# Improving animal traction technology

Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA) held 18–23 January 1992, Lusaka, Zambia

Edited by

Paul Starkey, Emmanuel Mwenya and John Stares







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Wageningen, The Netherlands



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# Preface and acknowledgements

# Workshop organisation and support

This publication is the proceedings of the first ATNESA workshop which was held from 18 to 23 January 1992 in Lusaka, Zambia. The workshop was attended by 107 people from 17 countries. More than 80 papers relating to animal traction were submitted and these form the basis of this publication.

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

This first ATNESA workshop was made possible thanks to the workshop hosts and local organising committee which included representatives of the Zambian Department of Agriculture and several Zambian organisations, institutions and donorassisted projects involved with animal draft power. Cooperation between the local organisers and the international members of the ATNESA steering committee was exemplary. Members of the local committee who are to be thanked and congratulated included E Mwenya (Chair), M Bwalya, B Chanda, H Dibbits, H Drechsel, R Meijer, G Phiri, E Sakala, H Sichembe, M Tambatamba, H van Slooten and H Vroom, with further support provided by P Jabani, F Kruit and P Stevens.

Following planning discussions involving staff of the Royal Netherlands Embassy in Lusaka, the Directorate General for International Cooperation (DGIS) of The Netherlands provided the "core costs" of the workshop and made this publication possible. With sponsorship from DGIS, organisational support was provided by the Institute of Agricultural and Environmental Engineering (IMAG-DLO) of The Netherlands, notably by H Dibbits and A Wanders, and also by consultant P Starkey.

Many external and local workshop participants were sponsored by their own organisations or by agencies within their own countries. Such local assistance to participants from eastern and southern Africa was vital in allowing workshop attendance and the preparation of papers. This clearly demonstrated the user-supported nature of ATNESA.

The ATNESA Steering Committee would like to convey its thanks to all the local, national, regional and international organisations that supported

participants, directly and indirectly. In the papers published in these proceedings, the names of many of the organisations concerned are cited. Institutions outside the region that sent participants included the Commonwealth Secretariat, the Food and Agriculture Organization of the United Nations (FAO), Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the International Livestock Centre for Africa (ILCA), IMAG-DLO, Intermediate Technology Development Group, IT-Transport, Larenstein International Agricultural College, Silsoe Research Institute, Tool (an NGO based in The Netherlands), the Universities of Ahmadu Bello, Edinburgh, Hohenheim, Uppsala and Warwick and the West Africa Animal Traction Network.

Several participants were sponsored by the Technical Centre for Agricultural and Rural Cooperation (CTA), Ede-Wageningen, The Netherlands, by the International Development Research Centre (IDRC) of Canada and by DGIS. The assistance provided by these sponsors is gratefully acknowledged.

# Workshop reporting

Workshop plenary sessions and group discussions involved active participation of many people who acted as chairpersons, discussion leaders, group facilitators or rapporteurs. E Sakala was the Chief Rapporteur. The Steering Committee would like to thank him and the many people who contributed towards reports, including A Aganga, M Anderson, A Astatke, M Bwalya, B Chanda, S Chikura, B Chikwanda, R Connor, S Croxton, H Dibbits, K Dippon, J Doran, H Drechsel, D Dube, C Ekemu, J Ellis-Jones, F Emhardt, R Fischer, J Francis, A Galema, J de Graaf, M Guntz, J Hagmann, L Handia, H Helsloot, F Inns, J Jansen, P Jones, J Kahumbura, C Kalima, H Kamphuis, A Kayumbo, F Kruit, W Kumwenda, E Kwiligwa, C Löffler, M Lombe, P Maina, A Makwanda, K Marshall, R Meijer, R Mpande, F Mujemula, I Mukuka, A Muma, J Muthama, G Muwanga, E Mwenya, G Mwakitwange, W Mwenya, M Mwinjilo, H Ojirot, A Okuni, J Olukosi, J Omoding, G Oodally, C Oram, K Owen, A Panin, A Pearson, G Phiri, R Shetto, H Sichembe, C Sikanyika, T Simalenga, R Simuyi, L Singogo, M Sizya, H Sosovele, P Starkey, P Stevens, L Sylwander, A Tembo, H Vroom, A Wanders and H Zaugg.

# Proceedings preparation and editing

Support relating to the preparation, printing and distribution of these publication was provided by

DGIS, GTZ and CTA. The ATNESA Steering Committee and the editors of these proceedings extend their warm thanks to DGIS, IMAG-DLO, GTZ and CTA for all their assistance.

