



Opportunities for Conservation Tillage with Animal Traction

Report of the ATNESA International
Workshop on

***Conservation Tillage
with Animal Traction for
Soil and Water
Management and
Environmental
Sustainability***

*5th - 10th October 1998
Rundu, Namibia.*

Animal Traction Network for East and
Southern Africa

Ministry of Agriculture Water and Rural
Development



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Opportunities for Conservation Tillage with Animal Traction

Report of the ATNESA International Workshop held
5-10 October 1998. Rundu. Namibia.

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*Responsibility for the information and
opinions presented in this report rests with
the workshop rapporteurs and editors.
The opinions reported do not necessarily
reflect the views of ATNESA nor those of the
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that supported the workshop and this
publication.*

Cover Pictures:

Various “faces” of Conservation Tillage in Namibia

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Introducing **ATNESA**

The Animal Traction Network for Eastern and Southern Africa (ATNESA) was formed in 1990 to improve information exchange and regional cooperation relating to animal draft power. The network aims to unite researchers, manufacturers, development workers, institutions and the users of animal traction in the region. Membership of the network is open to all individuals and organizations interested in its objectives.

The ATNESA steering committee, elected during major workshops, includes traction specialists from six countries in the region, as well as representatives of interested resource organizations. The committee initiates, coordinates and facilitates a variety of network arrangements.

ATNESA encourages the formation and operation of national animal traction networks, whether formal or informal. Responsibility for implementing ATNESA activities is delegated to these national networks and to ATNESA members in different countries.

ATNESA, in collaboration with national networks and other organizations, has arranged international workshops on several themes including

Improving animal traction technology (Zambia, 1992)

Gender issues in animal traction (Tanzania, 1992)

Design, testing and production of animal-drawn carts (Zimbabwe, 1993)

Weed control using animal power (Tanzania, 1993)

Meeting the challenges of animal traction (Kenya, 1995).

Improving donkey utilization and management (Ethiopia, 1997)

More than 400 people from 40 countries have participated in ATNESA international workshops and several resource publications have been produced.

ATNESA has a small secretariat in Zimbabwe to assist international liaison. Nevertheless, ATNESA encouraged interested people to work with their local national networks and to contact directly, their colleagues in other countries.

The addresses of ATNESA national networks, ATNESA Steering Committee members are given at the end of this publication.

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Introducing **MINISTRY OF AGRICULTURE, WATER AND RURAL DEVELOPMENT (MAWRD)**

Ministry of Agriculture, Water and Rural Development exists to promote and facilitate the environmentally sustainable development, management and utilization of water and agricultural resources to achieve sound socio-economic development together with all citizens.

- * The objective of the Ministry is to increase and sustain the levels of agricultural productivity, real farm incomes and national household food security within the context of Namibia's fragile ecosystem.
- * The division of agricultural training aims at supporting the development of human resources required for the sustainable development of the agricultural sector in Namibia at all levels and in all disciplines.

The Ministry considers land clearing and preparation as an important input constraint which must be addressed. The Government promotes private ploughing services and the establishment of private tractor maintenance facilities in rural areas. However, highest priority is placed on the promotion of animal draft power. The utilization of draft animal power and appropriate farm mechanization technology, to address seasonal labour shortages and raise the productivity and profitability of smallholder production is being fully supported. Promoting the use of improved animal draft technologies for soil cultivation and weeding is now receiving priority attention from Government extension and training services. The increasing demand from farmers should stimulate the private sector to produce and stock DAT implements and replacement parts.

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Conservation Tillage is about:

*Soil and Water Conservation
Reduced Tillage Energy and Power
Environmental Protection and Preservation*

Conservation Tillage is indeed about:

Sustainable Agricultural Development

Sustainable Development has been defined as:

*... "development that meets the needs of the present
without compromising the ability of future
generations to meet their own needs..."*



Workshop Participants

Acknowledgements

The organization and success of the workshop “*Conservation Tillage With Animal Traction For Soil-Water Management And Environmental Sustainability*” was made possible by the hardwork of many different people. The ATNESA steering committee and the workshop reporting team would like to thank all those people who made the workshop possible and who assisted in the preparation of this report.

The host organization was the Ministry of Agriculture, Water and Rural Development (MAWRD). The workshop was organized by a local committee, with representatives of Ministry of Agriculture, the University of Namibia, ATNESA and the Rural Support Development Programme (RSDP). The Committee comprised of:

- Mr. P.W. Misika
Under Secretary
- Mr. D. Tshikesho
Director of Extension and Engineering Services - Chairman
- Mr. S. Steenkamp
Deputy Director - North West Extension Division
- Mr. H. Venter
Deputy Director - Crop Research
- Mr. A.L. Martin
Acting Deputy Director,
Agricultural Training Division
- Dr. M. Schneider
Agricultural Training Officer
Department of Training
- Mr. B. Weightman - Rural Development Support Programme
- Mr. J. Mulanda
Namibia University College of Agriculture
- Ms. E. Namalambo - Agricultural Training Officer
In-service Training - DAT
- Mr. J. Reid - Training Officer - DAT
- Mr. E. Mwenya
National DAP Programme - Secretary
- Mr. G. Keib National DAP Programme
- Dr. T.E. Simalenga ATNESA Chair
- Ms. B. Mudamburi
ATNESA Secretariat

Deep appreciation is due to all these people for their dedication and hard work. Gratitude is also due to the Division of Agricultural Training and Mashare Agricultural and Research Institute who provided secretariat services and logistical assistance. Special thanks also go to Ms. A. Andreas; Ms. A. Libanda; Ms. S. Husselmann and Ms. S. Patoko who assisted in the secretarial services during the workshop.

The workshop secretariat and other core costs of the workshop were funded by:
MAWRD- Ministry of Agriculture, Water and Rural Development,
NNRDP - Northern Namibia Rural Development Programme,
RSDP - Rural Development Support Programme, Namibia
NOLIDEP- Northern Regions Livestock Development Programme, Namibia.

The funds sponsored all Namibian participants. Special appreciation is due to Dr. V.P. Shivute, the PS in MAWRD for his support and help in securing the funds.

External participants were sponsored by CTA - Technical Centre for Agriculture and Rural Cooperation, CF - Commonwealth Foundation and some by their own organizations or by agencies within their own countries. The ATNESA steering Committee would like to



Welcome to Namibia by Chief Host: Emmanuel Mwenya
convey appreciation to all the local, national, regional and international organizations that supported participants, directly or indirectly.

During the workshop many people acted as chairpersons or rapporteurs of plenary sessions, group discussions and informal evening meetings. All are warmly thanked.

After the workshop, a reporting team prepared this workshop report. The team comprised of the individuals listed on the Cover Page of this Report.

Ms. S. Husselmann of Tsumis Agricultural College assisted the reporting team with word processing.

The workshop will be followed up in a number of ways, as outlined in this report. The papers submitted at the workshop, are being edited for publication as Proceedings. Summaries of key ones are presented in this report. The proposed project proposals which arose will be finalized and presented to Namibian Government for follow-up. Emanating activities of regional nature will be implemented by ATNESA and other organizations with similar interest.

Lastly the ATNESA steering committee would like to warmly thank everyone who has been involved in the planning, implementing and support for this workshop. The steering Committee looks forward to further close collaboration with individual members, supporting organization and other networks.



Opening Ceremony: Rundu Governor's Address

OPENING SPEECH

Deputy Minister for Agriculture Water and Rural Development *Honourable S. Webster*



Hon. S. Webster

Mr. Chairman, Distinguished Guests, Workshop participants, Ladies and Gentlemen

Let me first of all take this opportunity to welcome all of you to Rundu and to our beautiful country, Namibia. You are all most welcome.

I am delighted to be in the midst of this distinguished gathering of specialists from different parts of the world who have considerable experience in the area of conservation tillage, animal traction and environmental sustainability. One therefore hopes that this technical workshop will effectively present the state of affairs; as regards conservation tillage, discuss the various options available, dissemination approaches and formulate recommendations and programs for further research intervention and extension.

I have noted that your workshop objectives are quite noble since you seek to share and exchange notes on recent technology developments on conservation tillage. You also intend to discuss the socio-economic constraints and transfer strategies vis-à-vis those developments. I have also noted that Rain-water harvesting for soil-water management in semi-arid areas is another issue high on your agenda. We in the Ministry of Agriculture, Water and Rural Development will be following closely on your deliberations and implementation strategies.

The importance of conservation tillage and environmental sustainability cannot be overemphasized. We need to conserve land at all costs. The majority of our smallholder agricultural land has poor soils, which are shallow with low soil fertility. In Namibia, the climate can be described as 37% semi-arid to arid. In most of our countries in the region (including Namibia), conservation tillage practices have been adopted and practiced by large scale commercial farmers for many years. What we need to address is the question of having sound conservation tillage practices based on animal traction systems that can be effectively adopted by small holder farmers. For example, if your recommendation is “tied ridging” or “zero tillage” system, how much does it adapt and how does it behave in different soil types e.g. sandy soils and with different farmers? We all know that tractors and draft animals can be used in agriculture. They can either be used on their own or combined to complement each other to improve the economic viability of the farm. For small holder farmers, animal traction is the best option as it is affordable, sustainable, profitable and environment friendly in most ecological systems.

Here in Namibia, about 60 – 80% of farmers in northern communal areas use draft animals for both ploughing and transport purposes. The Government of Namibia has recognised the important role draft animal power can play to uplift the standard of living of rural communities. This has led to the establishment of the National draft animal power program, which is centred at Mashare Agricultural Development Institute. Your input and exchange of ideas on how the program is ran, its research and training activities, and its future role in improving small holder agriculture will be mostly appreciated.

I cannot do justice to your workshop if I do not join in the popular theme of involving farmers (participation) and empowering them. As you are aware, most people are concerned with the need to involve others in issues which affect their lives. The call is for us to make farmers, partners in development. Farmers should therefore be involved not only in extension programs, but even in designing and carrying out on-farm research. So, the issue is not on whether farmers should participate or not but much more on how they should participate?

I want to believe that this workshop will make an attempt to make farmer participation and empowerment a reality. I suppose farmer participation will start with the field visits during this workshop.

The government fully recognizes the vital role which is played by research in the overall development of Agriculture. I am told that some of the outputs from this workshop are the Research and Extension Program on conservation tillage for Namibia and to launch the decade of promoting conservation tillage with animal traction in the region. I would like to challenge you to come up with viable proposals in achieving the intended target. If possible try to get farmers needs so as to put their input into the whole research agenda, especially if the research and promotion programs are going to affect their most needy areas. We will be waiting to receive the proposal as soon as possible.

This workshop has been made possible by efforts of various individuals and donor support. It is proper to recognize the input of the local workshop secretariat and organizing committee, who spent many hours in making plans and necessary follow ups. The following donor support is appreciated: CTA – Netherlands,

Commonwealth Foundation, the RSDP, NOLIDEP, NNRDP, FAO and other organizations who have financed participants to this workshop. We should not forget the crucial role the Ministry of Agriculture, Water and Rural Development, in collaboration with ATNESA has played in supporting this workshop.

Ladies and Gentlemen, I would like to remind you once again that while we are here making deliberations, farmers are anxiously waiting for our services. Our greatest challenge still remains that of helping smallholder farmers to help themselves in a sustainable way.

Let me wish you a very successful technical workshop.

And with these few words I hereby declare the workshop on Conservation Tillage with Animal Traction for Soil-Water Management and Environmental Sustainability officially open.

1. AN OVERVIEW OF THE WORKSHOP



ATNESA Chair: Introduction to the Workshop

Workshop background

Many smallholder farmers in Sub-Saharan Africa are faced with problems of recurrent droughts, loss of rain water to runoff, erosion and degradation of soils. Conservation farming is now seen by many as one of the solutions to these devastating problems. For optimum tillage, planting and crop management systems to be developed, promoted and subsequently adopted, it is essential for researchers, extensionists and development agents to understand the constraints within which individual farmers operate.

