence above indicates the farmers are already starting to do this in southern Africa. Secondly, the draught requirements for crop production can be reduced through the use of low-draught implements and fewer tillage practices.

While Government research and extension agencies in most sub-Saharan countries are giving attention to reduced tillage practices to improve soil and water management, and to

increased nutrient supply for draught oxen, virtually no attention is being given to the potential for use of animals of limited draught capability. One exception, however, is the Conservation Tillage Project of DRSS, in collaboration with SRI, which is looking at reduced energy input systems for semi-arid crop production. Basic information on requirements and outputs of donkeys, the effects of work on donkeys and smaller/weaker cattle and the suitability of current implements for this class of animal is necessary to produce models to develop or critically evaluate possible extension messages for farmers in the wide range of situations found in southern Africa.

*Benefits:*

The ultimate beneficiaries will be poor farmers in semi-arid Africa who will receive appropriate advice from extension agencies concerning how to improve their management of donkeys and cattle of limited draught capability and their role to increase crop production.

The intermediate beneficiaries will be national research and extension agencies, who will be provided with basic information required for the development of appropriate strategies, policies and programmes relating to donkeys and cattle of limited draught capability.

*Project activities:*

To test methods to estimate live weight from body dimensions using Zimbabwean donkeys and to develop a system of condition scoring for donkeys using Zimbabwean donkeys. (This will complement studies in North and West Africa).

An on-farm monitoring study of donkeys in Natural Regions III, IV and V to look at seasonal variations in live weight, body condition, health status (helminths; blood parameters and hooves), feed resources (see iii below), and use of donkeys. Some use will be made of post-mortem and slaughter house material where appropriate. Collaboration is envisaged with DVS in particular and the work will link with relevant components of project 1 (section 5.2).

iii Experimental studies in Zimbabwe will be carried out in collaboration with Matopos and Makoholi Research Stations, IAE and AGRITEX to:

\* establish the complementarity of donkeys with cattle and goats in the use of available grazing and browse.

\* quantify daily work potential of donkeys under different work schedules, planes of nutrition and disease status on-station and on-farm to provide

information for the production of management guidelines and implement requirements.

- \* test on-station the suitability of implements available in Zimbabwe for animals of limited draught capability, followed by validation trials on-farm. Potentially suitable foreign implements (if appropriate) will also be tested.

- \* develop and test design modifications to reduce draught requirements with minimal compromise to work quality, evaluating the effects of significant reductions in work quality where these are unavoidable.

- \* propose methods of introducing potentially suitable implement designs to the Zimbabwean market.

#### *Outputs:*

The project should lead to definition of simple research methodologies relevant to donkeys, and should provide basic information of work performance, management requirements and health care of donkeys. The work on implements should provide details of implement performance characteristics, methods for reducing implement draught requirements, and identify implements suitable for donkeys and cattle of limited draught capability.

The information resulting from the work will be disseminated as research articles in the scientific press, conference papers, popular articles, extension and teaching leaflets, with probably short practical guides.

The project is expected to lead to greater collaboration between agricultural engineers, researchers and the implement manufacturers in the identification and production of appropriate implements.

#### *Inputs:*

To be discussed with NRED programme managers, probably Livestock Production, Animal Health and Agricultural Engineering. The project is estimated to cost approximately £300,000 spread over a three to four year period. The precise budget can only be defined after detailed consultation with the proposed counterpart organisations in Zimbabwe.

#### **5.4 The next steps**

This report is to be distributed to all members of the ODA Draught Animal Working Group and to the appropriate institutions in Zimbabwe.

Several DAWG members including some (possibly all) of the present team are expected to be in Zimbabwe in January 1993 for an international workshop. Subject to comments invited

from the appropriate Zimbabwe institutions, it is recommended that the project concept notes included in this report are worked up to the stage of draught project memoranda at the time of that visit, and submitted to the Livestock Production and Nutrition Programme Manager for circulation to the Advisory Committee by the end of February 1993.

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## APPENDIX 1: BIBLIOGRAPHY

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Items included in this bibliography are not necessarily cited in the report. The aim was to put on record the literature identified and consulted by the mission, for possible reference by future workers in this area.

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## APPENDIX 2: LIST OF PERSONS AND ORGANISATIONS CONTACTED

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### Department of Research and Specialist Services:

#### Headquarters, Harare:

Mr R Fenner, Director.  
Mr P Nyathi, Assistant Director (Livestock and Pastures).  
Mr E Shumba, Assistant Director (Crop production).  
Mr B Mombeshora, Head, Farming Systems Research Unit.

#### (B) Makoholi Experimental Station:

Mr J Gambiza, Head of Station.  
Dr V L Prasad, Chief Research Officer, Animal Traction.

#### Provincial Office, Masvingo:

Mr B Mavudzenge, FSRU Research Technician

#### Matopos Research Station:

Mr T Smith, Head of Station.  
Mr G Calvert.  
Mr O Randi, Research Officer.

### AGRITEX

#### (A) Headquarters, Harare:

Mr G Tsododo, Assistant Director (Field Services).  
Mr J de Jong, Assistant Director (Specialist Services).  
Mr R Chitsiko, Assistant Director (Engineering Services).  
Mr D Sarupinda, Head, Monitoring and Evaluation Section.  
Ms P Huchu, Monitoring and Evaluation Section.  
Mr F Chinembiri, Assistant Chief Livestock Production.  
Branch.

#### (B) Institute of Agricultural Engineering, Hatcliffe:

Mr R Nazare, Chief Agricultural Engineer.

#### (C) Provincial Office, Masvingo:

Mr Maswaya, Chief AEO.  
Mr O Mugweni, Principal AEO (Field).  
Mr D Pagare, District AEO (Bikita).  
Mr G Mamhare, District AEO (Chiredzi).  
Mr M Mudofi, Acting District AEO (Chivi).  
Mr N Pambirei, District AEO (Gutu).  
Mr L Vengesai, District AEO (Masvingo).  
Mr D Ziso, District AEO (Mwenezi).  
Mr S Manhivi, District AEO (Zaka).

Mr P Mujuru, Agricultural Mechanisation Specialist.

At Chivi:

Mr Bunu, Extension Supervisor, Chivi.

Mr Chisi, Irrigation Scheme Manager, Chivi

At Gutu:

Mr Munodawafa, Gutai Specialist (CARD).

Ms Manyame, Pfumai Specialist (CARD).

Mr Dhliwayo, Extension Worker.

At Bikita:

Mr F Mutemachima, Acting DAEO.

Mr Muza, Extension Supervisor.

Mr Sherekete, Extension Worker.

GTZ/AGRITEX Coordinated Agricultural Rural Development  
Project (CARD), Gutu:

Mr Ngowe, ADA Project Co-ordinator.

