

Animal Traction Network for  
Eastern and Southern Africa

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Kenya Network for  
Draught Animal Technology



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# Meeting the challenges of animal traction

Report of the ATNESA workshop held  
4-8 December 1995, Karen, Kenya

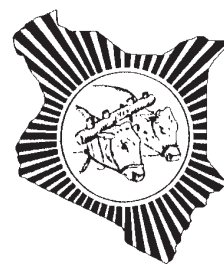


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4-8 December 1995, Karen, Kenya

*prepared by*

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ODA

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British Development Division in East Africa

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Food and Agriculture Organization of the United Nations

AGROTEC-FAO, Zimbabwe, Commonwealth Foundation

Technical Centre for Agricultural and Rural Cooperation (CTA)



# Animal Traction Network for Eastern and Southern Africa

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

### Cover picture

*Women farmers discussing some animal traction challenges and technology options during the field visits*

*Photos: Paul Starkey ©*



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# Workshop summary and press release

## ***Animal traction***

Animal traction is an appropriate, affordable and sustainable technology that is increasingly important throughout Eastern and Southern Africa, complementing both hand labour and tractor power. Work animals (oxen, cows, donkeys, horses, mules, etc) are mainly used for land preparation and transport, but they are also employed for weeding, ridging and planting and they can assist logging, milling and road construction. There was a period when animal traction technology was neglected by both governments and aid agencies, but it is now recognised as a crucial area for research and development. Animal power will continue to have great relevance for smallholder farmers in Africa for many years to come. Not only is the technology affordable, profitable and sustainable, it is also environmentally appropriate in most ecological systems.

## ***ATNESA***

The Animal Traction Network for Eastern and Southern Africa, ATNESA, formed in 1990, aims to improve information exchange and regional cooperation relating to animal draft power. ATNESA is an open, multidisciplinary network coordinated by a regional steering committee that works with national networks. ATNESA convenes international workshops and produces resource publications.

## ***Workshop***

The ATNESA workshop on *Meeting the challenges of animal traction* was held from 4-8 December 1995 at Karen, Kenya. The workshop was attended by 130 people from 27 countries. A total of 85 technical papers were prepared and circulated. Edited versions of the papers will be published in the forthcoming proceedings. The objective of the workshop was to bring together regional and international specialists involved in research, development, training and extension of animal traction to assess the current situation, review progress and plan to meet the future challenges.

## ***Hosts and sponsors***

The workshop was hosted by the Kenya Network for Draught Animal Technology (KENDAT), a non-governmental organisation based at the University of Nairobi. KENDAT is affiliated to ATNESA and aims to improve animal traction technology in Kenya. The

workshop core costs were supported by the British Development Division in East Africa (BDDEA) of the Overseas Development Administration (ODA), which also sponsored some participants. Other sponsors included the Technical Centre for Agricultural and Rural Cooperation (CTA), AGROTEC, Food and Agriculture Organization (FAO) and the Commonwealth Foundation. Many participants were sponsored by their own organisations or by agencies within their own countries.

## ***Workshop themes and methodology***

The workshop theme was explored with a multidisciplinary, holistic and farming system approach. Subthemes to focus discussion included: gender, transport, weed control, donkeys, environmental impact, cows for work and challenges of animal traction in Kenya. The workshop methodology was built on the experience of previous ATNESA workshops with emphasis on participatory activities rather than plenary sessions. During five days of intense interaction and activity, participatory methods were used to encourage information exchange, stimulating critical discussion, synergetic collaboration and constructive planning. A large number of poster displays and photographic exhibitions prepared by participants as well as some implements were on show and stimulated much discussion.

Invited lead papers were presented on each of the subthemes. Small, multidisciplinary, multinational groups visited farmers in seven areas within 180 km of Nairobi. Each small group held in-depth discussions with two different farming families. Additional visits were made to women's groups, implement manufacturers and *jua kali* artisans. Detailed analyses were made of the technical, social and animal-related challenges observed during the field visits. Further problem analysis on the themes was undertaken in specialised groups. Optional evening sessions provided further opportunities for special interest groups to meet. A summary of the identified challenges and solutions was presented. In order to turn the analysis into concrete action, various individuals, institutions or organisations agreed to undertake specific actions to tackle some identified challenges on behalf of ATNESA (and ultimately the end-users).

### ***Gender issues and challenges***

Women play a major role in agriculture, but official services are generally directed towards men. Household decision-making and control of animal traction have been dominated by men, but women are increasingly responsible for these. Some tasks that are traditionally female can be greatly helped by animal power (eg, transport and weeding). Women often lack access to assets such as land, capital and credit to buy equipment and animals.

Gender aspects of animal traction are under-researched. A study is required to estimate the economic (as well as social) advantages of reducing women's drudgery through animal power. Animal traction projects require a holistic, integrated gender-sensitive approach to analysis, planning and implementation. National animal traction networks will arrange workshops on gender issues. The ATNESA publication *Gender issues in animal traction: a handbook* will be expanded and re-published.

### ***Participatory processes in animal traction***

Conventional top-down approaches to developing and promoting animal traction need to be changed. Several animal traction projects in the region (including Sudan, Zambia, Kenya and Tanzania) have successfully used participatory technological development methods. Farmers, village artisans and other stake-holders are involved at all stages in the selection, modification and diffusion of technologies. Participatory rural appraisals help identify and prioritise constraints. Projects have facilitating roles, as farmers are assisted to review, screen, rank and test technological options on their own farms. Using their local knowledge, farmers and artisans identify problems and help control and direct the research-development processes. Participatory methods should also be used in animal traction extension, as extensionists work closely with male and female farmers to identify and rank their actual needs. Greater farm-level involvement and liaison with both artisans and manufacturers is required.

Since participatory methods are still not well known, ATNESA will help prepare guidelines, training materials and case histories, while national networks will arrange training workshops. National networks will make greater efforts to involve artisans and manufacturers, and compile information on equipment use, options and market demand.

### ***Environmental impact and sustainable production***

There is little reliable information concerning the environmental implications of animal traction (whether positive or negative) and alternative options. Land pressures exist and deforestation and erosion occur whether cultivation is by hand, animals or tractors. Draft animal are not the cause of such trends. Animal traction can be environmentally sustainable and assist erosion-control systems (eg, in hill agriculture). Certain animal-powered technologies may be environmentally inappropriate in some situations (eg, sledges in some ecosystems or mouldboard plows in arid zones). Drought conditions favour donkeys over cattle. Donkeys are sometimes blamed for environmental decline, whereas farmers see them as one solution to the problem. There is virtually no scientific evidence relating to the differential environmental impact of donkeys, oxen, cows or other work animals.

Research is urgently required to understand the positive and negative environmental implications of animal traction in the region. This should include work on assessing the environmental and socioeconomic impact of different tools and species. An ATNESA workshop, due to be held in South Africa in 1997, will address these issues further.

### ***Transport and equipment***

Animal-powered transport, whether by cart or pack, can have major socioeconomic benefits for women and men in rural areas. Access to transport reduces drudgery, favours higher agricultural inputs and outputs, enhances marketing opportunities and promotes social and economic development. Carts and pack animals benefit the owners and those who hire or borrow them. Use of animal transport is constrained by the high cost of oxen and carts and lack of credit. While donkeys provide a cheaper alternative, harnessing systems are often poor. An ATNESA publication on animal-drawn carts will be published in 1996.

In much of the world the ard plow is used, but in most of Africa, mouldboard plows designed and manufactured over 40 years ago are common. New designs of plows and cultivators have seldom been adopted, partly due to lack of participatory approaches to their development and extension. National animal traction databases are to be established, to include information on manufacturers, sales outlets,

equipment types, research and training institutions. Quality control procedures and prospects for greater involvement of blacksmiths in technology development will be studied. A case study on credit to assist women adopt technology will be prepared.

### ***Animal power for weed control***

Weeding is a major constraint in agriculture. Hand hoes are the main weeding tools in the region. Limitations of human time and power mean that effective weeding is difficult or delayed. Weeding using animal draft power can save time, labour and money. However, adoption of animal-drawn weeders in the region is low. Constraints include lack of suitable, affordable implements in rural areas, inadequate information on weeding issues and lack of participatory training systems.

To improve the situation, participatory work is needed on the use of existing plow-frames as weeders and on alternative, lightweight designs of ridgers and cultivators. Local blacksmiths and the large manufacturers should be involved. Donkeys may be used for light weeding operations. Farmers and national networks need more information on weeding technology and options. ATNESA will publish a book on *Animal power for weed control* in 1996

### ***Use of cows for work***

As pressure on land grows, the use of cows as draft animals becomes increasingly attractive to smallholder farmers with occasional requirements for cultivation and transport. In several parts of the world, cows are now the main work animals for smallholders and cows are increasingly used in Eastern and Southern Africa. Research suggests that with adequate feeding, cows can perform reasonable work with little loss of milk or reproductive performance. The system is economically attractive as any losses in milk/calves are compensated for by work. If cows are not well fed, their reproductive performance decreases with heavy work. In highland areas, the use of high yielding crossbred cows for milk, calves and work is technically possible and economically attractive. Farmers and extensionists may initially be reluctant to encourage cow traction, but the trend to work cows is likely to be seen throughout the region, particularly in intensive areas and highlands. As the issue is new to most people, ATNESA will prepare and circulate a booklet outlining the main issues related to cow traction.

### ***Donkey utilisation: issues and challenges***

Donkeys are playing an increasingly important role in transport in the region. They are also being used for light cultivation. Women are often the beneficiaries of donkey work. Teamed in pairs or fours, well-fed and well-maintained donkeys are able to perform most tasks undertaken by oxen.

Although donkeys are popular because they can survive with minimal attention on rough grazing, they benefit from good feeding and management. Little is known about donkey nutrition and health problems and research is needed, particularly as donkeys are being brought (by farmers and projects) into new areas. Information is required on appropriate feeding strategies, the epidemiology of donkey disease and low-cost remedies and management practices. There are few implements designed for donkeys and participatory testing, development and extension work is required on these and on effective, low-cost harnessing systems. There is a need to promote better management systems and increase public awareness of the value of donkeys, and their role for women and men in sustainable production, marketing and income generation. ATNESA will convene an international workshop on improved donkey utilisation resulting in a new resource publications.

### ***New perspectives and conclusions***

Animal traction must be seen in its wide context as one means to an end. A holistic, people-centred, gender-sensitive farming systems approach is needed to animal traction and alternative technologies. Participatory approaches are essential for effective technology development and promotion. Many animal traction challenges have been identified and networking will be a valuable tool helping to meet and overcome these.

The workshop was very popular (as confirmed by the confidential evaluation) and led to much formal and informal information exchange. Numerous new contacts were formed and many follow-up proposals for collaboration between individuals, organisations and countries have already been made. The new ATNESA steering committee, the national networks and individual members have committed themselves to a range of follow-up actions including further specialised workshops and resource publications.



# Acronyms and abbreviations

ACP	Africa, Caribbean and Pacific	IT-Transport	Intermediate Technology Transport, UK
ADP	Animal Draft Power (Animal Draught Power)	ITDG	Intermediate Technology Development Group, UK
AETC	Agricultural Engineering Training Centre, Zimbabwe	KENDAT	Kenya Network for Draught Animal Technology, Nairobi, Kenya
AGROTEC	Agricultural Operations Technology for Small Holders in East and Southern Africa, Zimbabwe	kg	kilogram
AGS	Agricultural Services Division of FAO, Italy	KIT	Koninklijk Instituut voor Tropen (Royal Tropical Institute), Amsterdam, The Netherlands
APNEZ	Animal Power Network for Zimbabwe	km	kilometre
ATNESA	Animal Traction Network for Eastern and Southern Africa	m	metre
ATNET	Animal Traction Network Tanzania	MEDUNSA	Medical University of Southern Africa
BDDEA	British Development Division in East Africa of the Overseas Development Administration	MIFIPRO	Mixed Farming Improvement Project, Mwanga, Kilimanjaro, Tanzania
CIRAD-SAR	Centre de coopération internationale en recherche agronomique pour le développement, Systemes agroalimentaires et ruraux, France	mm	millimetre
CMA	Christian Mission Aid, Kenya	MoA	Ministry of Agriculture
CTA	Technical Centre for Agriculture and Rural Cooperation, The Netherlands	MOP	Mbeya Oxenization Project, Tanzania
CTVM	Centre for Tropical Veterinary Medicine, Edinburgh, UK	N	newton (unit of force approximately equivalent to 0.1 kg weight)
DAN	Draught Animal News	NAMA	Network for Agricultural Mechanisation in Africa
DAP	draft (or draught) animal power	NGO	Non-governmental organisation
DAREP	Dryland Applied Research and Extension Project, Kenya	NC	No comment or no response
DGIS	Directorate General for Development Cooperation, Ministry of Foreign Affairs, The Hague	NRI	Natural Resources Institute, Chatham, UK
DMTS	Design, manufacture, testing, and standardisation	ODA	Overseas Development Administration, London, United Kingdom
DTU	Development Technology Unit, University of Warwick, UK	PRA	Participatory Rural Appraisal
EC	European Community	PTD	Participatory Technological Development
ECF	East Coast Fever	PhD	Doctor of Philosophy, university degree
ENAT	Ethiopian Network on Animal Traction	PROPTA	Projet pour la Promotion de la Traction Animale, Togo
FAO	Food and Agriculture Organization of the United Nations, Rome, Italy	RELATA	Red Latin Americana de Traccion Animal
GATE	German Appropriate Technology Exchange, GTZ, Germany	SACCAR	Southern African Centre for Cooperation in Agricultural Research, Botswana
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, Germany	SANAT	South Africa Network on Animal Traction
ha	hectare	SEASAE	Southern and Eastern African Society of Agricultural Engineers
IAE	Institute of Agricultural Engineering, Zimbabwe	SIAMMCO	Soroti Agricultural Implement Machinery Manufacturing Company, Uganda
IAR	Institute of Agricultural Research, Ethiopia	SIDA	Swedish International Development Authority, Stockholm, Sweden
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India	SUA	Sokoine University of Agriculture, Morogoro, Tanzania
ILCA	International Livestock Centre for Africa, Ethiopia	SUAS	Swedish University of Agricultural Sciences, Uppsala, Sweden
ILRI	International Livestock Research Institute, Kenya and Ethiopia	UK	United Kingdom (of Great Britain and Northern Ireland)
IMAG-DLO	Instituut voor Mechanisatie, Arbeid en Gebouwen - Dienst Landbouwkundig Onderzoek (Institute of Agricultural Engineering), Wageningen, The Netherlands	UN	United Nations
IT	Intermediate Technology	UNDP	United Nations Development Programme, New York, USA
		UNIFEM	United Nations Development Fund for Women, New York, USA
		US\$	United States dollar
		USA	United States of America
		WAATN	West Africa Animal Traction Network

# Preface and acknowledgements

## Workshop organisation and support

This publication is the report of the second ATNESA international workshop which was held from 4 to 8 December 1995 in Karen, Kenya. The workshop was attended by 130 people from 27 countries. More than 80 papers relating to animal traction were prepared and circulated at the workshop.

The organisation of a major workshop and the publication and circulation of its report depends on the help and cooperation of a large number of people and many organisations. The ATNESA Steering Committee would like to thank all those who participated in, or supported, the workshop and those who assisted with the preparation of this follow-up publication.

This second ATNESA workshop was made possible through the cooperation of the ATNESA Steering Committee and KENDAT, the local organisers who hosted the workshop. Members of the local organising committee who are to be thanked and congratulated include: Dr P G Kaumbutho (Chair), Ms T Ngamau (Vice Chair and field visit coordinator), Ms J Doran (accommodation), L Oudman (registration), Dr J Mutua (Treasurer), Dr E Waithanji (Secretariat), J Kimani, J Kipyakwai, Dr A Lewa and G E Chweya (transport). These were supported by ATNESA committee members including Dr T Simalenga (ATNESA Chair) E Mwenya (Workshop Manager), Ms B Mudamburi (Chief Rapporteur), T Yoba (Logistics) and Prof P Starkey (Technical Adviser).

The British Development Division in East Africa (BDDEA) of the Overseas Development Administration (ODA) provided the 'core costs' of the workshop. The planning assistance and vision of the Senior Natural Resources Advisor, Mr Jim Harvey, and practical inputs of the Programme Support Officer, Ms Rosemary Kiragu, are gratefully acknowledged.

Workshop participants benefited from the support of several different sponsoring organisations including ODA, the Technical Centre for Agricultural and Rural Cooperation (CTA), the Food and Agriculture Organization of the United Nations (FAO), the Commonwealth Foundation and the regional AGROTEC project based in Zimbabwe.

Many external and local workshop participants were sponsored by their own organisations or by agencies within their own countries. This clearly demonstrated the user-supported nature of ATNESA. The ATNESA Steering Committee would therefore like to convey its thanks to all the local, national, regional and international organisations that supported participants, directly and indirectly.

Institutions outside the region that sent participants included: FAO, Institute of Agricultural and Environmental Engineering (IMAG-DLO) of The Netherlands, Intermediate Technology Development Group (ITDG), IT-transport, Royal Tropical Institute of The Netherlands, Silsoe College, Silsoe Research Institute, Swedish University of Agricultural Sciences, University of Copenhagen, University of Edinburgh, University of Florida, University of Giessen, University of Göttingen, University of Reading, University of Warwick, Stockholm Group for Development Studies, National Dairy Research Institute, India, CIRAD-SAR and the West Africa Animal Traction Network.