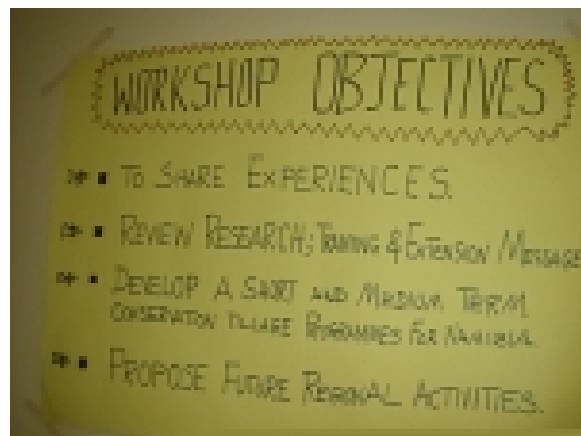
Studies on relationship between animal traction, environmental impact and the sustainability of production systems, are relatively recent. As a result, there is very little concrete information about environmental impact of using draft animal power. Animal traction as a power source, cannot be considered in isolation. It must be examined in the context of total farming systems, in order to assess its positive and negative environmental implications.

At an ATNESA workshop “*Meeting the challenges of animal traction*”, held in December 1995 in Kenya, the importance of

using draft animal power for conservation tillage in semi-arid areas was stressed. It was therefore within ATNESA planned to organize a regional workshop on conservation tillage and environmental issues. Such a Workshop would look into various options available as well as dissemination strategies. It would launch a decade of promoting sustainable conservation techniques based on draft animal power and utilization.

Animal traction is being strongly addressed as an important technology for Eastern and Southern Africa. In Namibia, the Government has acknowledged the importance of this technology by setting up a National Draft Animal Power (DAP) Programme, to assist the smallholder farmers especially in the Northern Communal Areas. This region, by Namibian standards, receives the highest rainfall (500 mm to 700 mm) per annum.

The Northern region is further characterized by sandy soils with low organic matter and water retention capacity. For the past few years, tillage specialists in Eastern and Southern Africa and elsewhere have been addressing issues related to the above factors, to acquire technologies based on animal traction for smallholder farmers. One issue identified for this purpose has been “Conservation Tillage” (CONTIL) and how it affects the environment.



Keeping participants and discussion in track!

Workshop objectives

The objective of the workshop was to bring together farmers, national and regional specialists involved in research, development, training and extension in order to:

- Share experiences regarding conservation tillage, rain water harvesting and environmental issues.
- Review the research, training and extension messages regarding the use and management of draft animal power (DAP) technology in conservation tillage.
- Develop a short and medium term conservation tillage programme for Namibia
- Propose future regional activities on conservation tillage

Workshop sub-themes

- Conservation tillage systems and soil-water management issues
- Implements for conservation tillage in semi-arid areas
- Rain water harvesting for field crop production
- Animal traction and environmental sustainability
- Technology transfer, adoption and extension strategies
- Socio-economic and gender issues

Participants

Participation comprised persons involved in research, training, extension and rural development programmes related to smallholder agriculture. A total of 84 participants attended the workshop. These were from Namibia, regional ATNESA member and non-member countries, West Africa and Europe. In attendance were multi-disciplinary individuals and organizational representatives with diverse experiences, from various countries and regions. Some participants brought in equipment used in conservation tillage for demonstration on the farmers fields. The names and addresses of participants are listed in Annex Two of this Report.

Host, dates and location

The workshop was hosted by the Ministry of Agriculture, Water and Rural Development of

Namibia. The planning and facilitation of the workshop was carried out in close cooperation with the ATNESA steering committee.

The workshop was held at Ngandu lodge in Rundu, Namibia from 5th - 10th October 1998.



Workshop Registration

Workshop programme

Detailed workshop programme is presented in Annex One. However, the following is a day to day summary of the workshop events:

Day 1

This was the day when participants arrived. After registration, participants put up posters and exhibits. In the evening of this day there was the official opening of the workshop by the Deputy Minister of Agriculture, Water and Rural Development, Honourable S. Webster. The

Governor of Rundu town also formally welcomed the participants.



Informal networking

Day 2

The first half of the second day was occupied by presentations of keynote papers first by Mr. P.W. Misika who presented a country synthesis of Namibia; followed by Dr. P. Kaumbutho who presented an overview of conservation tillage practices in East and Southern Africa. Case studies and country reports were presented in the afternoon.

Day 3.

All participants went to attend field demonstrations on tillage systems and technologies on a farmers field at Muroro, forty five kilometres East of Rundu. Later, three case study papers were presented on indigenous conservation tillage technologies and technology transfer techniques. In the afternoon there were plenary sessions, group discussions and presentations of group discussions.

Day 4.

The fourth day was spent on field visits to farmers. Participants were divided into eight groups and each group visited three farm villages to discuss with farmers their problems and possible solutions. Later the groups worked on and presented summaries of field findings and recommendations.

Day 5.

Participants were divided into small output oriented groups. These groups were involved in intensive discussions to make strategies and

action plans for both National and Regional level activities. This was a most useful day of the workshop.

Day 6.

On the last day of the workshop there was a plenary session to make recommendations and follow-up actions. This was followed by a Workshop Synthesis presentation by Richard Fowler of South Africa. Thereafter there was workshop evaluation session by all participants. The workshop was officially closed by the Under Secretary in the Ministry of Agriculture, Water and Rural Development Mr.P.W.Misika.

Workshop inputs

i. Papers

Most participants prepared papers and Case Studies on conservation tillage practices and environmental issues for sustainable agricultural production using DAP. These included research reports, indigenous practices such as rain water harvesting, experiences of extension programmes, and proposals for future and collaborative activities.



Informal Networking

Twenty five papers were prepared for the workshop. Summaries of keynote papers, case studies and regional experiences presented are included in this report. These and the rest of the papers submitted will be edited and produced in full as Workshop Proceedings.



Group Discussion

ii. Exhibits

Colourful and informative exhibits were put up by participants in the roundavel close to the conference room. These exhibits covered a wide range of topics from, various uses of animal power in agricultural production design and evaluation of equipment, field trials, manufacturing of farm equipment, indigenous soil conservation tillage techniques and gender issues. Some typical Programmes the posters presented were such as:

- Smallholder Agricultural Mechanization (SAMeP) in Zambia.
- Indigenous soil conservation tillage systems and risks of animal traction on land degradation in Eastern and Southern Africa.
- Palabana Farm Power and Mechanisation Centre Zambia.
- Northern Namibia rural development project evaluation of farm implements.
- Soil and water conservation tillage trials conducted at the institute.
- FAO case study on gender issues in agricultural engineering.

Expectations of Participants

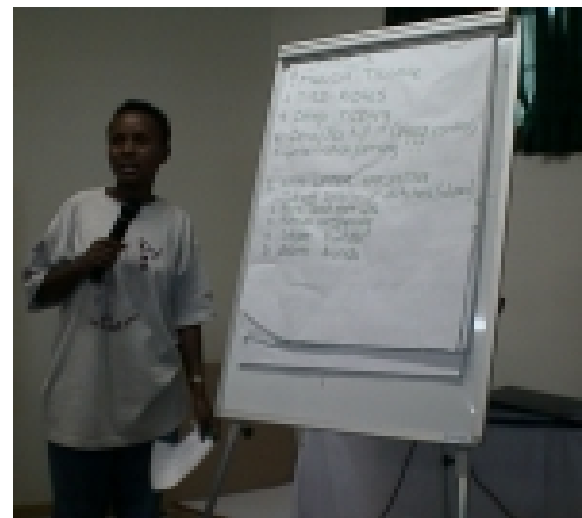
At the beginning of the workshop, participants were asked to write down on a card what they hoped would be an outcome of the workshop. The cards were put together, discussed and

summarized. The following were the main expectations as expressed by the participants:

- make practical sustainable conservation tillage recommendations for Eastern and South Africa.
- share experiences
- explore possibility of forming a regional network on conservation tillage
- develop a feasible project plan for Namibia
- review animal traction training methodologies
- make practical viable suggestions to improve animal traction methods.
- formulate a database and guidelines on conservation tillage with animal traction in semi-arid areas.
- review sustainable water harvesting technologies for semi-arid areas.

Evening Programmes

There were a number of optional evening programmes that were arranged and executed during the conference week. These evening programmes provided further opportunities for networking among individuals. The most notable programmes were:



Group Reporting

- Conservation tillage technologies and practices used in Zimbabwe.
- Socio-economic and gender issues in draft animal technology.
- Animal traction resources in Ghana.
- Regional conservation tillage network.

- Use of handtools by woman farmers in sub-Saharan Africa
- Several videos on animal traction.

Informal networking interactions

The workshop provided an excellent forum for intensive interaction among the participants. Many formal and informal arrangements were independently made between participants throughout the week. These will result in further collaboration and exchange of information on conservation tillage with animal traction for soil-water management and environmental sustainability.

“The overall balance of success in combating soil degradation throughout the world is unsatisfactory. We can even talk about a worrying trend since not only the quality but also the quantity of soil - the basis of our lives - is continuing to dwindle. Apart from regional improvements, often achieved at considerable financial expense, we can say that the soils in many regions of the world are continuing to degrade. The consequence of this is that efforts to implement site-appropriate, sustainable forms of agriculture and for the development and trials of new, innovative approaches will have to be further intensified”

International Soil Conservation Organization (ISCO) Secretariat, on Letter to Participants of 1996 ISCO Conference, Bonn. Germany.

Evaluation

At the end of the workshop all participants were invited to give their views on all aspects of the programme and logistical arrangements by completing evaluation forms anonymously. The participants were very positive and gave the

workshop a very high rating. A workshop analysis of the evaluation is presented in this report.

Workshop outputs

Many participants reported that after attending the workshop they were now more informed on problems affecting animal traction, soil fertility and management, environmental degradation and other multi-disciplinary factors. This means that the workshop enhanced understanding of issues on Conservation Tillage (CT) and increased motivation of participants. This is bound to benefit national and regional programmes working on conservation tillage with animal traction.

Many technical recommendations arose from the workshop deliberations. Proposals for a range of follow-up activities were made. The most notable proposals were:

i) Proposals for Namibia

Based on the stakeholders input and experiences from the region and elsewhere, received at the workshop, the reporting team prepared a proposal for Conservation Tillage Work in Namibia. Stakeholders presented a wide range of issues which were compiled into four broad activities in the Proposal:

- Promotion of Conservation tillage with animal traction
- Improving soil fertility, crop and weed management
- Crop / livestock integration for environmental sustainability
- Promotion of entrepreneurship in animal traction, facilitation of credit and marketing.

At the end of the reporting week a draft proposal was presented to the MAWRD. The Proposal was complete with a Log Frame and Budget and was well received by the highly cooperative senior members of Namibian Government.

ii) Regional Collaborative Activities

Other activities which were regional in nature, also emanating from the stakeholders input were mandated to ATNESA to take-up. These were as follows:

- development of guidelines on conservation tillage with animal traction for the East and Southern Africa region.
- development of a Database on conservation tillage systems.
- enhancing networking for information sharing and advancement of Conservation Tillage practices in the region.
- participate in the establishment of a regional network on conservation tillage in collaboration with other interested organizations while building on the CONTIL national efforts of countries such as Tanzania, Kenya and South Africa.