Dr Loos, GTZ Technical Adviser.

Provincial Office, Gweru:

Mr J Zvishiri, Chief AEO Midlands.

Mr B Mupeta, Principal AEO.

Mr G Mahowa, Agricultural Mechanisation Specialist.

Mr F Fushai, Livestock Production Specialist.

Mr T Bepura, Conservation Specialist.

Mr C Dube, Land Use Planning Officer.

Ms D Shumba, Crop Production Specialist.

Mr S Moyo, Extension Worker (Ag. mech.)

(F) Provincial Office, Matabeleland North:

Mr C Khane, Senior Extension Supervisor, Ntabazinduna.

#### Department of Veterinary Services

(A) HEADQUARTERS:

Dr S Hargreaves, Director.

Dr U Ushewokunze-Obatolu, Assistant Director (Research)

Mr Dune, Chief Animal Health Inspector, Dipping.

(B) PROVINCIAL OFFICE, MASVINGO

Mr Tigere, Chief Animal Health Inspector.

Mr Makone, Senior Animal Health Inspector, Gutu.

#### Department of Animal Science, U.Z.

Prof J Topps, Head of Department.

Dr L Ndlovu, Lecturer.

Mr S Sibanda, Lecturer.

ZERO

Mr R Mpande, Secretary of the Animal Traction Network for Eastern and Southern Africa.

ITDG Zimbabwe

Mr E Dengu, Country Director  
Mr I Sunga.

Zimbabwe Institute of Development Studies

Dr S Moyo, Head, Dept of Agriculture and Rural Development.

AGROTEC

Ms A-C Sylwander, Socio-economist, UNDP/OPS Programme on Agricultural Operations Technology for Small Holders in East and Southern Africa, IAE Hatcliffe.

Regional Tsetse and Trypanosomiasis Control Programme for Malawi, Mozambique, Zambia and Zimbabwe.

Mr D Lovemore, Regional Co-ordinator.  
Dr R Connor, Regional Trypanosomiasis Expert.

ILCA (Regional Office, Harare)

Prof J Kategile, Programme Liaison Officer for Eastern and Southern Africa.

Village leaders and elders at farmer meetings

Mhiti village, Chivi:

Mr Mhiti, VIDCO Chairman.  
Ms Murape, Kraal Head.

Tanyevenuka village, Bikita:

Mr Mukare, VIDCO Chairman.  
Mr F Chitika, Grazing Scheme Security Man.  
Mr Mungware  
Mr Sondomagaya  
Mr Chiriga  
Mr Munarwo

Chinai village, Gutu:

(names not collected)

Serima village, Gutu:

Mr Matizwa, Chairman of the Farmers' Group  
Mr C Nyamoenesu, Vice-Chairman.  
Mr C Runesu, Secretary.

Mr B Vengesa, Treasurer.  
Mr J Namoenesu, VIDCO Chairman.  
Ms G. Seche, Farmers' Group Policewoman.

Vukuuzenzele village, Lower Gweru:

Mr Nguve, Ward Chairman.  
Mr S Mukova, Member of the Ward Development Committee

Nkwenjani village, Lower Gweru:

Mr Sibanda, Ward Chairman.  
Mr Bepe, School Teacher

Ntabazinduna:

Mr J Maviva, Ward Chairman

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### APPENDIX 3: ITINERARY

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21 July	J Barrett arrived Harare.
21-25 July	Meetings in Harare.
25 July	D O'Neill and A Pearson arrived Harare.
25-26 July	Background reading over weekend.
26-29 July	Meetings in Harare.
July	Travelled to Masvingo.
30-31 July	Meetings at Makoholi and in Masvingo.
August	Background reading over weekend.
3 August	Meetings in Masvingo.
4 August	Field work in Gutu.
5 August	Field work in Chivi.
6 August	Field work in Bikita and Gutu.
7 August	Field work in Gutu
8 August	Return to Harare.
9 August	Sunday: day off.
10 August	Meetings in Harare.
11-12 August	Public Holidays: report writing.
12 August	Travelled to Gweru.
13 August	Meetings, Gweru. Field work in Lower Gweru.
14 August	Field work in Ntabazinduna and visit to Matopos Research Station.
15 August	Returned to Harare.
16 August	Prepared for workshop
17 August	Workshop at IAE Hatcliffe
18-20 August	Follow-up meetings and report writing
20 August	Departed from Harare.

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## APPENDIX 4: RECENT RESEARCH AND DEVELOPMENT PROJECTS ON DRAUGHT ANIMAL POWER IN ZIMBABWE

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This appendix provides supporting information relevant to the discussion of the research priorities of Zimbabwean institutions (see section 2 of the main text).

### A4.1 Department of Research and Specialist Services

The Department of Research and Specialist Services (DRSS) operates a number of research and experimental stations distributed throughout Zimbabwe. Research on draught animals has been carried out largely at the Makoholi Experimental Station, which is in natural region III/IV in Masvingo Province.

#### *Makoholi Experimental Station*

Dr V. L. Prasad in the Animal Production Unit has been largely responsible for the draught animal research at Makoholi. Studies of oxen and donkeys have been undertaken. Draught cows are currently being studied.

In 1988 a feeding trial was undertaken to look at the effectiveness of crop residues as a dry season supplement for draught oxen. Twenty four 35 month old Mashona steers (average animal live weight 275 kg) were grazed during the day at a stocking rate of 1 LSU/2.5 ha. From 1630 to 0700 h animals were penned in three groups of eight. One group (GP1) received no supplement, one group received 2 kg maize stover per animal (GP2) and one group received 1.5 kg maize stover plus 0.5 kg ground nut tops (GP3). The study was carried out in the late dry season of 1988. Live weight changes at the end of a 90 day feeding period were -16.5, -12.6 and -5.6 kg respectively for groups 1, 2 and 3. In a one hour 'ploughing test' after the 90 day trial the walking speed, area ploughed and work done by a span of four animals was higher in the two supplemented groups than in the unsupplemented one. It was concluded that regular dry season supplementation with crop residues is appropriate (DRSS, 1990a; Prasad, Khombe and Nyathi, 1992).

A survey of 95 communal farmers over natural regions III, IV and V in Masvingo and Midlands Provinces, was carried out in 1990 to establish the composition of the draught animal power used. The main conclusions were as follows. The proportion of draught animal power coming from cows and donkeys increased from natural region III to IV. The proportion of draught animal power from oxen increased as size of cultivated land holding increased. Figures for size and structure of households were not available.