The members of the ATNESA Steering Committee would also like to thank the proceedings editors for the impressive amount of hard work that has been invested in this publication. The ATNESA Technical Adviser, Paul Starkey, has had overall responsibility for the editing and desktop publication of the proceedings. At the time of the workshop, Emmanuel Mwenya was chairperson of both the ATNESA Steering Committee and the Local Organising Committee which made the workshop possible. John Stares, a professional scientific and English language editor and Freda Miller, Research Fellow of the Centre for Agricultural Strategy of the University of Reading, provided additional editorial support. Malcolm Starkey assisted with desktop

publishing and the preparation of tables, illustrations and the index.

The ATNESA Steering Committee hopes that this volume of proceedings will be one of many valuable resource documents that will be produced by ATNESA and its member organisations in the coming years. These should help achieve the important ATNESA goal of better information exchange between all those involved in improving animal traction research, development, extension, policy formulation and actual use.

The ATNESA Steering Committee warming thanks everyone who has been involved in the planning, implementing and supporting of this workshop and the various follow-up ATNESA activities. The Steering Committee looks forward to further close collaboration with individual members, national animal traction networks, supporting organisations and other networks.

### The ATNESA Steering Committee

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# ATNESA: an introduction and update

### Introduction to ATNESA

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

The Network is coordinated by a Steering Committee comprising specialists from six African countries and representatives of two supporting organisations, together with invited resource persons. The committee plans, initiates, stimulates and facilitates a variety of networking events. The network has no full-time staff or secretariat and responsibility for implementing network activities is delegated to ATNESA members in different countries.

## First ATNESA workshop

The first ATNESA workshop was held on 18–23 January 1992 in Lusaka, Zambia. The workshop was attended by 107 people from 17 countries. Full details of this workshop are to be found in this publication, together with reports of the first two ATNESA General Assembly meetings at which the ATNESA statutes were agreed. An outline is also given of the work programme the Steering Committee adopted at the end of this workshop.

Since the first ATNESA workshop reported here, there has been much progress and several follow-up activities. Full details will be contained in future network proceedings and resource documents, but mention can be made here.

### National networks

National animal traction networks, affiliated to ATNESA, have been launched in Kenya, Tanzania, South Africa and Ethiopia, with national workshops attended by colleagues from other ATNESA countries. Elsewhere, for example in Zambia, Uganda, Malawi, Botswana and Zimbabwe, informal animal traction networking and some formal activities have been encouraged by ministry of agriculture, project, university or NGO structures. In several countries directories of those involved in animal traction have been prepared.

## Thematic workshops

At an international level, ATNESA has held three follow-up workshops on particular themes highlighted during the 1992 workshop.

Gender issues and animal traction was the subject of an ATNESA workshop held in Mbeya, Tanzania, in June 1992. 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.

Design, testing and manufacture of animal-drawn carts was the topic of a workshop held in January 1993 in Harare, Zimbabwe. The workshop, hosted by the Institute of Agricultural Engineering, was attended by 40 people from 10 countries. The participants reviewed successful and unsuccessful cart designs, and drew up guidelines for large-scale and artisanal cart manufacture. Recommendations were made relating to harnessing, standardised cart testing, credit provision and policy issues.

Animal power for weed control was the subject of an ATNESA workshop held in November 1993 in Tanga, Tanzania, in collaboration with the Animal Traction Network Tanzania (ATNET). It was attended by 64 people from 14 countries. The workshop provided an overview of national, regional and international experiences relating to animal-drawn weeding. Participants discussed weeding issues with farmers and assessed 20 weeding implements, pulled by oxen and donkeys. Multidisciplinary groups established guidelines on weeder design, testing, manufacture and distribution. Specific follow-up proposals covered extension programmes, collaborative testing and improved implement supply and logistical backup.

# Planned workshops

The ATNESA Steering Committee has plans to hold another focused thematic workshop on "Improving donkey utilisation and management". It is envisaged that this may be held in Ethiopia in 1995 or 1996 in collaboration with the Ethiopian Network for Animal Traction (ENAT). Planning is underway for the next broadly-based ATNESA workshop on the theme of "Meeting the challenges of animal traction". This is expected to be held in cooperation with the Kenya Network for Draught Animal Technology (KENDAT) in 1995.