2. SUMMARIES OF KEYNOTE PRESENTATIONS

Conservation Tillage with Animal Traction for Soil-Water Management and Environmental Sustainability in Namibia

Presented by: Mr. P. Misika of Namibia Ministry of Agriculture, Water and Rural Development (MAWRD)



This paper constituted the Namibian background to the ongoing workshop and the statement of status. It highlighted the areas where the Namibians sought assistance from the experience of the delegates and the countries they represented.

This paper was basically compiled from the deliberations of a Namibian National Workshop on conservation tillage held between 16th and 18th June, 1998. The paper reviewed indigenous knowledge on the subject of Conservation Tillage in the commercial and small-scale farming sectors, implements available, rainwater harvesting techniques and the use of draft animal power technology in Namibia.

The following are highlights of the paper on Namibia:

- Land resources comprise 22% desert, 33% arid and 37% semi-arid
- Rainfall has bi-seasonal mode and ranges between zero and 700 mm with least amounts

experienced in the west where the Namib Desert is located.

- Soils, particularly where crop production is practiced, are generally sandy with low water retention capacity.
- Reliable crop production under rainfed conditions is only possible in 34% of the country, receiving an average of over 400-mm rainfall annually. 97% of the soils in these areas have clay content of less than five per cent (MAWRD, 1995).
- In the commercial farming sector conservation tillage has been practiced for over 15 years during which several tine implements have been introduced and conventional tillage implements such as mouldboard and disc ploughs replaced.
- Current estimates indicate that 60-80% of farmers in the northern communal areas use draft animals. Although crop production in communal areas such as Erongo, Kunene and Omaheke is very limited, draft animals still play a very important role in transport. Here, probably 80-90% of the rural households use donkey carts for water collection, personal transport and trade. There are more sledges than animal drawn carts being used in Northern Communal Areas especially Kavango Region.
- The trend with small-scale farmers is more towards conventional tillage where nearly all farmers using draft animals use the conventional plough. The hand hoe was reported as the most common implement and it is used in a few cases for dry planting.
- Planting on ridges and broad beds had been observed and the practice is traditional and eases planting and weeding labor requirements. This is a strategy out of indigenous ingenuity to facilitate drainage

and increase the crop-rooting zone in shallow profiles. Ridges however are rarely made across the slope.

- Only recently have animal drawn tine implements such as rippers been introduced. There are approximately 100 rippers under trial in Namibia. Results from two-year trials appear promising. However, there are some negative aspects of the new approaches. These include non-incorporation of manure into the soil and weeds tend to grow faster than in conventional tillage systems.
- Weeding is a constraint particularly because cultivators are scarce and weeding with draft animals is increasing. The light Senegalese, BS41 and Maun cultivators have been accepted by several farmers and need effective strategy for wide adoption.
- Management of draft animals is a major concern by farmers, financing institutions and promoters of draft animal power technologies. The productivity of draft animals is normally questioned in areas where grazing land is scarce. This situation threatens the success of the DAP technology. Strategies to improve care and nutrition should be formulated as a way of guaranteeing productivity of draft animals. Conservation of feed resources that are abundant during rainy season and after crop harvest could improve the situation.

Conclusions were made as follows:

i) On land preparation:

- Minimum tillage speeds up soil preparation
- Dry sowing spreads the work load over a longer period
- Dry sowing increases yields in case of terminal droughts
- Dry sowing with DAP results in a better germination than dry sowing with a hand hoe; more water is easily captured in the furrow

ii) On Rain Water Harvesting

Water harvesting techniques for crop and livestock production are limited. In most cases the rain water harvested has only been used for livestock. Techniques for use in crop production are lacking.

iii) On Agro-forestry:

- There is a strong case for dry land agroforestry systems in Namibia, especially the introduction of high value trees on farm land. Examples include trees, to conserve soil fertility and also improve crop production by acting as windbreaks, shade crops and through Nitrogen fixation.
- A unique concept is that of Riverline agroforestry particularly important for the Kavango and Zambezi river beds. In any year there is little crop production next to the water and no attempts have been made to trap and store flood waters.



Traditional mouldboard plough which is the most common animal drawn implement but not necessarily good for soil and water conservation. Here it is shown with the furrow wheel replaced with a wooden sledge.

Overview of Conservation Tillage Practices in East and Southern Africa

Presented by: Dr. P.G. Kaumbutho of Kenya Network for Draught Animal Technology, Kenya

Conservation Tillage: An Important Worldly Subject

This paper noted that conservation tillage was but one aspect of global, regional and national interest in environmental conservation. The subject however carried special meaning considering that it was about agricultural production in Africa. It was noted that concern for the environment, particularly so in East and Southern Africa was everybody's concern as well as frustration. Many factors contributed to environmental sustainability, which placed the region under great threat of total destruction.

Sustainable Development:

The presenter noted that although farmers and others in Africa recognized close link between soil and environment, little had been done in the region by way of environmental sustenance. Global efforts such as the World Environmental Congress of Rio-de-Jeneiro and interest by World Conservation Union, UNEP, WWF, WCED and others had made real change at rural level. These organizations had general mandate to undertake global inquiry on the prospect of combining social and economic development with environmental protection, a situation that was yet to make real impact in Africa.

Potentials for Sub-Saharan Africa

Quoting various authors, the presenter noted that Sub-Saharan Africa (SSA), was undergoing agrarian stagnation, becoming world famous as a region where natural resources were stressed to the limit and the place where relief efforts had become routine. Concerns of accelerated erosion, desertification, deforestation and other human-driven destruction phenomena placed SSA under threat of further starvation and malnutrition as waterways and reservoirs silted and rivers and lakes got polluted. Inappropriate tillage methods were a major cause of this trend and many soil conservation efforts in the region

had basically ignored tillage and its capacity to accelerate soil degradation.

Though loaded with high natural and economic diversity, it was highlighted that SSA had 2231 million hectares of land, of which only 6% was arable. Annual rainfall amounts ranged from zero in the deserts to 5000mm. Further, SSA has all major soils and is no longer limited in human capacity, it was noted.

While, effort had been put in place at national and regional levels it was more in terms of economic togetherness but less so, by way of arresting environmental degradation. Rural-urban migration was also rampant.

Quoting an FAO (1984) Report the presenter noted that SSA could support 1120 million people at low levels of input, 4608 million at intermediate levels and 12930 million at high levels of input. The report was written at a time when the SSA population was only 400 million.



Conservation Tillage Questions for East and Southern Africa:

Are there technologies available to manage soil and water resources for the much needed enhanced agricultural productivity?

Are the available conservation tillage technologies being adopted and what further action was needed to arrest the prevailing deteriorating situations and destruction of fauna and flora?

The Conservation Tillage System:

The presenter visualized the conservation tillage system as composed of natural factors, which influenced the various human and other capacities to manage soil. In this respect, soil was viewed as a small part of a larger system made up of natural and management factors. Soil had to accommodate all and various needs imposed on it.

Natural factors were visualized as:

- History and trends
- Cultural complexities such as values, societal and gender-based roles
- Weather and climate
- Topography and cover
- Soil type and distribution and
- Global warming

Capacities were visualized to be:

- Experience and information
- Training (formal and informal)
- Socio-economic well-being
- Technology quality and accessibility
- Research and extension
- Government and non-Governmental institutional support including policy

Management factors were such as:

- Role of people and their involvement
- Natural resources, their place and rights
- Land tenure, ownership and settlement
- Leadership and natural resource policy
- Legal base and establishment
- Dynamic capacity to flex and address
- Action and not reaction

Soil factors were:

- Basement material, structure and texture
- Microbial capacity, profile and cover
- Manipulation and compaction dynamics as well as sitting operational condition
- Erosion stability, penetration resistance and water retention capacity
- Tillage energy and other requirements

Technology advancement

Defining soil conservation technology in a broad sense the presenter noted that technology referred to much more than equipment and



included sustainable soil and crop management options available to farmers in the region. It was noted that various equipment had been tested and introduced in ESA. The range included technology for seedbed preparation, planting and erosion control. Emphasizing the need for systems approach to conservation tillage and management the presenter defined technology as including, no-till, minimum-till, vegetative hedges, sod-seeding, contour ridges, tied ridges, mulch farming, terracing, rough ploughing, deep sowing, pot-holes and several others. Time when these operations were carried out was noted as of prime importance.

Regional efforts:

Work carried out in introducing conservation tillage research and management at both stations and farms included that by: IITA in Ibadan, Nigeria; ICRISAT Sahelian Centre, Niamey, Niger; Zimbabwe's AGRITEX in collaboration with Silsoe Research Institute; works of KARI and RELMA in Kenya, GTZ funded work in the region, the Palabana, Zambia work on CONTIL equipment, the Improved Maresha prototype produced by University of Nairobi and Swedish University of Agricultural Sciences etc.

The slide show presented helped capture the technological as well as the socio-economic issues of importance and brought home the complexity of the problem at hand.

Conclusion:

In conclusion it was noted that many efforts towards conservation tillage practice had been put in place but impact was yet to be felt. Many factors had worked against research and extension efforts, as traditional practice continued to persist and dominate. Farmers were yet to adopt conservation tillage practices *en mass*.

The appropriate approach for the region was defined and set as the way forward. The definition of the path to be followed was based on the many literature items cited and the experiences of the presenter and others.



- experiences about technologies, with socio-economic and other concerns of end-users.
- iii. Identifying suitable equipment and promoting the same **nationally and regionally**.
- iv. Applied field testing with farmers as more research findings are made, especially to quantify the real gains of the use of various equipment while accommodating the natural and other development trends and narrowing the gap between research & end-users
- v. A systems approach capturing environmental protection and soil management techniques, agro-forestry practices and economic well-being of all parties involved, especially farmers.



The way forward was summarized as centering around the following:

- i. Farmer-centered, aggressive, on-farm, demonstration and practice as well as publicity for sensitization, with all parties (researchers, extensionists, farmers, support service providers, government and non-government operators) applying their appropriate and adequate roles.
- ii. Marrying traditional knowledge, ideas and practice, while accommodating fears and

3. SUMMARIES OF CASE STUDY PRESENTATIONS

IMAG-DLO and conservation tillage; activities and experiences

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The institute of Agricultural and Environmental Engineering (IMAG-DLO) is part of the Agricultural Department of The Netherlands Government The Department of Development Cooperation within IMAG-DLO works in countries in Africa and Asia and concentrates on animal traction and crop processing technologies.

IMAG-DLO in partnership with the Ministry of Agriculture in Zambia is developing alternative tillage systems in order to improve conservation of rainwater and soil, to improve timeliness of planting, and to cope with reduced availability of draft power.

The research resulted in the development of the following animal drawn conservation tillage equipment:

- a ripper,
- ripper-planter and
- subsoiler.

All implements are low-cost, durable attachments, which can be easily interchanged with the plough body on any commonly available, standard plough beam.

It was realized that when introducing these conservation tillage tools on smallholder farms, weeding would become an even more critical aspect than it already is in the conventional ploughing system.

Herbicides are beyond the reach of most farmers and the availability of, and effective mulch cover is not guaranteed. Mechanical weeding with draft animals is a practical option to keep the weed problem under control.

Another tool, which can be used for weeding is the ripper-ridger which is the ripper attachment fitted with a pair of adjustable wing extensions and an optional radar. All equipment is designed



to enable local manufacture in the region and is currently produced by a manufacturer in Zambia.

Conservation Tillage for Sustainable Crop Production Systems

Highlights of results and experiences from on-station and on-farm research in Zimbabwe (1988-1997).

Isaiah Nyagumbo



“Conservation Tillage For Sustainable Crop Production Systems” was a Zimbabwe collaborative project between the Department of Agricultural, Technical and Extension Services (AGRITEX) and the Germany Agency for Technical Cooperation (GTZ). The project was initiated in response to extensive problems of soil loss and run-off, which were being experienced by smallholder farmers (Elwell and Stocking, 1988; Whitlow, 1988). The primary objective of the project was to assess the yield merits of several conservation tillage systems with a view to the development of sustainable smallholder crop production systems in different agro-ecological regions.

