SILSOE RESEARCH INSTITUTE

OPTIMISING DRAUGHT ANIMAL POWER FOR CROPPING

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

Edited by D H O'Neill

IDG/99/21

ENGINEERING *for* Life

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Preface

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

To achieve the earliest involvement and collaboration of the stakeholders associated with the betterment of draught power performance and production management for smallholder farmers in Zimbabwe, a project initiation (or "Kick-Off") Workshop was organised as the first formal activity of a new Livestock Production Programme[1] research project.

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

Dave O'Neill
Silsoe

19th November 1999

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

Programme

Tuesday 14 September — Day - *Setting the scene*

9.00	Welcome and coffee	
9.30	Opening address	Mr R Chitsiko
9.45	Introduction to the Project and Stakeholders	D O'Neill
10.30	Background I: The use of animal-drawn implements in Zimbabwe	Chatizwa, J Ellis-Jones
11.15	*Coffee*	
11.30	Background II: Innovative methods for soil improvement in semi-arid production systems	S Twomlow
	Lunch	

Small group discussions (brainstorming)

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

15.30	*Tea*	
16.00	Report back to plenary session	
	Drinks and snacks	

Wednesday 15 September — Day 2 - *Project implementation*

8.15	Project structure and linkages	D O'Neill, S Twomlow
8.45	Small group discussions: Field activities	

1. Location and farmers
2. Survey design
3. Field trials
4. Data collection and analysis

10.30	*Coffee*	
10.45	Report back to plenary session	
11.15	Small group discussions: Development and extension	

1. Gender sensitivity
2. Role(s) of artisans and manufacturers
3. Format for "Best Practice Guidelines"
4. Dissemination - current methods and recommendations for uptake pathways for Project outputs

13.00	*Lunch*	
14.00	Report back to plenary session	
14.30	Project Activities - Incorporation of reports from groups	J Ellis-Jones, D O'Neill
15.45	*Tea*	
16.00	Presentation of agreed Project Plan	J Ellis-Jones
16.20	Closing address	Mrs E Mandishona
16.30	Depart	

CONTENTS

Opening Address

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

The importance of draught animal power (DAP) in Zimbabwe can not be over-emphasised. In production terms, 70% of the maize crop and 66% of the cotton crop in Zimbabwe are grown by smallholders, who, as a sector, all rely on draught animals for their farm power. These smallholders represent more than 70% of the population but recent reductions in the national herd, mainly because of droughts, have resulted in the demand for DAP outstripping the supply. There is, therefore, an urgent need to optimise the use of DAP in order to provide good access to as many farmers as possible.

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

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

- How, and on what scientific bases and principles, should animals be selected?
  ☛ species? ☛ breed? ☛ size? ☛ age? etc
- How can implements be matched to soil types and conditions and to (where appropriate) crop types?
- What are the key features of implement design and use which interact with farmers?

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

Introduction to the Project and the Workshop

D O'Neill, Silsoe Research In titute, UK

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

The *Goal* and *Purpose* of the project are as follows[2].

Goal

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

Purpose

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

This "Kick-off" Workshop is being held at the beginning of the project in order to:

- bring collaborators and stakeholders together;
- discuss the options, within the contractual framework of the project, to implement the project;
- agree local planning details;
- identify dissemination options;
- raise any other relevant issues.

The objectives of the Workshop may be described as:

- presenting project background and format;
- exchanging information on DAP and soil fertility;
- eliciting stakeholders' views on project implementation;
- planning for optimum dissemination.

Presentation and discussion of the project Logical Framework (LogFrame) will be the subject of the first session of Day " of the Workshop, but, in discussing the background to the project today, it is important to know what *Outputs* the project (and, hence, the collaborators) are contracted to deliver. There are three *Outputs* which are given below.

[2] As stipulated by the Livestock Production Programme (LPP).

Output 1
Best Practice Guidelines in implement use (setting, maintenance and harnessing), based on current knowledge, will be developed by appropriate stakeholders.
Output 2
The appropriateness of current DAP use in maize and cotton systems will be defined in terms of management of existing resource utilisation (animals, implements and labour) on yields and profitability.
The potential for resource utilisation in innovative crop production methods (eg green manures, use of dung, crop residues) will be quantified.
Output 3
The findings of the research will be promoted and disseminated by stakeholders.

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

Background Paper I

The Use of Animal-Drawn Implements in Zimbabwe

J Ellis-Jones[1] and I Chatizwa[2]
[1] Silsoe Research Institute, Silsoe, UK
[2] Institute of Agricultural Engineering, Harare

(Summarised by D O'Neill)

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

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

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

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

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

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

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

implement utilisation are given in figure 15 and these must be addressed if the Government's new production targets[3] are to be realised.

In conclusion, the widely accepted strategies for increasing crop / livestock productivity (eg see Barret *et al*, 1992) are reproduced in figure 16 and the lessons learnt from recent research and of relevance to this project are summarised in figure 17.

References

Barrett, J C, 1992. The economic role of cattle in communal farming systems in Zimbabwe. ODI Pastoral Development Network. Network Paper 32b.

Barrett, J C, O'Neill, D H and Pearson, R A, 1992. Strategic research needs relating to draught animal power: a diagnostic study in Zimbabwe. Unpublished Report, Natural Resources Institute, Chatham, UK. 70pp

Muvirimi, F, 1997. Current practices and characterisation of farmers using draught animals in semi-arid Zimbabwe. In Ellis-Jones, J, Pearson, A, O'Neill, D and Ndlovu, L (eds) "*Improving the Productivity of Draught Animals in sub-Saharan Africa*", Proceedings of a Technical Workshop, 25-27 February, Harare. International Developemnt Group Report IDG/97/7, Silsoe Research Institute, Silsoe, UK. 183pp

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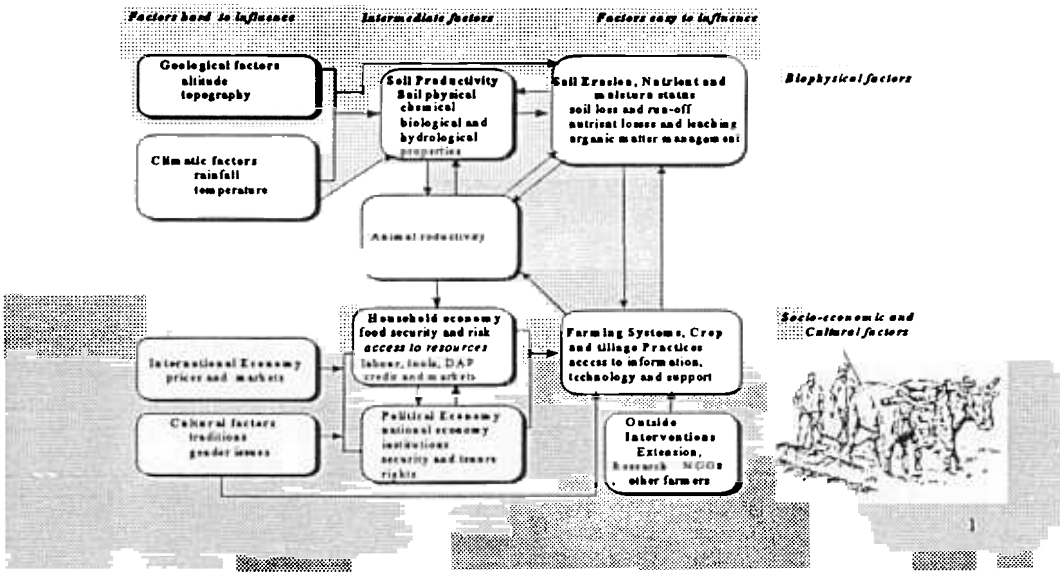
"Kangai sets 5-year maize yield targets" - headline in *The Herald*, 14/9/99, p9.
"..... farmers should aim to increase maize production from current levels of between 1,5 and 2 million tonnes to 2,5 million tonnes, which should peak at 3,1 million tonnes a year during the next five years....."

Factors affecting the Productivity of DAP



ESTIMATE OF ECONOMIC OUTPUT OF COMMUNAL AREA CATTLE AND DONKEYS

	% OF TOTAL VALUE	
	CATTLE	DONKEYS
USE	(a)	(b)
Draught	63.6	93
Milk	13.6	-
Manure	8.5	2
Local slaughter	5.7	
Sold outside local area	4.7	-
Herd growth	10.4	5
Social value	(?)	-
TOTAL	100	100

Source: (a) Barrett (1992), (b) Estimate through discussion with farmers

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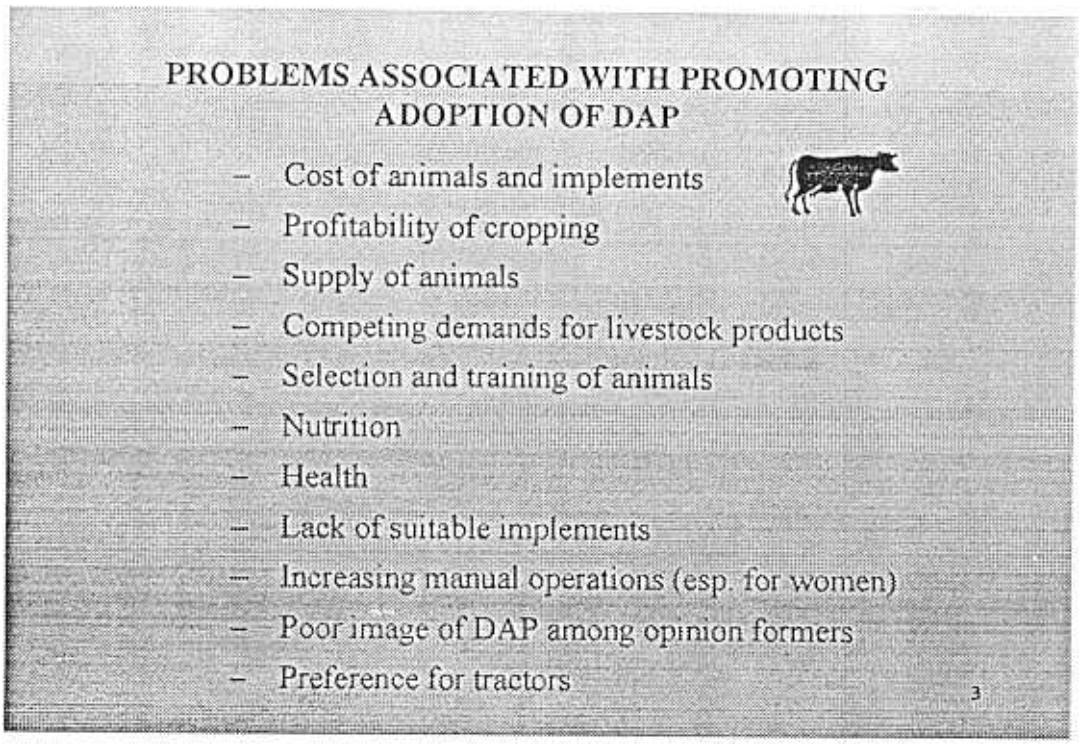

FARMER RECOMMENDATION DOMAINS

RURAL HOUSEHOLDS							
NO ANIMALS OWNED		ANIMAL OWNERS					
		INADEQUATE DAP			ADEQUATE DAP		
No access to DAP 7%	Some access to DAP 30%	Donkeys only 10%	Donkeys and cattle 2%	Cattle only 4%	Donkeys only 4%	Donkeys and cattle 12%	Cattle only 31%
37%		16%			47%		