## Workshop synthesis and reporting

Workshop plenary sessions and group discussions involved active participation of many people who acted as keynote presenters, chairpersons, discussion leaders, group facilitators or rapporteurs.

Keynote presenters included Dr Alemu, Dr R Blench, K Chelemu, S Croxton, Dr P Kaumbutho, M Massunga, Ms H Matsaert, D Mellis, S Mkomwa, Dr J Mutua, B Mwankikji, Ms T Ngamau, L Oudman, Dr A Pearson, C Relf, Ms J Rwelamira, Dr T Simalenga, Dr B Shapiro, Prof P Starkey, Ms L Sylwander and Dr E Waithanji.

Ms B Mudamburi (Zimbabwe) was the Chief Rapporteur and D Sutton (UK) was responsible for the final workshop synthesis. The international reporting team which was formed included: A B Bangura (Sierra Leone), Dr P Kaumbutho (Kenya), Dr J Mutua (Kenya), Dr A Rios (Cuba), Dr T Simalenga (ATNESA), Dr H Sosovele (Tanzania), Prof P Starkey (UK), Dr R Upadhyay (India) and Dr E Waithanji (Kenya).

The Steering Committee would like to thank the Keynote speakers, the Chief Rapporteur, the reporting team and the many other people who contributed towards reports, including A Aganga, R Blench, G Bwalya, K Chelemu, P Cowell, S Croxton, J Doran, R Fowler, J Francis, N Hatibu, F Inns, J Kangara, A von Keyserlingk, T Krecek, W Kumwenda, H Matsaert, D Mellis, S Mkomwa, M Mrema, A Muma, J Mwaniki, P Mwashu, M Mwinjilo, E Nengomasha, J Omoding, C Oram, A Pearson, J Rwelamira, N Seobi, R Shetto, D Sutton, L Sylwander, E Wella and T V Yoba.

### Report preparation and editing

The international reporting group remained in Kenya after the workshop to prepare the draft report. Gra teful thanks is due to the individuals for their hard work and to FAO, ODA and CTA,

the organisations that sponsored the individuals. The reporting team were assisted by John Stares (Professional Scientific Editor), Freda Miller (Research Fellow of the Centre for Agricultural Strategy of the University of Reading), Clare Chevalier (Editorial Assistant) and Angela Kimani (Secretary). The ATNESA Technical Adviser, Prof P Starkey, had overall responsibility for the final editing and desk-top publication of this report.

The ATNESA Steering Committee hopes that the preparation and circulation of this workshop report will help achieve the important ATNESA goal of better information exchange between all those involved in improving animal traction in the region. ATNESA looks forward to further close collaboration with individual members, national animal traction networks, supporting organisations and other networks.

#### *ATNESA steering committee*

Dr T Simalenga, *Zimbabwe, Chair*  
Dr P Kaumbutho, *Kenya*  
Ms B Mudamburi, *Zimbabwe*  
E Mwenya, *Zambia*  
Dr Alemu G/Wold, *Ethiopia*  
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Dr R Upadhyay, *India*  
Dr E Waithanji, *Kenya*  
Ms F Miller, *UK*  
J Stares, *UK*  
Ms C Chevalier, *UK*

*International reporting team including ATNESA Steering Committee members*





# An overview of the workshop

## Objectives

The overall aims of the workshop were to bring together a wide range of people of various nationalities, disciplines and organisations involved in networking, research, development, extension, training, planning and infrastructural support for the use of animal power in Eastern and Southern Africa; to stimulate the exchange of information and experiences; and to facilitate identification of challenges to the use of animal traction and to formulate possible solutions.

## Themes

The overall workshop theme was 'Meeting the challenges of animal traction'. This broad topic was chosen as a development-orientated framework for analysing and discussing animal draft power research and extension experiences. Seven themes were selected to allow contributors and discussion groups to focus on particular issues:

- Gender issues in animal traction technology
- Participatory processes in the study and promotion of animal traction
- Environmental impact of animal traction and sustainable production systems
- Improving animal-drawn transport
- Animal power for weed control
- Use of cows for work
- Challenges in the use of donkeys.

## Participants

The workshop was open to all persons actively concerned with animal traction. A total of 130 people from 27 countries participated. Most (103) were from Africa (23 were from Kenya) while the rest were from Europe, the Americas and Asia.

Participants came from a wide range of disciplines including agricultural engineering, social sciences, economics, veterinary sciences, agronomy or general agricultural sciences (the names and addresses of all participants are listed later in this publication).

## Host, location and sponsorship

The workshop was hosted by the Kenya Network for Draught Animal Technology (KENDAT) which comprises, among others, agricultural engineers, veterinarians, animal

welfare representatives, farmers, extensionists and artisanal manufacturers (*jua kalis*). The workshop was held at the Kenya Commercial Bank Institute of Banking and Finance at Karen near the Ngong hills about 20 km west of Nairobi.

Following ATNESA practice, all participants were required to stay at the Institute, which, being situated far from Nairobi city centre, provided a good working atmosphere. The Institute had good conference and recreational facilities, while its accommodation costs were lower than those of hotels with similar facilities.

The workshop secretariat and other core costs of the workshop were funded by the British Development Division in East Africa (BDDEA) of the Overseas Development Administration (ODA), which also sponsored some participants. Most participants were sponsored by their own organisations or by agencies within their own countries. Other sponsors included the Technical Centre for Agricultural and Rural Cooperation (CTA), AGROTEC, Food and Agriculture Organization (FAO) and the Commonwealth Foundation.

## Workshop methodology

In planning the workshop, the ATNESA and KENDAT steering committees noted the feedback provided by participants of previous workshops, particularly the first ATNESA workshop held in Lusaka in 1992. It was decided that the present workshop should provide a stimulating framework for informal information exchange with emphasis on participatory activities rather than on long plenary sessions. In addition, there should be keynote reviews of thematic topics and on-farm discussion with smallholder farmers. Small working groups would undertake detailed analysis of the challenges observed during the

### *Registration*





*Opening ceremony and plenary session*

field visits and those reported by participants from different parts of the region, and would also propose solutions. A summary of the identified challenges and solutions would be presented to all participants with the aim of identifying individuals, institutions or organisations who would agree to act upon the identified challenges using the proposed solutions.

## Opening ceremony

Welcoming and introductory remarks were made by the KENDAT chair Dr Pascal Kaumbutho and the ATNESA chair Dr Timothy Simalenga. The workshop was formally opened by the Director of the Kenya Agricultural Research Institute (KARI), Dr Cyrus Nderitu, in a speech read on his behalf by Dr Romano Kiome, Assistant Director of KARI.

The opening session concluded with a keynote slide presentation, given by Professor Paul Starkey, ATNESA Technical Advisor. He took participants 'around the world with animal traction', illustrating the workshop themes with reference to many systems of animal traction used on different continents.

## Day 1: Networking review

Discussion papers on each of the seven workshop themes had been prepared by subject matter specialists. In order to stimulate international collaboration, ATNESA had invited several keynote theme papers to be jointly prepared by experts from ATNESA countries and experts from outside the region.

The authors had been asked to prepare in-depth review papers for circulation during the workshop and for subsequent publication. During their presentation authors were asked to highlight the main points of the papers only, after which there was a short question and discussion session.

The first three keynote presentations were on the topics of gender, transport and weeding on which ATNESA had held smaller thematic workshops. These presentations were intended to share more widely the results of the thematic workshops for the benefit of all participants. The presentations were:

- *Gender and animal traction: a challenging perspective* by J Rwelamira and L Sylwander
- *Improving animal-drawn transport* by C Relf
- *Animal power for weed control: experiences and challenges* by T Simalenga and R Shetto.

Following the presentations, there was a review of networking experiences and an open networking session. During this each country in the region summarised its national networking activities. All participants then introduced themselves and summarised their work and interests.

## Day 2: New issues and challenges

On the second day, three new issues identified by ATNESA as highly relevant were presented. These were:

- *Development of cow traction technologies and implications for adoption in the East African highlands* by E Zerbini, Alemu Gebre Wold and B Shapiro



*Plenary sessions*





## Workshop programme

### ***Sunday 3 December***

Arrivals , registration, setting-up of posters

1930 Welcoming reception

### ***Monday 4 December***

0800 Registration and setting-up posters (continued)  
Poster viewing and informal networking

0930 Organisational matters and announcements

1000 Opening ceremony

1100 Keynote presentation 'Meeting the challenges of animal traction' (P Starkey)

1400 Review of some key challenges tackled in recent ATNESA workshops

- Gender issues in animal traction technology (L Sylwander and J Rwelamira)
- Improving animal-drawn transport (C Relf)
- Animal power for weed-control (T Simalenga and R Shetto)

1630 Review of networking progress  
Reports of APNEZ, ATNET, ENAT, KENDAT and SANAT (national networks) followed by an open session of brief networking announcements

2000 Optional evening sessions

### ***Tuesday 5 December***

0800 Review of further key challenges

- Use of cows for work (Alemu G/Wold, B Shapiro and E Zerbini)
- Challenges in donkey utilisation (A Pearson)
- Animal traction: environmental impact and sustainable production systems (R Blench)

1000 ◦ Participatory processes in animal traction  
S Croxton (Sudan); K Chelemu (Zambia)  
D Mellis, H Matsaert, B Mwankili (Kenya)  
M Massunga and S Mkomwa (Tanzania)

1130 The challenges of animal traction in Kenya

1230 Outline of field visits and objectives

1400 Equipment demonstrations (optional) and visits to Nairobi (optional)

2000 Optional evening sessions

### ***Wednesday 6 December***

0630 Field visits in small groups to different villages to see animal traction operations and hold discussions with farmers

1400 Field visits to Kenyan institutions, animal traction programmes, manufacturers, training centres and/or equipment demonstrations

1700 Initial small group discussions relating to field visit findings (summaries of key issues to be made by rapporteurs for synthesis report)

2000 Optional evening sessions  
(Group rapporteurs meet)

### ***Thursday 7 December***

0800 Small group discussions relating to field visits

1100 Presentation of key group observations and synthesis report followed by general discussion of issues raised

1400 Formation of new small groups to discuss key workshop themes and topics of special interest, to make recommendations and to plan follow-up actions

1630 ATNESA General Assembly Meeting  
Election of new ATNESA Steering Committee

2100 Optional evening sessions

### ***Friday 8 December***

0800 Group work

1000 Presentation and discussion of reports of small groups

1500 Invited keynote analysis of workshop findings and conclusions 'Meeting the challenges of animal traction: progress, needs and priorities in the light of workshop presentations and discussions' (D Sutton) followed by final plenary discussion and closing statements

1645 Workshop evaluation

1830 Workshop dinner and closing ceremony

### ***Saturday 9 December***

Departures



Discussion groups

- *The challenges for using donkeys for work in Africa* by R Pearson, E Nengomasha and R Krecek
- *Animal traction in Africa: environmental impact and sustainable production* by R Blench

The final keynote presentation concerned participatory methods, and involved several people discussing their experiences. The topic was introduced with the presentation:

- *Users in control: farmers in participation in technology research and development* by S Croxton

This was followed by three case histories from organisations in Kenya, Tanzania and Zambia that had used participatory methods in animal traction research, development and extension.

- *Meeting the challenges of animal traction through participatory technology development: experience from a semi-arid area of Kenya* by D Mellis, H Matsuert and B Mwaniki
- *Minimum tillage for soil and water conservation using animal draft power in Zambia* by K Chelemu and P Nindi
- *Experiences of participatory methods and sustainable support services: the case of the Mbeya Oxenization Project, Tanzania* by M Massunga and S Mkomwa.

The host country made a presentation on the challenges of animal traction in Kenya. The aim was to introduce, prior to the field visits, the challenges observed by the various members of KENDAT. The presentation focused on extension to farmers (T Ngamau), implements (J Mutua), harnesses (L Oudman) and animal diseases (E Waithanji). The presentation was summarised by P Kaumbutho with slides highlighting the issues presented.

### Day 3: Field visits

The third day was devoted to field visits. Small, multidisciplinary, multinational groups visited farmers in seven areas within 180 km of Nairobi. Each small group held in-depth discussions with two different farming families. In the afternoon, additional visits were made to

some organisations supporting animal traction including women's and youth groups, implement designers and manufacturers and non-governmental development groups. Places visited included East African Foundry, Alafdin, Triple W Engineering, Mwea Donkey Transporters Association and some *jua kali* (artisan) workshops. On their return, the groups started to discuss and analyse their findings.

### Day 4: Working groups

The same multidisciplinary groups that had participated in the field visits met to analyse their observations. They tried to draw out some general lessons from the specific case histories they had examined in depth. A synthesis report was presented in plenary session for each of the seven areas visited so that the conclusions and suggestions of the small groups could be shared and discussed.

The participants were then given the opportunity to form new groups in which they could have detailed discussions on those themes and issues they felt were most relevant to their work. Although it was recognised that topics would invariably overlap, participants opted to discuss: gender issues, participatory processes, environmental issues, weed control, working cows, donkeys and equipment issues (including transport).

#### ATNESA general assembly

The ATNESA steering committee met twice during the week. It also convened a more open planning meeting, attended by representatives of all participating networks and resource organisations.

On the fourth day, a formal general assembly meeting, open to all participants, was held. The outgoing chair gave a report on ATNESA's history, networking activities and outputs. After discussions, a new steering committee was elected and given the mandate to draw up and implement a new programme based on the workshop recommendations.



*Posters and poster viewing*

## **Day 5: Working groups and workshop conclusions**

Following a further period of intensive discussion in groups, the conclusions and recommendations of each group were presented and discussed in a plenary session. An invited speaker, Derek Sutton of Silsoe Research Institute, UK, then made a presentation that brought together the main issues arising from workshop papers, visits and discussions. He had prepared his synthesis in collaboration with a multidisciplinary group of participants, which had met several times to review the main issues raised during the week. The overview concluded with a final plenary session in which some of the recommendations made during the week were expressed as concrete proposals for follow-up actions by ATNESA members.

## **Workshop papers and exhibits**

### ***Papers***

A total of 85 technical papers were prepared for the workshop. Participants received copies of most of these, but only the invited key papers

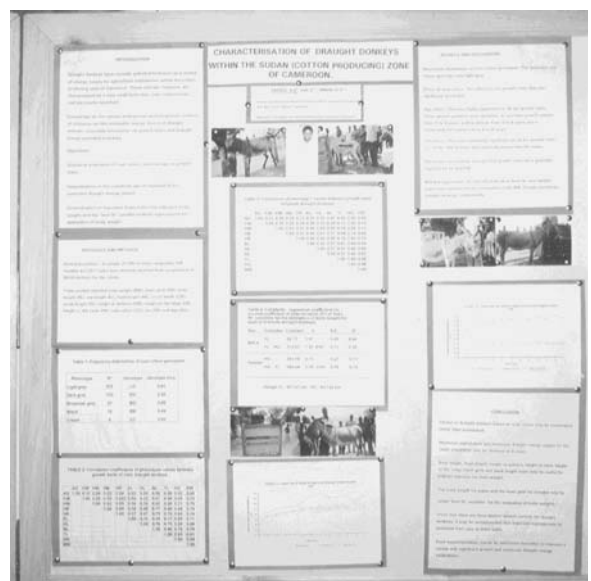
were presented in the plenary sessions. There were at least five papers per theme, the most popular being donkeys. Twenty-three of the papers discussed a range of challenges within specific countries or regions. Edited versions of the papers will be published in the forthcoming workshop proceedings.

### ***Posters and displays***

All participants had been asked to prepare some form of visual display relating to their work and a large number of notice boards were made available in the main hall and throughout the areas used by the workshop. A wide range of topics and display styles were presented and provided foci for participant debate and private study throughout the week. Posters ranged from detailed results of scientific investigations to simple photo displays of project activities and systems of using animal power world-wide.

### ***Books, pamphlets and equipment***

A variety of animal traction books and resource publications were exhibited. New organisations and forthcoming activities were publicised through posters and leaflets.







*Demonstration of donkey harness for lightweight plow (from F Inns) and ripper/seeder (from Palabana)*



During the workshop several implements were displayed, including:

- Conservation tillage equipment (planter, ripper tine and plow) from Palabana, Zambia
- Simple cart (designed and fabricated by C Oram)
- Lightweight donkey plow (designed by F Inns)
- Donkey and ox harnesses (KENDAT)
- Goat-skin donkey harnesses (P Jones)
- Locally-fabricated Kenyan implements including Bakura Mark II Mouldboard Plow from Guy Engineering (Nairobi), Rumpstad multipurpose frame and plow units, planters, weeding and furrowing equipment (KENDAT).