Two maize experimental sites were established on sandy soils under natural rainfall at Domboshawa Training Centre and at Makoholi Experiment Station. Soils on both sites are shallow granite-derived sands with clay content lower than 5%.

Tillage Systems.

The four tillage system under investigation were:-

i. No till tied ridging,

- ii. Mulch ripping,
- iii. Clean ripping and
- iv. Hand hoeing.

The trials considered soil loss, run-off and maize yields, organic carbon and weed control. The research adopted a farmer participatory research and extension approach known as “Kuturaya”.

Major findings and conclusions included:

- a) No-till tied ridging and mulch ripping were the most sustainable crop production techniques from a run-off and soil-loss point of view. From 6-year data, they maintained soil loss levels below the tolerable limit of 5 tones/ha/year and compared to conventional mouldboard tillage, No-till reduced soil loss by 84% (from 4.4 to 0.7 t/ha/year) and by 90% (from 10.1 t/ha/year) while Mulch ripping reduced soil loss by 72% and by 89.5% at Domboshawa and Makoholi respectively.
- b) Despite its outstanding water harvesting benefits through run-off reduction, tied ridging on sandy soils, did not overly increase soil water content within the rooting zone due to the low water holding capacity of sands. However No-till tied ridging increased the effective rooting depth of crops through the elevated ridges.
- c) Blanket recommendations were not realistic as yield results depended on site-specific rainfall, soil type and management capabilities of the farmer.
- d) Socio-economic and socio-cultural constraints played a very important role in the adoption or rejection of innovations. These problems could sometimes override the associated technical constraints.
- e) Farmers’ problems are multi-sectoral. There is need to combine tillage strategies with other erosion control structures such as infiltration pits, terraces and fertility improvement measures.

Socio - economic factors affecting the adoption of conservation tillage

Experience from the soil and water conservation and agroforestry program, SWaCAP, Lesotho

Lethla Mosenene



To promote conservation based agricultural production systems within a framework of client-demand, extension approach.

Specifically SWaCAP was to:

- Promote soil and water conservation measures and increase farm productivity;
- Establish agroforestry research capability.
- Create an effective agricultural extension service and
- Monitor and coordinate the Ministry of Agriculture soils and water conservation policies, programs and projects.

Constraints:

Poor soils combined with unpredictable weather conditions.

Inadequate moisture for crops during the growing season; high cost of inputs (inorganic fertilizers and hybrid seeds), and late planting due to inadequate (few & poor in health) draft animals and/or tractors.

Interventions:

Rip-line system, conservation tillage practice to conserve water in-situ and make it available to the crop over a longer period. The system though successful and popular was limited by soil type and animal power availability.

Concerns about Rip-Line were such as:

- gender sensitivity
- availability or accessibility of manure
- institutional support in packaging the technology.

Tied-ridges and minimum tillage techniques were tried, without much success.

Introduction

SWaCAP, a joint Lesotho - IFAD program was established as an intervention to encourage conservation based agricultural production practices. It covered extension in Northern District and agroforestry research and policy coordination in the rest of the country. The programme was terminated in June 1998.

SWaCAP was established as a means to boosting agriculture, in recognition of the poor economic situation. This was partly due to reduced remittances from miners in South Africa and rising unemployment and droughts of 1990s. Mining saw a situation where 63% of the households were without men, a major source of labour shortage especially for animal power utilization.

Lesotho has more than 80% rangeland, 67% of which is highland. Arable land has decreased from 14% in the 70s to 9% in the 90s. Yields have been on a decreasing trend despite increased use of fertilizer.

SWaCAP's main goal:

Conservation farming in smallholder farming systems: Palabana experiences

Martin Bwalya

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- i. Draft Requirement
- ii. Weeding
- iii. Planting
- iv. Yield and ripping (minimum tillage)

This led to the development and promotion of the:

- i. Magoye Ripper
- ii. The Palabana Subsoiler and
- iii. The Palabana Ripper-Planter
- iv. The ripper technology, including the Ripper Planter had immediate effects on timeliness in planting and both labour and energy demand, for both no-till and minimum tillage operations.

Through a participatory on-farm trial process, the Palabana Farm Power and Mechanization Centre has taken up to develop and provide mechanization inputs in the application of conservation farming with animal power systems. The centre has successfully adapted a ripper, a sub-soiler and a ripper-planter. These technologies are getting popular with farmers.

The main objective of the Palabana intervention was to develop and make available technologies that would enable farmers:

- prepare fields and plant in time and benefit from the shorter rain period
- store more rain water in the soil while reducing runoff
- prepare and plant larger areas on time.

Main issues and experiences

Over the years Palabana experiences with trials of different equipment developed to a shift from timely planting to soil conserving technologies. This is because much more than fertilizer and apparent soil degradation was affecting yields.

The broader approach included consideration of:

Zambia went through the adaptability phase of technology transfer with relative ease as the equipment showed, not immediate but shorter-term gains of change in tillage practice. Among other longer-term issues, farmers liked the gains in terms of:

- increase in yields as well as area cropped and
- reduction in drudgery in terms of energy and time efficiency.



Conservation tillage research and development in South Africa

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South Africa has a total area of over 122 million hectares, of which only one third is level to moderately sloping and only 14% is arable. Only 3% of the arable area is classified as being In post-1950 agriculture surface pulverization by raindrops, solar desiccation and heating, and trampling by stock had been identified as the most important factors contributing to the physical decline of soils. Noted possible solutions to these problems were:

- maintenance of mulch on soil surface
- tillage done immediately after the previous crop is removed.
- use of contour banks.

Conservation tillage in maize production involved mulching and reduced tillage using chisel ploughs. Ripping on sandy soil to depths of 450mm produced more significant increase in yield during low rainfall years.

Other factors that influenced sustained fertility of the soil included:

- wind erosion.
- soil - water - tillage interaction and effect on vegetative cover hence effect of radiant energy and crop performance.

of high agricultural potential. Almost 60% of the soils have very low organic matter content, and are conducive to land degradation and low productivity.

South African tillage principles and practices have been almost exclusively derived from those utilized in Europe and North America. The main focus in this tillage was to prepare a good seedbed, free from weed and surface trash.

In pre-1950 agriculture the ox was still the main source of traction with ploughing as the main tillage operation. The large heavy tine cultivators were being introduced to take the place of the plough in some cases. Tines were also used especially on the heavy turf soils of the springbok flats. Such fields were ploughed only once every 2-3 years.

- surface residues and soil loss

It was concluded that despite considerable research and development work in South Africa, there are gaps in the information available and this is a main constraint to adoption of conservation tillage, technologies. Much of this knowledge has still to be effectively digested and presented to users. Aspects such as crop rotations, animal power applications still need more research. However, research efforts are being hampered by:

- reduced research capacity at the Agricultural Research Council and
- lack of motivation to engage a small holder targeted research.

The Role of Draft Animal Power in Ghanaian Agriculture

by

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Draft animal power in Ghana was first introduced into the dryer North of the country in the 1930s mostly by British Settlers. This was to support the production of cereals and other export crops. Until the late 1950s animal power use grew popular even with local farmers. With independence in 1957 government policies shifted to support tractor mechanization and this considerably reduced interest in the use of animal power technologies.

Due to many reasons, including the collapse of the tractor programs, use of animal power is currently on a rapid up-swing. Most work animals are bullocks with over 35,000 pairs of oxen out of a total herd of about 1.2 million in use.

Nearly 15,000 donkeys are also in use especially on single donkey carts. There is increasing interest to use donkeys even for ploughing and ridging.

The Tamale Implement Factory and local blacksmiths make most implements, the majority of which are ploughs. Most such ploughs have problems with the beam and those from blacksmiths lack proper finish.

Some socio-economic research relating to animal traction has been conducted. However, systematic testing and durability trials, research and development of animal drawn implements have not developed.

Most frontline staff have limited skills and exposure in animal traction. Training for both staff and farmers at Farm Institutes and Agricultural Colleges is frustrated by lack of facilities including animals, implements,

teaching manuals, other materials as well as experienced instructors. Appropriate animal traction extension materials are almost non-existent.

Despite many years of neglect, animal traction is still a major farm power component especially in Northern Ghana. Animal traction, still offers the best opportunities for increase in farm size, reducing drudgery in farm work, reducing labor costs, raising yields and farm production in general. However, some issues have to be addressed as pre-conditions. These include:

- availability of work animals and implements at affordable prices
- availability of quantity spares.



Editors Note: This paper was presented to bring in the case of Ghana and it had not been prepared specifically for Conservation Tillage. The author however made the case of the existing potential for CONTIL practices in Ghana as anywhere else in Africa.

Rainwater Harvesting Technologies for Agricultural Production: A Case for Dodoma Tanzania

by

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Rainwater harvesting (RWH) was defined as the method of inducing, collecting, storing and conserving local surface runoff for agricultural production. The presenter viewed RWH as a resort solution, especially in drought prone areas, where irrigation and other means of sourcing the benefits of water were not possible or economical.

Presenting a brief treatise of the basis of rainwater harvesting, the paper reviewed major techniques of RWH as practised in crop production. The practices fell in three broad categories:

- 1) In-situ RWH: the system where rainwater is trapped or held where it falls and used there. The system is therefore favoured by deep tillage, rough surface, and mild-slope conditions.
- 2) Internal (Micro) catchment RWH was the system where the catchment area and the runoff utilization area are distinctly divided. This system is favoured for growing medium water

demand crops such as maize, groundnuts, sorghum and millet. Pitting, strip catchment tillage and contour bands, semi-circular bunds and Meskat-type system practices all favoured this system.

3) External (Micro) catchment RWH: the system where runoff is collected from small to large areas of 5 to 50% which are near or at appreciable distance from the place of water use. Intermediate storage, structures for diversion and distribution, may be necessary.

Referring to Dodoma the presenter noted in-situ RWH techniques were in use but only in areas where deep tillage was possible, using both animal power and tractors. In Kondoa District draft animals are the main source of power, used for deep primary tillage. Much of the draft animal power capacity available in Dodoma is idle due to shortage of traditional experience, exposure and appropriate equipment for utilizing animal power.

The Internal (Micro) Catchment RWH method used in Dodoma takes the form of contour bunds, a system widely promoted by extensionists. Some 775 km of bunds were constructed over a period of 10 years beginning 1984. While other methods are absent in Dodoma the Meskat-type system is in use.

Regarding the External (Micro) Catchment, the Hillside Sheet and Runoff utilization method is commonly used. The paper concluded by looking at the past, current approaches and the role of RWH in Dodoma region. The appropriate techniques and their relative viability was also highlighted.

Indigenous conservation tillage systems in East Africa; An example of their evaluation from South West Tanzania

B. Kayombo, J. Ellis-Jones, H.L. Martin

Available literature in East Africa reveals that indigenous conservation techniques (ICT) are prevalent in areas of water-deficit conditions and in semi-arid zones. Due to changing natural and socio-economic environment, some of these ICT systems are beginning to show signs of decline. The need to understand these systems as a step to their improvement (and hence reverse the declining trend) is paramount.

The *Ngoro* approach to soil and water conservation is a common ICT in Mbinga District of South West Tanzania. It has shown that *Ngoro* cultivation is efficient at controlling soil erosion, increasing soil moisture at critical times of the year and maintaining soil fertility.

However the *Ngoro* has problems associated with it, notably decreasing fallow periods and high labour requirement. The socio-economic evaluation of ICT techniques in Mbinga District indicate declining use. The technical evaluation has shown that when *Ngoros* are intact, they increase soil moisture and consequently bean yields, compared to ridges.