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

Source: Muvirimi, 1997

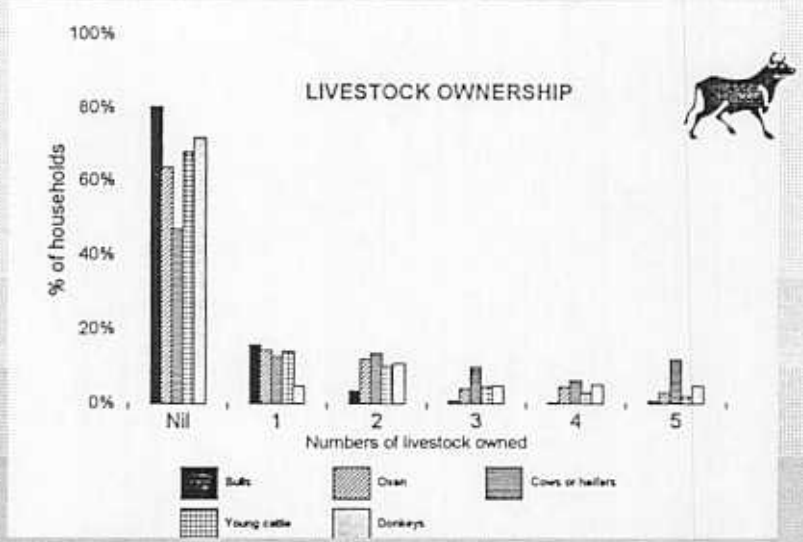

Figure: Livestock ownership (range owned by % households)

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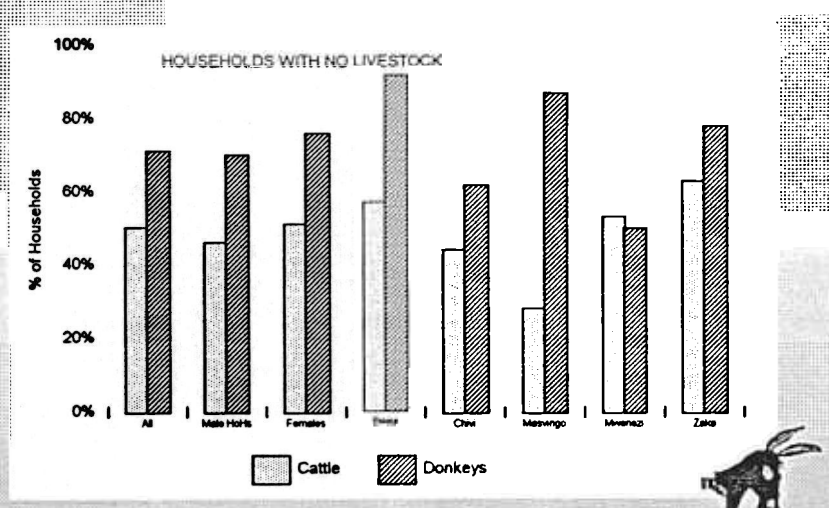

Figure: % households owning no livestock

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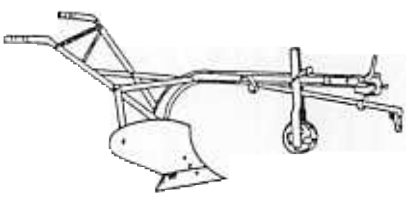
Percentage of farmers owning equipment in semi-arid Zimbabwe

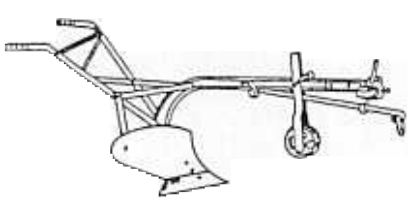
Implement	% of farmers owning equipment (n=248)	
	Nil	At least one
Ploughs	9	91
Carts	60	40
Cultivators	69	31
Ridgers	98	2
Harrow	71	9

Source: Muvirimi, 1997



Percentage of households owning or borrowing animal implements

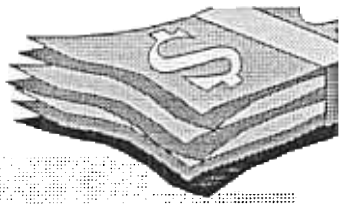
Implement	Owned	Borrowed
Ox plough	81%	15%
Ox cultivator	18%	14%
Ridger	2%	2%
Harrows	19%	19%
Ox planter	2%	2%
Scotch cart	35%	44%



Means of recompense and % of households using each

Type	% households
Nhimbe	19
Cash	61
Food	9
Beer	1
Kinship sharing	17
Exchange/barter	10

9



Significant trends

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

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Alternative use of DAP Implements

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

11

Constraints to DAP Implement Use

Limited knowledge/training for extension staff and farmers

- Poor awareness of implement design
- Poor condition of existing implements
- Inadequate maintenance (and maintenance facilities)
- Poor access to spare parts

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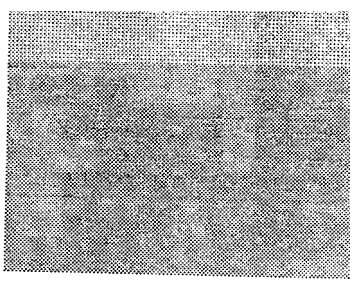
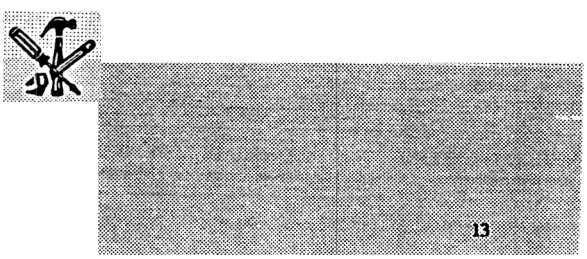
Supporting Infrastructure

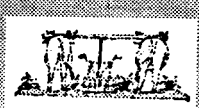
Formal sector *(ZimPlow)*	Wholesalers	Retailers *(Rural stores)*	Farmers
Informal sector *(Rural artisans)*			Farmers





Inadequate supporting mechanisms

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



Lessons learnt

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

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OPPORTUNITIES FOR INCREASING PRODUCTIVITY

- **Increasing the supply of DAP**
  - *Using existing animals more effectively*
  - *Greater use of donkeys*
  - *Encouraging DAP contractors*
  - *Increasing carrying capacity*
- **Reducing the demand for draught animals**
  - *Reduced tillage systems*
  - *Innovative implements*

16

Improving implement utilisation:

For farmers

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

For manufacturers - policies/incentives for

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

17

Discussion

(*Charles Sadzamara*) - Do you have any plans to investigate the effect of soil fertility (eg uses of animal manure)?
(*Steve Twomlow*) - This will be covered in the next presentation.

(*Clopas Rukuni*) - Farmers are not knowledgeable about their implements; what are the effects of stripping off the assemblies?
(*Aidan Senzanje*) - Obtaining the data is part of the project.

(*Norman Mhazo*) - Is there any merit in the project studying ploughing competitions, where AGRITEX still runs them?
(*Steve Twomlow*) - It may be interesting but how valid would the information be if all the entrants were Master Farmers?

(*Samson Khumalo*) - Have you noticed how quickly the wheel axle wears if the hitch assembly is removed?
Steve Twomlow, partly in response, provided an anecdote about a farmer who believed that a plough should always be set in the configuration of how it left the factory.

Background Paper II

Water conservation technologies: promising options and adoption constraints

S Twomlow
Silsoe Research Institute, Silsoe, UK

[This summary provides a brief narrative of the key points It accompanies the continuous sequence of detailed figures and tables which follow - ed.]

The goal of research and extension has to be the improvement of farmers' capacities to manage their land sustainably. Management-intensive technologies like soil and water management in particular require a high level of 'land literacy' and skills. The development and adaptation of innovative practices are one of the vehicles to achieve this goal. However, the major lessons learnt during several decades of research and extension highlights that, unless these techniques are built upon farmers' existing knowledge, resource base and decision-making criteria, they remain 'on the shelf'. The introduction and imposition of exotic technologies developed in the isolation of the research station has had little success. It is therefore essential that research and development workers understand the resources, constraints and options within which individual farmers operate. This includes identifying who actually grows the crop and who will use new technological interventions. All too frequently in the past, the research and dissemination process has ignored the role of women, particularly in Africa, where they provide up 75% of the labour inputs in agriculture.

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

Recent work in Zimbabwe has shown that the majority of smallholder farmers rely heavily on draught animal power (DAP) and mouldboard ploughs for primary tillage and crop establishment. Seed is planted by hand into a furrow made by the plough and covered during the next pass, ensuring the maize germinates into a relatively weed-free seedbed (Third Furrow Planting - TFP). Unfortunately, farmers face the problem that the peak demand for DAP coincides with the period that animals are in their weakest condition at the end of the dry season (Shumba *et al.*, 1992). Farmers recognise the need for weed control to remove weeds and allow enhanced capture of rainfall. Weed management is a key component of conservation tillage (Norton, 1987; Riches *et al.*, 1997) and with weeding accounting for up to 60% of pre-harvest labour input for maize production (MLARR, 1992), considerable strain is placed on household supplied labour, particularly women. This could be reduced through more appropriate use of the cultivator or plough.

The availability of labour, DAP (to both men and women) together with well maintained and correctly used implements are key resources that determine the area planted, timeliness of operations, efficient utilization of other resources and, hence, the productivity and sustainability of the cropping system (Shumba *et al.*, 1992; Ellis-Jones & Mudhara, 1997; Chatizwa, *et al.*, 1998). The heterogeneity of household resource availability has been well established (Ellis-Jones and Mudhara, 1995; Scoones, 1995) and it is clear that farmers should have a range of technology options from which to select, based on individual socioeconomic and biophysical conditions. Research work over three seasons has provided opportunities for technology development with farmers in Zimuto Communal Farming Area and the adjacent Mshagashe Small Scale Commercial Farming Area to evaluate alternative crop establishment and weed control systems across a soil catena. This participatory approach to technology development has ensured that farmers have remained central to identifying, testing and evaluating the technology options (Twomlow *et al*, 1998; Ellis-Jones *et al.*, 1998). The conclusions that can be drawn from this research are:

- Farmers have a deep understanding of the interrelationships between the factors which need to be considered in achieving acceptable maize yields.
  Farmers are willing to make a number of trade-offs to achieve timely planting, crop stands and acceptable levels of weeding.
  On all soils, planting into a furrow created with a ripper tine (RIP) or a plough (OPFP - open plough furrow planting) makes the best use of both available draught animals and labour, and they produced the best maize yields. Both methods are better than the traditional farmer practice of TFP (third furrow planting).
  Hand hoe weeding is better than both the ox-cultivator and ox-plough. The poor performance of the draught animal weeding methods is largely due to the poor condition of the farmers' implements and their lack of knowledge about their efficient use. This includes both men and women farmers.
  Households with greater access to DAP and labour seem prepared to accept that earlier weeding will be needed following planting into rip lines or OPFP, if this consistently allows more timely planting and results in a good crop stand.
- Those households with low DAP and low labour availability (mainly female-headed households) are less willing to accept the trade-off and see TFP as less risky and a method of saving both DAP and labour.