#### **Videos**

During the optional evening sessions, a number of videos were shown and discussed. Some were not commercially available and/or were unedited and included the subjects of donkey harnessing (P Jones), donkey behaviour, hoof treatment and the making of simple equipment. A video relating to conservation tillage was

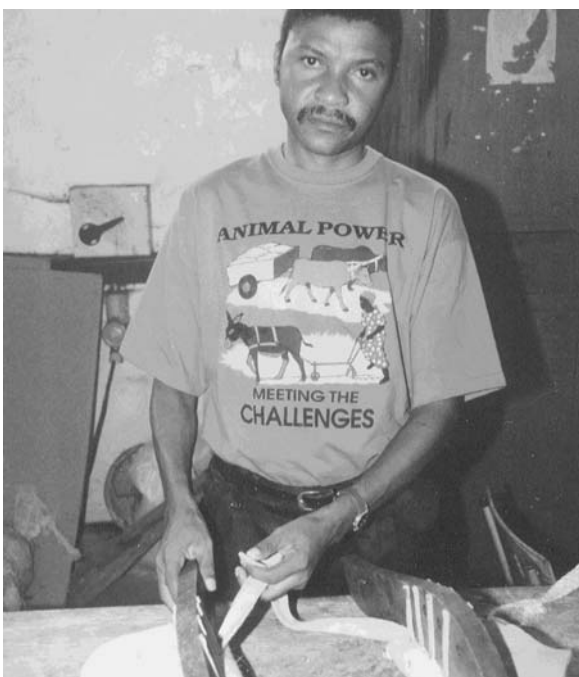
submitted by R Fowler. Some of the videos prepared by the Palabana Draft Animal Power Training Centre, Zambia were shown. Copies of these can be obtained by organisations involved in animal power promotion. They include:

- Selection and training of draft oxen
- Riem making
- Yoke making
- Plowing and weeding
- Ripping
- Groundnut harvesting
- Manufacture of Magoye ripper (Palabana jigs)
- The Palabana subsoiler
- The Palabana ripper/planter.

#### **Special groups and panels**

On the second day, an optional visit was made to the Kabete campus of the University of Nairobi, to see field demonstrations of the Palabana ripper/seeder and a donkey plow developed by Professor Frank Inns. The

*Demonstration of donkey harness manufacture (by KENDAT) and cart using rod bearings (by C Oram)*





*Informal networking*

ripper/seeder, as well as a cart designed and constructed by Dr Colin Oram, were donated to KENDAT at the end of the workshop.

Various groups of participants with special interests met during the workshop to discuss their work and interests, to coordinate activities and to plan new collaboration. The groups included participants concerned with socioeconomic issues and engineers interested in simple cart designs. National interest groups that met included Namibian participants and members of the Animal Traction Network Tanzania (ATNET) and the South Africa Network on Animal Traction (SANAT). Other groups that met during the evenings included members of the Southern and East Africa Society of Agricultural Engineers (SEASAE) and the West Africa Animal Traction Network.

### **Informal networking interactions**

The workshop provided an opportunity for many people to interact and network informally. With over 100 participants each talking to more than 20 people, there were many hundreds of new contacts made, many of which will lead to specific collaboration. Some examples of networking collaboration are given below, although these are just the tip of the information exchange iceberg.

- SEAZ Agricultural Equipment in Tanzania agreed to supply equipment to the Smallholder Cotton Rehabilitation Project in Uganda and the Lake Zone Farming Systems Research Project in Tanzania.
- R Shetto (Tanzania) met A Pearson (UK) and they agreed to write a joint proposal for a research project on nutritional aspects of draft animals.
- B Mudamburi (Zimbabwe) contacted participants from Mozambique, South Africa and Uganda who will send their personnel to the 1996 regional animal traction training course at the Agricultural Engineering Training Centre in Zimbabwe.

- The economics group met and discussed issues of common interest, and future contacts between group members were foreseen.
- Copies of videos shown will be obtained by several participants.
- C McCrindle (MEDUNSA, South Africa) proposed collaboration with a training workshop relating to cart production, assisted by C Oram (University of Warwick) with 50 participants envisaged in November 1996.
- Henk Dibbits (IMAG-DLO, The Netherlands) met with the SANAT (South Africa) steering committee to discuss collaboration in training and research.
- A Pearson (UK), B Joubert (South Africa) and T Krecek (South Africa) planned a collaborative research programme relating to donkeys and nutrition.

### **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 anonymous evaluation forms. The results and analysis are presented later in this report.

#### *Vote of thanks on behalf of participants*





# Kenyan overview

## Importance of animal power in Kenya

Animal power was introduced in Kenya early this century. To date it is widely used in areas of Eastern, Central, Western and Nyanza Provinces. The number of cattle and donkeys employed in tillage and transport is estimated at about 700 000. Animal power is mainly used in tillage operations and to a lesser extent in transport using sledges and carts. Donkeys are also used as pack animals.

Animal power technology in Kenya has changed relatively little in recent years. The Victory plow, introduced from South Africa about 50 years ago, continues to be the most widely used implement in the country. The annual demand for this implement is estimated at 150 000 units.

About 200 000 ha of Kenya's total farmed area of about 3 million ha are cultivated with animals. Most farmed land (about 1.8 million ha) is cultivated with hand tools. Tractors are used on the rest of the farmed area, which includes the large-scale farms. The majority of farms on which hand and animal-powered tools and implements are used are smallholdings, which nevertheless feed 80% of the country's population.

## Mechanisation issues

It is generally accepted that if Kenya is to keep up with the ever-increasing demand for more food, the productivity of the smallholder farming sector must be increased.

Mechanisation is one way of meeting this demand by increasing the area under cultivation and making better use of available labour.

Motorised mechanisation is not economically viable in most smallholder farming communities for technical and socioeconomic

reasons including small farm sizes. Hand tools are tedious to use. The future therefore lies in increasing the use of animal power to alleviate drudgery and increase labour efficiency.

## Some reasons for low adoption

According to KENDAT, low adoption of animal powered technology in Kenya is attributed to a number of factors, including:

- Low productivity in smallholder farming making it impossible for many farmers to acquire good quality implements.
- Failure by researchers, innovators, extensionists and others involved in technology transfer to involve the farmer in problem solving.
- Lack of implement standards which has resulted in farmers acquiring poor quality equipment. This has made some farmers lose faith in new technologies.
- Lack of adequate information on available equipment and implements options.
- Low priority rating from policy makers.

According to KENDAT, provision of appropriate tools and implements is a prerequisite for successful development of animal draft power. To increase the popularity of draft animal power and its use, good quality and appropriate implements must be made available to farmers at a price they can afford. This can only be possible if the farmers are involved at all levels of solving their farming problems. Adequate equipment standards must be set and enforced to safeguard farmers' interests from unscrupulous people.

Activities on animal health and welfare vary between areas and different animal species. Generally cattle appear more likely to suffer severe diseases leading to death than donkeys.

*Oxen pulling sledge near Mount Kenya*



# Field visits

## Introduction

Seven different areas located within a radius of 180 km from Nairobi were visited. They were: Machakos, Naivasha, Limuru, Kirinyaga, Embu, Kajiado and Naro Moru. These areas represent a variety of agro-ecological zones and the farmers use different traditional practices. The farmers visited differed in many respects, including gender, wealth, farm size, experience of using draft animals, formal education, training and relationship with local extension services.

Although participants had themselves selected which of the seven areas they would visit, the actual small groups of about six participants were structured to ensure a mix of profession, nationality and gender. It was intended that the small groups would talk in depth with individual farmers or farming families. The objective of the visits was to find out from the farmers what the key challenges in animal traction were for them, bearing in mind the seven workshop themes.

## Machakos

Machakos district is located in eastern province, and is generally semi-arid with an annual rainfall of about 680 mm. The district headquarters is located in a town of the same name approximately 90 km south-east of Nairobi. The National Dry Land Research Institute is located close to the town. The district is inhabited by the Akamba people, one of the larger tribes of Kenya. Soil erosion is one of the serious problems facing the district, but the farmers use soil conservation structures known as *fanya juu* terraces.

### *Key observations*

Farming was largely subsistence and was carried out mostly by elderly couples. To compensate for labour shortage during peak periods, most farmers hired labour. Most activities were performed by both men and women, but men were generally the heads of families and handled financial matters.

Increase in human population had caused land holdings to get smaller forcing farmers to reduce their cattle herds. Zero grazing was likely to be practised in future for this reason. Inter-cropping was common but it still allowed mechanised weeding to take place. Maize was

the most important crop followed by beans, pigeon peas, sorghum, finger millet, sweet potatoes and cassava. Gross margins were generally low.

Oxen were the only animals used for cultivation work and were well trained. Cows were reserved for milk production and calving. Donkeys were few and mostly used as pack animals.

East Coast Fever was prevalent. Its incidence had increased following the withdrawal of subsidised veterinary services. Dip operators were said to use excessively diluted dipping solutions.

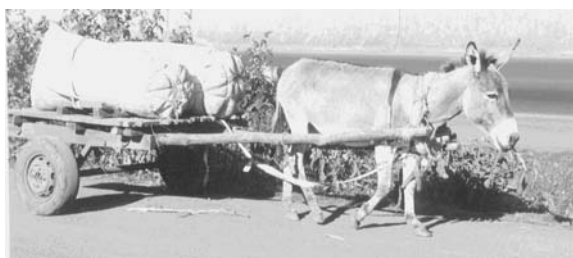
Lack of availability of implements of suitable design and quality was a major constraint. Most farmers used old plows for both plowing and weeding. Many implements dated from the early 1950s. Recent plows and cultivators had been rejected due to bad design or because farmers could not see their advantage over what they already owned. There seemed to be lack of knowledge on equipment options available for various operations. Spares were reported to be of poor quality and maintenance facilities were either far away or inadequate.

## Naivasha

Naivasha lies in the great rift valley about 76 km north-west of Nairobi and is surrounded by mountains. It is potentially a high producing area as it is endowed with fertile easy-to-till volcanic soils. A series of long droughts has reduced yields. Recent political conflicts have also affected farming in the area forcing farmers to keep fewer livestock. Main crops include maize, beans, potatoes and vegetables.

### *Key observations*

Except for some commercial horticulture and floriculture activities concentrated around lake Naivasha, much of the farming was primarily subsistence in nature. Most of the agricultural operations were carried out by women. Men were usually engaged on paid contract work for the commercial horticultural farmers. Decisions were made jointly by men and women. Most of their income was generated from sale of vegetables (in good rainfall seasons) and contract carting of water. Other income came from men and children working in urban centres.



*Participants and farmers discussing the problem of donkey carts and neck harnesses at Limuru*

Donkeys were numerous with about 80% of the farmers having at least one donkey. They were used for transporting water and charcoal either using carts or on their backs.

The carts, made by local manufacturers, were of poor design but the most obvious constraint in the use of donkeys was poor harnessing. Donkeys and cattle were not generally used for plowing. A scheme was planned to train farmers to plow with donkeys (using plows donated by a Catholic church).

Most farmers did not have adequate access to veterinary services. They used traditional ways to cure diseases. Predators, stock theft and tribal conflicts were threatening widespread adoption of draft animal power.

## **Limuru**

Only 30 km north-west of Nairobi and next to the Rift Valley, Limuru is characterised by undulating topography. Long, thin strips of farm land run down the slopes and contrast sharply with other areas only 10 km away. Soils are shallow with sparse vegetation. People settled here in 1990 on government schemes giving each family 2 ha of land. Farming is intensive. Zero grazing of cattle is common, as is semi-intensive poultry production. Land preparation and other operations are performed by hand hoeing. The main crops are maize, beans, potatoes, sorghum, capes and pigeon peas.

### *Key observations*

It was observed that women did nearly all the agricultural work and played a major role in decision making. Income was generated through sale of farm surpluses and through contracting transport work. There was a shortage of labour due to urban migration forcing some farmers to sublet some of their land to others. Tractors were not readily available.

Donkeys were numerous and mostly used in transportation of water, fodder, firewood and

farm produce. Poor harnessing was a serious problem. The type of harnesses used lacked braking systems, which, in an area of undulating land was a serious omission.

Although farmers were aware of collar harnesses, they felt they were too expensive. Donkeys were often mistreated. Farmers seemed unaware of donkey diseases and care practices such as hoof trimming.

Recent attempts by KENDAT to introduce the use of donkeys for plowing were apparently, well-received but farmers needed assistance in finance and training in order to adopt the technology. All carts used in the area were locally-made using wheel-axle assemblies from cars together with pneumatic tyres. There seemed to be no problem with their maintenance because spares were available.

## **Kirinyaga**

Kirinyaga is 125 km north-east of Nairobi. The terrain is undulating which favours the extensive use of animal power for the transportation of farm produce and water. Oxen and donkeys were used in distinct ways. Oxen were primarily used for plowing while donkeys were used for transport using carts. Cows were used only for milk and calving.

### *Key observations*

Farmers in this area have a long tradition of using animal power and the practice seems to have stabilised as a normal part of farming systems. Nevertheless, owning work animals is expensive and some farmers lack direct access to draft animal power. Such farmers may rely on local arrangements to hire animal traction services for their agricultural operations.

Harnessing systems used for donkeys were considered inappropriate by workshop participants. The traditional yoke, as used for oxen, was the only donkey harness known and available to farmers. The donkeys worked long hours without rest. Only male donkeys were





*Participants discussing animal traction and plow quality with a group of women farmers, Embu*

used for pulling carts. Oxen were generally not used for pulling carts used for commercial water transport. According to the commercial transporters (and even farmers), they are not as patient and fast as the donkeys and tired quickly.

Carts were made using car axles. Wheel bearings were removed and replaced with simple bushes as transporters claimed the bearings wore out quickly and broke.

Farmers used Victory mouldboard plows, often very old. The tended to remove the normal adjustment systems from the plow (which agricultural engineers considered would result in improper use of the implement and poor quality tillage operations).

Little attention was paid to animal welfare issues. Health support services for draft animals were inadequate.

## **Embu**

Embu is located 150 km north-east of Nairobi at the foot of Mount Kenya. Embu town is the provincial administrative headquarters of Eastern Province. The upper parts of Embu closer to the mountain are considered of high agricultural potential. The lower parts (which were visited) are semi-arid with less intensive production systems. Small-scale subsistence farming is mainly practised by women.

### *Key observations*

Oxen were commonly used for tillage and some donkeys were employed for transport. The farmers met were sceptical about using donkeys

as they associated their droppings with tetanus. Cows were not used as draft animals, and there was a feeling that government legislation would prevent their use for work.

Various discarded implements were observed in the farmers' yards. These were relatively recent innovations found poor or inappropriate. Such experiences had made farmers less receptive to new technologies, and most preferred their very old Victory plows. Some farmers weeded with their plows and seemed unaware of weeding cultivators and weeding yokes.

The presence of East Coast Fever was a big threat to animal health, particularly since the withdrawal of government subsidies for tick control.

## **Kajiado**

Kajiado is located approximately 90 km south of Nairobi and is inhabited predominantly by the Maasai people. It is a vast, flat cattle-herding area with little cropping. The Maasai

*Participants visiting a jua kali artisan, Embu*



are a nomadic community where the man, usually polygamous, is the head of the household. Land demarcation and settlement were introduced recently. The soils in Kajiado are sandy with low infiltration due to surface crusting and the area is rocky. Settlement has resulted in deforestation and increased soil erosion.

#### *Key observations*

The main crops included maize and beans. Tillage was by hand although a few farmers were being assisted to use donkeys. Donkeys were important for pack transport and were controlled by women. Oxen were not generally used for draft purposes due to cultural beliefs. It was thought that working cattle would have increased susceptibility to diseases. Hand labour was mainly domestic though the financially well-off Maasai hired labour from outside. External hire services were unaffordable to the majority of the farmers who were financially disadvantaged.

Cattle mortality rates were very high due to the tick-borne East Coast Fever. Presence of

wildlife in the environment had also contributed to the high incidence of East Coast Fever.

Extension and agricultural support services appeared inadequate. The area was remote and transport facilities were poor.

### **Naro-Moru**

Naro-Moru is located 180 km north of Nairobi on the slopes of Mount Kenya. The parts closer to the mountains have high agricultural potential with small plots of land, while the lower regions are drier and dominated by large-scale ranches. Mechanised power is used in the larger farms, while draft animal power is used in the smaller greener areas mostly for potato farming.

#### *Key observations*

Primary tillage was carried out with ox-drawn plows while weeding was carried out by women by hand. Suitable alternative implements were not readily available and some farmers improvised with what they had by making their own modifications. In some areas an alternative yoke manufactured by a local artisan had been accepted and was being used. Donkeys were scarce.



# Gender issues and challenges

## Introduction

Gender identifies the social relationship between men and women. It therefore refers not to men or women, but to the relationship between them and the way this is socially constructed. Gender relations are contextually specific and often change in response to altering economic circumstances.

In many parts of Africa, women play a major role in food production. Although most of their time is spent on household tasks, they are responsible for caring for animals and are an important component of planting and weeding labour. It is essential, therefore, that women receive at least the same considerations as men.

In general the impact of development initiatives is unequal, with men tending to benefit more than women. The reasons for this need to be understood and some are outlined below.

## Constraints and problems

### *Different associations with technologies*

There are many changes in technological development but the division of labour between sexes restricts women to the domestic sphere and to tasks that are traditionally female. Plowing is primarily done by men, household chores by women.

### *Decision making*

Decision-making processes have remained the same, ie, they are male-dominated.

### *Agricultural training and extension*

Most agricultural work is done by women, but training is given to men. How can women be reached when most extension agents are men?

### *Gender roles*

Gender planning recognises that in most societies women have a triple role: women undertake reproductive, productive and community managing roles. Some women's tasks could be helped by the use of animal power (eg, transport, weeding and plowing).

### *Women occupy a weak economic position*

Women have a key role in food and agriculture and yet there is still a gap in policy and technical support necessary for improving the value of women's labour in this sector.

### *Access to factors of production and credit*

In some countries in Africa, women lack access to assets such as land and finance to buy equipment and animals.