When badly degraded, soil moisture is decreased but despite this, maize growth and yield are better than on ridges when no fertilizer is used. In the *Ngoro*, the majority of eroded soil is redeposited into the pit, whereas on ridges it is often transported elsewhere.

The immediate future challenge is to build productivity enhancing improvements into the present system without destroying its unique advantages.



Participatory Extension of conservation tillage techniques: lessons and experiences from the development and dissemination of conservation tillage system in Southern Zimbabwe.

Edward Chuma, Kudakwashe Murwira and Juergen Hagmann



The presenter reported that rampant soil erosion and land degradation continue to destroy the agricultural base of Zimbabwean farming. This land management crisis has been attributed to the poor adoption research proven techniques for soil and water management. Both on - station and on-farm research had received very little impact, mainly due to poor integration of on-farm research with disciplinary and commodity research as well as weak links with extension services.



Receiving feedback after a gender touchy presentation!

In response to the above constraints, the AGRITEX-GTZ conservation tillage research project and the Intermediate Technology Group, Food Security Extension Project initiated the development of a farmer participatory technology generation approach. This approach, locally referred to as “Kuturaya” was built on combining farmers indigenous knowledge with Western knowledge. It aimed at facilitating the development and spread of sustainable farming practices while enabling rural communities and individual families to solve their own problems. The conceptual model of Kuturaya was based on “Training for Transformation” concept and consisted of research, extension and active farmer participation components.

The implementation model consisted of three major components, which were closely inter-linked. These were:

- the process initiation,
- the seasonal cycle, and
- the support system.

A preparatory phase was essential and took place before “Kuturaya” was initiated. This included assessment of agro-ecological, socio-economic and farming system details using Participatory Rural Appraisal (RRA) tools.

In Conclusion the presenter noted that the application of “Kuturaya” has initiated a participatory process with new potential to tap indigenous knowledge held by farmers. To increase impact and sustainability, the approach needs to be institutionalized. For longer term impact a change of attitude of all players involved is required as well as integration of the approach into a wider community resource management concept.

4. ON FARM DEMONSTRATION OF CONSERVATION TILLAGE IMPLEMENTS USING ANIMAL POWER



comments made by participants regarding the various types of implements:

The Subsoiler

This implement is designed for braking the hard pan on smallholder farms that have been continuously cultivated either with a handhoe or animal drawn plough. The subsoiler is pulled by two oxen and is good for soils in dry areas. The subsoiler works 20cm deep in the soil which is deeper than the standard plough that can only go 15cm deep.

General comments and observations:

- requires high draft power
- rigid hitch assembly allows restricted adjustment
- a good implement for the job.

On the third day of the workshop, all participants attended on farm demonstrations of conservation tillage implements and technologies. The objective of the demonstrations was to show the range of equipment and technologies available, though not necessarily in use by the majority of farmers. The demonstrations were to give a chance to the participants, some of whom were seeing them for the first time, to comment on the performance of the implements.

Demonstrations were conducted on the farm belonging to Mrs. Helena Shininge of Muroro village. The farm was situated 48 km East of Rundu. The farm was a typical one in the area, was 6ha in size with predominant sandy soils. Pearl millet was the main crop grown.

Main implements demonstrated came from Palabana Farm Power and Mechanization Centre in Zambia, the IMAG-DLO project on smallholder agricultural Mechanization Promotions in Zambia, Mashare Agricultural Development Institute and the Northern Rural Development Program of Namibia.

Some of the implements demonstrated were the Magoye Ripper and Planter attachment, the Palabana Sub-soiler, the Cultivator, the hand weeder, the Senegalese cultivator, Tie-Ridger and the range of Zimbabwean made equipment.

Under each of the following sub-headings are descriptions of the equipment and some of the



The Senegalese Donkey Cultivator in use

The Ripper

The implement has been designed for minimum disturbance of the soil during cultivation while opening the ground for adequate amounts of the water to be harvested. The ripper with extended wings attached becomes a mini-ridger, good for making furrows in dry sandy soils. Once the furrow is made, planting of cereals can be conducted. Two oxen pull the ripper when working on lighter soils but 4 animals may be needed on heavier soils.

General comments and observations:

- the ripper is an appropriate equipment for the soil and water conservation task. It has been carefully designed and adapted.
- it is good for sandy soil as it leaves furrows when used as a ridger.
- although introduced to farmers, it was still to catch on and be a common implement with farmers in Zambia and elsewhere.
- it worked well and was probably the best implement for conservation tillage.



The Ripper- Planter

The Ripper - Planter

This implement consisted of the standard (as described above) ripper without wings but with a planter unit attached. The machine is used for ripping the soil and planting the seeds in a single pass. This is meant to cut down on the labour and soil manipulation energy, as well as drudgery and time required to perform the two field operations. Less tillage energy can be a real asset during dry ploughing and saves on soil structure destruction and soil compaction. The planter had an interchangeable seed-metering unit in order to work with several types of seed.

General comments and observations:

- ◆ very good and effective
- ◆ requires a study on ergonomics especially with regard to use by women and smaller men.
- ◆ expensive for the majority of farmers but worth the price.

The Cultivator

The cultivator is used for weeding. It is particularly suitable for weeding in fields that have no ridges as it tends to destroy the ridges as it goes in the furrow. It is however adjustable to suit the crop or ridge spacing that is in the field.

General comments and observations:

- ◆ highly recommended and already in use with many farmers.



The width adjustable cultivator

The Hand Weeder

Crop weeding has been noted by many farmers as one operation which is time consuming and very critical in crop protection. Poor weeding reduces yields significantly. Two hand weeders were demonstrated. The machines were designed in such a way that two people are required to operate the machine, one person pulls the machine using a raw hide rope while the other pushes it. The weeder cuts the weeds under the soil as it goes along in between plants. It is particularly useful for farmers without animals to provide the power needed.

General comments and observations:

- ◆ performs better on sandy soils and in early weeding
- ◆ requires a wider front wheel preferably covered with bicycle tyre to avoid slippage.
- ◆ Definitely faster and more attractive, ergonomically, than one hand hoe.

The Grain Planter

Traditional manual planting is slow and inconsistent resulting in low plant populations and hence lower yields. The animal drawn planter is designed as a precision row planter, not suitable for solid planting as necessary for fine seeds such as millets. The machine is adjustable to meet a small range of seed sizes and seed rates.

General comments and observations:

- ◆ cost of US\$ 85 is too high
- ◆ heavy for female farmers to handle comfortably.



The tie-ridger

Tie – ridger

In order to conserve rain water falling on to a particular field, the need arises to tie ridges. This is achieved by building short ridges within the furrows, earlier- made with an ordinary ridger. The implement for doing this type of work is the tie-ridger or tie-ridge maker. A single donkey is adequate to haul it. The operator moves behind the implement directs it within the furrow or in between planting stations. As the implement moves forward it bulldozes soil which is released by raising the implement vertically using the handle bars to release the soil which then makes the tie ridge.

General comments and observations:

- ◆ needs a bit of practice to use
- ◆ implement only useful when water harvesting is required
- ◆ would work under deep fertile soils.
- ◆ not yet common in farmers fields.



Viewing equipment demonstration

5. FIELD VISITS



Farmers' views sought

Introduction

The main objective of the field visit was to discuss with farmers on issues concerning socio-economic, farming systems, environmental and other issues based on the potential and use of DAP for conservation tillage in Namibia.

Each group was to come up with a possible strategy for the introduction of conservation tillage for the area or village visited. Each group was also asked to identify possible conservation tillage interventions, which could be introduced or demonstrated. Following the field demonstration the previous day, the participants had already become familiar with the range of implements and technology selection available.

Eight (8) groups with 7 - 8 participants each, visited 24 villages, and encountered a total of 124 farmers. The communal villages visited surrounded Rundu, within a radius of ± 200 km.

The Kavango region covers much of the area visited and is located to the North East of Namibia bordering Angola. The Kavango river makes up the Northern and Eastern borders of the region. Here rainfall (400 - 500mm per annual) is scarce, scattered and unevenly distributed over the falling period. According to farmers rainfall has generally been decreasing over the last ten (10) years.

Apart from the Kavango River, there is no other source of surface water. The interior of the region depends on underground water from boreholes. Soils are generally sandy. The area is generally flat with undulated sand hills. The following are the summaries of the main observations and recommendation of group discussion. Due to the similarities of the visited villages, issues have been grouped and summarized to get an overview picture of the



villages in Northern Namibia.

Building materials and their provision can contribute to environmental degradation

Farming systems

Mixed farming is the major farming system, with cattle, goats and mahangu as the main elements. Other types of livestock kept include pigs, chickens and donkeys. Some farmers visited were also involved in other part-time activities such as fishing and trading. Farmers who lived near the Okavango river and Omurambas (valley) were also growing vegetables.

The places visited were found to have communal grazing land and their crop fields were fenced off to restrict livestock from going in to destroy their crop.

Some farmers practiced dry planting such that their seeds germinated with the first rain storm. The common crops included pearl-millet, sorghum, cowpeas, groundnuts, bambara nuts, pumpkins, maize, beans and water melons.



Water is life!

Land clearing was commonly carried out by men starting from about 2 months before the onset of the rains. The clearing was usually done using an axe. The cut material would then be raked using a wooden rake, in readiness for either burning or use as fencing material for the fields. After burning of the cut material (trash) farmers normally wait for the first rains before going in to plough, using the ox drawn plough or hand hoe. This again was commonly done by men. Weeding was predominantly carried out by women, though it was reported that men were increasingly getting involved in weeding. Bird scaring especially for millet was by both sexes.

Socio – Economic Issues

The local governance responsibilities are traditionally vested in village headmen with authoritative powers to regulate all issues including those of socio-economic nature such as land allocation. Having women village-heads was common. Government intervention is normally through the local elected regional councilors in constituencies.

In the area of Namibia visited agriculture provides the basis for the peoples' livelihood. Other sources of income include pension to the elderly and disabled, remittances, formal employment (private and public); and local



Arid Namibia: Several parts receive no rain at all in some years

opportunity earnings, selling of wild fruit, selling of thatching grass, casual work, brewing and distilling and rendering of services e.g. DAP - ploughing and transport.

Farm labour is concentrated on the family house hold. It is becoming scarce. Hiring of labor paid in cash or kind is quite common especially for seasonal work such as weeding, harvesting and threshing. The “NZAMBI” system is widely used. In it a farmer brews beer and calls other farmers to assist with farm work.

Marketing is a problem during surplus years in some areas. Farmers have no or limited access to financial resources. The existing Agribank loan scheme is not accessible to the majority and most needy and poor farmers.

Almost all the villages visited had schools, clinics, hospitals, shops (“cuca shops”), boreholes and wells.

Due to declining rainfall there was talk of declining food security situation at household level.

Environmental Issues.

The traditional way of crop production was found to be very destructive in the area. Most farmers did not use any soil improvement techniques such as application of cattle manure in their fields. Some farmers complained that they did not use cattle manure because it brought weeds. This was identified as one of the major problems. A few farmers said they could use cattle manure from their kraals if the exercise

was not as labour intensive and if they had ox carts to transport the manure. In the area cattle kraals were generally located near the homesteads but fields were farther away.



Children of Namibia, like others elsewhere are direct beneficiaries of sustained rural environment

Farmers who grew vegetables on small plots near the river used cattle manure on their plots. A small number of farmers shifted the cattle kraal in the field so that the manure could be deposited straight into the field.

Many farmers were not aware of conservation tillage methods although a number of them grew crops on slopes of up to 2.5% practiced ploughing across the slope. Some farmers found out from experience that in order to flatten their land they could plough from say, North to South in one year and plough across (i.e. West to East) the following year. The “excess” trash was burnt as part of the preparation of the fields for ploughing.