A 'draught performance trial' was undertaken at Makoholi in which teams of four donkeys (mean animal live weight 120 kg) and four oxen (mean animal live weight 326 kg) were compared when pulling sledges producing a draught force of 950 N. Donkeys worked for two hours with this load before stopping, whereas oxen continued to work for another two hours. The experiment lasted a total of 10 days in April. The donkeys were slower than the oxen and produced less work during their two-hour period than did the oxen over the same period. A different team worked each day (DRSS, 1990a; Prasad, Marovanidze and Nyathi, 1991).

Twenty three of the 46 farmers using cows in the Makoholi survey complained of animal health problems or reduced birth weight and other reproductive problems in their draught cows (Prasad et al, 1991). The current draught animal research project at Makoholi is concerned with the impact of traction stress on production and reproduction of cows. Two groups of eleven cows (one group working and one group not working) have been monitored for two seasons. In the first season 10 out of the eleven cows in the unworked group conceived and gave birth to calves (average birth weight 22.3 kg). In the same season only six out of the worked group gave birth to calves (average birth weight 20 kg). Both groups received some supplementation in the dry season. The work is continuing (DRSS, 1990b).

#### *Matopos, Grasslands, Henderson and Chiredzi Research Stations*

Research on the nutrition of the Matabeleland donkey has recently been initiated on-station at Matopos in natural region IV. The first investigation is concerned with the grazing behaviour of donkeys on the veld. The times spent in grazing, browsing, resting and moving are some of the parameters being investigated.

Other livestock research at Matopos while not directed specifically at draught animals does have relevance as it aims to improve the nutrition and husbandry of communal land livestock. This research includes work on harvesting effects on the quality of millet and sorghum residues, on reinforcement of veld, on browse species and comparisons of growth and reproduction of local and crossbred cattle. Research on the utilisation of crop residues particularly from maize, and the development of legume based pastures is occurring at Grasslands in natural region II/III (DRSS, 1990ab). Work at Chiredzi in natural region V on the storage of crop residues will also indirectly benefit draught animals (DRSS, 1990ab). Livestock research at Henderson is less relevant to the communal draught animal, being largely concerned with the problems of the commercial dairy farmer.

#### *The Farming Systems Research Unit (FSRU)*

The Farming Systems Research Unit was set up in 1980 as an autonomous interdisciplinary unit reporting directly to the directorate at DRSS headquarters. It is responsible for designing or adapting research strategies, methodologies and

programmes of work, with field teams in two areas, Chivi and Mangwende, selected as study sites (Mombeshora, undated). The FSRU works closely with AGRITEX in monitoring on-farm projects. In the mid 1980s thorough investigations were carried out into crop and livestock interactions (e.g. Shumba, 1985) to identify on-farm research priorities. Since then the following studies on the use of draught animals have been reported:

In November 1984 on-farm trials in Mangwende were initiated to study the effect of feeding maize stover, with a protein block, on the performance of draught cattle. Mangwende was selected as it was a high potential area where farmers were more likely to have sufficient maize stover to collect and store it for dry season feeding. Animals in the supplemented group (26) received an allowance of approximately 6 kg of maize stover and a protein block lick containing 24% crude protein and 5% urea daily. The draught cattle were only allowed access to the lick and crop residues for one hour per day after work, before joining the rest of their herd. Animals in the unsupplemented group had neither maize stover nor block lick. The feeding trial lasted for 90 days. All farmers ploughed during the study period, but intervals between ploughing days varied. There were no significant differences between the weight gains of animals in the supplemented and unsupplemented groups nor in the rate of use by farmers. Conclusions were that farmers were more concerned with timely land preparation than with the condition of their oxen (Chikura, 1992a).

On-farm trials of an animal-drawn ripper tine in combination with a herbicide have been undertaken since the 1983/84 season in Mangwende in an attempt to reduce draught power requirements using reduced tillage systems. In a survey after running the trial for six years, farmers favoured the tine, which assisted root establishment but suggested the price restricted the use of herbicides. In the 1990/91 season a trial was run to compare the use of herbicide with an animal-drawn cultivator. Results of this trial showed no significant yield differences between weeding treatments and suggested that farmers could use either method depending on which they preferred (Chikura, 1992b).

#### **A4.2 The Department of Agricultural, Technical and Extension Services (AGRITEX)**

The Department of Agricultural, Technical and Extension Services (AGRITEX) comprises a field extension service backed up by specialist sections in crop and livestock production, planning, training, agricultural engineering and irrigation. The last three functions are partly carried out by the Institute of Agricultural Engineering (IAE) at Hatcliffe.

DRSS and AGRITEX carry out on-farm projects involving draught animals. These projects are selected by the Committee for On-farm Research and Extension (COFRE). Projects for the 1989/90 season for example included further trials of weed control methods in maize using combinations of ox

cultivation, in-row weeding and herbicide to control weeds in small scale farming systems. On-farm demonstrations of winter feeding of draught animals using 25% protein blocks and stover were also planned (COFRE, 1989). Other AGRITEX projects on-farm have been concerned more with improvements in animal feed supply from pastures. These projects have included field studies of grazing schemes, veld reinforcement using grasses and legumes and fodder intensification schemes using fodder banks on arable land, agroforestry, browse trees and storage of crop residues.

Research on conservation tillage is being carried out by DRSS and AGRITEX assisted by the GTZ in the 'Con-Til' Project, based at Masvingo. An animal-drawn disc ridger has been developed for use in tied-ridging tillage. In initial trials at Zaka and Chivi implement draught requirement and work time were less than with the currently available local high winged ridger (Hagmann, 1992) making it more acceptable in communal lands. The main disadvantage of the implement is its weight. This makes it expensive to buy and has also meant that a short training period is necessary to show farmers how to turn it easily at the end of each row.

#### *The Coordinated Agricultural Rural Development Programme (CARD)*

CARD is a GTZ-financed integrated development programme operating in Gutu District, with close involvement of AGRITEX. The agricultural activities in the programme include land use planning, formation of livestock management groups, grazing schemes, veld management and promotion of improved cultivation practices, crops, horticulture and agroforestry. The activities are largely extension based. The programme has collected a considerable amount of data on the type, numbers, ownership, management and application of draught animals in the Gutu area (eg Lacher and Dikito, 1991).

#### **A4.3 Department of Veterinary Services (DVS)**

While the DVS Veterinary Research Laboratory has not carried out any research specifically on the theme of draught animals, this has been the subject of research carried out under the auspices of the DVS Tsetse and Trypanosomiasis Control Branch. Working on an ODA-funded technical cooperation project, Barrett identified provision of DAP as the most important function of cattle in the communal herd (Barrett, 1992) and concluded that the contribution of communal cattle to crop production and rural incomes has not been fully appreciated in the past.