## Gender planning

There is a need for a planning approach that is gender sensitive and recognises that, because women and men play different roles in society, they often have different needs, priorities and constraints. The gender planning process involves the following steps:

- Identification of the division of labour.
- Identification of the resources available to men and women for various agricultural tasks.
- Analysis of the needs, conditions and positions of women and men.
- Analysis of the relationship between the division of labour and the access to social, economic and environmental resources.

Sociocultural factors, economic factors, environmental, political, demographic, institutional and legal parameters need be taken into consideration.

It is also important to identify both practical and strategic needs that can be met by use of draft animals.

## Some key gender questions for animal traction projects

- Who is using animal draft power and for which activities?
- Which of the tasks could be done by animal power?
- Which activities are most time-consuming and labour-demanding and who does this work?
- How can the need for labour reduction in domestic and productive activities be addressed?
- Do women have equal access to animals and equipment for animal traction?
- Who controls animal traction resources?
- Can current views on access and control of draft animals be changed?
- Who has access to credit for animal power?
- How has information and extension on animal power been disseminated so far?

### Some specific recommendations

- National networks should organise workshops on gender issues. ATNESA can facilitate these activities.
- National networks should draw up guidelines on gender and training in draft animal power. ATNESA can help with the dissemination of the information to other users.
- ATNESA should explore the possibilities for the production of a book on finance, credit and saving schemes that will have gender focus on draft animal power.
- Everyone was urged to lobby against discriminatory policies.
- To extend and update the ATNESA publication '*Gender issues in animal traction: a handbook*' (Sylwander and Mpande, 1995).

### Conclusions

A holistic and integrated approach is needed to address gender issues in animal traction.

Women need to be thoroughly integrated in all phases of development right from the planning stage, as well as in social and political activities.

Animal traction technology must be based on the active participation of the community for whom it is intended from the definition of problems to the selection, application and evaluation of possible solutions.

The gender analysis proposed is therefore vital to participatory approaches and can do much to reveal to participants of both sexes, as well as the researcher, the true roles of all concerned.

As with many other aspects related to animal draft power, gender is an under-researched and under-recorded topic.

## Participatory processes in animal traction: issues and challenges

### Introduction

There is a growing recognition that conventional methods using top-down approaches to developing and promoting agricultural technologies need to be changed. This recognition has developed into the adoption of participatory methodologies in technology research and development.

Participatory Technological Development (PTD) methods are increasingly being used in Eastern and Southern Africa. They have successfully been used in Sudan, Zambia, Kenya and Tanzania. The methods have been seen to be effective in the selection and adoption of technologies. PTD uses existing local skills and knowledge as a starting point. It is built around a process that enables farmers to control and direct research and development of technologies that meet needs identified by the farmers themselves.

PTD can also facilitate the empowerment of the participants, increase their confidence, and enhance their ability to cope with changes. Experiences gained in the process of technological development are thus shared with the other users and stakeholders through the dissemination of information. Important decisions on technological development can be

made by the local farmers and manufacturers, whilst the role of project staff becomes more and more that of facilitating.

### Participatory Technological Development

The PTD approach includes the following steps:

#### *Problem identification*

Researchers, extensionists, farmers and other stake holders together identify key issues using diagnostic survey techniques such as participatory rural appraisal (PRA) and suggest ways of tackling them.

#### *Selection and priority setting*

This involves the search for the best technological option from among the choices available. This can be done by using a ranking method to screen the technologies together with farmers.

#### *On-farm trials*

After the screening of the technologies, testing and adoption of the technology are carried out by farmers in their own fields. Farmers, extensionists and others may need training before trials can be conducted. The local manufacturers are also involved in an attempt to improve the quality of the implements.

## Regional experiences of PTD

The following programmes have used PTD methods in promoting the use of animal power.

- Developing donkey plows with farmers in Kebkabiya, Sudan (Oxfam/ITDG)
- Palabana Animal Draft Power Project, Zambia
- Dry-Land Applied Research Extension Project (DAREP) in Lower Embu and Tharaka, Kenya
- Mbeya Oxenization Project, Tanzania
- Animal Draft Power project in Mbozi, Mbeya, Tanzania
- Oxenization Extension and Training Services (OXETS) based in Mbeya, Tanzania.

## Participatory methods in animal traction extension

Key issues and challenges involving participatory methods in extension and in animal traction technology development were highlighted and possible solutions were proposed.

The main problems encountered in extension were identified as poor linkages between extension and the community. There was little attempt to find out farmers' actual needs and to prioritise them.

### *Proposed actions*

It was proposed that, in order to overcome some participatory problems in extension the following measures could be followed:

- Develop a training manual about participatory methods in extension on animal traction.
- Establish network links between extension workers involved in animal traction.
- Arrange exchange visits involving extension workers and farmers to people/projects using participatory methods.
- Organise regional workshops on participatory methods in animal traction.

The ATNESA Steering Committee was requested to play an active role as facilitator and coordinator of these proposed actions.

## Participatory methods in animal traction technology development

It was identified that linkages are required between and among:

- manufacturers
- government institutions
- farmers/end users

- donors
- stockists
- mobile traders
- the media.

Linkages between these individuals and institutions are weak and result in insufficient feedback, inappropriate tools and low spare-part supply. Poor linkages can be caused by distance between various sources; top-down approaches; lack of farmer organisations and poor market research skills of manufacturers.

### *Importance of artisans*

The role of artisans in technological development has not been fully appreciated. Village artisans often have low profile and low status. Linkages between village artisans and development agents are often poor. Causes of the weak linkages include top-down animal draft power programmes and negative attitudes of researchers, extension workers and governments towards artisans. Thus the immense potential contribution of artisans to the PTD process has often been undiscovered or ignored.

### *Proposed actions*

- Develop farmers'/manufacturers' associations and linkages.
- Testing of implements by farmers and researchers in liaison with manufacturers.
- Manufacturers should produce implement instruction manuals for users.
- Obtain equipment sales statistics and carry out market research.
- Encourage participation of village artisans in national and regional networks.
- Compile and make available to other networks and users information on local artisans and their products.

### *Some interventions for animal traction networks*

- Organising workshops for manufacturers, stockists and farmers.
- Assisting information flow among manufacturers, stockists, farmers, researchers, extension workers and governments.
- Encouraging manufacturers to join regional and local networks.
- Linking village artisans and development agents.

# Environmental impact and sustainable production systems: issues and challenges

## Introduction

Studies on the relationship between animal traction and its environmental impact and the sustainability of production systems are relatively recent. As a result, there is little concrete information about environmental impact, and most of it is anecdotal.

The shortage of scientific evidence is due to chronological and technological reasons: research on all types of animal traction is relatively recent, and most of the research has tended to be on technical aspects. It is now increasingly recognised that animal traction cannot be looked at in isolation. It must be examined in the context of total farming systems in order to assess its positive and negative environmental implications.

In order to understand the relationship between the environment and animal traction, it is important to consider, at least the following key issues: socioeconomic context of animal traction; animal traction technologies and animal species.

## Socioeconomic context of animal traction

It is important to try and disentangle broader social trends from those specific to animal traction. For example, deforestation and land clearance will usually be taking place whether cultivation is by hand, animals or mechanical means. Higher populations usually lead to decreasing soil fertility and the need to increase cultivated areas. Animal traction is often adopted in response to these trends, but it is not the cause of them.

However, as population increases, farmers are forced into cultivating smaller plots, on steeper slopes and to trap water. In these cases, the use of living bunds, water harvesting and all types of terracing can be made easier with animal power. It remains an open question whether the availability of animal power induces intensification or encourages it. Animal traction does not require removal of all trees in the fields as animals can move around them (this is

more difficult for tractors). Therefore the keeping of trees might be an incentive to the farmers to use animal power.

## Animal traction technologies

Animal traction technologies are often determined by the availability of specific implements and the agendas of different types of development agency. Thus, if manufacturers are producing inappropriate tools, farmers may have no choice but to use them even if their use causes further environmental degradation. For example, sledges may cause erosion, but it is not known whether their impact can be reduced with simple wheels (eg, solid wooden wheels).

## Animal species

A major environmental concern with cattle is soil compaction, especially in areas where the numbers are increasing (for example, when deforestation has removed tsetse habitats). Donkeys are increasingly being used for traction. Although much has been said about their potential negative environmental impact, there is virtually no evidence for this. All types of intensification can cause some environmental change and usually some damage. All proposed interventions should be subject to wide-ranging cost/benefit analyses for policy and planning purposes.

## Recommendations

At present this topic is much under-researched. There is an urgent need to expand research to disseminate results.

There is evidence that inappropriate tools and species are used in many parts of Africa. A simple programme of testing and extension could help substitute more suitable technologies.

The workshop planned by ATNESA for 1997 to be held in South Africa will be on environmental issues and conservation tillage. It is expected that more scientific evidence will be brought forward for discussion then.



# Transport and equipment: issues and challenges

## Transport

Access to an effective means of transport is an essential component in promoting the social and economic development of farmers in most African countries. Effective means of transport provide easier access to, and management of, inputs and therefore help improve yields. They also allow farmers to market their produce more easily and achieve higher economic returns. The availability of transport also reduces the time and effort of day-to-day household activities such as water and firewood collection. The main means of transport in many rural areas are head portage, pack animals and animal-drawn sledges and carts.

In recent years there has been increasing interest by development agencies in promoting better transport systems for rural areas. There is a general need to develop intermediate means of transport, eg, wheelbarrows, hand-carts, bicycles and animal-based transport. Adequate availability of these forms of transport will not only benefit the owners, but also those who hire or borrow them. Under most farming systems animal-based transport is an appropriate mode since animals are often already available to the farmers.

### Key constraints to animal-based transport systems

- Draft animal ownership is expensive: the high cost of oxen is a major constraint.
- Problems maintaining animals (eg, inadequate grazing land and water).
- High cost of carts and the lack of access to credit can make cart purchase unaffordable.

### Proposed actions

- Promote donkey use for rural transport (more affordable).
- Help reduce the cost of animal-drawn carts.
- Improve the capacity and capability of rural workshops.
- Improve access to credit.
- Improve access to tools and equipment.
- Improve access to alternative materials and components.

## Equipment

Among the key issues that affect equipment adoption and use are the following concerns.

- Inefficiency (eg, harnesses for donkeys).
- Inappropriateness (eg, ridgers and cultivators cannot be easily used on slopes, and often carts have no braking systems).
- Poor availability and maintenance (eg, weeders and spare parts).
- Affordability (in some areas carts are very expensive).
- Poor quality of equipment.
- Inadequate information about the use of equipment (eg, farmers sometimes remove some important but little understood plow adjustment parts).

With regard to quality of the implements, there is no doubt that a new approach based on sound engineering principles and modern materials could improve the quality and produce better equipment. The user should, however, be the one to determine quality and the price must be acceptable.

As an alternative to the top-down approach to equipment design and production, a participatory approach would ensure close interface and dialogue between users and producers. The action recommended was to provide the producers with designs and manufacturing options so that they can respond to the needs and preferences of the users.

However, better equipment must be judged, based on net benefit to a user. For example, if a better plow costs US\$50 more than a traditional plow, but can lead to a US\$200 increase in farm income, then manufacturers and engineers will have a strong and well-informed basis for convincing the users to adopt it.

In view of this, it is important to undertake economic modelling to see how animal draft power equipment can contribute to the household and farm economy.

### Recommendations

National animal traction databases should be established. Inventories should be compiled to include manufacturers, sales outlets, equipment types, research and training institutions.

A study should be undertaken to calculate the economic advantage of removing drudgery.



# Animal power for weed control: issues and challenges

## Introduction

Weeding is one of the major constraints in agricultural production: weeds can cause yield reductions of up to 50%. In smallholder farming systems, the hand hoe is still the most common weeding tool: because of its limited capacity, delayed weeding is common. Weeding using animal draft power increases soil loosening, infiltration and moisture conservation and can save considerable time, labour and money. Although animal-drawn weeders are available in the region, the adoption rate among smallholder farmers has been very low.

## Constraints

Specific constraints to promoting the use of animal power for weed control include:

- Low availability of suitable implements.
- Low affordability of weeding implements.
- Inadequate information and dissemination about alternative weeders that are available.
- Inadequate repair services at village level.
- Training of both farmers and animals.
- Limited promotion of the uses of donkeys for weed control.

## Possible solutions and recommendations

### *Lack of suitable implements*

Many farmers use plows to weed, but plows are heavy and the power requirements are high. Some models of ridgers and cultivators are in use but are poorly developed. The main recommendations on this issue were:

- Undertake research to improve plow design to suit weeder attachment.
- Make implements lighter and hence easier for operator and animals.
- Encourage the use of donkeys or single oxen for cultivation (with lighter weeders).
- Improve farmers' access to information about weeding technologies and implements through manuals, on-farm implement trials and extension programmes.
- Design an effective over-the-row weeder.

### *Use of donkeys for weeding*

Recommendations included:

- Improve extension services providing training to farmers in the correct use and care of donkeys for weeding.

- Make available good harness designs for donkeys used for weed control.
- Design and manufacture appropriate implements for weeding with donkeys.
- Donkeys need good training in how to walk in straight lines along crop-rows.

### *Availability of implements*

Farmers are generally unaware of the existence of different types of cultivators or their use.

The possible solutions are:

- Improve supply and distribution of implements for weed control.
- Gauge the potential demand for each type of implement to encourage manufacturers.
- Stimulate demand through extension services, demonstrations and other on-farm participatory methods.

### *Affordability*

The construction of cultivators and other implements for weed control depends on imported steel which is expensive. Poor profitability of food crop farming and absence of credit put the prices of existing weeders beyond the reach of most farmers. The following measures were proposed:

- Encourage the growing of high value crops to make crop production more profitable.
- Organise farmers' animal draft power groups to provide adequate information on prices and demand and to increase mutual cooperation on the use of implements.
- Improve policy decisions in the promotion of marketing strategies and technical and financial support.
- Create credit schemes with farmers' groups.
- Improve local manufacture of spare parts and simple implements to reduce dependence on industrial producers.

### *Maintenance and after sales services*

Most of the existing weeders are in poor condition. Repair services at village level are inadequate and the role of local blacksmiths is poorly developed. The possible solutions and recommendations are:

- Train local blacksmiths to repair implements and manufacture spare parts.
- On-farm, participatory training in use and maintenance of implements.
- Improve implement construction standards to facilitate interchange of spare parts.

# Use of cows for work: issues and challenges

## Introduction

Due to increasing population and livestock pressure on the land, farmers in many developing countries may not be able to continue maintaining oxen for farm work. Many farmers in South-east Asia use cows for traction. In changing economic conditions the use of crossbred dairy cows for animal traction could benefit total farm output and income through increased milk production. At the same time this would alleviate the need to feed and maintain draft oxen throughout the year and reduce the need to maintain a follower herd to supply replacement oxen. The use of cows for work reduces the burden on feed and fodder resources and offers more opportunities for increasing production and reducing stocking rates. The use of cows for work on small farms and/or on marginal land is sustainable and is likely to increase economic viability.

## Technical and social implications

### *Social acceptance*

Many countries in Africa and South-east Asia have traditional restrictions relating to the use of cows for farm work. Therefore, there may be some resistance among farmers and/or extensionists against the acceptability of the use of cows, particularly in the early stages of technology transfer (whether farmer-to-farmer or through the extension services). Social acceptability is likely to increase due to the economic benefits derived by small and marginal farmers. Indigenous, non-improved cows are suitable for arid and semi-arid regions, but high-yielding crossbred cows will be able to contribute to highland areas together with the indigenous breeds. This will mean a dual-purpose (milk and work) or triple-purpose (milk, work and meat) animal.

### *Farming systems*

In general, oxen are most suitable for the cultivation of large areas of land and where regular work is carried out. Cow traction can be an ideal technology for the small and marginal farmers with limited land for cultivation.

In sub-Saharan Africa, the greatest impact of using crossbred cows for milk and work can be expected in high potential highland regions (ie Ethiopia, Kenya and the Great Lakes Regions of Uganda, Malawi, Tanzania, Rwanda and

Burundi). These highlands often have the highest population densities, market accessibilities and stocking rates.

### *Work output and efficiency of cows*

In general, cows may be worked for 40-80 days per annum distributed throughout the cropping season. Cows are often able to sustain a horizontal pull of about 550-650 N which compares favourably with oxen.

### *Lactation and reproductive performance*

The lactation curve of supplemented working cows is unaffected by work. However, a decrease in milk yield of 10-15% is generally observed in high-yielding cows as a result of work, without any appreciable changes in reproductive pattern. To an extent these effects could be reduced by feeding supplements (eg, oilseed cakes) and green legumes (eg, lucerne) and green fodder (eg, maize, oats).

Even under conditions where adequate feed and supplementation may not be available to maintain body weight and production level of cows, they can still be worked, but there is a further decrease (up to 20%) in milk production.

As a result of heavy work, fertility may be reduced by 6-10% in well-nourished animals. If cows in very poor condition are expected to work hard, reproductive performance is likely to be low. Diet supplementation is likely to improve body condition of working cows and the adverse effects of work are reduced.

Barren cows may be used for work without any adverse consequences on health, and in some cases their fertility may be improved.

Late pregnancy and early lactation restrict the use of cows in most farm operations. Cows in these physiological states should preferably not be worked.

Cows are able to work for 3-4 hours under mild, comfortable conditions. Preferably they should be worked in the early morning and late evening and direct intense sunlight should be avoided.

### *Management and health*

Regular health checks and routine vaccinations may need to be carried out on working cows to protect them from prevalent endemic and epidemic diseases. Adequate sanitary/hygienic

conditions should be provided for housing milk cows. If possible, milk cows should be covered by animal insurance programmes.