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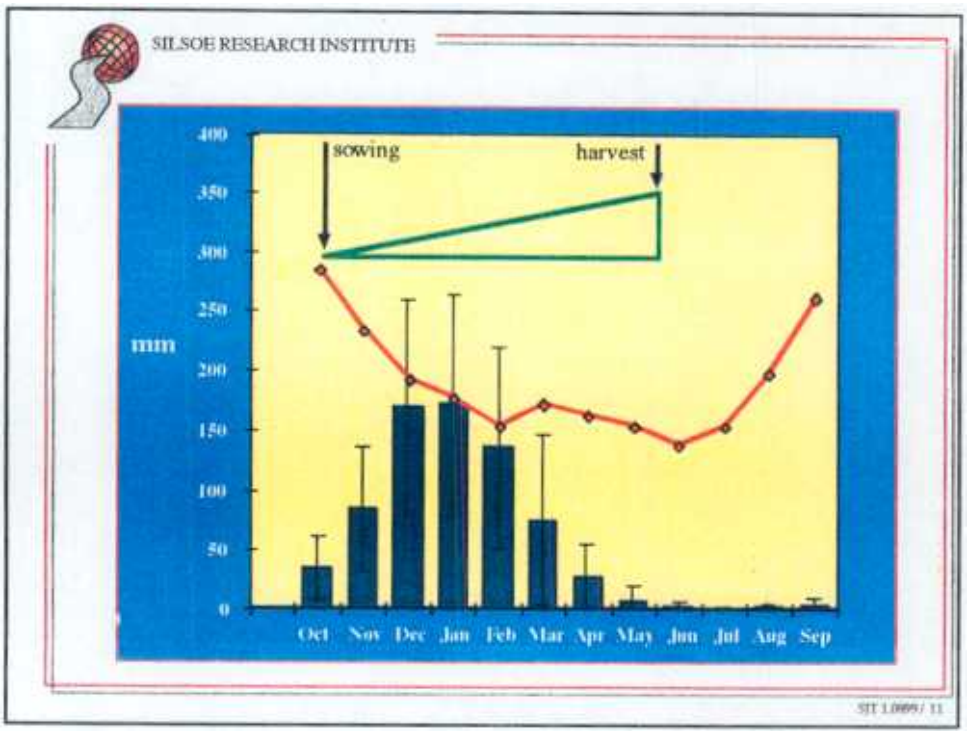
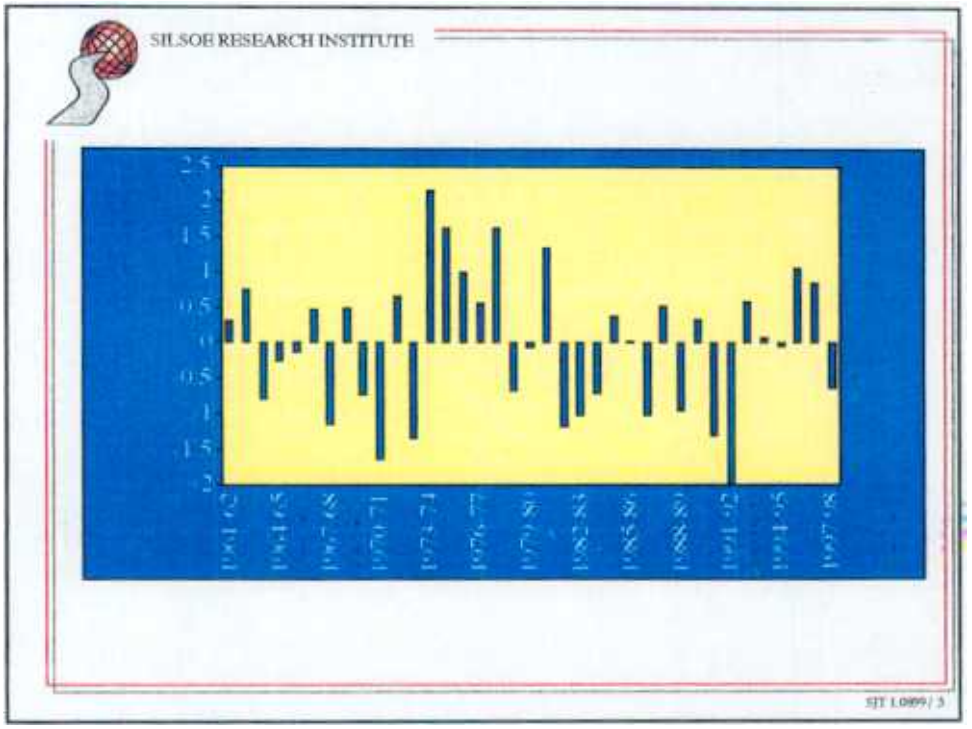
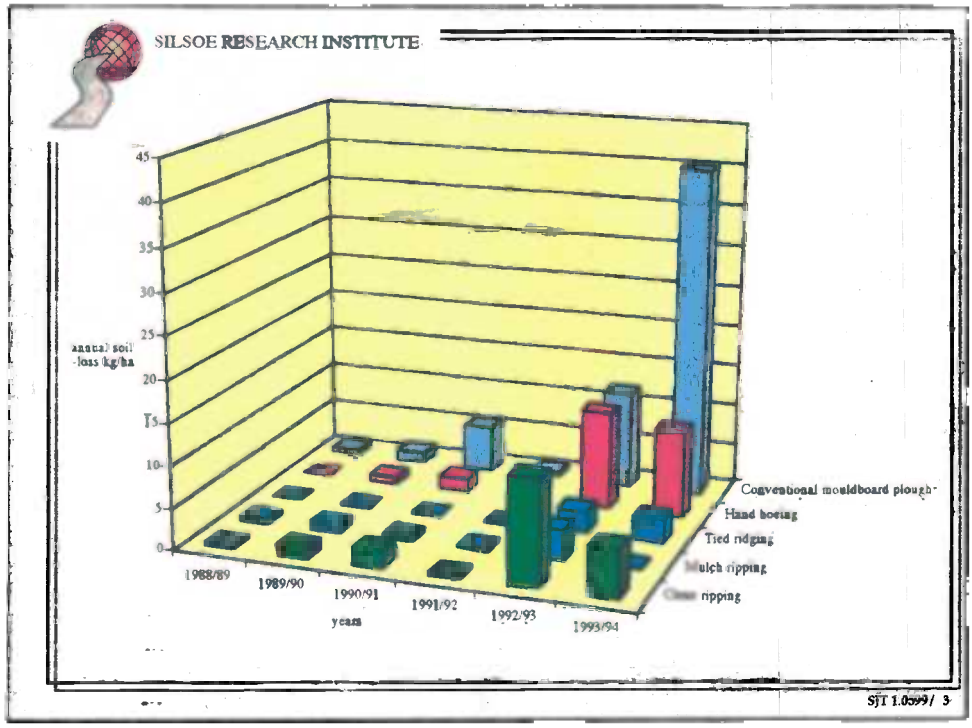


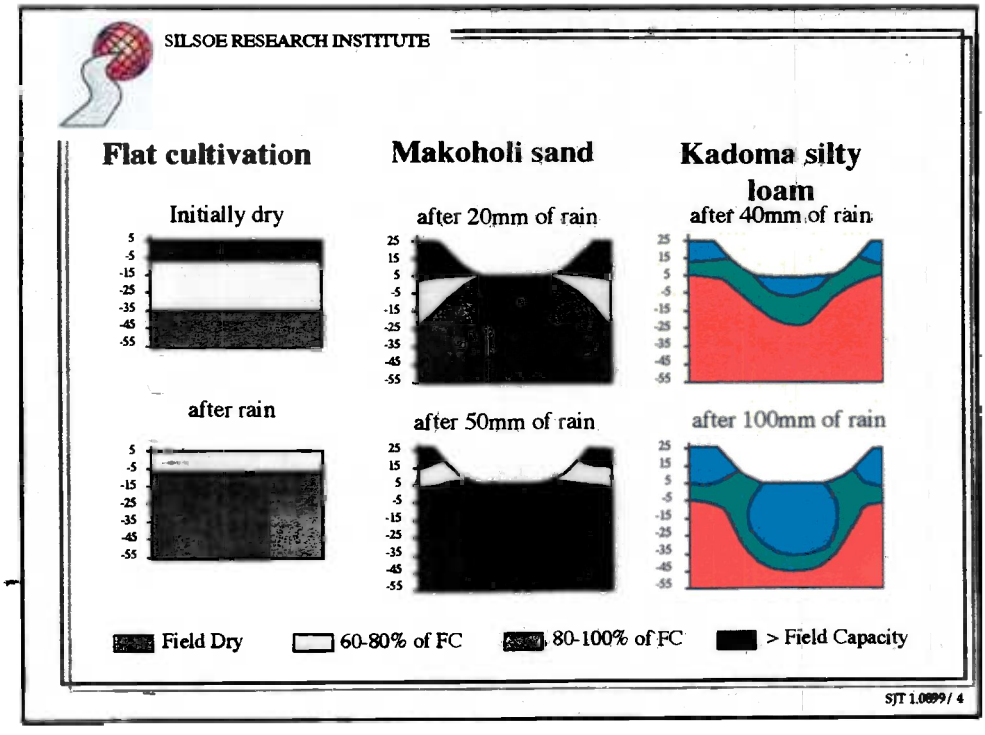
1. Schematic cropping calendar for semi-arid Zimbabwe



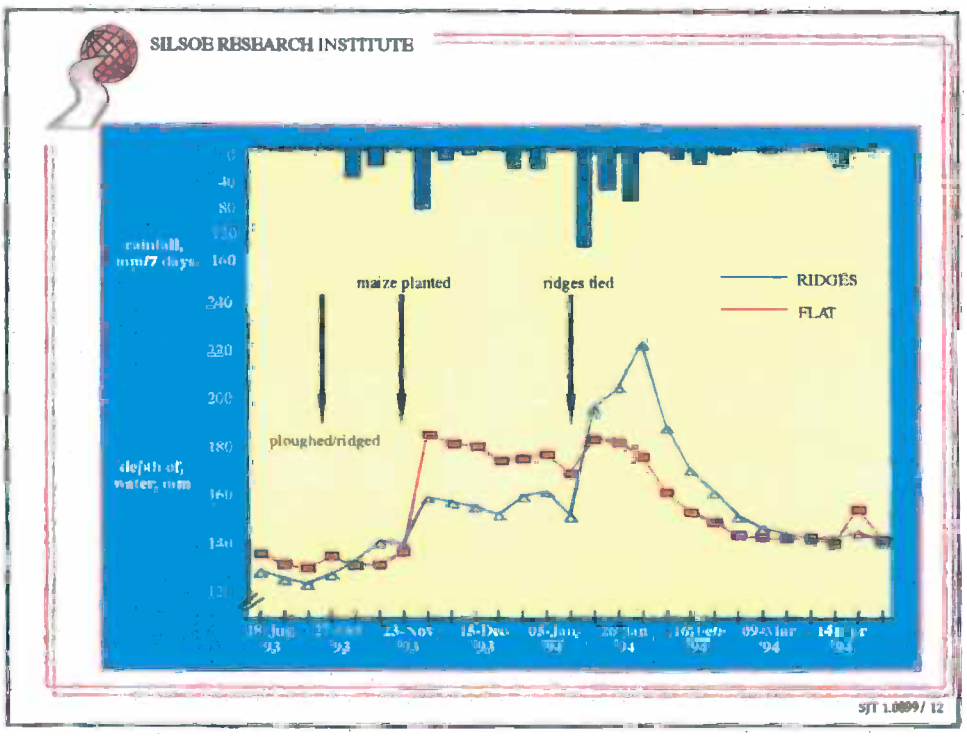
2. Meteorological drought index - based on 30 year rainfall records from Makoholi