#### **A4.4 University of Zimbabwe**

##### *Department of Animal Science*

Dr L Ndlovu has been investigating the impact of nutritional supplementation on the performance of Mashona oxen at the University experimental farm. The work is supported by the

Rockerfeller Foundation and the University of Zimbabwe Research Board. The first study investigated the relationship between time of feeding of concentrate supplement (500g crushed maize grain) during the working day on work output and some physiological parameters. The normal communal area practice of winter ploughing for four hours a day (0600- 1000 h) in June was followed. Each team worked for four days then rested for 14 d before working again. Work involved ploughing red clay soils with a mouldboard plough. There were no significant differences in work output or physiological parameters when oxen were provided with maize supplement immediately before work compared with when they were provided with the same supplement 12- 14 h before work. All teams worked erratically in the last hour of work, despite supplementation. The smallest ox team (mean animal live weight 290 kg) showed the greatest signs of stress assessed by degree of drooling, panting, in coordination of gait and increase in plasma lactic acid concentrations. The main conclusions were that live weight of the oxen strongly influenced work performance. Heavier spans covered more distance and did more work in the given time (Francis, Ndlovu and Nkuehe, 1992).

In a second study two methods of providing maize stover to draught oxen in the dry season were investigated: Feeding a little stover each day for a couple of months before the start of the working season compared with feeding stover only in the two weeks prior to the onset of work, but then in larger daily amounts. The total amount of stover fed to each group was the same. Live weight changes and work output were assessed. Unfortunately the results of the study were inconclusive. All animals were grazed on relatively good pasture over the dry season, liveweight losses were small compared to those generally seen in the communal areas in the dry season and beneficial effects of stover supplementation on work output in these conditions were not observed. There are plans to repeat this study.

The effects of work and level of feeding on voluntary feed intake, digestibility, rate of passage and live weight of oxen were investigated by Mupeta (1990). The experimental work was carried out at Makoholi in collaboration with DRSS. Work (pulling at a draught force equivalent to 11% of live weight for four hours) had no significant effect on voluntary feed intake although the working animals showed a decrease in intake compared to non-working animals. Work and feeding level had no significant effect on digestibility and rate of passage of low quality roughage through the gut. Animals on restricted feeding lost weight over the 21 d study period, working animals significantly more than those not working. Ad libitum fed working animals lost weight but those not working gained weight on the low quality roughage. It was concluded that work and feeding level in animals offered low quality roughage had no significant effect on voluntary food intake or digestibility of feed, however the nutrient intakes were not sufficient to maintain live weight and body condition in working animals, even when the diets was offered ad libitum (Mupeta, 1990).

*Department of Agricultural Economics*

Mary Muchena questioned 180 households in eight VIDCOs in Wards 19 and 23 of Buhera district in natural region IV. The questions were designed to elicit information on the effect of ox sharing arrangements on the supply and use of draught animals in the communal areas. She found that in general owners of draught animals first ensured they ploughed their own land before hiring their draught animals to others. Priority was given to family members before relatives, friends and other local farmers. Lending was often free though other informal exchanges took place such as draught in return for labour or crop residues. Payment offered appeared not to be a major motivating force behind hiring out draught power (Muchena, 1989).

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APPENDIX 5: QUESTIONNAIRE ADMINISTERED TO DAEOS IN  
MASVINGO PROVINCE

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A5.1 Background to the questionnaire:

The following questionnaire was used to collect information and views from the seven District Agricultural Extension Officers in Masvingo Province on 31 July 1992, when all seven attended a Provincial AGRITEX meeting in Masvingo. After the questionnaire had been administered, the topics covered were discussed in open forum.

A5.2 Text of the questionnaire:

RESEARCH ISSUES IN DRAUGHT ANIMAL RESEARCH

DISTRICT:

NAME OF DAEO:

What proportion of farmers in  
your area are livestock owners?

STRATEGIC NUTRITION

The following list includes various ways in which farmers could be encouraged to improve the nutrition of their draught animals. Please give your opinion on how interested farmers in your area are likely to be in each method.

Score:     0   No interest at all.  
          1   A few farmers will be interested.  
          2   Many farmers will have some interest.  
          3   Many farmers will be very interested.

Greater use of crop residues

Grazing schemes

Fodder legumes as fodder banks

Fodder legumes as veld reinforcement

Use of bought-in concentrates

Comment if you wish:

DONKEYS

Please estimate how many farmers in your district use donkeys for the following tasks (tick the appropriate box):

0-25%      26-50%      51-75%      76-100%

Ploughing

Weeding

Pulling carts

Carrying loads

Personal transport

In recent years, has the use of donkeys as draught animals increased, decreased or remained the same?

.....

Would it be helpful to farmers in your district if government services (DRSS, AGRITEX, Vet Dept) gave more emphasis to donkeys? Circle one of the following answers:

NO                      YES, BUT LIMITED                      YES, IMPORTANT

How great is the need in the following areas:

Field implements

Harnessing

Extension advice concerning husbandry

Extension advice concerning health and nutrition

Comment on other needs if you wish: .....

.....

.....

## COW TRACTION

Please estimate how many farmers in your district use cows as draught animals (circle as appropriate):

0-25%      26-50%      51-75%      76-100%

In recent years, has the use of cows as draught animals increased, decreased or remained the same?

Would it be helpful to farmers in your district if government services (DRSS, AGRITEX, Vet Dept) gave more emphasis to use of cows as draught animals? Circle one of the following answers:

NO

YES, BUT LIMITED

YES, IMPORTANT

## IMPLEMENTS

Can you suggest any scope for improvement in the design and use of animal-drawn implements used by farmers in your district:

## AGRONOMY ISSUES

How many farmers in your district winter plough?

0-25%      26-50%      51-75%      76-100%

In recent years, has winter ploughing increased, decreased, or remained the same?

What changes in crop production activities have taken place in your district in the last few years?

ANY OTHER COMMENTS

### A5.3 Results of the questionnaire survey

The findings are summarised in the Table A5.1. For explanation of the responses refer to the style of the question as given in Appendix 5.2 above.