#### *Economic implications and technology adoption*

The incremental internal rate of return of work from milk cows is very high due to low investment cost and large benefits derived. Therefore, the technology is highly suitable for small-scale and marginal farmers under sub-Saharan African conditions. Any reduction in milk production is likely to be more than compensated for by work production benefits derived from the cows.

#### *Extension of the technology*

Research has been conducted in Ethiopia by the International Livestock Research Institute and the Institute of Agricultural Research. This suggests that some of the farmers who had previously been apprehensive for socio-traditional reasons have realised the benefits of using cows for work and are likely to work with cows in future. Once the technology is made available as a package to small and marginal farmers, the use of cows may spread further in arid, semi-arid and highland regions.

## **Conclusions and recommendations**

The use of cow traction is a highly economically viable technology that is environmentally friendly and sustainable and is available to farmers under most farming systems in sub-Saharan Africa.

In agroclimatic zones with high ambient temperature, low quality and low availability of feed and fodder, the native indigenous cows are recommended for work.

In the highlands where environmental conditions are suitable for high producing cows, the use of crossbred cows for work is recommended. Adaptable crossbreeds of appropriate genetic make up should be recommended for different agroclimatic conditions.

The reproductive state of cows may be modified in order to obtain work from them throughout the cropping season depending on the specific farming system.

Where appropriate, credit/loan facilities should be extended for the purchase of multipurpose milk cows.

It would be useful to prepare a booklet on the main issues related to cow traction. This would benefit ATNESA members, national networks, development agencies and end-user farmers.

# Donkey utilisation: issues and challenges

## Introduction

Donkeys play an important role in transport in arid and semi-arid areas and where there is poor infrastructure. In some parts of sub-Saharan Africa, there has been a notable increase in the use of donkeys for tillage. This has resulted in changing perceptions of the value of the donkey in many rural communities relying on animal power for crop production.

## Performance capabilities of donkeys

Most adult African donkeys weigh between 90 and 210 kg and their small size limits their work potential. However, well-fed and well-maintained donkeys are able to perform most tasks undertaken by oxen, if teamed in sufficient numbers. Studies in Zimbabwe have shown that well-fed, trained donkeys teamed in fours are capable of sustaining a combined draft force of over 1 kN for a four-hour working period. This draft force is sufficient to plow relatively deep soil with a mouldboard plow and complete most other farm operations usually carried out by oxen in various farming systems. One donkey can weed and pull a cart as these operations require lower draft forces than plowing, and the low liveweight of a donkey is less of a constraint.

## Key challenges

### *Nutrition*

Good feeding and management of donkeys lead to better resistance to diseases, faster growth and increased reproductive efficiency.

Donkeys are able to digest high fibre feeds and forages better than horses. Donkeys are normally able to maintain feed intake even on poor quality feeds.

Nutritionists need to develop recommendations on feeding strategies that allow farmers to make economic decisions on feed input. More information is required on:

- nutritional requirements of donkeys
- role of supplementation
- effects of work on water and nutrient requirements.

### *Health*

Veterinarians need to develop recommendations on disease control strategies. Information is needed on:

- epidemiology of donkey disease(s)
- role of nutrition in control of diseases
- low-cost remedies and management practices to reduce contact with disease-causing agents
- physiological limits of work in donkeys
- effects on work and water deprivation on animal health.

### *Working practices*

More information is needed on appropriate low-cost implements and harnesses for donkeys. A major challenge to engineers is to identify existing implements suitable for donkeys and/or to design or adapt alternatives.

### *Extension*

Extension agencies should develop techniques that promote adoption of improved harnesses and working practices that minimise injury to donkeys. This is likely to improve work output per animal and extend their lifespan.

## Recommendations

- Increase awareness of donkeys as alternative draft animals to oxen.
- Increase awareness of the potential uses of donkeys, including income generation.
- Promote value and positive perception about donkeys to dispel misconceptions.
- Increase the use and productivity of donkeys.
- Improve health, welfare and management of donkeys.
- Increase adoption of appropriate, available and affordable harnesses, carts and other implements for donkey traction.
- Provide donkeys in various areas to target groups seeking to build up donkey populations and increase the use of donkeys.
- Increase knowledge on donkey breeding.
- Increase women's access to donkeys.
- Prevent abuse of donkeys.
- Promote good working practices among donkey users (eg, appropriate loading).



# Analytical synthesis, conclusions and actions

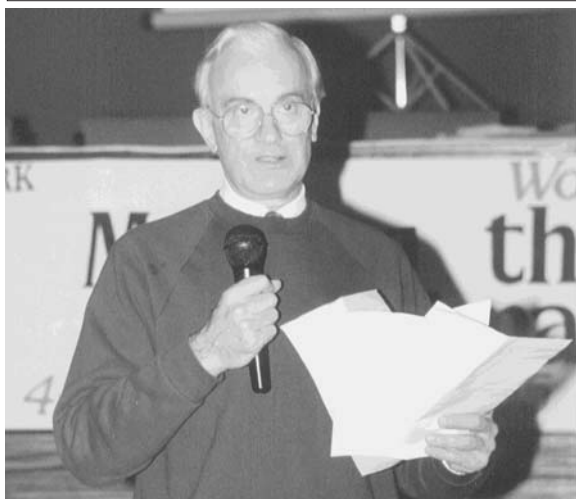
## Introduction

The aim of this closing synthesis is to draw together many of the threads that have been running through the various workshop deliberations. In so doing it is hoped to clarify the main conclusions, identify success stories and assess the progress made by ATNESA in the past few years. It is also intended that, through the final workshop session, ATNESA and its members will become committed to a set of actions with time-bound targets. This will help ensure the continued development of draft animal technology.

Derek Sutton, who was responsible for the final workshop synthesis has long been involved with animal power, starting with farm delivery work with horses in southern England in 1949. In 1965 he worked in The Gambia, developing animal-drawn implements, carts and wheeled toolcarriers as part of a wide-ranging agricultural mechanisation programme based on the concept of a 'mechanisation ladder'. Between 1965 and 1970 he was involved in the development, testing and local manufacture of a wide range of animal-drawn equipment, with field trials in many countries in Latin America, Southeast Asia and Africa (including Kenya).

Now, nearly 40 years later, he observed, with regret, that very little had really changed in animal traction. Hence his enthusiasm for the renewed interest in draft animal technology is now apparent in many parts of the world. This resurgence of interest is due to a great degree to

This synthesis was prepared and presented by  
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the higher profile given to the subject by the growing number of networks, as represented that this workshop. It is therefore envisaged that the workshop conclusions and plan of action should aim to have a major impact on animal traction which can greatly affect the lives and well-being of people in the rural sector. It is most important to remember from time to time that technologies such as animal traction serve the needs of people. Without people they have no purpose whatsoever. Draft animal technology is a means to an end not an end in itself.

## Review of the workshop

Monday morning began with some erudite, profound and highly entertaining presentations at the inauguration and in the keynote session. We went on a lightening world tour with Paul Starkey's photographs, guaranteed to make everyone aware of the world-wide importance and relevance of animal traction. We then heard of three important topics addressed at recent ATNESA workshops: gender issues in animal traction, improving animal-drawn transport and animal power for weed control. We heard about the progress being made by national animal traction networks in South Africa, Zimbabwe, Tanzania, Kenya and Ethiopia, as well as about activities in some other countries (such as Zambia) where formal networks do not yet exist. We were introduced to important issues in the employment of cows and donkeys for work and the impact of animal power on production systems and the environment. We were enlightened on the use of participatory processes by animal traction programmes in Sudan, Zambia, Kenya and Tanzania.

On Wednesday we visited farms and organisations in seven different parts of Kenya (a masterful piece of logistic planning by our Kendat hosts). We were able to gather a wealth of interesting and useful information which provided fuel for subsequent group discussions and presentations. We then reviewed and revised the main discussion topics and reformed into new groups to debate the main workshop themes. We tried to draw appropriate conclusions and recommend follow-up actions aimed at enhancing the application of animal traction in Eastern and Southern Africa.

## Discussion

A number of issues stood out from the initial presentations.

- There are many areas in the world where animal traction has been used virtually unchanged for decades or generations or even centuries.
- The wooden ard plow is still in use in many parts of Africa, Asia and Latin America as the main, if not only, tool to assist men and women farmers to produce a subsistence living.
- There are many areas of the world, including East and West Africa where animal traction has been introduced and promoted within living memory. There are areas where it has yet to play a role at all.
- Technology is usually very location and even time specific. Rarely can technologies be transferred without careful adaptation or modification.

It has been stressed that draft animal technology must be viewed as part of the wider issue of farm power involving human, animal as well as mechanical sources. We were reminded of data published by FAO which indicated that in Sub-Saharan Africa over 80% of farm power comes from human sources, about 14% from animal sources and only 6% from tractors. Animal traction should not be encouraged in circumstances where it does not appear appropriate.

There has been a strong undercurrent all week on the importance of the socio-economic (social, cultural, economic, financial and political) aspects. We concluded that it would be better in future to promote these as a cross-cutting issues relevant to all subthemes (they should not be debated in isolation). We have heard on a number of occasions about the importance of the availability of credit. We have touched upon the difference between savings and credit and the probability of repayment and the possibility of group ownership (eg, for carts) which may be difficult to organise.

We have considered the importance of quality: quality of products, quality of ideas, quality of equipment, quality of tools and advice. We have emphasised the importance of encouraging enterprise and in developing local initiatives. Coming from outside local communities, we

must not automatically assume that our ideas are likely to be better.

We gave some thought to the changes that have occurred since the last workshop in Zambia in 1992. We have all been impressed by the large number of excellent poster displays. Such extensive use of posters has been an innovation for ATNESA and they have been useful throughout the week as focal points for discussion, argument and debate. As in previous workshops, the programme of field visits was very well organised. Some participants have commented that the level of discussion has been more intense and more effective than previous workshops. One reason may be that more people participating at this workshop have had hands-on animal traction experience (over 75% of people claim to have worked with draft animals themselves) which has added immeasurably to the quality of debate and the outcome. There has been excellent interaction between the national networks, which not only further justifies the existence of ATNESA but also further strengthens it.

## Key issues

In order to assist us focus our minds at the beginning, we were asked to concentrate on seven main topics. There were three important cross cutting issues of gender, environmental aspects and participatory methods which helped to link our discussion on the four other topics of transport, weeding, donkey power and the use of working cows.

The title of the workshop was 'Meeting the challenges of animal traction'. Through our deliberations, it has emerged that we must be challenged to:

- Understand draft animal technology better
- Ensure growth and wider application of draft animal technology
- Ensure that animal power serves the needs of people
- Remind ourselves that animal traction is a means to an end, not an end in itself
- Ensure that our achievements are in actions not only in words
- Ensure that we know what is going to be done, by whom and by when!

## Gender issues

Gender issues involve men and women (as well as children). Women's work is far too often undervalued. We need to define and understand the relative roles of men and women, including the question as to who has control over access to inputs. We need to undertake gender analysis more frequently and more carefully. There is a lack of literature on gender and technology. Some very good progress seems to have been made since the workshop in Zambia in 1992, when gender issues seemed to be taken seriously only by a minority. Still many injustices exist in the region. In many cases training is given by and to men when it is the women who are doing most work. There are many differences in land allocation and ownership. The value of women's groups was emphasised and the importance of taking account of the difference between generations. We need to be gender sensitive and transparent in our actions. The work load for women is doubly hard with their responsibilities for agricultural operations and domestic chores (transporting fuel and water, cooking, caring for children, etc). Improved transport facilities and the use of pack animals may well help to relieve some of these burdens. Much more research is needed on gender issues.

### *Some actions proposed*

- As there is lack of information, all the national networks should prepare guidelines on gender-sensitive training relating to draft animal power based on national experiences. The guideline should refer to the ATNESA report *Gender issues in animal traction*.
- The report on *Gender issues in animal traction* should be expanded and published as a book (L Sylwander to arrange this).
- Accessibility and affordability of resources for women need to be improved. A booklet on finance, credit and saving schemes should be produced (L Sylwander to identify an author and coordinate this).
- The national networks and/or ATNESA should help plan national workshops on gender issues in animal traction, with possible collaboration with AGROTEC and FAO (ATNESA committee and national network committees including KENDAT).
- Further liaison with the recently established Rural Transport Forum would be very beneficial (ATNESA Committee, national networks, C Relf).
- A UNIFEM sourcebook will be circulated (J Doran)

- All participants and ATNESA members should endeavour to lobby (or other appropriate action) against discriminatory gender policies. Where possible, members should assist the development of gender sensitivity within their own fields of operation (all members).

## Environmental impact

Animal traction allows more area to be cultivated. Therefore greater pressure is placed on land and forest resources and available feed and forage. This pushes farmers to more marginal areas, up steeper hillsides and into more inhospitable semi-arid areas. Fertility is more difficult to maintain. Soil degradation can occur and reduced vegetative cover results in increased erosion. It was concluded that there were many pressures on the environment, and most of them were nothing to do with work animals. However, draft animals are sometimes used as scapegoats. There are many misconceptions as to the effect of livestock on erosion for which there is a lack of scientific evidence.

There is high value in improving conservation tillage systems, especially for more marginal semi-arid areas. Some technologies may have negative environmental impact (eg, mouldboard plows in some semi-arid areas, sledges). Feeding strategies need to be developed where grazing is short and there is a need to compensate for the loss of organic matter and soil fertility. Wildlife management needs to be improved by and for the community to avoid conflicts with farm livestock. Extension advice must be relevant to the local environmental conditions.

### *Some actions proposed*

- An ATNESA/SANAT workshop on conservation tillage with animal power is being planned for South Africa in 1997. Environmental issues will be very important and the environmental impact of animal power could be usefully tackled as a major theme (SANAT/ATNESA committees).
- The importance of exchanging research results was highlighted as was the relevance of the considerable amount of 'grey' literature. Means of collecting, recording and disseminating relevant documents needs to be established, and the use of the Internet and/or e-mail should be considered. (T Krecek and colleagues at University of Pretoria to investigate).
- Research is needed on environmental aspects of animal traction in South Africa. (SANAT to

write proposal for European Union to be submitted via P Zille).

## Participatory approaches

We were challenged by several speakers to continue to increase the involvement of all those concerned in any problem area (the stakeholders) through participatory methods. Without participation of all stakeholders links with the community are poor and top-down approaches tend to be used to little effect. Farmers often progress faster than the extension service can react. External ideas are often imposed without adequate preparation and understanding.

Success stories perhaps need to be more clearly identified. Technical cooperation between developing countries should be encouraged as well as farmer-to-farmer contact and the promotion of farmers' groups. Greater use could be made of village blacksmiths (*jua kali*) as focal points and meeting places for village dissemination.

There is a need for greater use of participatory data collection. Diagnostic surveys and studies are essential to gain understanding, and should involve open-ended discussion and consultation, to ensure people learn from one another. Age factors were emphasised and the difficulties the generation gap were highlighted. Older people have a wealth of experience to share but people often learn best from their own mistakes. Young people have the ability to learn rapidly but they are moving to cities and away from rural areas. Since the Zambia workshop in 1992 there have been encouraging signs that engineers and social scientists are increasingly listening to each other's point of view. More inter-disciplinary listening and collaboration is needed.

There is a need for manufacturers and extensionists to better understand farmers' selection processes. It is important to provide sufficient information for the right choices to be made by farmers. We need to improve the flow of information and communication between farmers, extension staff and manufacturers. Participatory methods take time but they result in technology that gets used sustainably.

### *Some actions proposed*

- Report on involvement of engineering and social scientists working together to be circulated (D Sutton).

- Manual on use of participatory methods in draft animal power development to be prepared and published (S Croxton to coordinate and prepare funding proposal).
- Information exchange can be improved through greater dissemination of case histories and 'success stories'. FAO intends to commission some case studies (FAO with P Starkey).
- *Draught Animal News* is a valuable medium that should be widely read *and contributed to* by ATNESA members (A Pearson, ATNESA Steering Committee, all ATNESA members).
- Exchange visits between national networks, individuals and institutions should be promoted. ATNESA membership lists will be useful (ATNESA and national network committees).
- Manufacturers of animal drawn equipment should be encouraged to participate actively in national networks.

## Transport and equipment

Little progress has been made in plow design since the 1940s. Availability of equipment within the region is only partly determined by market demand. There is a need for a critical mass of demand to ensure that sales take off and can be sustained. Affordability depends on the availability of savings or credit. Although there is some hiring or contracting of animal traction equipment at village level, this multi-farm use is seldom promoted as a way of making equipment more affordable to individuals.

Low cost is desirable but quality should not be compromised. There is need for better quality of design and manufacture with more user participation, better materials, better instructions on use and more standardisation. A wider range of equipment is needed for farmers to have a choice.

Sustainability of operation is important and this includes the availability of spare parts and repairs and training for maintenance. There is a lack of special rice production equipment in Kenya. Training facilities need to be improved for artisans, blacksmiths (*jua kali*) and small manufacturers. 'Bare-foot' trainers may have a role as well as greater use of manufacturers' associations and small enterprise development organisations. These may be able to commission teams to undertake training programmes.

Relieving women's workload is perhaps better promoted on the basis of its economic advantages which may provide a stronger



argument among decision makers than 'merely' a reduction in drudgery (important though that is). There is much value in increasing users capability to make items themselves (eg, harnesses).