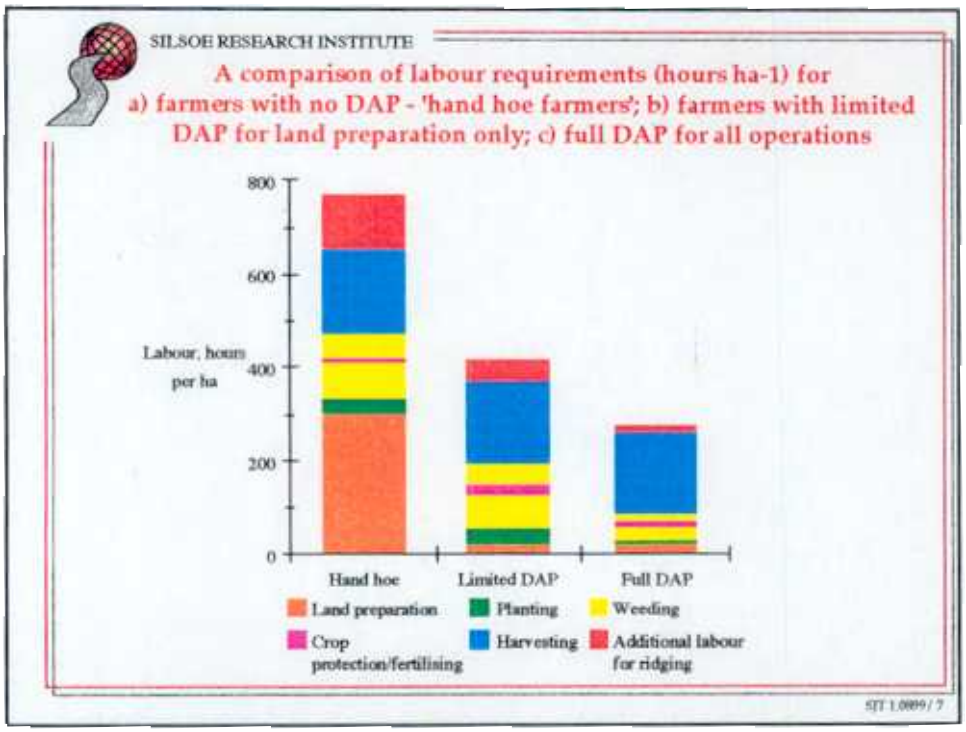
3 Annual soil loss (kg/ha) observed for 4 tillage treatments at Makoholi from 1988 to 1994



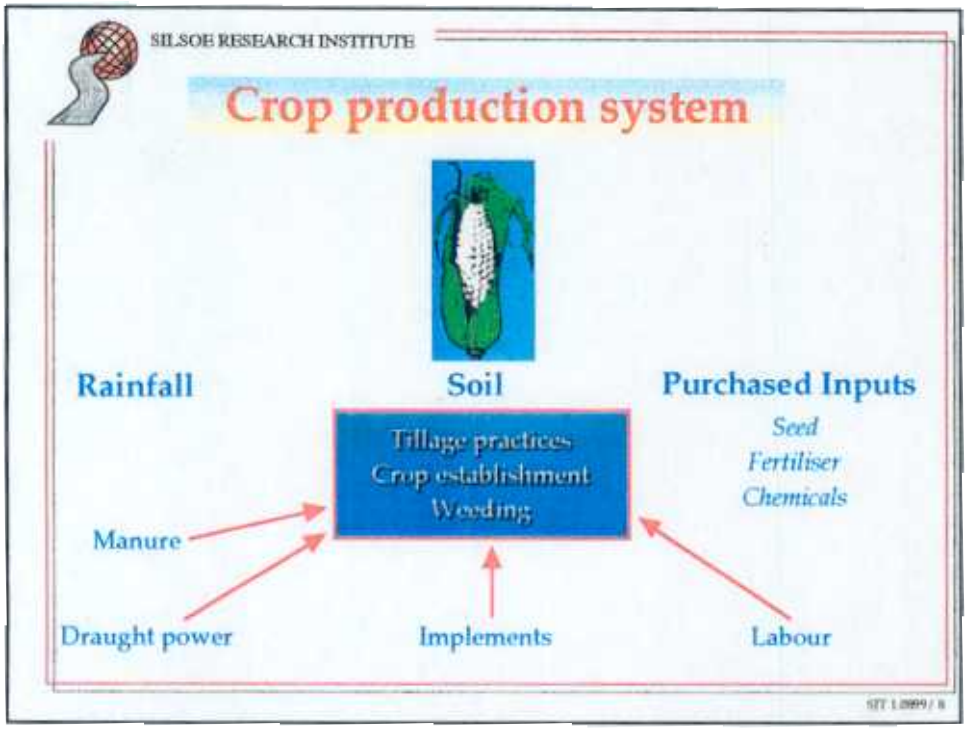
4. Progression of wetting fronts for a conventional flat system compared to ridges constructed on Makoholi sand and Kadoma silty loam from an initially dry state to a wet state



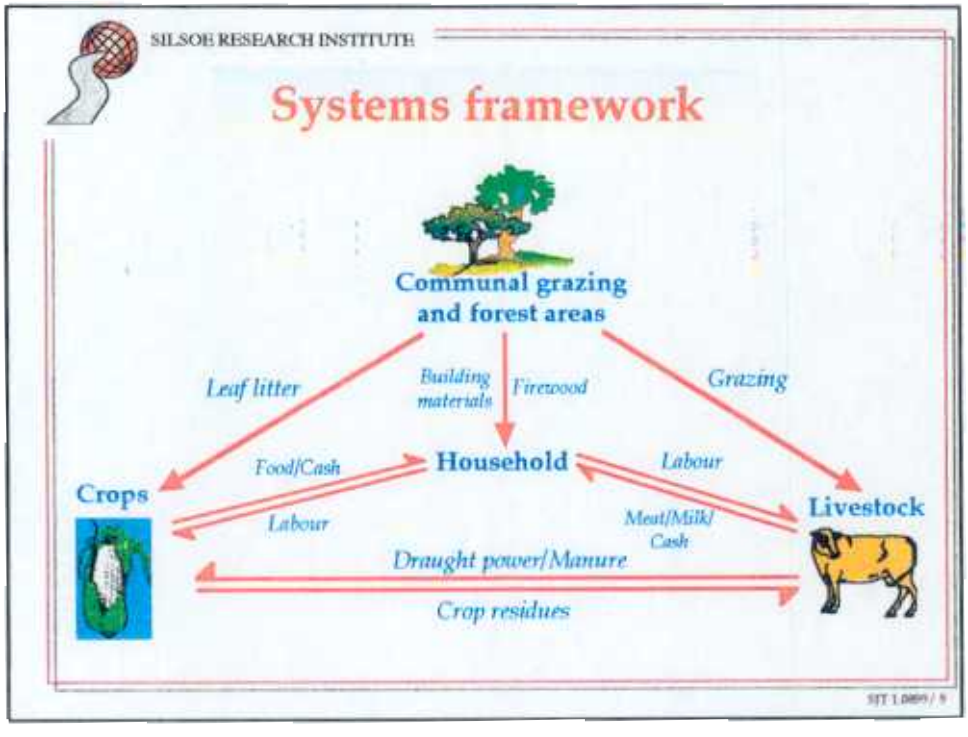
5 Seasonal fluctuations in soil water content (mm) for a sandy loam (Sanyati) in response to flat and tied ridge cultivation for the 1993/94 season when ridges were tied late



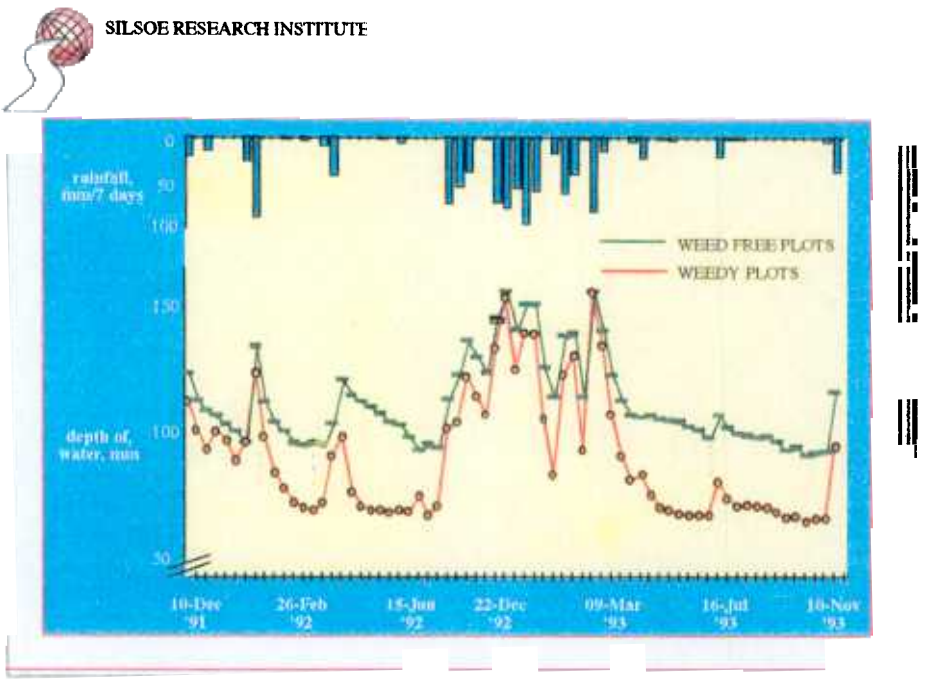
6. A comparison of labour requirements for farmers with different resources to carry out land preparation, weeding and ridging



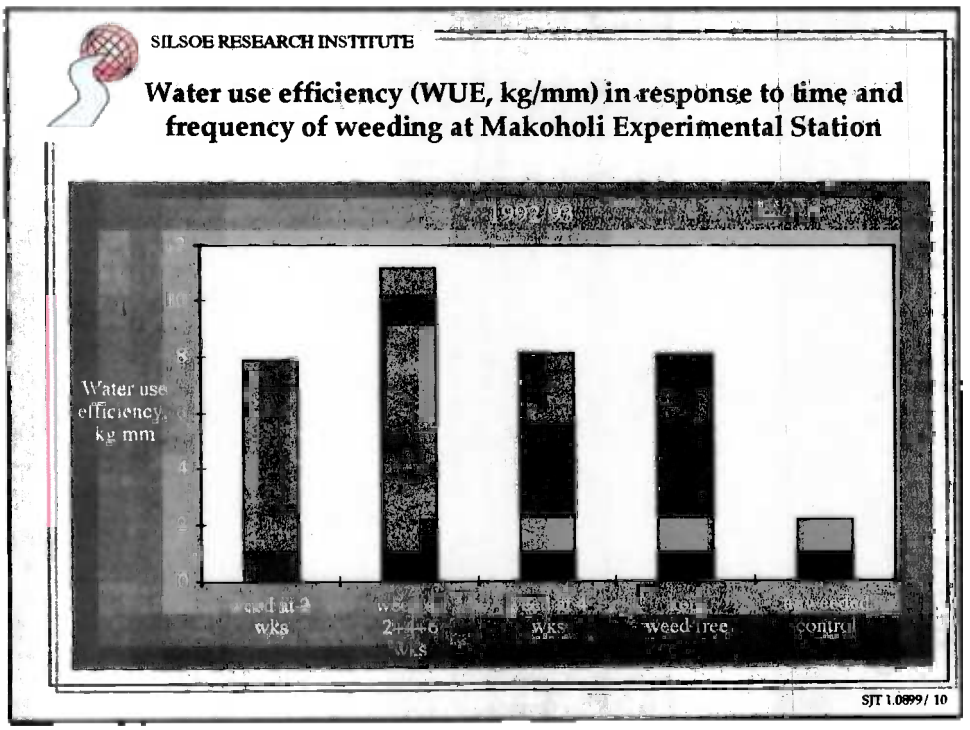
7. The crop production system - as seen by researcher in the past