Forest fires were also widespread and led to speedy deforestation. This resulted in increased erosion and general reduction in the quality of grazing lands, among other effects. Deforestation due to indiscriminate cutting of trees was also common.

For example the Muramba ecosystem was destroyed due to ploughing and growing crops in it. Most fields in the Muramba were abandoned after 3 - 4 seasons due to reduced productivity, which was suspected to be due to the development of a hard plough pan. The problem

of hard pan was noticed by a number of farmers. Many did not do anything to alleviate the problem. However a farmer who used 6 oxen, and a big mouldboard plough and ploughed deeper to break the hard pan reported to have seen the benefits.

No Agroforestry was practiced in the area although this could be a way of improving the soil and also provide cover. All farmers left stover in the field after harvesting. Some farmers harvested a little stover for fencing their homestead but most of the stover was left for animals to graze. Before ploughing some farmers would take the left over stover and burn it, whilst others would just plough it in.

Use of DAP in Conservation Tillage.

All farmers visited used draft animals. Some had their own while others hired from neighbours. Use of oxen was restricted to ploughing with single furrow ploughs and transport mainly by use of sledges.

Using draft power was noted to critically influence area cultivated, hence, crop production. Donkey use was restricted to transport and actually it was not so common in the areas visited.

Cattle hire prices varied a lot in the areas visited with N\$100 per 5 hours in Mungunda and Fumbe areas and N\$40 - N\$50 at Bagani and Muthinduko.

Ox drawn cultivators were not yet common with the farmers visited, but the few farmers who had experienced them reported their liking of them. Some other farmers who had only seen the cultivators demonstrated also showed interest in their acquisition.

Group Discussion on the Implications for the adoption of DAP in Conservation Tillage in the Visited Villages

The concerns raised included:

- Some villages were observed to have local leadership vacuum and this may indirectly affect adoption of CONTIL techniques,
- For labor intensive activities like weeding the adoption of labor saving technologies could be enhanced. The use of cultivators

will, however be hindered by the numerous tree-stumps in young fields, some of them practicing shifting cultivation.

- The adoption of some tillage tools like the rippers can only take place if the farmers appreciate them. This can only be achieved by on-farm, hands-on demonstrations for farmers to make their own judgement.
- In fields that are not ridged, and as was observed to be the case in the areas visited, the use of ox drawn tie-ridger for water harvesting purposes is not useable. The introduction and adoption of the ridger might therefore have to precede that of the tier.
- Some equipment may not be adopted simply because of their prohibitive prices. Farmers had the general feeling that anything above N\$200 was too expensive. For the ripper / planter attachment, credit provision would have to be considered. The introduction and consequent adoption of all conservation equipment will not take place if nothing is done to the prevalent problem of cattle theft in the area.

Possible Conservation Tillage Technologies to be Tested in the Visited Villages

Participants agreed that the aim of using conservation tillage was not only to increase farm labour productivity and food security, through water and soil conservation but also to do it in a more sustainable manner. They agreed technologies which need to be promoted and tried include tillage, based on subscribing, ripping, planting and weeding practices. Details and needs would however vary from one location to another.

* Palabana subsoiler attachment:
This implement can be fitted to any common plough beam. The implement is used to break the hard pan thereby improving water infiltration and conservation. It can be used in the dry season on lighter sandy soils to get maximum shattering effect and during the rainy season between crop rows.

The major disadvantage of the implement is its high power requirement (4 animals). It is however unlikely that any design work would

lead to a lighter equipment that did the necessary work while utilizing two animals.

* Magoye Ripper Attachment:
This implement was used for making planting furrows either on ploughed or un-ploughed land. For conservation tillage purpose it is used on unploughed land. The Magoye Ripper Attachment works fairly well on dry soils and can be attached to any common plough beam. With this implement early planting and early weeding is possible.

* Ripper Planter Attachment:
The planter attachment helps achieve a simultaneous ripping and planting operation. Dry planting is made possible with this equipment. In terms of gender considerations, this implement eliminates the labour burden on women who commonly do the planting. Different seed metering devices can be used to fit the differences in seed size.

* Ripper Ridger Attachment:
This is a ripper attachment with extended wings. It is needed for making ridges prior to planting, either after ploughing, directly on flat land or by splitting old ridges. In this form the implement is a mini-ridger. The implement can also be used for weeding.

* Cultivator :
This is an implement with two front tines to break up the soil before the weeding sweeps come to action. The space in-between is weeded by hiller blades, which also re-form the ridges. The equipment is popular as a weeder.

* Tie Ridger:
If planting has been done on ridges, the tie ridger could be used to harvest rain water for the crops grown.

Strategies for the adoption of the Conservation Tillage Technologies in Northern Namibia.

The workshop identified the following strategies which can be used to promote conservation tillage technologies in Namibia

- Create awareness on the importance of CT through publicity and demonstrations at all levels
- Use participatory research and extension approaches with farmers as the prime

- clients in the designing, implementation monitoring and evaluation of technologies.
- Facilitate creation of Community Based Organizations (CBO's) through which sustainable CT development can be propagated.
 - On-farm testing and demonstration of relevant CT techniques and implements, to give farmers options.
 - In depth investigation on the status of soil and water including soil water and design of appropriate technologies and techniques.
 - Encourage the availability of improved seed in remote areas.
 - Encourage harvest and storage of crop residues by farmers.
 - Encourage collection and storage of highly nutritious natural Fodder.
 - Encourage exchange of knowledge and experience by farmers through networking and exchange of farmer to farmer visits.
 - Training of both technical staff, farmers in all DAT aspects.
 - Facilitate development and improvement of local manufacturing, supply and repair capacities for DAT implements.
 - Include DAT learning and practice in school and college curricula.
 - Branding of animals to counter theft.
 - Gender considerations in all aspects.
 - On-going monitoring and evaluation.
 - Facilitate or ensure the availability, affordability and accessibility of implements through:
 - a) initial stock and supply by the Republic of Namibia (GRN) or it's agents
 - b) Deliberate financial back up through:
 - Loan guaranteed by GRN through Agribank using the National Credit Program (NACP).
 - Possible subsidy by GRN or Donors.

Possible Conservation tillage systems for short and medium term interventions

After discussing with farmers and taking into account the existing farming systems, the resource-material and knowledge available participants used their experiences with socio-economic and technological factors as well as the

physical characteristics of the area, to come up with the following CT system proposals for Namibia. Of essence, the recommendations were both short and medium term:

Short term recommendations:

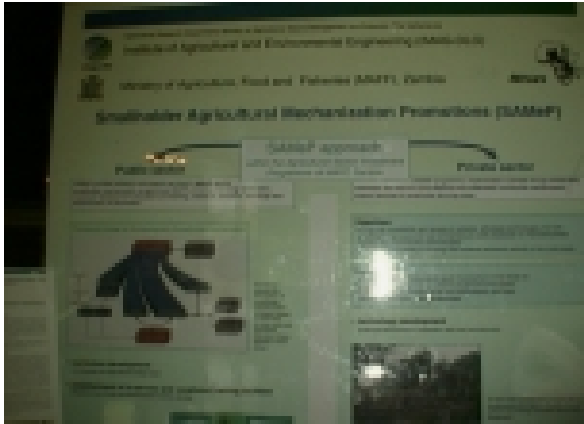
- a) Manuring
Since most farmers had livestock, manure could be used for both environmental and soil fertility considerations.
- b) Ripping
Ripping was highly recommended especially for the fine sandy soils of Northern Namibia which tended to form an impenetrable hard-pan layer 12-20mm below ground surface.
- c) Weeding
Weeding was mentioned as a major problem. Considering that the technology had been adoption-tested with positive results little effort was needed in incorporating it into conservation tillage systems of Namibia. Animal power was available to back it, though specialized training for weeding as would be necessary.
- d) Draft Animal Nutrition
DAP nutrition and management would remain very important for Namibia. Draft animal power supplementary feeding was considered necessary especially because animals are weak at the beginning of the season when they are needed most for land preparation
- e) Rainwater Harvesting
For water harvesting and considering that Namibia is characterized by heavy down pours followed by heavy runoff, it was noted that there is room for water harvesting especially in the interior region of the country.

Medium term

Although the shorter term efforts would not be carried out in isolation but in integration with longer term ones, the following initiatives were considered of a medium term nature:

- Agro-forestry programme
- Crop Rotation as well as inter-cropping research on-station and on-farm.
- Crop and livestock integration in line with a) and b) above where animal feed and nutrition is a critical consideration.

6. POSTER PRESENTATIONS



To compliment the workshop program, several poster presentations were made in the open roundavel next to the conference room. The following is a summary of the major presentations

1. Palabana Farm Power and Mechanization Centre (Zambia).

The objective of this presentation was to provide information on the activities of the animal traction research and development. The display included steps in rural development which included:

- needs assessment
- prototype development
- on-farm testing
- monitoring and evaluation
- manufacture
- marketing and promotion.

2. Small holder Agricultural Mechanization (SAMEP) Zambia.

The objective of this presentation was to provide program information. Small holder Agricultural production in East and Southern Africa is hampered by the shortage and low productivity of labor. SAMEP aims at increasing agricultural productivity and profitability in the rural areas of Zambia. Its activities are primarily geared towards making relevant technologies including the necessary hardware available and accessible to the farmers and rural entrepreneurs.

Highlights of SAMEP activities include

- to promote manufacture of conservation tillage equipment and post-harvest machinery
- to promote distribution and marketing of animal traction and post harvest equipment
- to promote improved supply and management of draft animals.
- encourage liaison and networking both at national and international level with public and private sector.

3. Indigenous soil conservation tillage systems and risks of animal traction on land degradation in Eastern and Southern Africa.

The objectives of this presentation were to show the importance of indigenous systems in soil conservation and highlight the risks of animal traction on land degradation. The main points of the presentation were:

- Indigenous soil conservation tillage systems still play an important role. However they are labor intensive and difficult to mechanize thus limiting the cropped land.
- Animal traction like any other conventional flat cultivation whether by hand or tractor has the potential of increasing land degradation
- deforestation for agricultural land expansion or fuel wood, bush fires and overgrazing are the other sources of land degradation.
- the incorporation of appropriate soil conservation measures such as contour bunds, (mechanical, agronomic and vegetative) is important in animal traction systems, as it is on the increase.
- Appropriate use of implements is important in animal traction to reduce risks of land degradation.
- Participatory community based approaches are important in the adoption of soil conservation techniques.

4. Northern Namibia Rural Development Project: Evaluation of Farm Implements.

The objective of this presentation was to show five new implements for small holder farmers that have been tested in the North and central Divisions of Namibia. The implements were the Cultivator BS41, light plough, yellow cultivator, green cultivator and the hand push weeder. The message was enhancing animal traction for farm operations on smallholder farms.

Since 1996 there has been promotion of the use of draft animal power in the NCD in Namibia. Different extension messages have been developed to help the agricultural extension techniques relay the messages to the farmers.



5. Soil and water conservation tillage trials conducted at the institute of Agricultural engineering Zimbabwe.

The objective of the presentation was to show work that is going on and the results of soil and water conservation tillage trials conducted since 1995.

Highlights of the presentation were:

- soil management techniques play a role in influencing the water balance of available lands under crops.
- tillage techniques in particular can increase or decrease the availability of water to crops by influencing water infiltration, runoff and underground drainage or deep percolation through seepage.
- during drought seasons mulch ripping allows the fields to wet up faster than mouldboard ploughing and this allows early crop establishment.

This is the most sustainable system for deep, well-drained soils.

- tied ridging showed problems of delayed wetting-up due to high evaporation and deep percolation resulting in poor crop establishment in drought-prone seasons

6. Gender issues in Agricultural Engineering.

The objective of this presentation was to raise awareness among technicians and engineers on the importance of gender issues in agricultural engineering and in their daily work.