#### *Some actions proposed*

- Manufacturers should be encouraged to produce simple instruction manuals for all equipment (national networks and manufacturers).
- Each national network should prepare a database of equipment in use and sales and the numbers of animals in use (national networks, ATNESA committee, FAO).
- National networks should explore improvements to training programmes, including that relating to equipment use and maintenance. National inventories should be prepared on under-utilised training facilities already available (B Mudamburi and FAO).
- Calculations to be made of the economic advantages of removing drudgery, particularly for women's tasks (C Relf).
- A review to be made of quality control procedures and options for animal traction equipment (B Joubert).

### **Weeding with animal power**

Weed control is critical to yields. In fact in many situations it is the single most critical factor in determining how much land a farmer can cultivate. The use of animal-drawn weeders is increasing in the region. Constraints to more rapid adoption include lack of suitable and affordable implements. Concern was expressed over the lack of understanding of the economic aspects of improved weeding, which may partly explain the low use of animal-drawn weeders. It must be remembered that the farmer's problem is controlling weeds (not the low adoption of weeders). Animal-drawn weeders may not necessarily be the best or cheapest way to achieve this. Greater use of integrated systems, including inter-cropping, cover crops, improved rotations and biological control should be considered as well and animal powered options.

#### *Some actions proposed*

- Information from Zimbabwe and DAREP in Kenya relating to modification of plow design to allow weeding to be prepared and circulated (APNEZ and DAREP).
- Publication of an ATNESA publication on *Animal power for weed control*, to include recent contributions on this topic (P Starkey to coordinate).

### **Donkeys**

Donkeys have featured quite strongly this week and we have some impressively dedicated colleagues with a wealth of experience and enthusiasm on these animals. We discussed the challenges to better utilisation of donkeys which are often used by farmers (women and men) with very limited resources. It is therefore important to help farmers make the best use of their donkeys. In spite of their ability to tolerate low feed quality, donkeys do perform better with improved nutrition, perhaps with some supplementation. Donkeys appear to be able to carry loads of 50 kg for long periods (they can carry their own weight for short periods, although this is not a recommendation). The importance of better management, animal welfare and veterinary care was highlighted, and we considered the value of herbal remedies. The relative advantages of using single animals and donkey teams was discussed. There is a need for light, durable and affordable implements and carts. Donkeys need a better image. Publicity is required to dispel unfavourable myths about these important animals and to encourage greater care and attention to them. The target groups should be extension workers, policy makers, schools, farmers and their families and commercial users.

#### *Some actions proposed*

- To improve regional exchanges and encourage relevant initiatives national networks should nominate some person (or organisation) to provide a focal point for donkey related matters (all networks and ATNESA Committee).
- An ATNESA 1997 calendar portraying favourable images of donkeys (and other animals) should be produced (P Starkey and P Kaumbutho to coordinate).
- Cassettes on donkey issues to be made available (P Jones).
- The Zambian example of credit for women to purchase donkeys should be well documented and considered by other countries (Palabana and national networks).
- Information on a donkey breeding farm in Tanzania to be provided to others on request (P Mwashia).
- An ATNESA workshop on donkey utilisation to be held in Ethiopia in 1977 with subsequent publication of manuals and guidelines (ATNESA/ENAT committees).

## Cows for work

We were reminded of the potential for the use of cows for work. We heard of the advantages of feed supplementation in increasing milk production and that output may be achieved through body weight loss. We noted on our visits and subsequently discussed the constraints to the use of cows. These are mainly due to traditional, social, cultural attitudes and beliefs, and we considered the ways of overcoming these through education and demonstration.

As farm size shrinks intensification increases and multi-purpose animals become more necessary and triple-purpose animals for milk, power and meat desirable, particularly for smaller farms. Management of multi-purpose animals becomes more important. Cows should not be worked too long in pregnancy (3-4 hours per day maximum) and supplementary feed and health care needs to be improved.

### *Some actions proposed*

- A booklet or information leaflet for use by the networks should be prepared on the main issues relating to using cows for work (A Pearson and Alemu G/Wold).
- Reports relating to cow traction to be submitted for publication in *Draught Animal News* (A Pearson to coordinate).

## Some additional concerns

A number of other concerns that have arisen during the week should be borne in mind as we return to our respective countries and implement these various recommendations.

- Are we getting carried away by animal traction issues at the expense of other important inputs to agricultural production and sustainable livelihoods? Do we always accept that draft animal technology is a means to an end and not the end in itself.
- Is there a tendency for us to promote our own favourite themes and topics (operations, implements, species, diseases, etc) and to forget that it is other people we are trying to help and not ourselves?
- Are we still using or accepting top-down approaches, which have been so thoroughly discredited? Do we concentrate on one aspect of technology in isolation without fully defining and understanding the real problem first? Do we really listen to

farmers about their problems instead of just talking about our technology as a solution?

- Do we still try to reinvent the wheel when in reality many problems can be solved by promoting known technology, sometimes with minor adaptation?
- Are we learning quickly enough by our own or others mistakes? Do we write-up and publish the results (good or bad) of our work and experiences?
- Do we make a sufficiently thorough search of the literature before we start our development or research work on our 'better mouse trap'? (We should all use existing knowledge better, take full advantage of the huge potential for knowledge dissemination and exchange, which is a key feature of networks like ATNESA).
- When it becomes clear that a particular aspect of draft animal technology is appropriate, affordable, sustainable, needed and wanted by farmers, are we prepared to promote and publicise it adequately? ('Better mouse traps' do not sell themselves without promotion and ATNESA has an important role in spreading information about successes).
- Are we measuring success by the growing number of networks rather than by a close scrutiny of the quality and number of specific outputs? (For example, we must improve the availability of training and extension materials in the region).
- What is the future of the ATNESA network? Can we ensure that the networking successes in Africa are repeated elsewhere? How can ATNESA continue to develop its programme and maintain and enhance its credibility while keeping animal power in a realistic human, economic and technological context?

## Conclusion

This week has seen a superbly successful workshop. We all need to take the many lessons we have learned to heart. In this way, when we next meet we can review further real progress as we strive 'meet (*and overcome*) the challenges of animal traction'.

# Workshop evaluation

## **Introduction**

At the end of the workshop participants were invited to complete anonymous evaluation forms. There were 37 questions which dealt with specific aspects of the workshop programme and organisation. Participants graded the answers on the scale A to E (very good to very poor). There then followed seven open-ended questions each with a space for participants to express their views on a range of issues. Eighty-three completed evaluation forms were returned. A visual picture of some key ratings is shown in the bar charts.

## **Specific programme elements**

The evaluation was highly positive, with very few negative ratings given. About 85% of participants who answered the question thought that the workshop had been good or very good. Using the system of analysis employed in the previous ATNESA proceedings (*Improving Animal Traction Technology*), the participant responses were ranked and the most popular elements of the programme were as follows (in order of popularity):

- Field visits (78% very good or good)
- Opening keynote presentation/introduction
- Field visit discussions and presentations
- Key presentations (Themes and Kenya).

Most participants rated the venue and the various administrative arrangements as good or very good, although some commented that more could have been done to improve the secretariat in terms of the production of papers. The posters and photographic exhibitions were also rated highly (80% good or very good). The editorial advice service was rated very good or good by 70% of those answering that question.

## **Most useful aspects**

The participants felt that general networking (information exchange), field visits and group discussion were the most useful aspects. The keynote presentation and other some paper presentations were also cited, as were the topics of gender, donkeys and cows.

## **Least useful aspects**

There was no general agreement as to the least useful aspect of the workshop; indeed it was commonly stated by participants that all aspects of the workshop were useful. Some participants (20%) thought the presentation of papers should have been better organised and that

presentations should have been by subject areas with better time management. A small number of people thought there was too much focus on Kenya, rather than on the region as a whole. Other issues mentioned as less useful by more than one person included the ATNESA general meeting, the formal opening ceremony, group discussions and the field visits.

## **Ways to improve the workshop**

Several participants (15) said there was nothing to improve. Others suggested the following improvements:

- Better secretariat facilities (11 respondents).
- Avoid too many paper presentations and/or make a synthesis of all papers which should be presented and discussed (9).
- Allocate more time for individual paper presentation and discussion (8).
- Better time management (6).
- Getting farmers to the workshop (8).
- Avoiding broad workshop topics (5).
- Papers should be scientific, not narrative (1).

## **Workshop size and mix of participants**

Most participants were happy with the size of the workshop. Fourteen participants thought the workshop was too big to be effectively managed. None mentioned that it was too small.

Overwhelmingly, participants were happy with the mix of people (different countries, disciplines, organisations, etc). Some felt the mix could be further enhanced by:

- involving farmers and/or more emphasis on field workers (14 respondents).
- less dominance of agricultural engineers relative to other disciplines (9) and/or more social scientists (4).
- fewer host country participants (2).
- more NGO involvement (2).

## **Further ATNESA workshops**

All respondents except one wanted ATNESA to to organise further workshops. The following themes were suggested by several people:

- Socioeconomic issues
- Animal health and nutrition
- Research on cows and donkeys
- Environmental aspects
- Equipment design
- Food security through animal traction
- Credit, marketing and policy issues.

### Comments and suggestions

Several participants thanked the KENDAT organisers and the ATNESA Steering Committee for a job well done.

A few specific issues were raised by individuals for future consideration by the Steering Committee. These included the suggestion that ATNESA should be institutionalised with a permanent secretariat.

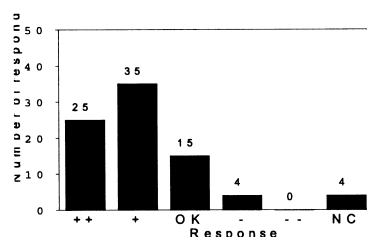
### Conclusion

The evaluation was similar to those of previous workshops. The overall workshop content and methodology appeared very popular with most people (which is remarkable considering the range of participants' nationalities, disciplines and work experiences). A few weaknesses were apparent and these will be noted by future ATNESA organising committees.

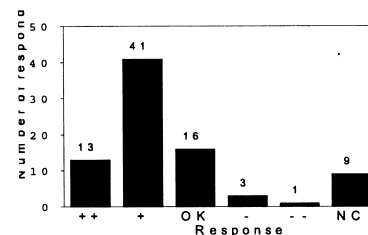
### Summary of some evaluation responses

Bar charts show number of responses ranging from very good (++), through 'OK', to very poor (—); NC = no comment

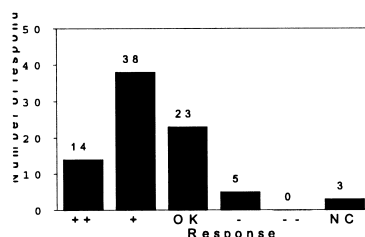
#### 1 Keynote presentation



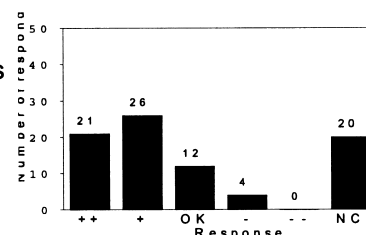
#### 6 Group discussions on key workshop themes



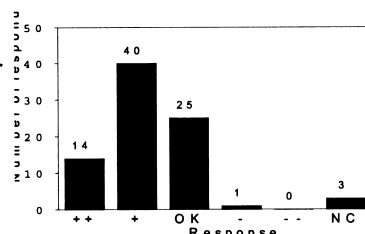
#### 2 Review of key challenges



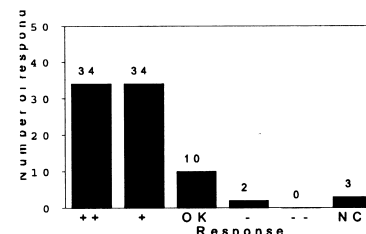
#### 7 Keynote analysis of workshop findings and conclusions



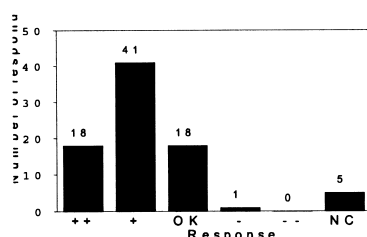
#### 3 Review of further key challenges



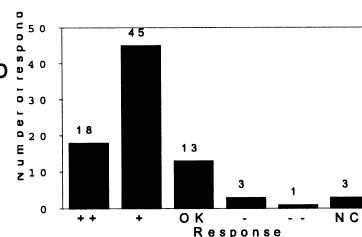
#### 8 Photo displays and posters



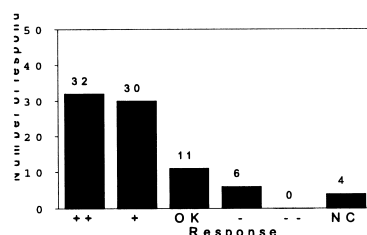
#### 4 Challenges of animal traction in Kenya



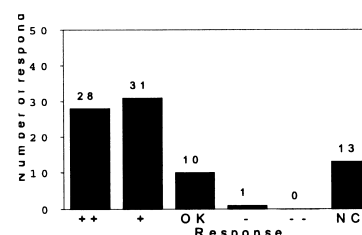
#### 9 Overall workshop organisation



#### 5 Field visits to farmers



#### 10 Overall usefulness of workshop





## Second ATNESA general assembly

The second general assembly of ATNESA was held on Thursday 7 December 1995. It was chaired by J Omoding (Uganda). The rapporteurs were W Kumwenda (Malawi) and G Bwalya (Zambia).

The meeting began with Dr T Simalenga, the ATNESA Chairperson reading the minutes of the First General Assembly meeting. These were adopted as correct.

Dr T Simalenga then presented the ATNESA report (1990-1995) prepared by himself and P Starkey. The meeting adopted the report and the Chairperson concluded by thanking all donors, NGOs and governments for their continued assistance to ATNESA.

Dr T Simalenga introduced the outgoing Steering Committee members who were present and thanked them for their efforts and commitment to ATNESA. The old committee had been:

- Dr T Simalenga, *Tanzania, Chair*
- Dr (Ms) A Aganga, *Botswana*
- R Mpande, *Zimbabwe*
- E Mwenya, *Zambia*
- Ms L Sseruwo, *Uganda*
- Y Metaferia, *Ethiopia*
- M Guntz, *GTZ*
- Ms L Sylwander, *AGROTEC, Zimbabwe*
- H Helsloot, *The Netherlands*
- P Starkey, *UK, (Technical Adviser)*.

### Elections

The relevant section of the ATNESA statutes relating to elections were read out. These stress

the importance of geographical, disciplinary and gender balance on the Steering Committee.

A Pearson (UK) and A Bangura (Sierra Leone) were appointed as returning officers for the election of a new Steering Committee.

Participants from each country represented had selected one candidate for possible election.

The elections were conducted by secret ballot, with each entitled person having six votes.

### New steering committee

The following were elected as the new committee members:

- Alemu Gebre Wold, *Ethiopia*
- P Kaumbutho, *Kenya*
- B Mudamburi, *Zimbabwe*
- E Mwenya, *Zambia*
- N Seobi, *South Africa*
- T Simalenga, *Tanzania*

Resource persons

- G Oodally, *FAO, Rome*
- L Sylwander, *Sweden*

The new steering committee appointed Dr T Simalenga to continue as chairperson for at least six months. Dr P Kaumbutho was appointed as the new ATNESA treasurer. The steering committee agreed to retain P Starkey as ATNESA Technical Adviser.

### ATNESA plans

The general assembly gave a mandate to the new Steering Committee to plan and implement a new programme, that was likely to include the following activities.

- Workshop on improved donkey utilisation to be held in Ethiopia in 1996/7
- Workshop on conservation tillage and animal power to be held in South Africa in 1997
- Technical meeting on blacksmith support for animal power (E Mwenya and G Oodally to develop a status paper for discussion)
- Review of available educational and training materials on animal draft power and major needs (B Mudamburi, N Seobi and P Starkey to liaise and plan meeting).
- Production of database on animal draft power with reliable statistics.

*Chair of the ATNESA General Assembly meeting*



(P Kaumbutho and G Oodally to coordinate).

- Review possibilities for ATNESA videos and TV programmes promoting animal draft power: (P Starkey to coordinate).
- Animal health and nutrition issues (Alemu Gebre Wold to prepare a status paper and to coordinate activities related to the issues).

### Envisaged ATNESA publications

*Animal power for weed control* (based on the 1993 Tanga workshop) due 1996.

*Networking for animal traction* (an update of the GTZ-sponsored publication)

*Introduction of animal traction in Tanga, Tanzania* (GTZ-sponsored book planned).

Preparation of resource document on examples of successes and failures of animal draft power programmes in the region (studies by national experts followed by an FAO publication).



*The new ATNESA Steering Committee*

### Strengthened linkages

It was proposed that linkages between ATNESA and other regional and international organisations or associations involved in agricultural development be strengthened and joint activities and/or publications arranged.

## ATNESA Report 1990-1995

### The launch of ATNESA

In 1987, the Southern African Centre for Cooperation in Agricultural Research (SACCAR) organised a regional animal traction workshop in Maputo, Mozambique. At this it was resolved that a regional information-sharing network should be established under the auspices of SACCAR (Namponya, 1988). For institutional and organisational reasons, there was no immediate follow up to this, but several individuals from Eastern and Southern Africa participated in animal traction workshops organised in 1988 (Senegal), 1989 (Indonesia) and 1990 (Scotland and Nigeria). On each occasion, the participants from the region affirmed that they should form their own animal traction network.