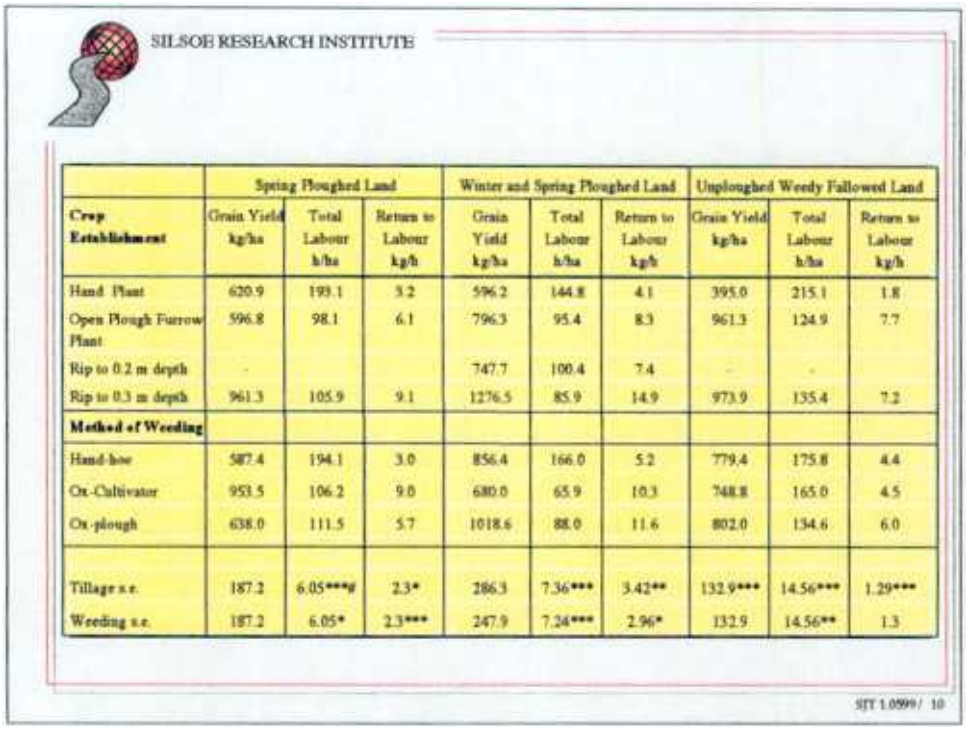
8. Crop production and its position within a systems context



9 Impact of weeds on the soil water regimes that develop under a maize crop grown on Makoholi sand

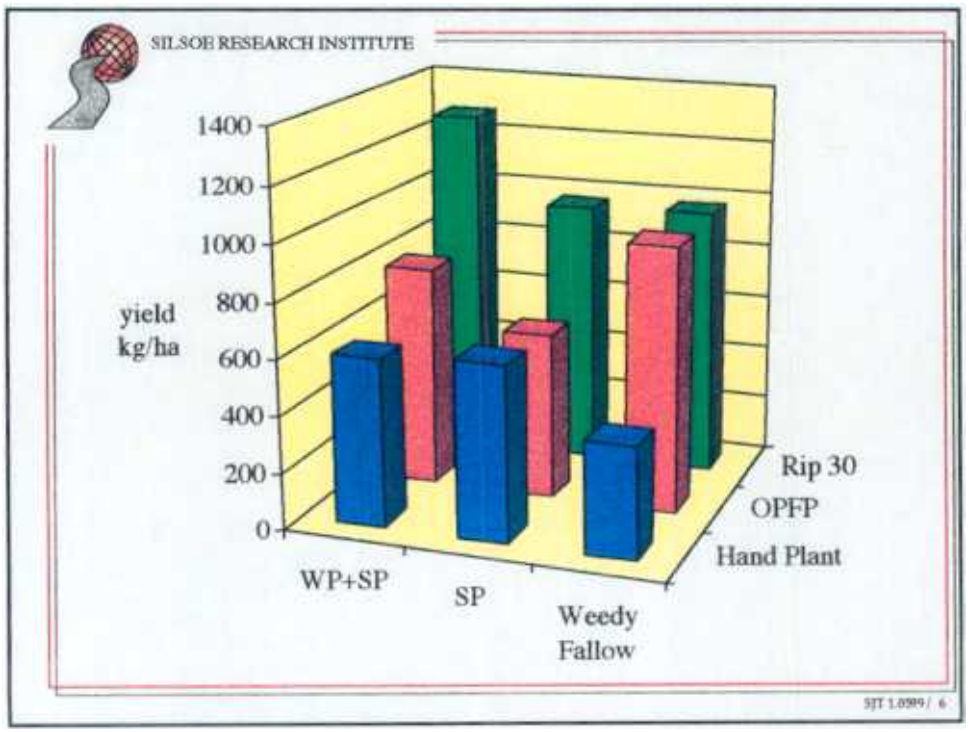


10. Water use efficiency (WUE, kg/mm) in response to time and frequency of weeding on a Makoholi sand

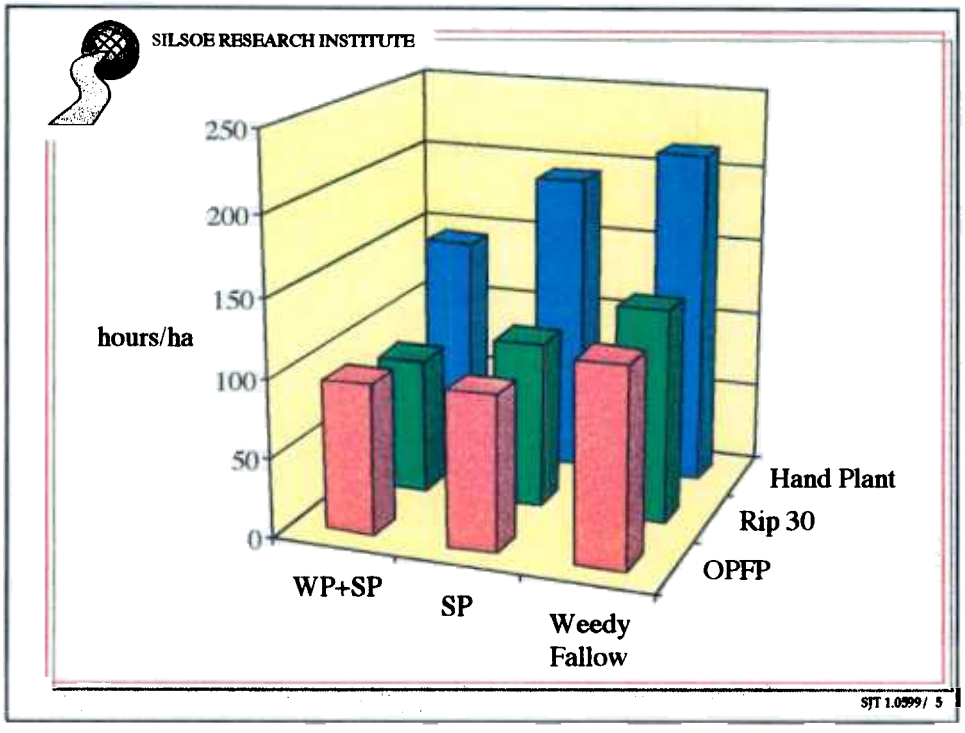


	Spring Ploughed Land			Winter and Spring Ploughed Land			Unploughed Weedy Fallowed Land		
Crop Establishment	Grain Yield kg/ha	Total Labour h/ha	Return to Labour kg/h	Grain Yield kg/ha	Total Labour h/ha	Return to Labour kg/h	Grain Yield kg/ha	Total Labour h/ha	Return to Labour kg/h
Hand Plant	620.9	193.1	3.2	596.2	144.8	4.1	395.0	215.1	1.8
Open Plough Furrow Plant	596.8	98.1	6.1	796.3	95.4	8.3	961.3	124.9	7.7
Rip to 0.2 m depth	-			747.7	100.4	7.4	-	-	
Rip to 0.3 m depth	961.3	105.9	9.1	1276.5	85.9	14.9	973.9	135.4	7.2
Method of Weeding									
Hand-hoe	587.4	194.1	3.0	856.4	166.0	5.2	779.4	175.8	4.4
Ox-Cultivator	953.5	106.2	9.0	680.0	65.9	10.3	748.8	165.0	4.5
Ox-plough	638.0	111.5	5.7	1018.6	88.0	11.6	802.0	134.6	6.0
Tillage s.e.	187.2	6.05***#	2.3*	286.3	7.36***	3.42**	132.9***	14.56***	1.29***
Weeding s.e.	187.2	6.05*	2.3***	247.9	7.24***	2.96*	132.9	14.56**	1.3

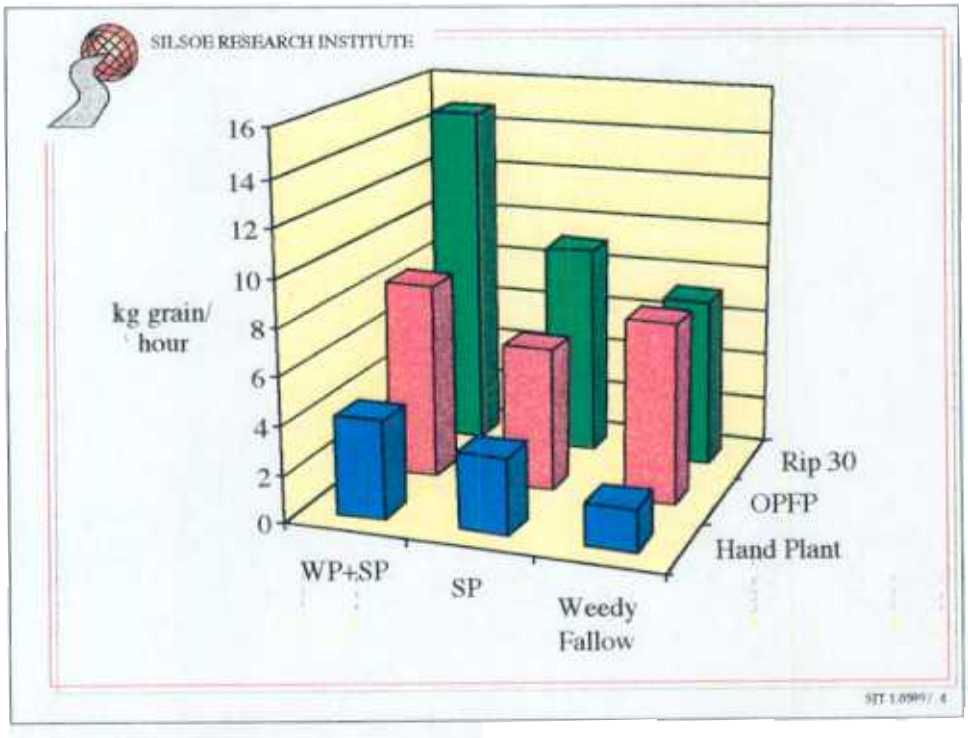
11. Maize yield response to different methods of crop establishment and weeding for spring ploughed, winter and spring ploughed land and an unploughed weedy fallow



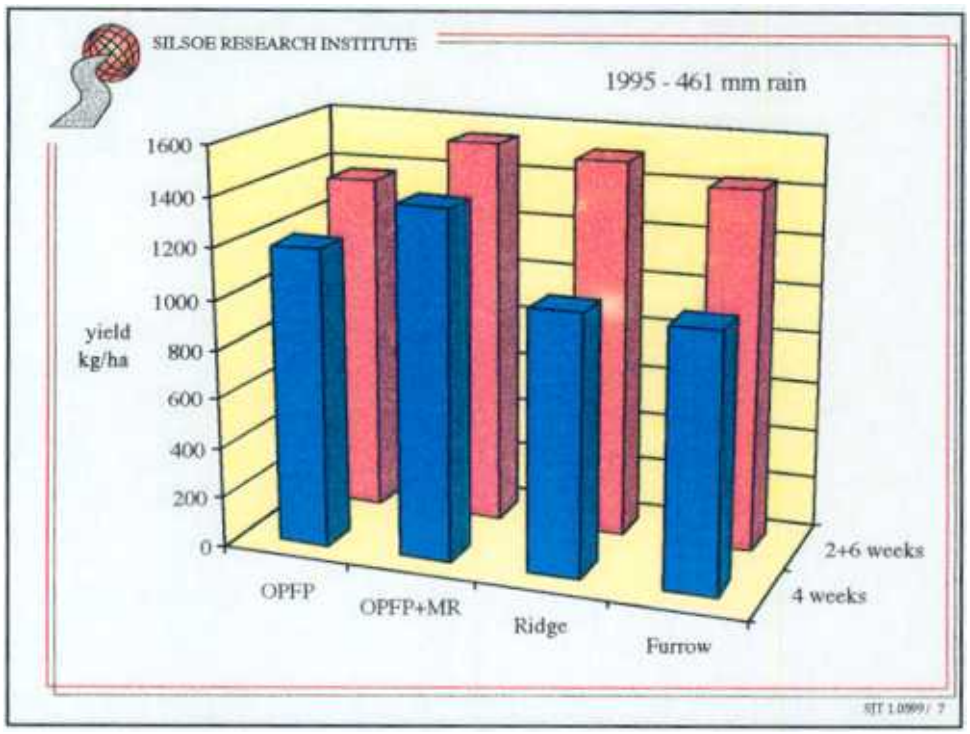
12. Interactions between primary land preparation and crop establishment technique on maize