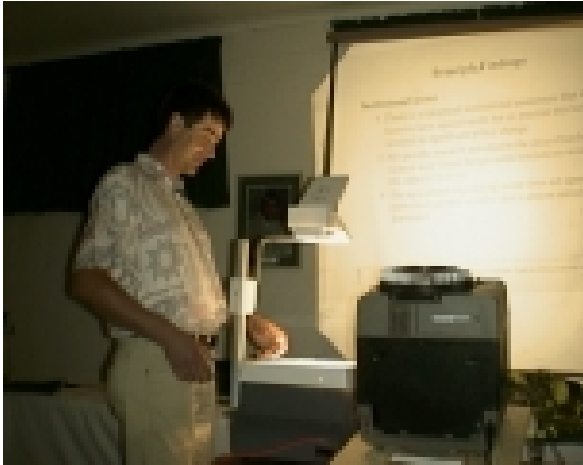
Highlights of the poster were:

- A brief introduction on gender issues in agricultural engineering
- Two picture stories explaining in an illustrative, comical and thoughtful way, how women farmers are often neglected, or just overseen in the day to day work of extension or development workers.



“Making each and every farmer count” was a book and poster, produced by FAO. It presented six case studies of agricultural engineering projects in Africa which had employed a range of techniques to get farmers to participate in projects and to adopt or adapt technologies. Some of the techniques had worked but many of them had failed. The presentation was intended to convince middle and senior level agricultural engineers working in Government, University academics; and project practitioners that adopting a gender approach was the only way to make sure that each and every farmer counts.

7. INFORMAL EVENING SESSIONS



Suitability of handtools for women in Uganda

1. Conservation Tillage Technologies and practices used in Zimbabwe.

The presentation by Isaiah Nyagumbo of the Institute of Agricultural Engineering in Zimbabwe was aimed at sharing and clarifying myths about some conservation tillage technologies with participants. Highlights of the slide presentation showed on the farm advantages of various conservation tillage technologies including mulch tillage; tied ridging; infiltration pits; weed problems. Various awareness raising tools were presented.

2. Socio - economic and gender issues in draft animal technology.

This was a presentation by Mrs. Tabitha Ngamau, a Lady Farmer from Kenya and KENDAT (Kenya Network for Draught Animal Technology) Vice Chair. The objective of the presentation was to share her unique experiences, especially with research scientists present at the workshop. Her presentation was followed by intense discussion as participants took the chance to learn more about the farmer perspective.

She covered a brief history of small holder farming in Kenya, the use of donkeys as a tradition by the small holder farmers, capacity building and self reliance mechanisms and the

role of women in small scale farming. Including her own personal and national experiences the discussion that followed was enlightening indeed.

3. Animal traction resources in Ghana.

This slide presentation by Emmanuel Bobobee of the University of Science and technology in Ghana showed exciting animal traction resources and activities in Ghana. Vast information was made available on draft animal availability , types of animal breeds, including pest and disease tolerant breeds, types and range of implements in use, artisan and manufacturing support and tillage practices among the small holder farmers using draft animal power.

4. Regional Conservation Tillage Network.

The conservation tillage workshop held in Harare in June 1998 recommended the formation of a regional network in order to promote conservation tillage technologies and approaches in the region. A draft proposal for such a network was presented at this session by Dr. Kurt Steiner of Germany. The objective of this session was to exchange ideas further on needs for such a regional organization. Major issues discussed were:



- the need for yet another network and whether its activities could be accommodated in existing Networks such as ATNESA.



- the structure of the network, scope of activities and membership including both individuals and institutions.

These issues were not finally resolved and participants agreed to continue discussion even after the workshop, led by Richard Fowler of South Africa and Kurt Steiner of Germany.

Proposed activities would be such as:

- collection of CONTIL data and setting up a regional databank,

- production of a newsletter either electronic or printed,



- information exchange within the region and between the regions such as with Latin America,
- holding of regular workshops and visits across localities and countries, to exchange CONTIL ideas and more to the benefit of national, regional and international efforts.

8. WORKSHOP RECOMMENDATIONS AND FOLLOW UP

During the last two days of the workshop, participants were divided into working groups to carry out structured discussions. The group discussions were reported and followed by a panel session which formulated workshop outputs. The groups were asked to keep in mind the project proposal for improved conservation tillage and practice for Namibia and indeed the ATNESA region. It had been planned by ATNESA that the workshop output would be passed on to a smaller speciality, working group which would not only report the workshop but also develop a CONTIL Proposal for Namibia. This had been planned for the week following the closure of the workshop.

Indeed a week after the workshop a CONTIL Proposal was submitted for consideration by the Ministry of Agriculture , Water and Rural Development. The proposal set a time frame and logical framework with an aim to promote and support conservation tillage practices in Namibia.

Additionally the workshop set out collaborative regional activities, of which ATNESA was given the mandate to coordinate. ATNESA and collaborating organizations would also provide the necessary backstopping for the proposed Namibia programme.

The following recommendations summarize the output of the workshop discussion groups. They reflect the priorities identified by the groups and the discussions held with farmers during the field visits.

A. Possible Project Proposals for Namibia to Consider:

1. *Promotion of conservation tillage with animal traction*

The objective of this project is to conserve soil and water, reduce farm drudgery and increase farm productivity. The project will also aim at alleviating poverty and creating employment opportunities within the rural areas of Namibia.

Possible activities will include:

- identification and documentation of appropriate conservation tillage techniques,

Rain Water Harvesting methods and implements suitable under Namibian conditions.

- Further on-station and more on-farm testing of the promising technologies.
- Training of technicians, farmers and artisans on the use and maintenance of implements and rainwater harvesting techniques.

Other issues, which will need to be addressed include:

- Farmer credit and marketing strategies.
- Incorporating conservation tillage training in schools and colleges .
- Availability of Draft Animal Power and management issues.
- Networking to avoid duplication of work and exchange of experiences.

2. *Improving soil fertility, crop and weed management.*

The main issue here is to improve and sustain soil fertility and crop yields. The ultimate goal is to contribute towards improving agricultural productivity and promote sustainable utilization of agriculture land.

Key issues to be addressed will include:

- The use of organic manure.
- Mulching and techniques.
- Crop rotation.

Possible activities for the project will include:

- On-farm research on crop rotation and mulching techniques.
- On-farm testing of manure distribution
- Farmer and technician training on soil fertility and crop rotation.
- Promotion of mechanical weeding for weed management.
- Crop and livestock production for environmental sustainability and management of crop residues.

3. *Crop and livestock integration and environmental management*

The objective here will be to create awareness on the need to conserve natural resources. Also the project will aim at maximizing agricultural and livestock production through agro-forestry initiatives.

Possible activities and key issues to be addressed will include:

- Identification and documentation of fodder trees which can be planted and used for both crop and livestock production.
- Provide knowledge, skills and supportive services to rural communities on environmental degradation and encourage environmental protection.
- Training of farmers and technicians on environmental issues and the integration of crops and livestock in agricultural production.

4. *Entrepreneurship, credit and marketing support.*

The MAWRD will be responsible for coordinating the implementation of those projects, working closely with farming communities, the public and private sector and with the country's development partners.

ATNESA will provide the necessary backstopping.

B. Regional Collaborative Activities

i. Development of guidelines on conservation tillage with animal traction in semi-arid areas of East and Southern Africa.

It was noted that FAO is currently preparing general international guidelines on conservation tillage. What is required for the region are specific guidelines for Eastern and Southern Africa on Conservation Tillage with Animal Traction.

Among others, key issues to be addressed in the guidelines will include:

- Cover crops.
- Management of crop residues.
- Weed management.

- Suitable implements and their availability.
- Soil fertility management and practice.
- Economics of crop residues as fodder or ground cover and use of conservation tillage implements.
- General information exchange and updates.

ii. Development of Database (Info-base) on Conservation Tillage systems.

FARMESA, a regional program has initiated collecting information on Conservation tillage systems. Participants felt that there is need for ATNESA to collaborate with FARMESA and produce a comprehensive Database and inventory of existing technologies.

Accessibility to the information base was also discussed at length. It was agreed that the use of electronic database in the region should be explored among other means of information access and exchange.

iii. Establishment of Regional Network on Conservation Tillage

This was a follow up discussion from Harare Workshop organized in June, 1998 by FAO and GTZ. During this workshop, participants expressed the need for a regional conservation tillage network. The main objective of this network will be to enhance the exchange of conservation tillage information. Main activities may include research, publication and promotion of conservation tillage. The network will mainly operate in East and Southern Africa region.

Participants were informed that Dr. Kurt Steiner has submitted a proposal to EU to fund the network secretariat. Discussions led to the nomination of contact persons for South Africa, Tanzania and Kenya.

C. National Programs and Activities.

Discussions to initiate national activities and programs on CT were made both formally and informally. The following activities were in the making and were to be implemented by ATNESA members in their respective countries.

- a) Training in CT in Kenya. This will involve the following organizations; RELMA (Regional Land Management Unit), Ministry of Agriculture, KARI (Kenya Agricultural Research Institute) and

KENDAT (Kenya Network for Draught Animal technology).

- b) National program on CT in Tanzania. The Project will initially concentrate in the Southern Highlands of Tanzania and will be coordinated by Mr. R. Shetto. The proposal has been submitted to Worldbank for consideration and funding.
- c) Study on CT in South Africa. A pilot project has been proposed to look into CT for smallholder farmers in Eastern Cape. Dr. Simalenga will coordinate the project and a proposal has been submitted to donors for consideration.

9. WORKSHOP EVALUATION

At the end of the workshop participants were invited to complete evaluation forms anonymously. There were thirteen questions dealing with specific aspects of the workshop programme, organization accommodation and facilities.

Participants graded their responses on a scale ranging from A to E (Very Good to Very Poor). The last question was open ended to give a chance for participants to express their opinions on a number of issues. A total of sixty-one completed evaluation forms were returned. A summary of the responses is given below and also pictorially shown on the graph that follows.

The field visits received the highest evaluation score followed by presentation of keynote papers and case studies. Also rated highly were the overall workshop methodology and content and group discussions as well as presentations of field trip results. The item that received the lowest rating was the hotel rooms and services provided. Of the six hotels in which participants resided, the low score may be attributed to Ngandu Tourist Lodge, which was the venue of the workshop. This hotel was a new one and the only one with adequate conference facilities in Rundu. It was partially, still under construction. This notwithstanding several participants had verbally referred to the services offered by the lodge as of low quality and hostel staff were rude or just generally unfriendly!

On how the workshop could have been improved, some suggested that more time could have been availed for group work to draft project proposals. Participants also wished that more time had been allocated for field visits.

Suggestions were that few villages could have been visited or if all the villages visited had to be visited, then more time should have been allowed.

Most participants thought that the workshop was well organized. Some participants thought that there was little emphasis on gender and social issues. A few participants thought that workshop of this nature should be conducted during the

cropping season for field demonstration and discussions to have more relevance and be more impact.

Participants were particularly impressed by the heavy presence of high-level government officials through out the workshop. Their participation was linked to the interest and the seriousness the government attached to small holder farmer and other development.