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# Acronyms and abbreviations

ASCEAM Association Buro-Africaine des Centres de Machanisation Agricolic, Camerono and France ACIAR Australian Centre for International Agricultural Research, Australia CEGOT Comparing in ACIAR Drawght Animal Power Project, Townswille, Australia CEGOT Comparing in Acide and Agricultural Severation of the Reparations de Machanisme Agricole Topical, France CIAE Centre de Construction et de Réparations de Machanisme Agricole Topical, France CIAE Centre de Construction et de Réparations de Mafériel Agricole, Niger ADD Agricultural Development Bank ADD Agricultural Development Bank ADD Agricultural Development Marketing Corporation, Malawi ADP Animal Draft Power (Animal Draught Power) Animal Draft Power (Salouenty) Programme), Magoy, Cambia AES Agricultural Extension Department of Agricultural Extension				
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CBPP Contagious Bovine Pleuropneumonia FSRU Farming Systems Research Unit, Zimbabwe	ann-			
	CBPP	Contagious Bovine Pleuropneumonia	FSKU	rarming Systems Research Unit, Zimbabwe

FSSP	Farming Systems Support Project,	kN	kilonewton (unit of force approximately
	Gainesville, Florida, USA		equivalent to 100 kg weight)
FTC	Farmer Training Centre	kph	kilometres per hour
FTSS	Farmer Technical Service Station	KSDP	Kabwe Smallholder Development Project,
g	gram (unit of mass)		Zambia
GATE	German Appropriate Technology Exchange,	LENCO	Lusaka Engineering Company, Zambia
OMIL	GTZ, Germany	LIAC	Larenstein International Agricultural College,
GFA		2	Deventer, The Netherlands
UrA	Gesellschaft für Agrarprojekte mbH,	LPDP	•
	Hamburg, Germany	LFDF	Lokitaung Pastoral Development Project,
GNP	Gross national product		Kenya
GRZ	Government of the Republic of Zambia	m	metre
GTZ	Deutsche Gesellschaft für Technische	MAAIF	Ministry of Agriculture, Animal Industry and
	Zusammenarbeit GmbH, Germany		Fisheries
h	hour	MALD	Ministry of Agriculture and Livestock
ha	hectare		Development
HABITAT	United Nations Centre for Human Settlements	MATI	Ministry of Agriculture Training Institute
Hata	houe à traction asine (donkey cultivator)	MAWD	Ministry of Agriculture and Water
			Development
HIMA	Iringa Soil and Water Conservation Project	MAWRD	Ministry of Agriculture, Water and Rural
IAE	Institute of Agricultural Engineering,		Development Development
	Zimbabwe	MDM	Name of an engineering company based in
IAR	Institute of Agricultural Research, Ethiopia	MIDIM	Kitwe
IBRD	International Bank for Reconstruction and	N. arc	
	Development (World Bank), Washington	ME	metabolisable energy
	DC, USA	MEDA	Mennonite Economic Development
ICRISAT	International Crops Research Institute for the		Associates
remorn	Semi-Arid Tropics, India	MEIDA	Metal Engineering and Industrial
IDDC	•		Development Association
IDRC	International Development Research Centre,	MIFIPRO	Mixed Farming Improvement Project,
	Ottawa, Canada		Mwanga, Kilimanjaro, Tanzania
IEMVT	Institut d'Elevage et de Médecine Vétérinaire	MJ	megajoule (unit of energy or work)
	des Pays Tropicaux, France	mm	millimetre
IFAD	International Fund for Agricultural	MoA	Ministry of Agriculture
	Development, Rome, Italy		
IITA	International Institute of Tropical	MOP	Mbeya Oxenization Project, Tanzania
	Agriculture, Nigeria	MSc	Master of Science, university degree
ILCA	International Livestock Centre for Africa,	N	newton (unit of force approximately
ilen	Ethiopia		equivalent to 0.1 kg weight)
11.0	•	NALERP	National Agriculture and Livestock
ILO	International Labour Office (Organisation),		Extension and Rehabilitation Programme
	Switzerland	NAMA	Network for Agricultural Mechanisation in
IMAG-DLC	Instituut voor Mechanisatie, Arbeid en		Africa
	Gebouwen - Dienst Landbouwkundig	NATSC	National Animal Traction Steering
	Onderzoek (Institute of Agricultural		Committee
	Engineering), Wageningen, The Netherlands	NEI	Nederlands Economisch Instituut
IPI	Institute of Production Innovation,	14631	(Netherlands Economics Institute)
	University of Dar es Salaam, Tanzania	NGO	*
IRDP	Integrated Rural Development Programme	NGO	Non-governmental organisation
ISRA	Institut Sénégalais de Recherches Agricoles,	NIAE	National Institute of Agricultural
ISKA	Senegal		Engineering, UK (subsequently Silsoe
IT	~		Research Institute)
IT	Intermediate Technology	Nm	newton metre (unit of work or energy
-	Intermediate Technology Transport, UK		equivalent to 1 joule)
ITDG	Intermediate Technology Development	NORAD	Norwegian Agency for International
	Group, UK		Development
J	joule (unit of work or energy)	NRDC	National Resources Development College,
K	Kwacha currency		Lusaka, Zambia
KADICU	Kaoma District Cooperative Union	NRDP	National Rural Development Programme,
KAEC	Katapola Agricultural Engineering Centre		Malawi
KENDAT	Kenya Network for Draught Animal	NRI	Natural Resources Institute, Chatham, UK
	Technology, Nairobi, Kenya	NS	not significant
kg	kilogram	NUC	Njala University College, Sierra Leone
	kilogram force (unit of force approx.		North Western Cooperative Union
kgf	equivalent to 1 kg weight or 10 N)	NWCU	•
VIT		NWIRDP	North Western Integrated Rural
KIT	Koninklijk Instituut voor Tropen (Royal	0.411	Development Programme
	Tropical Institute), Amsterdam, The	OAU	Organization of African Unity
	Netherlands	ODA	Overseas Development Administration,
kJ	kilojoule (unit of work or energy)		London, United Kingdom
km	kilometre	P	probability