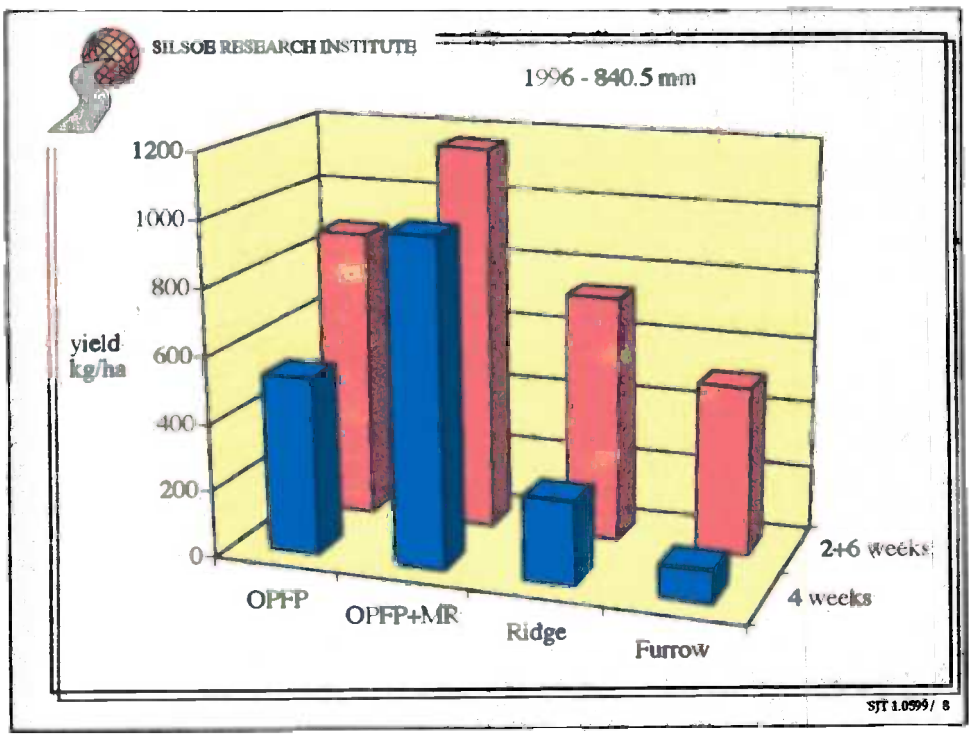
13. Interaction between primary land preparation and crop establishment technique on labour requirements



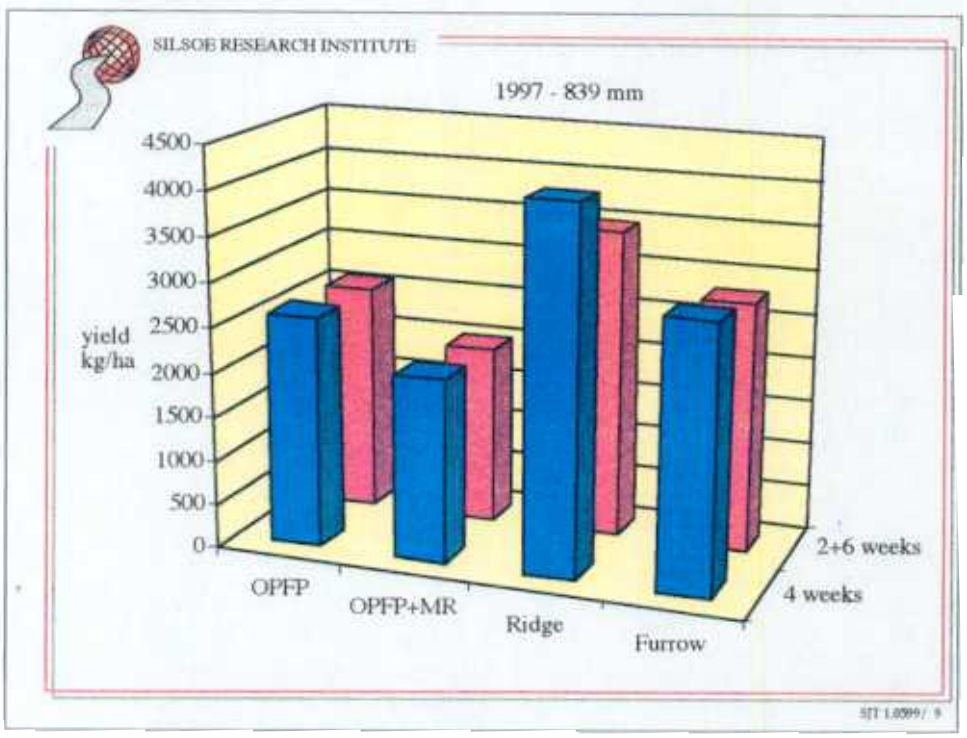
14. Maize grain yield per hour worked (kg/ha)



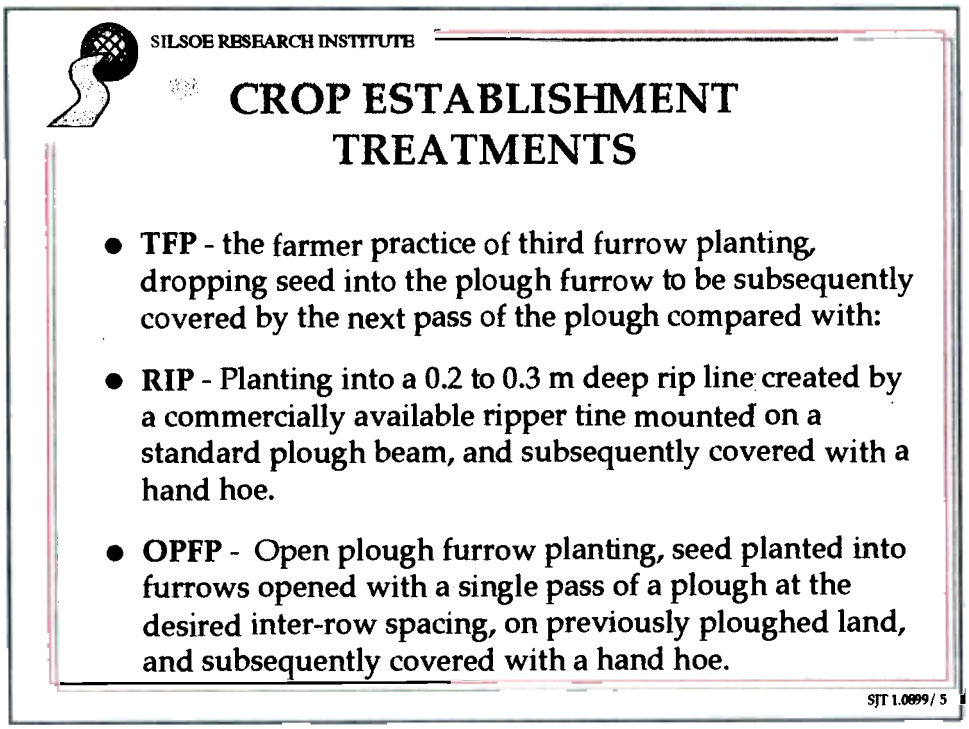
15. The interaction between 4 different conservation tillage and frequency of weeding 1995



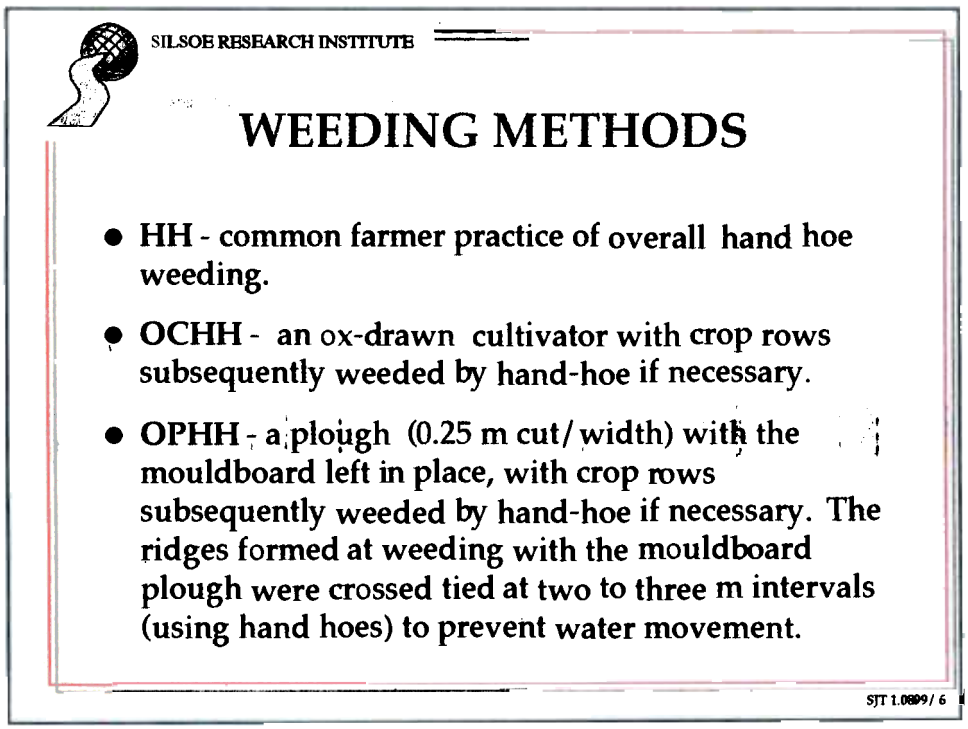
16. The interaction between 4 different conservation tillage and frequency of weeding 1996



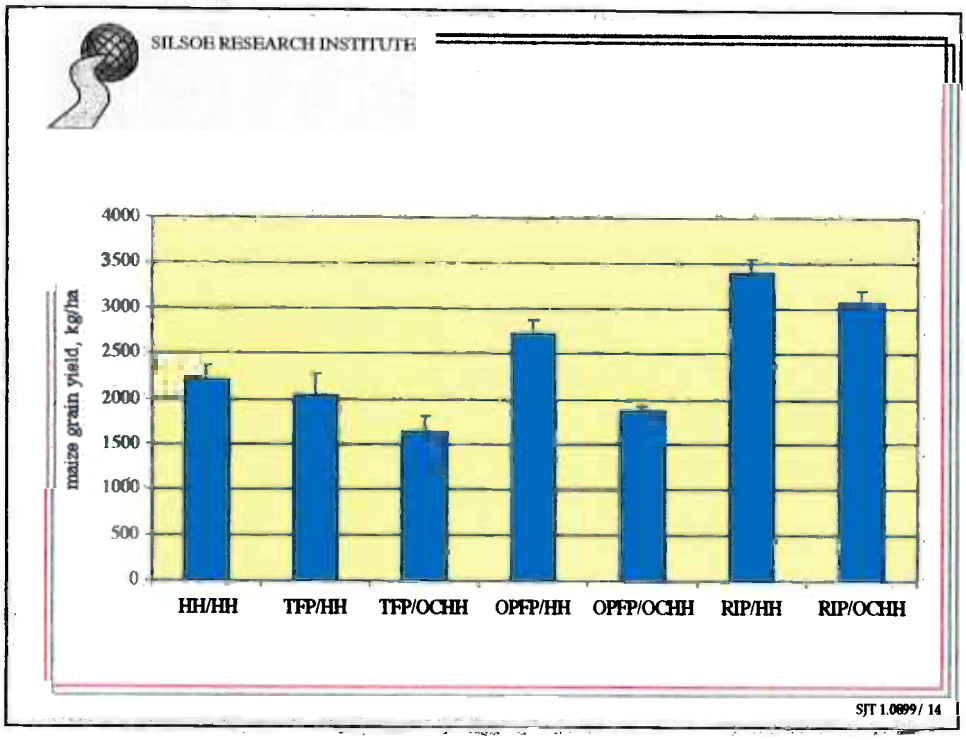
18. Farming operation by different farmer categories in Mshagashe and Zimuto