As a direct result of the 1990 workshops, two separate networking initiatives in Eastern and Southern Africa were started. For a few months

they coexisted as parallel schemes, but they came together in 1991. One was initiated by staff of Christian Mission Aid (CMA), a non-governmental organisation based in Kenya. The other involved animal traction specialists based in Zambia and Zimbabwe.

A valuable opportunity to launch the animal traction network for Eastern and Southern Africa came in November 1990. The setting was a regional course on planning integrated animal draft programmes, held at the Agricultural Engineering Training Centre (AETC) of the Institute of Agricultural Engineering in Harare, Zimbabwe. The course was arranged by AGROTEC (Programme on Agricultural Operations Technology for Small Holders in East and Southern Africa) a regional project of the United Nations Development Programme (UNDP), funded by the Swedish International Development Agency (SIDA). During the course, the experiences of the West Africa Animal Traction Network were presented and there was much discussion about regional networking. The course participants

ATNESA Report prepared by  
T E Simalenga, , ATNESA Chair  
and P Starkey, ATNESA Technical Adviser

therefore selected six people from different countries to form a committee to discuss organisational details and prepare an action plan for the Network. Representatives of AGROTEC and GTZ and a consultant from Animal Traction Development (P Starkey) were invited to join the committee. The decision of this committee to launch the network and organise a major workshop were endorsed by the final plenary session of the AGROTEC course (Kalisky, 1990).

The provisional steering committee of the new Animal Traction Network for Eastern and Southern Africa (ATNESA) met in Zambia in 1991 to discuss network organisation and to plan the first major open workshop. The chairman of the committee had prepared a paper on possible ways of coordinating the network, and another member had prepared draft statutes, based on those of the West Africa Animal Traction Network (WAATN). The committee decided to adopt an informal system of network organisation, based on national networks linked through a regional network steering committee.

### **First ATNESA workshop**

The first ATNESA workshop was held in January 1992 in Lusaka, Zambia with the theme of *Improving animal traction technology*. A total of 107 people from 17 countries participated and over 80 technical papers were circulated. Most external and local workshop participants were sponsored by their own organisations or by agencies within their own countries. This demonstrated the user-supported nature of the network and workshop. The core costs of workshop planning and implementation were provided by the Directorate General for International Cooperation (DGIS) of The Netherlands, in cooperation with the Dutch agricultural engineering institute (IMAG-DLO).

The workshop followed the pattern established by the West Africa network, with emphasis on field visits and small group discussions. Where possible, invited lead papers were prepared collaboratively, with experts in two or more countries (or resource organisations) combining their experiences prior to the workshop. The workshop was also offered as a means whereby members with specialised interests could meet to coordinate activities and plan collaboration. Among these groups were people interested in farming systems research and extension, gender

issues, local manufacture of implements, donkey power, cart design and animal-powered systems.

During the workshop, two open General Assembly meetings were convened. At the first meeting, organisational arrangements and draft statutes for the network were discussed and an ad hoc committee was nominated to finalise these. At the second meeting, the statutes were formally adopted and a new steering committee was elected. The steering committee was given a mandate to arrange a programme of activities based on the workshop recommendations. The committee stressed that while it would help stimulate, coordinate and facilitate such a programme, actual responsibility for implementing network activities would be that of individual ATNESA members in different countries (perhaps with support from resource organisations).

The workshop proceedings, containing 85 edited papers prepared by 105 authors from 30 countries were published in collaboration with DGIS, GTZ and CTA (Starkey, Mwenya and Stares, 1994).

### **Initial ATNESA programme**

In the light of workshop discussions, the Steering Committee proposed that ATNESA members should initially undertake the following networking activities.

- Organise formal or informal national animal traction networks in as many countries in the region as possible.
- Facilitate the holding of small international workshops on specific themes, such as gender issues, animal-powered transport, weed control, donkey utilisation and conservation tillage.
- Collect and collate information on organisations and individuals involved in animal traction in the region for use in national and regional mailing lists. Such information could form the basis of an ATNESA directory of people and resources to assist organisations to recruit people from nearby countries as local consultants.
- To increase awareness of the existence, aims and objectives of ATNESA through formal publications, publicity materials and in contributions to newsletters and journals.

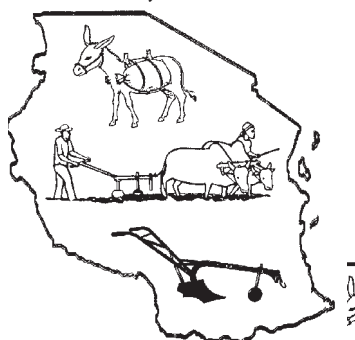
## National networks

The statutes of ATNESA, adopted in 1992, state:

*The network will function largely through the interaction of autonomous national animal traction networks and direct contacts between the different programmes in the region.*

ATNESA members and the steering committee have therefore endeavoured to stimulate the organisation of informal or formal national animal traction networks in as many countries in the region as possible. The national networks have goals comparable to those ATNESA but they operate at a national level. They seek to improve information exchange and national collaboration through meetings, workshops, proceedings and publicity. They generally aim to influence national policy in favour of animal traction, and are in better positions to 'lobby' than the international network.

### ATNET, Tanzania



The Animal Traction Network Tanzania (ATNET) was launched in 1991. ATNET is an informal organisation, with a 12-person steering committee which includes representatives of the Ministry of Agriculture, two universities, the major implement manufacturer and several projects and NGOs. The ATNET secretariat was initially based at Sokoine University of Agriculture. Its first workshop was supported by the Mbeya Oxenization Project and its proceedings contained 16 papers by 21 authors (Simalenga and Hatibu, 1991). ATNET hosted an joint ATNESA-ATNET thematic workshop on *Animal power for weed control* held in Tanga in 1993. (In 1996, ATNET adopted a new constitution under the name of the Tanzania Association for Draught Animal Power – TADAP).

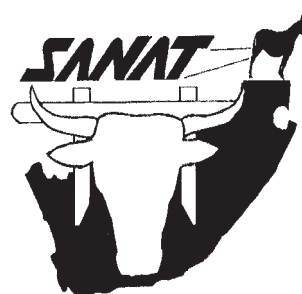
The Kenya Network on Draught Animal Technology (KENDAT) was formed in 1992.

### KENDAT, Kenya



at the University of Nairobi, it has been formally established as a national NGO. It has received practical and financial assistance from a Dutch-supported project. Its first national workshop in 1993 was attended by 50 people and the published proceedings contained 18 edited papers (Kanali et al, 1993). KENDAT held its second national workshop in 1995, attended by 70 Kenyans and six resource persons from other ATNESA countries. The proceedings contained 30 papers and abstracts (KENDAT, 1995). In the same year, KENDAT hosted the second major ATNESA workshop.

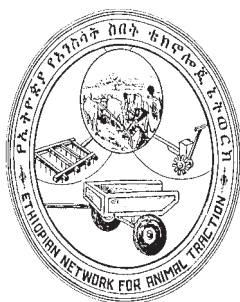
### SANAT, South Africa



The South African Network on Animal Traction (SANAT) was formed in 1993. Its secretariat, based at the University of Fort Hare, publishes the twice-yearly *South African Network of Animal Traction Newsletter*. SANAT organised a nation-wide appraisal survey and discussed the results at its 1994 national workshop. The survey results and workshop conclusions were published by the Development Bank of Southern Africa (Starkey, 1995). SANAT has also held training and planning workshops.

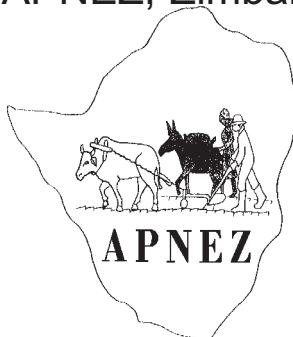


## ENAT, Ethiopia



The Ethiopian Network for Animal Traction (ENAT) was launched at a two-day national workshop held in 1994. This was opened by the Minister of Agriculture and attended by 120 people. It was decided to register ENAT as a non-profit-making, non-political organisation supervised by a national steering committee comprising 18 representatives of relevant organisations including government, NGOs, universities, development projects, the private sector and farmers. The proceedings of the first workshop were published and contained summaries of the ten key papers, reports of working groups and the ENAT constitution (MoA, 1994).

## APNEZ, Zimbabwe



The Animal Power Network for Zimbabwe (APNEZ) was launched in 1994 at a workshop attended by 38 people. It is a non-profit, non-political non-governmental organisation that aims to stimulate information exchange and awareness of farmers' needs relating to animal traction (DAN, 1995). Its secretariat was initially based near Harare at the Institute for Agricultural Engineering. The first APNEZ general assembly was held in 1995 during a national animal traction workshop.

At a national workshop held in Mozambique in 1995 it was agreed that an national network affiliated to ATNESA would be started.

Discussions relating to national networking have also taken place in Botswana, Malawi, Namibia and Uganda, although formal networks have not yet been launched.

While Zambia does not have a named network, it actually has one of the strongest national networking programmes. This has been developed by a national animal traction coordination project and a national research, development and training programme. These programmes (supported by The Netherlands) hosted the first major ATNESA workshop. Animal traction activities are coordinated by national and provincial committees. National surveys have been undertaken (Starkey, Dibbits and Mwenya, 1991; Dibbits and Mwenya, 1993). A twice-yearly newsletter *Zambian Animal Draft Power* is widely circulated. National workshops have been held and the proceedings have been circulated (Bwalya et al, 1991; Bwalya and de Graaf, 1992; Palabana, 1992; Palabana, 1993).

At all the national workshops mentioned (Ethiopia, Kenya, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe) there have been representatives of the ATNESA Steering Committee and/or invited guests from neighbouring countries. This has reinforced linkages and strengthened the mutual recognition and legitimacy of ATNESA and the national networks.

### Thematic workshops

ATNESA and its steering committee recognised that large, wide-ranging workshops were important for encouraging general information exchange and the cross-fertilisation of ideas. However, smaller workshops focused on specific themes were also needed to allow specialists to concentrate on particular issues. Smaller workshops could be organised relatively simply and cheaply in cooperation with national networks or interested host organisations.

The workshop on *Gender issues in animal traction* was held in 1992 in Mbeya, Tanzania. The workshop, hosted by the Mbeya Oxenization Project, was attended by 32 people from Tanzania, Zambia and Zimbabwe. The participants reviewed project experiences relating to gender and animal traction and discussed ways in which women can gain more from animal traction technology. As a follow-

up, a booklet with gender-related guidelines was published (Sylwander and Mpande, 1995).

ATNESA members had expressed interest in thematic workshops relating to the *Design, manufacture and distribution of animal-drawn tillage implements*. These topics coincided with areas of interest of the regional organisation AGROTEC, based in Harare. Thus ATNESA had no need to tackle these issues itself and AGROTEC organised two workshops relating to this theme. These were each attended by about 20 participants from six countries and ATNESA members played key roles (Simalenga and Kalisky, 1993; Shetto, Kwiligwa and Simalenga, 1994).

A thematic workshop on the *Design, testing and production of animal-drawn carts* was held in 1993 in Harare, Zimbabwe. The workshop, hosted by the Institute of Agricultural Engineering, was attended by 40 people from ten countries. The participants reviewed successful and unsuccessful cart designs, and drew up guidelines for large-scale and artisanal manufacturing of carts. Recommendations were made relating to harnessing, standardised cart testing, credit provision and other technical and policy issues. As a result, a 120-page resource book of guidelines was published (IT, 1996).

A total of 64 people from 14 countries participated in a workshop on *Weed control using animal power* held in 1993 in Tanga, Tanzania. It was hosted by Animal Traction Network, Tanzania (ATNET). Following a review of national and international experiences relating to animal-drawn weeding, participants field-tested 20 implements pulled by oxen and donkeys, prior to establishing guidelines on weeder design. Participants visited farming families and discussed farm-level constraints and socioeconomic preconditions for effective extension. Groups of specialists prepared guidelines for the design, testing, manufacture, distribution and extension of weeding technologies. The proceedings including the technical guidelines and 50 edited papers will be published by ATNESA in cooperation with ODA and CTA (Starkey, Simalenga and Miller, 1996).

ATNESA thematic workshops already being planned and scheduled for 1996/7 include *Donkey utilisation and management* and *Conservation tillage using animal draft power*.

## Concluding remarks

Accomplishment of ATNESA activities has been made possible through joint effort and determination of steering committee members. We would like to recognise their inputs and time set aside for ATNESA without which there would be no successful story to tell.

The challenge ahead of us is to sustain the achievements made in the past few years. We hope the new steering committee will keep up the momentum and let ATNESA go from strength to strength.

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# Networking introductions, announcements and resources

*(For the addresses of these organisations, please refer to the participant address list)*

## **National networks and programmes**

### ***Animal Power Network for Zimbabwe, APNEZ***

APNEZ was formed in September 1994 during a national workshop organised by AGROTEC and ATNESA. Its secretariat is based at the Institute of Agricultural Engineering in Harare. To date, APNEZ has 35 subscribing members and formal registration is at an advanced stage. APNEZ held a combined workshop and general assembly on "Meeting the challenges of animal power in Zimbabwe" on 30-31 August 1995. Of the 43 participants, 11 were smallholder farmers. APNEZ collaborates with other networks and national organisations. It has assisted Zambians to purchase about 90 donkeys from Zimbabwean farmers. APNEZ has organised short tours for visiting Namibians and Ugandans. One member participated at the Mashare Animal Draft Power Workshop in Namibia.

In Zimbabwe Matopos Research Station is conducting research relating to donkeys, partly funded by ODA. Dr Peta Jones is providing donkey power teaching and consultancy services in Binga.

### ***Animal Traction Network for Tanzania, ATNET***

ATNET started in August 1991 as a National Animal Traction Steering Committee and the network was inaugurated in 1992. Formal registration of the network is in process. Two national workshops have been conducted and ATNESA workshops on Gender Issues and Weed Control were organised in conjunction with ATNET. ATNET has drafted a syllabus for extension workers on draft animal power and has also conducted a survey of local manufacturers and dealers. (In January 1996, ATNET adopted a new constitution under the name of the Tanzania Association for Draught Animal Power – TADAP).

### ***Ethiopian Network on Animal Traction, ENAT***

ENAT was established in 1994 at a major national workshop attended by 120 participants (including some ATNESA steering committee members). ENAT hopes to host the coming ATNESA donkey workshop, now likely to be held in 1997.

### ***Kenya Network for Draught Animal Technology, KENDAT***

National networking initiatives started in Kenya in 1991 and KENDAT was formally registered as a non-governmental organisation in 1993. The secretariat is based at the University of Nairobi where collar harnesses and other equipment have been developed. These are now distributed in association with KENDAT. KENDAT held its first national workshop in 1992 in collaboration with the Dutch-funded Animal Draft Power project of the University of Nairobi. KENDAT held its second national workshop in March 1995.

KENDAT has been represented at agricultural shows and has held field visits and demonstrations. KENDAT has produced resource materials on donkeys, manuals on design and construction of harnesses, donkey carts, manure spreaders and other equipment. Current University of Nairobi/KENDAT work includes research on tillage for soil and water conservation funded by SAREC of Sweden.

### ***South African Network on Animal Traction, SANAT***

SANAT was started at a national workshop held in May 1993, convened by the Development Bank of Southern Africa in cooperation with the University of Fort Hare. The SANAT secretariat is based at Fort Hare University. Three SANAT members attended the ATNESA 'Weeding with Animal Power' workshop in Tanga, Tanzania, in 1993. A national animal traction survey to determine the current status of animal traction was conducted during March-July 1994. A second national workshop was subsequently held in October 1994 to discuss the results of the survey. This resulted in the publication of the book *Animal traction in South Africa: empowering rural communities*. In February 1995, a workshop was held to train local and provincial animal traction coordinators. SANAT plans another workshop in March 1996 and will host the ATNESA workshop relating to conservation tillage and animal power the following year.



## Botswana

There is much interest in animal traction at Botswana College of Agriculture where several staff (who are ATNESA members) are carrying out animal traction research. Currently there is little national-level networking on draft animal power, but discussions have been held on the formation of a national network.

## Malawi

Although there is no formal animal traction network in Malawi, informal networking takes place. This was assisted by a national-level animal draft power project, supported by FAO.

## Mozambique

The recent improvement in the national security situation has allowed issues relating to animal traction in Mozambique to be tackled. The biggest problem appears to be the shortage of draft animals, following years of war. An animal traction training seminar was held in June 1995 supported by the Swedish University of Agricultural Sciences, in which several ATNESA members from other countries participated. The seminar generated many ideas and discussions, including proposals to form a national animal traction network. Staff of the Eduardo Mondlane University are keen to be involved in animal traction research and training.

## Namibia

Animal traction is a relatively new topic for the government services in Namibia, and there is much interest in the topic. While no formal network has been established, informal networking has been taking place, stimulated partly by this ATNESA workshop. Namibia is attempting to benefit from the experiences of neighbouring countries. Extension agents have been sent to Zimbabwe for training and a new curriculum for training extension agents on draft animal power is being developed within Namibia. Various animal draft implements have been purchased from Zimbabwe and distributed to extension centres. Demonstrations have been held on the use of the cultivator, especially for land preparation and weeding. Namibia is also developing support for blacksmiths.

## Sudan

Sudan has no formal network and although several people are interested in animal traction

topics, it is difficult to arrange national meetings or participate in international ones. Participatory methods have been used in promoting and improving donkey plows in Kebkabiya. In parts of the south there is interest in introducing animal traction technologies, but limited access to animals and logistical problems have delayed progress.