Table A5. - ANALYSIS OF DAEO QUESTIONNAIRE, MASVINGO PROVINCE

	Gutu	Chir	Zak	Chiv	Mwe	Mas	Bik	Total	
% own cattle	45	?	70	?	11	?	60		
Interest in:	3	2	3	3	3	2	2	18	
grazing schemes	2	1	2	2	2	2	3	14	
fodder banks	1	1	1	1	1	1	2	8	
veld reinforcement	2	1	1	2	1	1	2	10	
concentrates	1	1	1	0	2	1	1	7	
% use donkeys for: ploughing	2	2	2	2	2	1	2	13	
weeding	1	1	1	1	1	1	1	7	
carts	3	3	3	2	3	4	4	22	
carrying loads	4	2	4	2	4	4	4	22	
personal transport	4	1	1	2	4	?	1	(13)	
Use of donkeys	↑	↑	↑	↑	↑	?	↑	(↑)	
More attention to donkeys?	YBL	YBL	YES	YBL	YBL	YBL	YES	YBL/YBL	
- field implements	✓		✓✓	✓✓	✓	✓	✓	8	
- harnessing			✓✓	✓✓✓	✓✓	✓	✓	9	
- husbandry	✓		✓✓	✓	✓		✓	6	
- health & nutrition	✓			✓	✓	✓	✓	5	
% using cows	1	1	1	3	2	3	1	12	
change over time?	↑	↑	→	↑	↓	?	↓	Variable	
more attention	YBL	No	YBL	YBL	YBL	YBL	NO	YBL/NO	
% winter ploughing	4	1	3	3	2	3	3	19	
change over time?	↑	→	↓	?	↑	→	↑	↑	
Interest in: browse	?	2	2	?	?	0			
% using yokes on donkeys	1	?	4	3	2	1			
Notes:									
Gutu	=	Gutu	Chir	=	Chiredzi				
Zak	=	Zaka	Chiv	=	Chivi				
Mwe	=	Mwenezi	Maz	=	Masvingo				
Bik	=	Bikita							

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**APPENDIX 6: QUESTIONNAIRE ADMINISTERED TO EXTENSION  
WORKERS AND SUPERVISORS IN GUTU DISTRICT**

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On 6 August 1992, all the extension supervisors (7) and extension workers (7) in Gutu District attended a management course in Gutu. The opportunity was taken to administer a simple questionnaire to collect information and views on their perceptions of the farming practices relevant to the use of draught animals in their areas. One of the aims of the exercise was to establish whether there were any marked differences in draught use between the natural regions III, IV and V which should be taken into consideration in identifying research options.

The extension agents were asked to score their replies to a series of questions either 1 (0-20%), 2 (21-40%), 3 (41-60%), 4 (61-80%) or 5 (81-100%) relating to the proportion of farmers in their respective areas who carried out the activities listed in the series of questions (see Table A6.1). The reply scores were divided into those from natural region IV/V (5 replies), those from natural region IV (3 replies) and those from natural region III (6 replies). The scores for each question for natural regions VI/V and III are given in Table A6.1.

Although only a limited 'survey' some observations on the extension agents perceptions of the use of draught animals in their areas can be made: The results suggested that there were no large differences in the use of draught animals between the regions. Cattle, both oxen and cows, were more widely used to provide draught power than donkeys in both regions. However more farmers in natural region III owned and ploughed with cattle than in natural region IV/V. More farmers in natural region IV/V owned and used donkeys than in natural region III. Use of cows was similar in both regions. Few farmers in either region prepared and cultivated the land by hand or using a tractor. Responses to weeding by hand and with oxen varied widely between extension agents in both regions. It is likely that there may have been some confusion in these two questions, since farmers usually weed within rows by hand regardless of whether they have animal power or not. Hence both methods of weeding are used in their crops.

Cattle owners in natural region III appeared to pay more attention to animal management than in natural region IV/V. More of them collected and stored crop residues and dosed their cattle than in natural region IV/V. Winter ploughing was more widespread in natural region III than in IV/V. Tied-ridging was not used extensively. Owners of carts made use equally in each region of donkeys and of cattle for carting, although the use of cattle was greater than that of donkeys. The proportion of farmers in both regions having

off-farm income was low overall but there were exceptions in some areas.

The extension agents were asked about the situation 'last year'. The severe drought this season (1991/92) has left many farmers with high cattle losses. Donkeys numbers appear to have been less severely depleted. Although the use of donkeys is low, compared to cattle, at present it is increasing. It was felt that the use of donkeys (and manual labour) for land preparation and cultivation will feature more widely in the future, and certainly in the next few years, until cattle numbers recover.

Table A6.1

Responses of 11 extension agents in Gutu district to a questionnaire on the use of draught animal power in their respective areas.

Question: What proportion of farmers in your area:-		*Score		
		National Region IV/V (n=5)	Comparison	National Region III (n=6)
1.	Own cattle?	3.3	<	4.0
2.	Own donkeys?	1.8	>	1.4
3.	Plough by hand?	1.0	=	1.0
4.	Plough using oxen?	4.0	<	1.0
5.	Plough using donkeys?	1.3	>	1.0
6.	Plough by tractor?	1.1	=	1.0
7.	Weed by hand?	3.3	=	3.4
8.	Weed by oxen?	3.3	=	3.6
9.	Weed using donkeys?	1.0	=	1.0
10.	Collect and store crop residues	3.5	<	4.2
11.	Cattle owners dose for worms?	2.4	<	3.2
12.	Use cows for draught?	2.3	=	2.2
13.	Normally winter plough	3.3	<	3.8
14.	Normally tie-ridge?	1.0	=	1.0
15.	Cart owners use donkeys?	1.3	=	1.4
16.	Cart owners use oxen?	3.8	=	3.8
17.	Have off-farm income?	1.4	=	1.6

\* The maximum value for a score is 5 (i.e. 81-100%)#  
The minimum value is 1 (i.e. 0-20%)

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## APPENDIX 7: FINDINGS FROM FARMER GROUP MEETINGS

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### A7.1 Conduct of the group meetings

Interviews were held with 7 groups of farmers, across Natural Regions (NR's) III to V in three Provinces - Masvingo (3 groups), Midlands (3 groups) and Matebeleland (1 group). The interviews did not follow a strict format but, in general, about 30 questions were asked along the lines indicated in section A7.4 below. Farmers appeared comfortable to answer basic questions about their farm practices by a system of raising hands, which allowed for collection of some crude quantitative information at each meeting.

This was intended to be more of an orientation and familiarisation process for the team, but produced some data presented below which are of some value if taken in a broad perspective.

Not every question was posed to each group and, according to the responses, certain issues were examined in greater depth with the different groups. On average the interview sessions lasted two to two-and-a-half hours and involved between approximately (some came or left early) 20 and 90 farmers. Women farmers were in the majority in three of the groups. In addition, two individual farmers (one male and one female, in Masvingo) were interviewed and their responses are included below, where significant.

Apart from questions for which group answers were taken, other lines of questioning were followed. Often one of the village elders or a self-elected speaker was invited to explain certain aspects of the local farming system, with open opportunity for follow-up comments from the floor.

### A7.2 Evaluation of the interviews

Approximately half the questions asked were amenable to a quantitative analysis, and these are summarised in Table A7.1. There is no intention of presenting the results of these interviews as being representative of all the communal farmers in the villages visited, let alone the Districts or Natural Regions in which the villages were situated. At the outset it is emphasised that the sampling frame was inappropriate for this purpose. Therefore, the positive responses have been shown according to quartile ranges only, rather than as the actual percentages, to avoid the implication of any precision and unjustified comparisons. The only comparisons which the mission members believe are of value for the purposes of identifying a difference would be those with a dramatic jump e.g. from A to C or B to D (and vice versa).