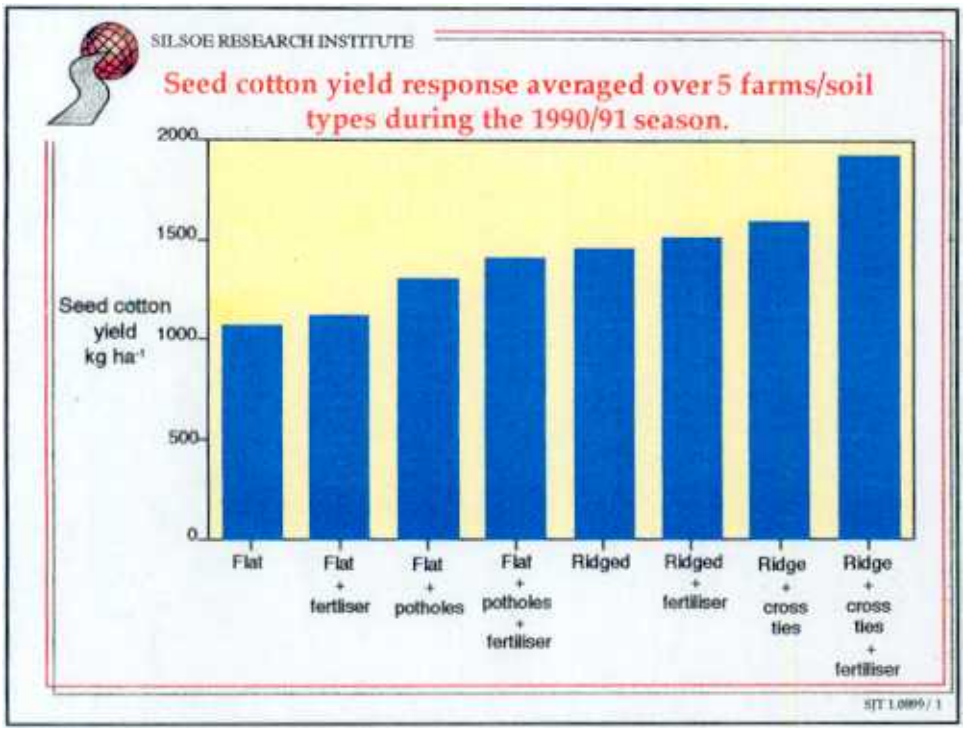
19. Crop establishment treatments tested over 4 seasons in Mshagashe and Zimuto



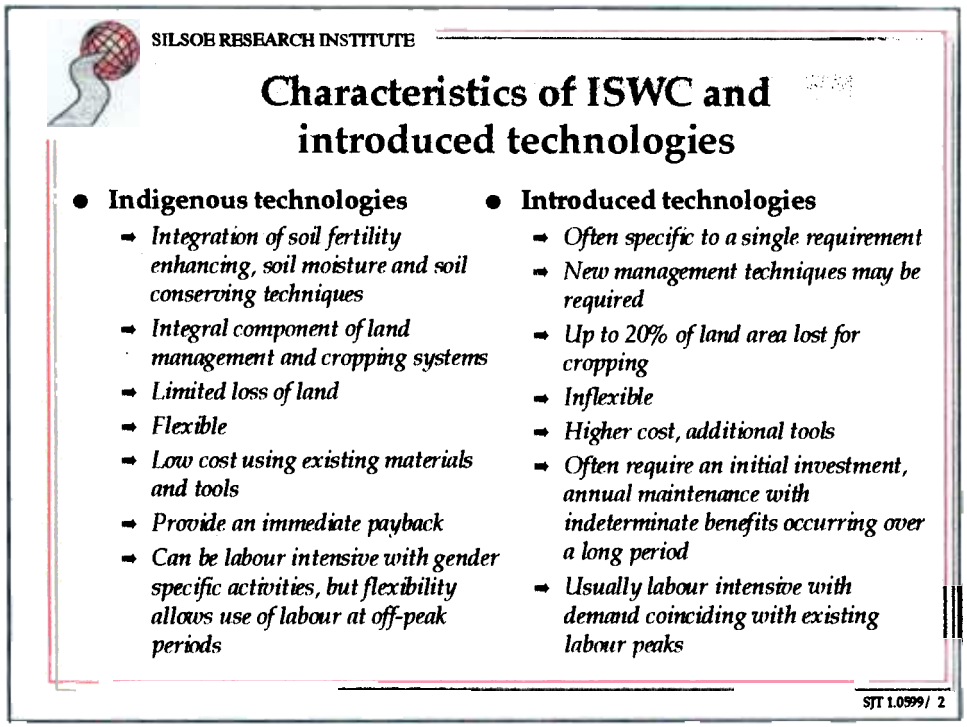
20. Weeding tested over seasons in Mshagashe and Zimuto



21. Maize yield response to different combinations of crop establishment and weeding carried out by farmers in Mshagashe and Zimuto in 1998



22. Seed cotton yield response averaged over 5 farms/soil types during the 1990/91 season in Sanyati



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

Discussion

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

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

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

Small Group Discussions I

Issues of Concern to the Project

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

Group Reports

Issue 1 Interventions for improved implement use

(Rapporteur: Norman Mhazo)

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

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

2 Approaches to improve implement use

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

Discussion

(*Jim Ellis-Jones*) - Do farmers see the problem (eg using a dilapidated plough) as we see it?

(*Mrs Mandishona*) - The feedback that ZFU gets is that problems are more to do with a lack of draught animals than with poor equipment.

(*Pitiel Mujuru*) - Farmers need step-by-step demonstrations and are very appreciative of them.

(*Clopas Rukuni*) - Where do colleges get DAP teachers from?
- No real answer.

(*Pitiel Mujuru*) - The problems are also attributable to poor attitudes, low interest and low motivation.

Issue 2 Adoptability of innovative methods

(Rapporteur: Joanne Mhunduru)

Areas for intervention

- Soil conservation
- Fertility management
- Water conservation
- Weed management
- DAP - animal breeding, implements, ergonomics

Promoters of adoptability

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

Inhibitors of adoptability

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

No discussion

Issue 3 Availability of cattle and donkeys for alternative uses

(Rapporteur: Samson Khumalo)

1 Current uses

Use	Cattle	Donkeys
Ploughing		
	✓	
		✓
		✓
		✓
	✓	o
		o
	✓	o
	✓	o
		o
		✓
	o	

2 Potential uses

Use	Cattle	Donkeys
Harvesting		
	✓	✓
	✓	✓
		✓
	✓	
	o	✓
Breeding / genetic conservation	✓	o
Recreation and sport		

3 Constraints on potential uses

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

No discussion

Issue 4 Effects of innovative DAP practices on livelihoods

(Mrs Gova)

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

1 Direct beneficiaries

Farmers / families
Rural blacksmiths
Contractors (hiring out animals and implements)
Manufacturers and traders

2 Benefits to farmers (livestock owners / non-owners)

- increased yield
- time and labour saving
- DAP saving
- increased income

3 Benefits to the community

offer labour for hire
income generation

4 Benefits to blacksmiths

demand for services
income generation

5 Benefits to contractors

increased income

6 Benefits to traders

increased sales
higher stock turn-over

7 Benefits to manufacturers

increased sales

8 How to promote

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

9 Disadvantages

- high cost
- availability
- lack of capital
- competition
- social unacceptability
- non-tangible benefits

General Discussion

(*Steve Twomlow*) - There is a lot of information presented to (communal) farmers which is contradictory. This is very confusing to the farmers.
(*Jim Ellis-Jones*) - There will always be contradictory information around.

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

Project Structure and Linkages

D O'Neill and S Twomlow
Silsoe Research Institute

The project structure was described mainly by use of the LogFrame. The formal collaborative linkages between Silsoe, UZ and AGRITEX and the Outputs described on Day 1 (Introduction to the Project) were referred to briefly. The LogFrame was presented and the Activities discussed, both separately and in conjunction with the Outputs, to indicate how the Activities were expected to lead to the Outputs. The project LogFrame is given in the Appendix to this paper.

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

Table 1 Organisations offering possible field work collaboration

Organisation	Location(s)
CARE	
IES (Institute of Environmental Studies) - with CARE	Romwe Mutangi
ICRISAT	Chiredze Gwanda Tsholotho Zishavane
IFAD	
CTC / COTCO	
OCCZIM	

Some of the advantages and disadvantages of these locations and the expectations of the different organisations were discussed, but not recorded.

One major discussion point that arose was that the locations must offer access to the three main types of DAP farmer, viz: **communal, resettlement** and **small-scale commercial**.

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumptions
Goal Performance of livestock (including draught animals) in semi-arid crop/livestock and livestock production systems improved.	By 2005 in two nominated target countries where primary demand exists: - area cultivated per livestock unit increased by 15% - total crop yields in areas cultivated by livestock increased by 10%	Reports of target institutions National production statistics Evaluation of LPP Research programme reports Monitoring against baseline data	
Purpose Develop and promote strategies for the allocation and management of on-farm and locally available resources in order to optimize livestock production and improve their contribution to the crop/livestock farming system.	By 2003 Improved strategy adapted to at least two sub-Saharan countries that: - improves DAP efficiency by 10% - reduces labour input by 10%	Research programme reports	Target institutions invest resources in the uptake and application of research products
Outputs 1 Best Practice Guidelines in implement use (setting, maintenance & harnessing) based on current knowledge will be developed by appropriate stakeholders.	Guidelines available by December 2001	Project reports	Stakeholders involvement from the initial design of the project, through implementation will facilitate achievement of this Output.
2 The appropriateness of current DAP use utilization in maize and cotton systems will be defined in terms of management of existing resource utilisation (particularly animals, implements and labour) on yields and profitability. The potential for resource utilisation in innovative crop production methods (green manures, animal manures, crop residues) will be quantified.	By 2001, potential for DAP use in innovative crop production systems established	Reports of collaborating institutions	Stakeholders promote the findings. Productivity increases achieved through better maintenance and use of equipment can be quantified and are significant.
3 The findings of the research will be promoted and disseminated by stakeholders.	By 2001, findings of research promoted by ZFU and AGRITEX as part of their on-going extension programmes		