## Uganda

Many governmental and non-governmental organisations and projects in Uganda are working on draft animal power, although there is no formal animal traction network. Sponsorship is being sought to support a national workshop to accelerate the networking process.

## Zambia

Zambia has a long history of official involvement in animal draft power and there has been a national focus on draft animal power since 1985. Although there is no formal network, there is a national animal draft power coordinating programme and a national animal traction research and training centre has been established at Palabana. Palabana has produced many draft animal power publications including national surveys, research reports and workshop proceedings. Members of Zambia's animal draft power programme have visited Tanzania (Mbeya Oxenisation Project), Zimbabwe, Botswana and South Africa. There has been increased use of donkeys (partly as a result of recent droughts) and about 90 donkeys were recently purchased from Zimbabwe. During the workshop, members of the Palabana team demonstrated plowing and ripping using donkeys and the new Palabana planter. This conservation tillage equipment has been donated to KENDAT for testing and promotion with Kenyan farmers.

## Other networking resources

**AGROTEC (*Agricultural Operations Technology for Small Holders in East and Southern Africa*)** is a regional agricultural engineering and farming systems programme funded by the Swedish International Development Authority (SIDA) and implemented by FAO. Based in Zimbabwe it operates in Lesotho, Kenya, Tanzania, Uganda, Zambia and Zimbabwe. It has funded small agricultural engineering research programmes in the six countries, which are monitored by

regional reference groups. It has held regional training workshops and has produced training manuals, including ones on animal-drawn implements and transport. It was at an AGROTEC workshop in Harare that ATNESA was launched and AGROTEC has supported several ATNESA activities.

**CTA (Technical Centre for Agricultural and Rural Cooperation)**, financed by the European Community under the Lomé Convention with ACP (Africa, Caribbean and Pacific) countries is based in The Netherlands. It is actively involved in gathering and disseminating information relating to rural development in tropical Africa and elsewhere. Animal traction is an area of interest of CTA, which has co-sponsored several animal traction workshops in Africa, including this one. CTA has co-funded the publication of some animal traction proceedings including *Improving animal traction technology* and the forthcoming book on *Animal power for weed control*.

**CTVM (Centre for Tropical Veterinary Medicine)** of the University of Edinburgh is carrying out research on the nutritional and physiological implications of draft work, using cattle, buffaloes, horses and donkeys. Equipment had been developed that allows the measurement and logging of many factors associated with animal work. At CTVM, this equipment can be used with treadmills and climate chambers. Portable versions of the equipment have been used in the field in several countries. Several students from the region have undertaken higher degrees in collaboration with CTVM. CTVM publishes *Draught Animal News* twice a year and welcomes contributions from ATNESA members.

The **Commonwealth Secretariat** is aware that animal traction is important for women and men in Commonwealth countries. The Agriculture and Rural Development Division supported the formation of a **Network for Agricultural Mechanisation in Africa (NAMA)**, and it hopes there will be scope for valuable collaboration between NAMA and ATNESA. NAMA was formed in 1992 in Nairobi, Kenya. To date, its main activity has been to produce some newsletters which discuss agricultural mechanisation issues. These have been edited by Professor G C Mrema of the Botswana College of Agriculture.

**FAO, the Food and Agriculture Organization of the United Nations**, has for many years been supporting projects and initiatives in the region concerned with animal traction and with supporting services such as rural blacksmiths. Over the years, FAO has produced a variety of animal traction publications, including the recent *Draught animal power manual* available from its Animal Production Service.

**GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit)** has financed several projects in Africa undertaking research and development on animal traction. The **German Appropriate Technology Exchange (GATE)** is a specialised division of GTZ that has published several books relating to animal traction, and these are normally supplied free-of-charge to people working in developing countries.

**ILRI (International Livestock Research Institute)** is based in Nairobi and has a second major campus in Ethiopia which used to be the facilities of the former International Livestock Centre for Africa (ILCA). For ten years ILCA had been involved with animal traction in Africa, through research programmes, workshop and association with animal traction networks. A number of ILCA publications on animal traction are still available, through ILRI in Addis Ababa. ILRI continues a research interest in animal traction, with particular emphasis on the use of cows for work.

**IMAG-DLO** is an agricultural engineering and environmental institute based in The Netherlands. It has provided technical support to several animal traction programmes in Africa, notably in Zambia. It has assisted Zambian programmes in the production and distribution of several animal traction publications and videos.

**ITDG (Intermediate Technology Development Group)** is a British NGO involved with appropriate technology. Over the years, emphasis has moved away from the development of hardware prototypes to socially sensitive, participatory development initiatives, including animal traction projects in Sudan (reported at the workshop by S Croxton). Publications include the quarterly journal *Appropriate Technology*.

**IT Transport** is a British consultancy organisation affiliated to ITDG. It has carried out consultancies relating to animal-powered transport for many different development agencies. It helps to coordinate the International

Forum for Rural Transport and Development which publishes a newsletter. It assisted ATNESA in the holding of the workshop on animal-drawn carts and the production of the resulting publication.

**RELATA (*Red Latin Americana de Tracción Animal*)** is the new Latin American animal traction network whose formation was influenced by ATNESA. RELATA was launched during a workshop held in Managua, Nicaragua in November 1995. Hosted by Fomenta, the workshop was attended by 88 people from 12 countries. Fomenta is a Swiss-supported animal traction project which operates in El Salvador, Honduras and Nicaragua. One objective of RELATA will be to promote and strengthen links, information exchange and collaboration in animal traction research, extension, training, manufacture in the region. In the first instance, Fomenta will act as a secretariat for RELATA. Fomenta publishes a colour magazine *El Yuntero* (in Spanish), which is circulated in Central America and a RELATA newsletter could be included within this.

**Silsoe College** of Cranfield University is involved in teaching and research on agricultural engineering, including animal traction. Dr P Cowell has a research interest in the dynamics of animal traction (emphasis on the foot-ground interface). Professor F Inns has retired from the college but continues research on harnessing systems and donkey plows.

**Silsoe Research Institute** of UK has been working on animal traction topics for many years and has collaborated with many organisations in Africa and elsewhere. It developed instrumentation for measuring and logging many mechanical and physiological parameters associated with animal draft power. Recent emphasis has been on integrating engineering principles with environmental and socioeconomic research, notably in hill agriculture and semi-arid farming systems. It is cooperating with a multidisciplinary Zimbabwe research programme that includes aspects of donkey utilisation.

**The Southern and Eastern African Society of Agricultural Engineers (SEASAE)** was formed in 1993 with the aim of supporting activities of national societies of agricultural engineers. A

workshop on design, manufacture, testing, and standardisation (DMTS) of agricultural equipment was held in Naivasha with the help of AGROTEC where the need for a database on DMTS was identified. Workshop proceedings will be distributed soon. An international conference has been planned for October 1996 in Arusha, Tanzania. Information was circulated to all participants at the ATNESA workshop. SEASAE is inviting applications for membership from within and outside the region. Membership fees are US\$10 per year.

**The Swedish University of Agricultural Sciences (SUAS)** is based in Uppsala. It provides technical support services to several farming systems and agricultural engineering projects in the regional. Dr Girma Gebresenbet has been undertaking research at SUAS relating to animal-drawn plows, and has collaborated with the Universities of Nairobi and Eduardo Mondlane in the development of instrumentation.

The **Development Technology Unit (DTU)** of the **University of Warwick** in UK has carried out research and development work on the use of animal power to drive stationary machinery for water-lifting and crop processing. Currently it is undertaking research on bearings suitable for animal-drawn carts and methods of testing and evaluating these. At the workshop a cart was displayed that had been fabricated by Dr C Oram in a few hours from locally-available materials. The bearings were made from mild-steel rods, and information about these were provided in a poster and a paper. DTU would be interested to test and evaluate these technologies with partner organisations in Africa.

The **West Africa Animal Traction Network (WAATN)** was very active between 1985 and 1990 when it organised a series of animal traction workshops and published several books. WAATN was an important influence in the launch of ATNESA. However, it is currently relatively dormant due to problems with resources and centralisation. Informal networking contacts are still taking place in West African and there are plans to reactive the formal programme of the network.

# Papers prepared for the workshop

## ***Gender***

- Bwalya G M and Akombelwa M. Animal traction development and gender: experiences of the Western Province Animal Draught Power Programme.
- Ochido W O. Gender issues on draft animal technology: the Nyanza experience.
- Rwelamira J and Sylwander L. Gender and animal traction: a challenging perspective.
- Tangka F L. Gender and animal traction technology in eastern and southern Africa.

## ***Participatory methods***

- Croxtan S. "Users in control": farmer participation in technology research and development.
- Kwilligwa E, Rock J, Massunga M and Sizya M. Complementing formal knowledge with informal farmers' knowledge: case studies on sledges and ethnoveterinary medicine in Ileje district, southern highlands of Tanzania.
- van Leeuwen M. Towards privatisation in ADP extension in Zambia.
- McCrindle C M E and Moorosi L E. Extension methods to motivate the welfare of traction animals.
- Meinderts J H, Chibango M and Mwenda N. Dry-season crop residue feeding for improved draft power in Zambia.
- Mellis D, Matsaert H and Mwaniki B. Meeting the challenges of animal traction through participatory technology development: experiences from a semi-arid area of Kenya.
- Mukuka I. Challenges of animal draft technologies in north-western province of Zambia.
- Muvirimi F and Ellis-Jones J. A farming systems approach to improving draft animal power in sub-Saharan Africa.
- Mwanakulya R. Animal traction development in Iringa region, Tanzania: project approaches and future requirements.
- Roeleveld A C W, Wella E B and Ngendello A. Intensifying the use of animal power through participatory research: a brief overview of activities.
- Sutherland A. What is the problem? Challenges in diagnosing animal draft constraints and opportunities in Tharaka and Lower Embu, Kenya.
- Veikko I and Pitois C. The introduction of the cultivator in north Namibia: the reasons for hope.

## ***Environment***

- Blench R. Animal traction in Africa: environmental impact and sustainable production.
- Chelemu K and Nindi P C. Minimum tillage for soil and water conservation using animal draft power in Zambia.
- Havard M and le Thiec G. Animal traction in western Africa and Madagascar: influence of the environment on its development and use.
- Kilemwa A M. Animal traction: environmental impact and sustainable production systems: Rukwa status.
- Wakindiki I I C. Animal traction: a review of the environmental impact and sustainable soil productivity in Kenya.

## ***Transport and equipment***

- Chelemu K and Nindi P C. Minimum tillage for soil and water conservation using animal draft power in Zambia.
- Dennis R. Meeting the challenge of animal-based transport.
- Hanekom D. Donkey cart axles and harnessing material development in South Africa.
- Joubert B. The "Golovan" one-ox cart.
- Kumwenda W F. Design and manufacturing of a withers yoke for oxen and cows.
- van Leeuwen M and Siyambango N. Ox carts in Kaoma, Zambia.
- Mengistu Geza. Harnessing techniques and work performance of draft horses in Ethiopia.
- Mkomwa S and Shetto R M. The supply of animal drawn implements: a constraint to the widespread use of animal draft technology in Tanzania. Experiences of SEAZ Agricultural Equipment Ltd.
- Msagusa M. Improving animal drawn transport (Tanga region, Tanzania).
- Mutua J M and Cowell P A. Dynamic steering response of animal drawn plows.
- Ogwang V. Improving animal drawn transport.
- Oram C E. Low-cost animal cart developments.
- Shitanda D. Use of draft animal power for vegetable oil processing.
- le Thiec G and Havard M. Developing suitable yokes for draft oxen in sub-Saharan Africa.
- Veikko I and Pitois C. The introduction of the cultivator in north Namibia: the reasons for hope.

## ***Weeding***

- Masinde B K. Animal power for weed control: Lamu experience, Kenya.
- Muma A K. Promotion of ADP for weed control in Kaoma, Zambia.
- Ngendello A M, Wella E B and Roeleveld L. On-farm participatory research on ox-drawn weeding technology in Sukumaland, north-west Tanzania.
- Simalenga T E and Shetto R M. Animal power for weed control: experiences and challenges.

## ***Cows***

- Cole G O and Steinbach J. Comparative draft performance of oxen and heifers in northern Sierra Leone.
- Faifine O and Mustando A. Farmers' attitudes and perceptions about using cow traction in Chokwe, Mozambique.
- Singh S V and Upadhyay R C. Work induced changes in female lactating buffaloes during summer and winter seasons.
- Upadhyay R C and Singh S V. Working cows: role and future potential in India.
- Zerbini E, Alemu Gebre Wold and Shapiro B I. Development of cow traction technologies and implications for adoption in the East African highlands.

## ***Donkeys***

- Aganga A A and Seabo D. Current status of draft animal utilisation by small-scale farmers in Kgatleng and Kweneng districts of south-eastern Botswana.



- Aganga A A and Tsopito C M. Adoption and challenges of donkey power technology in Gabarone region of Botswana.
- Chisembele C. Pros and cons of quarantining donkeys and their use in Zambia.
- Doran J. Improving the use of donkeys for transport in Kajiado, Kenya.
- Ebangi A L, Vall E and Mbah D A. Characterisation of draft donkeys within the Sudan (cotton producing) zone of Cameroon.
- Hanekom D. Donkey cart axles and harnessing material development in South Africa.
- Inns F M, Shetto R M and Mkonwa S. Single donkey plowing: design basics and operation of a modern lightweight swing plow and associated harness.
- Jones P A. Work, sex and donkeys.
- Mrema M N J. The economics of the utilisation of donkeys in Botswana: the case of Kweneng and Kgatleng districts.
- Mrema M N J. Major constraints facing female farmers in owning and using of donkeys in Botswana.
- Mwakitwange G, Haule S, Massunga M and Sizya M. Donkeys in the southern highlands: their potential in agricultural production is yet to be exploited.
- Mwenya E. Donkey supply: experiences during importation of 89 donkeys into Zambia.
- Nengomasha E M, Jele N and Pearson R A. Phenotypic characteristics of working donkeys in western Zimbabwe.
- Pearson R A, Nengomasha E and Krecek R C. The challenges in using donkeys for work in Africa.
- Saul C, Siefert L and Opuda-Asibo J. Disease and health problems of donkeys in Kaptanya sub-county, Tingey county, Kapchorwa district in Uganda.
- Wells D and Krecek R C. Findings of a socio-economic questionnaire implemented in communities using donkeys in Hammanskraal, South Africa.
- Case histories**
- Aeschlimann M. Workhorses in Norway.
- Bangura A B. The effects of the on-going rebel war on animal traction in Sierra Leone.
- Birch-Thomsen T. Factors affecting the adoption pattern of animal traction in a period of changing market conditions: a case study from south-western Tanzania and northern Zambia.
- Daramola A G. Appropriate and sustainable technology in African agriculture: animal traction versus mechanised tractors in south-western Nigeria.
- Dibbits H J. The support of a survey in animal traction development: an example from Zambia.
- Fowler R. Animal draft power in South Africa: past, present and future.
- Francis J, Mudamburi B and Chikwanda B. Animal draft power challenges in Zimbabwe.
- Hesse J H and Runge-Metzger A. Bullock traction in a long term perspective: policy implications of a socio-economic panel study in northern Ghana.
- Kakwaba K and van Leeuwen M. Hiring and lending of ADP for plowing in Kaoma, Zambia.
- Karim-Sesay J A. Draft animal power potential and utilisation in the Tonota district of Botswana.
- Kaumbutho P G, Oudman L, Owende P M, Anyangu A, Makokha H, Mbuthia J and Misee-Meeuwissen E. Meeting the challenges to draft animal technologies in Kenya.
- von Keyserlingk A. The challenges of reintroducing animal traction in a post-war Mozambique using the example of Tete province.
- Langha K. Evolution of farming systems and the adoption and profitability of animal traction: a case study from the Savanna highlands of north-west Cameroon.
- van Leeuwen M. Towards privatisation in ADP extension in Zambia.
- Manyama N D. Trends of animal traction in the Lowveld region of the Northern province, South Africa.
- Mtunze R N and Lyimo M G. The development of animal traction in Tanzania in recent years.
- Mudamburi B, Chikwanda B and Francis J. Animal draft power training in Zimbabwe: experiences and future challenges.
- Mukumbuta W M. Constraints facing animal draft power technology in the northern province of Zambia.
- Mumbi M D. Recommendations towards integration of animal traction into the farming systems of northern Zambia.
- Mutali A. Challenges and constraints of animal traction in Luapula province, Zambia.
- Mwinjilo M L. Possible initiatives for increased utilisation of animal traction in Malawi.
- Nyugo A and Olupot J. The challenges of reviving cotton production in eastern Uganda: the animal traction perspective.
- del Rio A. Improving animal traction technology in Cuba.
- Sakala E A. The challenge of supply and distribution of ADP equipment and tools in Zambia.
- Sosovele H. The challenges of animal traction in Tanzania.
- de Toro A A and Nhantumbo A B. Statistical aspects of animal traction in Mozambique: results from a broad survey of subsistence and small-scale farmers.
- Tsimba R, Chawatama S, Ndlovu L R, Mutimba J, Ndlovu P, Dzama K, Topps J H, Hikwa D and Mudhara M. Socio-economic aspects in draft animal-crop linkages: a diagnostic study of Tsholotsho, Chinyika and Mutoko communal areas of Zimbabwe.

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