The analysis of responses in Table A7.1 has been presented on the basis of Provinces (with the proviso that there was only one group interview in Matebeleland) and between NR's or, more correctly, between certain villages in different NR's. Thus, the first three columns of responses could be regarded as a comparison of Provinces, whilst the second and fourth columns could be regarded as a comparison of NR III/IV villages (since all the Midlands data were collected within a radius of about 10 km), and the fourth and fifth columns may indicate differences between villages in NR's III/IV and V respectively in the same Province (Masvingo).

### A7.3 Observations

The following observations can be made from Table A7.1. (The 14 observations relate sequentially to each of the 14 lines of Table A7.1).

- 1 At least 50% of communal farmers own cattle, with probably a greater percentage in NR V, as would be expected.
2. Donkey ownership is in the minority except in Matebeleland.
3. Spanning with cows and donkeys is relatively uncommon in Midlands and Matebeleland. This may be attributable to (i) in the Midlands: no shortage of oxen and (ii) in Matebeleland: a shortage of oxen and cows.
4. Only a few communal farmers treat their cattle for worms. (It is also understood that donkeys are never treated for worms.)
5. Virtually all communal farmers collect their crop residues (actual percentages ranged from 93 to 100%).
6. Fewer than half the farmers referred to in columns 3 and 5 plough with oxen. This is attributed to (i) lack of oxen and (ii) poor condition of oxen respectively.
- 7 Ploughing with donkeys is practised by only a minority of communal farmers.
8. Ploughing by hand is practised by only a minority of farmers but the results suggest that, in contrast to 7 above, hand ploughing is more significant in the apparently poorest village. However, in a more affluent village, donkeys may be the more significant substitute for ox power.
9. Tractor ploughing is more prominent in Matebeleland than elsewhere. This is attributed to the fact that the particular village represented in the third column was the only one to have heavy soils, not sandy soils. However, it also appeared that there was substantially more off-farm income in this village, thus facilitating access to tractors and tractor power.

10. Winter ploughing is becoming increasingly popular.
11. The number of farmers expressing complaints about the design and use of ploughs may appear to be fairly irrelevant. However, the consistency of the complaints across all groups was remarkable and the poor design of the currently available plough clearly warrants attention.

Table A7.1 Summary of Quantifiable Responses

% Households 0-24 = A 25-49 = B 50-74 = C 75-100 = D	Province			NR II/IV	NR V
	MAS III/V	MID III-IV	MAT IV	Village	Village
1. Owning cattle	C	C	C	C	D
2. Owning donkeys	A	B	C	A	A
3. Spanning cows/donkeys with oxen	D	A	A	D	D
4. Treating for worms	A	B	A	A	A
5. Collecting crop residues	D	D	D	D	D
6. Ploughing with oxen	D	C	B	D	B
7. Ploughing with donkeys	A	A	B	A	A
8. Ploughing by hand	A	A	A	A	B
9. Ploughing by tractor	A	A	C	A	A
10. Winter ploughing	D	B	B	B	D
11. Difficulties with plough	B	A	A	A	A
12. Weeding with cattle	A	A	B	A	B
13. Weeding with donkeys	A	A	B	A	A
14. Weeding by hand	D	D	A	-	-

12. Only a minority of farmers use cattle to pull weeders
13. Only a minority of farmers use donkeys to pull weeders.
14. Weeding by hand is less prominent in Matebeleland where both cattle and donkeys seem to be used to a slightly greater extent.

Responses to the questions of a more qualitative nature may be summarised as follows.

- a) Most farmers provide supplementary feeding to their draught animals. Of these farmers, most (but not all) start to do so in August rather than when the animals start to work. A greater amount and greater variety of residues are being used now compared to 5 or so years ago.
- b) There is some variability in the use of residues by non-cattle-owning farmers regarding bartering or selling for cash. Nevertheless, the majority of the residues are fed to animals, the remainder being used for compost.
- c) Cash, or cash-flow, is the main constraint on providing animals with supplementary feed or medication (e.g. deworming). In the latter case the cost of travelling to purchase the medication may be more significant than the cost of the medication itself.
- d) Farmers are finding that they have to span more animals than formerly. This is attributed to their generally poorer condition (and smaller size) in recent years.
- e) The most attractive aspect of grazing schemes is the associated reduction in herding labour.
- f) The growing of fodder crops/legumes or veld reinforcement present many practical difficulties, such as the protection of young plants, the communal use of arable land after harvest or simply the non-availability of suitable land.
- g) The number of farmers suffering cattle losses this year varies widely between villages, those in NR III suffering least. Those in NR III seem more concerned with increasing the size(s) of their herd(s) to compensate for the weaker animals than simply keeping their animals alive.
- h) Donkeys are preferred to cattle for carting because they are more controllable and docile.
- i) Donkeys are becoming increasingly important because of their survivability in very dry years, but they will never replace cattle as they are not regarded as sources of milk or meat and are not used for "lobola".
- j) Ploughing by tractor is not perceived as superior to ploughing by oxen (or donkeys) provided that the latter is done properly.

It is concluded that there was considerable heterogeneity amongst the groups interviewed. It would seem, therefore, that any recommendations for crop and livestock production practices targeted at the communal areas of a particular NR

could be only general in nature and not ideally suited to a specific village or district. The type of soil, rainfall characteristics, livestock ownership and distribution etc. must all be considered, together with the farmers' philosophies for risk aversion, in the determination of the "best" practices. More systematic information is required to identify and characterise appropriate recommendation domains relevant to DAP research and extension for communal farmers in different circumstances.

#### A7.4 Questions for which quantitative data was collected

1. Is supplementary feeding or curing a sick animal a greater benefit?
2. How many cattle:-  
Do you have now?  
Have died this year?
3. How many do not own ploughs?
4. How many do not own carts?
5. How many own cultivators?
6. How many plough by tractor?
7. How many plough by hand?
8. How many plough with mombes?
9. How many plough with donkeys?
10. How many winter ploughed?
11. How many made tied ridges?
12. How many weeded with cultivator pulled by mombes?
13. How many weeded with cultivator pulled by donkeys?
14. How many used donkeys for carting?
15. How many find difficulties using the plough?
16. How many collect crop residues for feeding cattle, even if they do not own cattle?
17. Which animals receive crop residues and when?
18. Are residues other than maize stover fed?
19. Are any other supplements fed?
20. How old are draught animals at start of training?
21. For how many years are animals worked?

Do cows need training?

How many people are involved in the ploughing operation:

- (a) 1
- (b) 2
- (c) 3

How many buy worming medicine

How many use traditional remedies for worming?