Narrative Summary	Objectively Verifiable Indicator	Means of Verification	Important Assumptions
Goal			
Performance of livestock (including draught animals) in semi-arid crop/livestock and livestock production systems improved.	By 2005 in two nominated target countries where primary demand exists: - area cultivated per livestock unit increased by 15% - total crop yields in areas cultivated by livestock increased by 10%	Reports of target institutions National production statistics Evaluation of LPP Research programme reports Monitoring against baseline data	
Activities			
1.1 Preliminary workshop with all stakeholders, to identify and agree the roles of the main collaborating institutions.		1.1 Workshop Proceedings available December 1999.	- Climatic conditions are favourable during the project. - Farmers are willing to participate in diagnostic surveys and evaluations. - Suitable In-country stakeholders from extension, research, NGOs and commercial organisations are identified and willing to collaborate. - Stakeholders have resources to publish guidelines. - In-country collaborators willing to acknowledge guidelines produced and incorporate findings into future research initiatives.
1.2 An assessment of the efficiency of use of DAP implements will be made with existing farmer groups (with and without previous training) a. surveys, b. farmers and c. scientists' diagnostic evaluations.		1.2 Surveys and diagnostic evaluations completed by Dec 2000.	
1.3 An assessment will be made of current dissemination methods for DAP/implement use identifying strengths and weaknesses in order to build on the strengths.		1.3 Literature survey, survey and discussions with stakeholders compiled into a report April 2000.	
1.4 An assessment will be made of current institutions' (traders, artisans, manufacturers) ability to support farmers' repair and maintenance needs.		1.4 & 1.5 Literature survey, survey and discussions with stakeholders compiled into a report October 2000.	
1.5 An assessment will be made of the social and economic implications of promoting DAP technologies.			
1.6 Participatory development of best practice guidelines for farmers on correct implement use and setting.		1.6 Guidelines available by 2001.	
2.1 Innovative crop production methods likely to be disseminated by crop production scientistswill be identified.		2.1 Innovative practices confirmed by Jan 2000.	
2.2 DAP requirements (power and implements) for these innovative crop methods will be assessed.		2.2 DAP requirements reported by March 2001.	
2.3 The implications of innovative technologies for farmers' adoptability based on farmers' current resources will be assessed.		2.3 Implications for farmers reported by Dec 2001.	
3.1 The best practice guidelines produced in Activity 1.5 will be made available for dissemination by appropriate stakeholders (ZFU, AGRITEX, commercial companies).		3.1 Guidelines dissemination initiated by May 2001.	
3.2 The research findings will be promoted through an end of project workshop and publications.		3.2 Final project Workshop Proceedings available by Jun 2002.	

Small Group Discussions II

Field Activities

Group 1	Location and farmers
Group 2	Survey design
Group 3	Field trials
Group 4	Data collection and analysis

Group Reports

Group 1 **Location and farmers**

(Vurayai Zvarevashe)

Major criteria

- farmer groups
- other projects
- potential collaborators
- crops: maize / sorghum, cotton
- Natural Regions III, IV and V
- back-up
- continuation beyond end of project

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

Discussion

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

(*Mrs Mandishona*) - What are the Districts in Masvingo?
There are several to choose from. These can not be confirmed until more detailed discussions are held with the collaborators.

Area	Resettlement farmers	Small-scale . commercial farmers	Communal farmers	Collaborative projects / database	Farmer groups	Crops	Back-up services	RANK
Masvingo III, IV & V	✓	✓	✓	CARE - /IES IUCN OCCZIM UZ	DRC IC Agronomy	Maize, cotton, sorghum	Agric Mech	
Mat. S & N Gwanda Tsholothso IV, V		✓ OCCZIM Filabusi	✓	ICRISAT DR&SS OCCZIM	Research groups	Maize, sorghum	Zimplow	4
Mash Cent Muzarabani V			✓	GTZ CPC	Resource farmer groups (?)	Cotton, maize, sorghum	IAE (?)	3
Mash E Mtoko IV, V			✓	ENDA (?) C/CARE OCCZIM	Farmer groups	Maize, cotton		5
Mash W Sanyati, Nembudziya IV	✓	✓	✓	DR&SS CTC UZ	Big 12 Big 15	Cotton, maize, small grains	Agric Mech	2

Group 2 **Survey design**

(Pitiel Mujuru)

1. Information required

1.1 Socio-ecc ıomic / Wealth ranking

Household

Assets
- livestock: availability, distribution, accessibility
- implements:
- landholding: grazing, arable

Farming systems - crops and livestock

Use of livestock - cattle and donkeys

Sources of income - on-farm, off-farm

Attitudes - on use of DAP

Cultural values

1.2 Technical

Livestock management
- grazing area management
- supplementary feeding: crop residues
- preferential feeding
- health and care
- selection and training of DAP
- multi-farm use: hiring, sharing
- uses for DAP: ploughing, weeding, transport etc
- types: breed, age, sex, condition
- roles: of men, women, children (and ages)

Implement management
- range of implements
- sources of implements
- age and condition
- uses of implements
- maintenance - replacement rate

Owners, Blacksmiths, Dealers
- operating costs
- operational skills
- source(s) of knowledge, skills, attitudes
- implement innovations: adequacy of mechanisation
- problems, limitations with implements
- capacity, work rates: soil type and condition
- roles in operations: men, women, children / ages

Crop management and productivity

(Tillage practices and options and effects on productivity)

Practices *vis-a-vis* yields
- methods of crop establishment
- number of ploughings
- time of ploughing(s)
- methods of weeding
- methods of harvesting

2 Methodology

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

Who	When	With whom / what
IAE AGRITEX HQ ZFU SILSOE	From October 1999 to end March 2000	

No discussion

Group 3 **Field Trials and Demonstrations**

(Ephraim Mbanje)

1 Indicator(s)

Yield

2 Parameters

Animals size, type, performance, condition

Implements - state/condition, type, weight, draught, efficiency, setting

Labour - operations, gender, work rates, work load(s), training

Soil - type, physical characteristics, moisture, field conditions

3 Trial set-up

Paired plots - farmer managed

Compare innovations, labour, yields etc

Trained and untrained groups

Exchange visits

4 Demonstrations

Field days

Ploughing - competitions or demonstrations
Training
Field trials
Exchange visits

Discussion

(*Norman Mhazo*) - Add work rate to indicators

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

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

Group 4 Data collection and analysis

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

A General

1 Environment

Natural Region; rainfall pattern (amount and distribution); soil type(s); vegetation; water sources; grazing land; annual temperature; infrastructure (roads, bridges, etc).

2 Farmers

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

3 Cropping

Major crops and areas grown; crop production constraints; planting time(s); cropping calendar (weeding, harvesting etc); inputs; input sources; average yield of each crop; marketing.

4 Livestock

Types and breeds of cattle; types of donkeys, goats, sheep etc; uses of animals; herd composition (bulls, cows, calves etc); numbers of female and male donkeys; production constraints; management practices (dosing, de-horning etc); average weight of animals.

B From Individual Farmers

1 Household

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

2 Crops and livestock

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

3 Draught implements

Types; condition; age; maintenance; source(s) of spares; which implements for which animal; knowledge and skills in implement setting; constraints; sources of implements Which local artisans, if any).

C Analysis

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

D Resources

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

No discussion

Small Group Discussions III

Development and Extension

Group 1	Gender sensitivity
Group 2	Role(s) of artisans and manufacturers
Group 3	Format for "Best Practice Guidelines"
Group 4	Dissemination - current methods and recommendations for uptake pathways for Project Outputs

Group Reports

Group 1 Gender issues

(Tiri Koza)

1 Household compositions

- male / female headed
- avoid biassed approach

2 Animals

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

3 Implements and field operations

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

4 Trials and demonstrations

- issue of the "real farmer"
- farmers of all wealth rankings must be involved
- representative of the community: eg including female-headed households
- participation
- do not force issues
- establish **user** training needs:
  operation, maintenance, selection / care / use of animals
- training for **all**; no segregation
- well linked to Best Practice Guidelines

Discussion

In discussion it was noted that women had attended the Blacksmith Course at the Rural Technology Centre.

Group 2 **Role of artisans and manufacturers**

(Ivan Chatizwa)

1 Survey

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

2 Activities of artisans

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

3 Activities of manufacturers (in addition to 2 above)

- manufacture implements and parts
- develop new designs
- develop prototype models

4 Communication

Artisan to:	farmer	-	strong
	dealer	-	weak
	manufacturer	-	minimal
Farmer to:	artisan	-	strong
	dealer	-	strong
	manufacturer	-	very weak
Dealer to:	farmer	-	strong
	artisan	-	weak
	manufacturer	-	strong

Manufacturers' linkages evident from the above.

5 Potential roles for artisans (researchable?)

diagnose farmers' implement problems from the condition of their implements

- train farmers in implement operation and maintenance

Group 3 **Format for "Best Practice Guidelines"**

(Charles Sadzamare)

1 Targets

- farmers
- extension agents
- artisans
- dealers and retailers
- manufacturers

2 Methodology

- review existing materials (collection and evaluation)
- review existing dissemination methods (collection and evaluation)

3 Criteria for farmers

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

4 Criteria for extension agents

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

5 Criteria for artisans

- guidelines on repair and maintenance of farm implements
- guidelines on making parts and templates
- guidelines on keeping minimum stock in store

6 Criteria for dealers and retailers

- posters
- manuals
- stock lists

7 Criteria for manufacturers

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

Discussion

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

Group 4 Dissemination - current methods and recommendations for project outputs

(Edward Nengomasha)

Current Activities	Recommendations
Field days and demonstrations	Increase frequency Decrease "non-associated" activities Improve farmer participation Greater practical content
Training programmes	Include DAP knowledge and skills in syllabi (2nd and tertiary) Prioritise resource allocation towards DAP issues Increase coverage of farm machinery training (AGRITEX) Encourage farmer-farmer information exchange Farmer Field Schools / Groups Encourage PEAs and PTDs
Ploughing contests	Promote more ploughing contests Promote on-farm ploughing Introduce judging of implement management (maintenance, assembly, storage)
Pamphlets / magazines / mass media	Increase production and distribution Encourage DAP video clips
DAP management	Improve selection, handling, training Encourage preferential husbandry practices for DAP

Discussion

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

Incorporation of Group Reports

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

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

Output 1 ("Best Practice Guidelines")	Actions
• Collect and collate existing material.	DO'N, SJT
• Assess target beneficiaries' views on "Best Practice Guidelines".	All
• For rural artisans, manufacturers and retailers - survey and identify needs.	IC/All

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

Output 2A (Appropriateness of current DAP use)	Actions
• Finalise locations for (i) survey and (ii) trials and demonstrations.	AS
• Finalise survey details - (i) formal and (ii) informal.	JEJ/TK
• Run trials (i) on-farm, (ii) on-station[4], researchers collecting key data.	TK

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

Output 2B (Potential innovations)	Actions
• Conduct on-station trials of innovative practices (1999-2000 season):-	
Domboshawa and Hatcliffe	TK/EM
Matopos (possibly)	EN
• Identify potential innovations relating to:-	
animals (including mixed spans)	EN
implements (tines, light ploughs)	EM
crop management	SJT
for on-farm trials in the season 2000-2001.	

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

Output 3 (Promotion and dissemination)	Actions
• Assessment of dissemination methods.	EC/(AS)
• Farmer field days in Masvingo.	PM
• Farmer Workshop(s) after 1999-2000 trials.	All
• Quarterly newsletter to all stakeholders.	AS/JM
• Other promotional events.	All

Experimental designs for both on-farm and on-station trials are to be prepared by SJT in association with the local researchers and ratified by a biometrician. As these Proceedings go to press, the experimental designs have already been completed and are available in the project Working Document No. 1[5] at Annexes 2 and 3.

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

International Development Group Report **IDG/99/18**, Silsoe Research Institute, 1999.

Closing Address

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

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

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

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

ANNEX 1

List of Participants

No.	Name	Position	Institution	Address
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17	Norman Mhazo	Appropriate Tech Officer	Development Tech. Centre	University of Zimbabwe, Box MP 167, MT Pleasant, Harare.
18	EpiphaniaViolet Mandishona	Chief Educ. & Training Officer	Zimbabwe Farmers Union	Box 3755 Harare
19	Majorie Gova	Senior Horticulturist/Agronomist	Agritex	Box CY639, Causeway, Harare
20	Aidan Senzanje	Lecturer	University of Zimbabwe	Box MP 167, MT Pleasant, Harare
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