Average evaluation scores

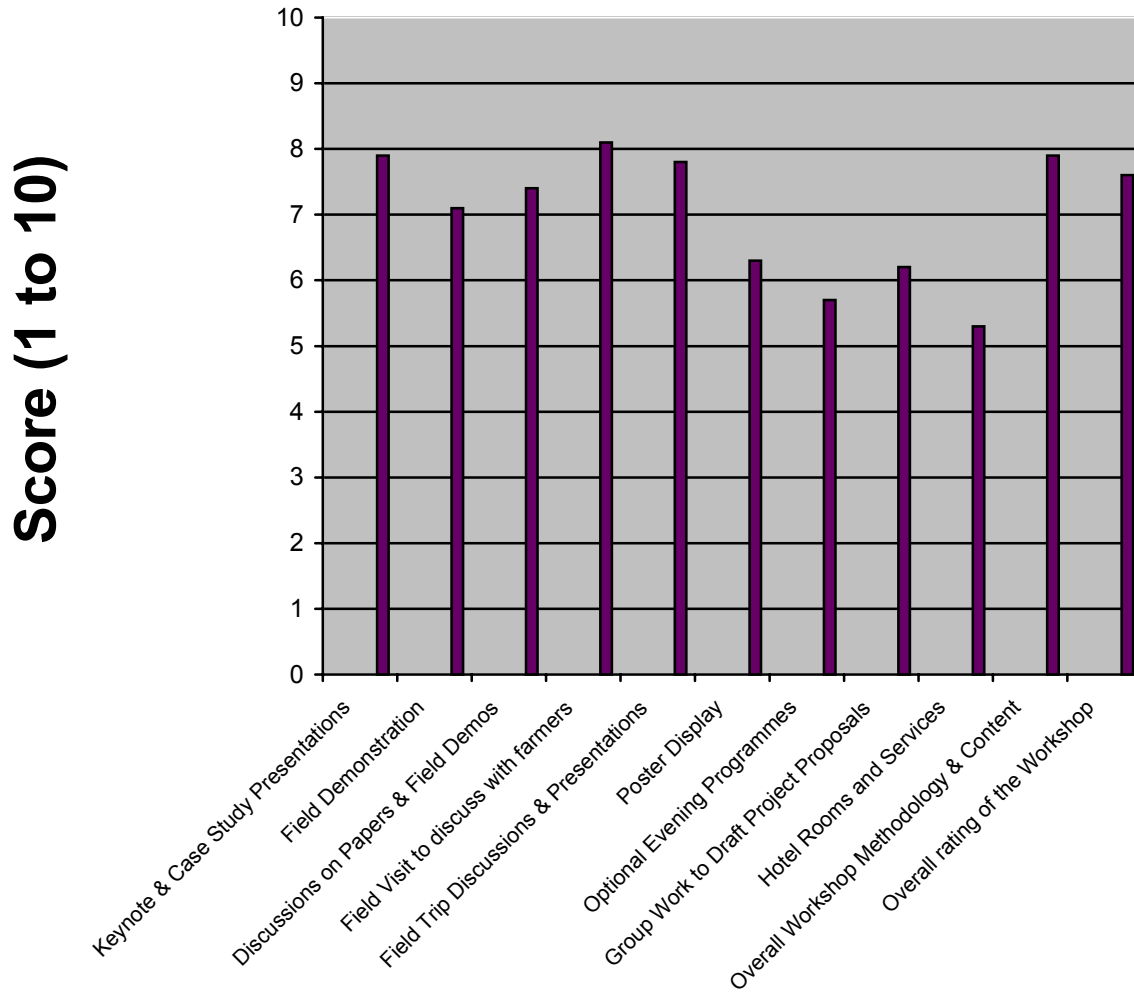
<i>Programme elements (ranked)</i>	<i>Score</i>
Field visit to discuss with farmers	8.1
Keynote papers and case studies presentations	7.9
Overall workshop methodology and content	7.9
Group discussions & presentations on field trip results	7.8
Overall rating of the workshop	7.6
Group discussions on papers & field demonstrations	7.4
Field demonstration of implements and technologies	7.1
Poster display	6.3
Group work to draft project proposals	6.2
Evening optimal programs	5.7
Hotel rooms and services (meals etc.)	5.3

Mean scores are based on A=10, B=7, C=5, D=3 & E=0

If all participants rated an element as Very Good, the mean score would be 10. A mean score of 7 represents an overall assessment of "Good and Useful".

A mean of 5 would represent "Acceptable".

Workshop Evaluation



ANNEX ONE
WORKSHOP PROGRAMME

DAY 1: Sunday, 4th October, 1998: ARRIVAL AND OPENING

14h00	Registration
16h00	Setting up posters and exhibits
19h00	Welcoming reception and Workshop Opening

DAY 2: Monday, 5th October 1998: KEYNOTE PRESENTATIONS

Chairperson: *Mr. A.S. Kruger*

08h30	Introduction of Participants and Workshop Methodology <i>E. Mwenya and T Simalenga</i>
09h00	Namibia Paper: Country Synthesis Presentation. <i>P.W. Misika</i>
09h45	Overview of Conservation tillage practices in East and Southern Africa. <i>P. Kaumbutho</i>
11h00	IMAG-DLO and Conservation Tillage: Activities and Experiences. <i>C. Kaoma</i>
11h45	Rain Water Harvesting for Agricultural Production. <i>H. Mahoo</i>

Chairperson: *Ms. J. Rwelamira*

14h00	AGRITEX/GTZ Project Experiences in Promoting Conservation Tillage in Zimbabwe. <i>I. Nyagumbo</i>
14h30	Socio-Economic Conditions Affecting the Adoption of Conservation Tillage: Experiences in Lesotho. <i>L. Mosenene</i>
15h00	Palabana Experiences in Development and Promotion of Conservation Tillage in Zambia. <i>M. Bwalya</i>
16h00	Research and Development in Conservation Tillage in South Africa. <i>R. Fowler</i>
16h30	The Role of Draft Animal Power in Ghanaian Agriculture. <i>E. Bobobee</i>
17h00	Poster Viewing and Networking Evening - Optional programs

DAY 3: Tuesday, 6th October, 1998: FIELD DEMONSTRATIONS & CASE STUDIES

Chairperson: *Mr. P. Horn*

07h30	Field Demonstrations: Tillage Systems and Technologies
11h00	Indigenous Conservation Tillage Systems. <i>B. Kayombo</i>
11h30	Investigations into Soil Fertility in the North Central Region of Namibia. Case Study of NNRDP. <i>T. Phillipie</i>

12h00 Extension and Technology Transfer: Approaches for Enhancing Dissemination of Conservation Tillage Practices.
E. Chuma

Chairperson: Mr. N. Seobi

14h00 Plenary Session and Group Discussions
16h00 Presentations of Group Discussions and Outline of Field Visits
Evening - Option Programs

DAY 4: Wednesday, 7th October, 1998: FIELD VISITS

06h30 Field Visits: To Visit Farmers in Small Groups
16h00 Preparation of Group Summaries on Field Findings
Informal Networking

DAY 5: Thursday, 8th October, 1998: FORMULATION OF WORKSHOP OUTPUTS

Chairperson: Dr. Simalenga/Mr. E. Mwenya

08h00 Plenary Session: Issues and Formation of Output Oriented Working Groups
09h00 Group Discussions: Strategies and Action Plan for Regional and National Level Activities
14h00 Plenary Session: Reviewing Progress
19h00 Workshop Dinner

DAY 6: Friday, 9th October, 1998: RECOMMENDATIONS AND CLOSING

Chairperson: Mr. R. Shetto

08h30 Plenary Session and Workshop Synthesis
09h30 Recommendations and Follow-Up Actions
11h00 Workshop Evaluation and Closing
13h00 Departure

ANNEX TWO

LIST OF PARTICIPANTS

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ANNEX THREE

LIST OF PAPERS SUBMITTED

KEYNOTE PAPERS

Misika P.W. and Mwenya E.

Conservation Tillage with Animal Traction for Soil Water Management and Environmental Sustainability in Namibia (Country Paper).

Kaumbutho PG, Gebresenbet G, and Simalenga T.E.

Overview of Conservation Tillage Practices in East and Southern Africa.

CASE STUDY PAPERS

Kaoma - Sprenkels C, Stevens P A and Wanders AA

IMAG - DLO and Conservation Tillage: Activities and Experiences.

Nyagumbo Isaiah

Conservation Tillage for Sustainable Crop Production Systems. Highlights of Results and Experiences from On-Station and On-Farm Research in Zimbabwe (1988-1997).

Kayombo B, Ellis - Jones J, Martin H.L.

Indigenous Conservation Tillage System in East Africa with an Example of their Evaluation from South West Tanzania.

Bwalya Martin.

Conservation Farming in Smallholder Farming Systems: Palabana Experiences.

Mosenene Letla.

Social - Economic Factors Affecting the Adoption of Conservation Tillage. Experience from the Soil and Water Conservation and Agroforestry Programme SWaCAP, Lesotho

Bobobee, Emmanuel Y.H.

Role of Draft Animal Power in Ghanaian Agriculture.

Chuma, E, Murwira and Hagmann J.

Participator extension of Conservation tillage techniques: Lessons and experiences from the development and dissemination of conservation tillage system in Southern Zimbabwe.

Fowler Richard.

Conservation Tillage Research and Development in South Africa.

Hatibu N and Mahoo H.

Rain Water Harvesting Technologies for Agricultural Production: A Case for Dodoma, Tanzania.

Rigourd C, Sappe T.

Investigation into Soil fertility in the North Central Regions of Namibia.

OTHERS

Kumwenda Wells F.

The Role of Animal Traction in Soil and Water Conservation Tillage Practices Among Smallholder Farmers in Malawi.

Lubwama F. B.

Socio - Economic and Gender Issues Affecting the Adoption of Conservation Tillage Practices.

Mtunze RN and Nusuhela K.A.L.

Conservation Tillage with Animal Traction for Sustainable Soil and Water Management.

Musiwa T.M.S.

Conservation Tillage in Zambia: Some Technologies in Use, Indigenous methods and environmental issues.

Ngamau T.W.

Social - Economic and Gender Issues in Draft Animal Technology (DAT)

Rigourd C, Sapper T and Talavera P.

Case Study: Investigation into Soil Fertility and Tests on Minimum Tillage / Dry Sowing in North - Central of Namibia.

Rwelamira J.K.

Effect of Socio - Economic and Gender Issues on Sustainable Resource Management.

Sakala Isaac

Conservation Tillage Implement Supply, Effort and Initiatives: A Case for Zambia.

Shetto R.M.

Indigenous Soil Conservation Tillage Systems and risks of Animal Traction on Land Degradation in Eastern and Southern Africa.

Tsimba R, Hussein J and Ndlovu LR

Relationships Between Depth of Tillage and Soil Physical Characteristics of Sites Farmed by Small Holders in Mutoko and Chinyika in Zimbabwe.

Bangura Abu B.

Conservation Tillage with Animal Traction in the semi - arid Regions of West Africa.

Chawatama S, Ndlovu LR, Richardson FD, Dzama K and Mhlanga F.

Use of Computer Simulating Modelling to Improve Management of Animal Powered Farming Systems in Semi Arid Regions.

Fall A and Faye A.

Soil – Water Management and Minimum Tillage with Animal Traction in the Sub - Saharan West - African Region.

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Animal Traction Network for Eastern And Southern Africa (ATNESA)



Animal Traction is an appropriate, affordable and sustainable technology that is increasingly being used in the countries of eastern and southern Africa. Cattle and donkeys are the main draft animals. They provide smallholder farmers with vital power for cultivation and transport.

ATNESA (Animal Traction Network for Eastern and Southern Africa) was formed in 1990 to improve information exchange and regional co-operation relating to animal draft power. The network aims to unite researchers, manufacturers, development workers, institutions and the users of animal traction in the region. Membership of the network is open to all individuals and organisations interested in its objectives. ATNESA is co-ordinated by a regional steering committee.

ATNESA has arranged several important workshops on improving animal traction, meeting the challenges of animal traction technology, gender issues in animal traction, animal-drawn carts and weeding using animal power. More than 400 people from 40 countries have participated in ATNESA workshops and several resource publications have been produced. ATNESA encourages the formation of national animal traction networks. Contacts for ATNESA and some national networks are given above.