How many dose more than once a year?

- a) improved nutritional status
- b) less labour for herding
- c) other

28. How many are aware of fodder legumes?

29. Are fodder legumes etc. a good idea?

30. Have there been any changes in agricultural practices in the last 6-7 years?

When are labour shortages greatest?

Has there been a shortage of draught animals in recent years?

Follow up if appropriate.

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APPENDIX 8: AGENDA AND REPORT OF A WORKSHOP HELD AT THE  
AGRITEX INSTITUTE OF AGRICULTURAL ENGINEERING,  
HATCLIFFE, ON 17 AUGUST 1992

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A8.1 Workshop title

STRATEGIC RESEARCH NEEDS RELATING TO  
DRAUGHT ANIMAL POWER:

A DIAGNOSTIC STUDY IN ZIMBABWE

A8.2 Objectives

To present and discuss the findings of a diagnostic study carried out in Zimbabwe from 20 July - 20 August by an ODA team comprising John Barrett (team leader and agricultural economist, NRI), David O'Neill (agricultural engineer, SRI) and Anne Pearson (livestock production specialist, CTVM). The team worked closely with staff of the Department of Research and Specialist Services (coordinated by P Nyathi, Assistant Director, Livestock and Pastures) and AGRITEX (coordinated by P Malusalila, Acting Head of the Crop Production Branch).

A8.3 Agenda:

0930 Tea.

1000 INTRODUCTION

Review of the background and objectives of the mission. Description of the approach, methodology and conduct of the study. Plan and objectives for the workshop. Key issues to be addressed.

1045 PRESENTATION OF FINDINGS

Research opportunities perceived by central institutions: review the team findings from meetings with appropriate staff in government, university and NGO organisations including discussion of ongoing programmes and activities.

Research opportunities perceived by field staff: review the team findings from meetings with Provincial level staff field staff in AGRITEX and DVS.

Research opportunities reflected by farmer meetings.

1200 DIAGNOSIS OF RESEARCH NEEDS

The framework for establishing priorities for research. Prospects for: producing useful information; transfer of

results to effective extension; prospects for farmer adoption. Issues for ODA: poverty, gender, semi-arid areas. Strategic versus adaptive research.

Identification of opportunities for new initiatives in research, development and extension in Zimbabwe, and where ODA-funded research might fit in.

1300 LUNCH

1400 OPTIONS FOR FUTURE INITIATIVES

Detailed discussions of potential for new research initiatives in the following areas:

- (1) Evaluation of the role of the donkey as a draught animal.
- (2) Evaluation of animal-drawn implements with respect to reduced draught power.
- 3) The health and nutrition of oxen used for contract ploughing.
- 4) Identification and characterisation of recommendation domains for research and extension relating to draught animal power.

General discussion about other possible areas of new research, including:

- \* improved use of crop residues;
- \* intercropping;
- \* range and herd management;
- \* strategic veterinary care; and
- \* implications of change in the genetic base of the communal herd;
- \* development of better economic methodology for appraising the likely adoption of proposed changes in farming practices.

1530 General discussion.

1600 Close of proceedings.

#### A8.4 Report of the workshop

As the findings of the ODA team are fully presented in the main text of the report, the material presented below concentrates on recording the views of other participants in the workshop.

The workshop began at 1015 hrs and followed the agenda given above. The purposes and findings of the mission were presented and the morning session ended with an outline of the key issues identified. In the afternoon the key issues options for future initiatives were discussed as summarised below. The meeting finished at 1615 hr.

#### A8.4.1 The health and nutrition of oxen used for contract ploughing.

This topic generated a very lively exchange of views at the workshop. The underlying philosophy is that Zimbabwe has sufficient draught animals to meet its needs: the fundamental problem is that these animals are not in adequate condition to plough at the time of the rains. The idea of focusing on contract-ploughers was that this group of farmers see draught animal production as a business, and will be prepared to invest in animal nutrition if it is profitable.

Some participants felt that there are not technical issues relevant to draught animals used for contract ploughing which differ from draught animals used in other circumstances. However, research needs to be linked to a group of target beneficiaries. The available evidence suggests that the average subsistence farmer who is interested only in ploughing his own fields will not be prepared to invest much labour or expenditure to improve the condition of his animals before the ploughing season. There is very limited prospect of adoption of supplementary feeding other than using crop residues, which is already widespread. The targeting of more entrepreneurial communal farmers would therefore have practical implications for the design of extension programmes. It would also affect the design of on-farm trials, as the level of nutrition and stress would be in the context of ploughing a much larger area than the average farmer has available within his own fields.

Other workshop participants objected to the proposed research theme because they felt that the government should be putting emphasis on helping the poorest farmers, not those who are already proving successful. The counterargument here is that expensive tractor schemes are being implemented by the government with the specific aim to help farmers who do not have access to draught animals. What these farmers need is access to farm power, not necessarily immediate ownership. By promoting the availability of animal draught through contract ploughing, non-owners of cattle will benefit. Such schemes are likely to be more sustainable than tractor schemes, and will the development of village businesses should stimulate rural economy.

Other participants were enthusiastic about the approach. Some took the view that contract ploughing could become an income generator in the future, and so an understanding of draught animal capabilities and the inputs needed to use them to maximum effect was necessary. It was recognised that a change of policy concerning the direction of agricultural extension would be required before any research aimed at entrepreneurial farmers in this area could be effectively applied.

Other participants questioned whether many farmers would be interested to pay cash to hire draught animals - there was open argument on this issue. It was felt that much more

information was needed about the nature and extent of inter-household transactions in draught animal power before a major initiative in this direction could be contemplated. This viewpoint was readily accepted by the ODA team, and this research proposal was subsequently merged into the proposed study to develop recommendation domains for DAP research and extension. This should include study of arrangements for sharing of animals and exchanges of draught power for stover, manure and labour as well as for financial payments. Such a study should investigate reasons for entering into contracts for ploughing on both sides of the agreement and 'customer satisfaction'.

#### A8.4.2 Understanding and evaluating the donkey as a draught animal.

In general it was felt that although donkeys were owned by only a small proportion of farmers compared to cattle, they represented a good method of risk management for farmers, especially in the drier areas of the country where cattle are often unfit to plough at the end of the dry season. A need was expressed for more information on nutritional requirements, performance characteristics, harnesses, and suitable implements for donkeys.

The institutions represented at the workshop expressed an interest in collaborating in such a project.

#### A8.4.3 Identification and characterisation of recommendation domains for research and extension relating to draught animal power.

There was a consensus that research and extension programmes affecting draught animals would be improved significantly if more information was available concerning various aspects of draught animal production and utilisation.

There was no question that the information was needed by the AGRITEX and DRSS among other institutions but there was some discussion as to how wide the study should be and how the information might best be collected. The central problem in carrying out a study which potentially involves a wide range of skills and organisations is who should take the lead. AGRITEX and DRSS FSRU expressed some concern about staff availability but at the Provincial level this was thought to be less of a constraint than operating budget. Use of students or recent graduates from the University Faculty of Agriculture was considered to be one way of alleviating any problems of staff availability in the Institutions.

In general participants felt the work could probably start with a desk study to assemble and evaluate the wealth of data already available from AGRITEX field reports and other studies. This should be followed by a pilot-scale field study before being extended elsewhere.

#### A8.4.4 Evaluation of animal-drawn implements with respect to reduced draught requirement

The discussion on implements was concerned mainly with the operational problems and difficulties experienced by farmers, rather than with reduced draught requirements. It was felt that these should be examined as part of any new project tackling animal-drawn implements, although this would be more adaptive in nature. The need for strategic research to identify the most appropriate methods of reducing draught requirement and to underpin development work and the setting of standards, with the involvement of manufacturers, was not questioned.

Other possible areas of research were considered to be:

Implications of change in the genetic base of the communal herd: this could form a useful topic for a MSc or MPhil student to tackle at the University both through a desk study and farmer interviews.

It was suggested that any work on intercropping with forage legumes should be complemented by studies of crop rotation.

Participants in the workshop

Table A8.5

	NAME	POSITION	ORGANISATION
1.	S Chakeredza	RO	DR & SS (HRS)
2.	P Mujuru	AES (mech)	Agritex
3.	G G Mahowa	AES (mech)	Agritex
4.	J de Jong	Assist Dir (Tech)	Agritex
5.	J H Topps	Prof of Animal Science	UZ
6.	E M Shumba	Asst Dir (Crops)	DR & SS
7.	E Pambirei	DAEO - Gutu	Agritex
8	M Shumba	PAEO (T)	Agritex - Masvingo
9.	T Munyonbwe	RO	VE Res Lab
10.	U Ushewokunze-Obatolu	Asst Dir (Vet Research)	Vet Department
11.	Z Manyame	Livestock Officer	GTZ -CARD
12.	F Mutemachimwe	AEO	Agritex
13.	A A Ogunmokun	Lecturer	UZ
14.	V L Prasad	Chief Res Officer	DR & SS
15.	S Sibanda	Lecturer	UZ + Animal Science Dept
16.	L R Ndlovu	Lecturer	Uz + Animal Science
17.	P R Hatendi	Sen Res Officer	DR & SS
18.	B Mupeta	PAEO (T)	Box 233 Gweru
19.	P Huchu	AES (MRE)	Agritex
20.	R C Mpande	Consultant	Zero
Randi			
23.	N Munodawafa	ATO	GTZ - CARD
24.	A C Machaya	AES (beef and dairy)	Agritex (HQ)
25.	J r Nkuuhe	Lecturer	UZ
26.	B G Mombeshora	RO	DR & SS
27.	J Gambiza	Head, Makoholi Exp Station	DR & SS
28.	J N Maswaja	GAEO	Agritex
29.	J Francis	Dept of Animal Science (research student)	Un of Zimbabwe
30.	I Sunga	Economist	ITDG
31.	T Rukuni	Research Fellow	UZ
32.	R Nazare	Engineer	Agritex
33.	I Pompei	Senior Provincial Agronomist	Agritex
34.	P Nyathi	Assistant Director - Livestock & Pastures	DR & SS
35.	A Pearson		
36.	J Barrett		
37.	D O'Neill		

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**APPENDIX 9:        TRAINING IN DRAUGHT ANIMAL POWER  
                      IN ZIMBABWE**

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Training courses in all aspects of animal traction are run at the Agricultural Engineering Training Centre (AETC), IAE, at Hatcliffe near Harare.

Five courses concerned with draught cattle have been offered for several years, covering all the common animal-drawn implements:

- (1) selection care and training of draught cattle;
- (2) ploughing with draught animals;
- (3) crop establishment using draught animals;
- (4) crop maintenance; and
- (5) crop harvesting, transport and processing with draught animals.

Recent developments at the AETC, assisted by GTZ, include the introduction of a training course on the use of donkeys in agriculture in Zimbabwe for which Jones (1991) has produced a training manual. A course on donkey harness making has also been introduced.

Participants on the courses come mainly from the government extension services (90%) and very often the extension staff already have experience in using animal traction. Some students (about 10%) come from other countries in the SADCC region. GTZ have sponsored some of their 'master' farmers from Chivi and Zaka on the donkey courses in conjunction with the 'Con-Til' project.

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APPENDIX 10: SUPPORTING TABLES

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Table A10.1

Masvingo	CATTLE	DONKEYS
Total numbers	667,668	40,306
District:		
Masvingo	80,948	6,301
Gutu	148,072	6,591
Bikita	85,324	2,061
Chivi	99,859	8,966
Zaka	112,926	7,145
Midlands		
Total numbers	697,716	63,892
District:		
Gweru	37039	4,416
Kwekwe	79,661	4,365
Gokwe	258,933	16,079
Mberengwa	107,859	28,106
Matabeleland North		
Total numbers	512,378	118,818
District:		
Bubi	24,102	3,238
Kezi	61,499	24,446
Matabeleland South		
Total numbers:	291,703	66,531
District:		
Gwanda	89,582	27,403

**Table A10.2**

Trends in cattle and donkey numbers in Zimbabwe since 1987/88 census.

	COMMUNAL	SMALL SCALE	RESETTLEMENT	TOTAL
<b>CATTLE</b>				
1987/88	3,500,969	227,721	314,194	4,042,884
1988/89	3,555,012	213,046	301,320	4,168,378
1989/90	3,500,969	279,248	394,500	4,451,026
1990/91	3,802,997	298,170	432,670	4,533,837
<b>DONKEYS</b>				
1987/88	307,860	6,529	31,294	345,683
1988/89	424,407	6,290	7,505	438,202
1989/90	314,930	6,519	17,964	334,413
1990/91	318,318	8,457	21,255	347,880

**Table A10.3**

Data on relative contribution of different species and classes of livestock to total draught availability in Chivi (a low potential area) and Mangwené (a higher potential area) and other draught power statistics (from Mombeshora, Agyemang and Wilson (undated)).

Class of Stock	CHIVI	MANGWENDE
Oxen	32.5	75.6
Cows	25.4	17.3
Bulls	7.8	0.8
Heifers	2.4	0.4
Steers	1.7	1.1
Donkeys	30.2	4.9
Percentage of livestock owners with draught animals	69.5	86.9
Average numbers of draught animals per draught owner	4.5	3.4
Percentage using cows for draught	53.3	31.3
Harvest and store crop residues	96.0	16.9