PAFSAT	Project for Promotion of Adapted Farming	SNV	A development and volunteer organisation
	Systems based on Animal Traction,		based in The Netherlands
	Cameroon	SUA	Sokoine University of Agriculture,
PARC	Pan-African Rinderpest Campaign		Morogoro, Tanzania
PCV	packed cell volume	SUAS	Swedish University of Agricultural Sciences,
PhD	Doctor of Philosophy, university degree		Uppsala, Sweden
PRIVAT	Projet participatif pour le renforcement des	t	tonne
	institutions villageoises pour le	TAMTU	Tanganyika/Tanzania Agricultural
	développement de l'agriculture à Tahoua, Niger		Machinery Testing Unit, Tanzania
PROPTA	Projet pour la Promotion de la Traction	TDAU	Technology Development Advisory Unit,
IKOLIA	Animale, Togo	mm to	University of Zambia, Lusaka
PTA	Preferential Trade Area (eastern and	TFNC	Tanzanian Food and Nutrition Centre, Dar es Salaam, Tanzania
	southern Africa)	TIDDED	
PV	bearing pressure in relation to the sliding	TIRDEP	Tanga Integrated Rural Development Programme, Tanga, Tanzania
	velocity between bearing and axle	TOOL	Technologie Overdracht OntwikkelinsLand,
PVC	polyvinyl chloride (synthetic material)	TOOL	The Netherlands
RDP BV	Name of a consultancy company based in	TSh	Tanzanian shilling
	The Netherlands	UAC	Uyole Agricultural Centre, Mbeya
RDP	Rural Development Project/Programme	UCOMA	Unité Construction Matériel Agricole, Niger
revs/min	revolutions per minute, rpm	UFI	Ubungo Farm Implements, Dar es Salaam,
RIIC	Rural Industries Innovation Centre, Botswana	011	Tanzania
RNAM	Regional Network for Agricultural	UK	United Kingdom (of Great Britain and
RRM	Machinery, Pasay City, Philippines rural roads maintenance		Northern Ireland)
RTC	Rural Technology Centres	UN	United Nations
RTDU	Rural Technology Development Unit, Kenya	UNDP	United Nations Development Programme,
RTPC	rural technology promotion centre		New York, USA
RTPD	Rural Technology Promotion Department,	UNECA	United Nations Economic Commission for
	Ethiopia		Africa, Addis Ababa, Ethiopia
s	second	UNICEF	United Nations Children's Fund, New York,
SACCAR	Southern African Centre for Cooperation in		USA
	Agricultural Research, Botswana	UNIDO	United Nations Industrial Development
SADCC	Southern Africa Development Coordination		Organization, Vienna, Austria
0 + ECD + D	Conference	UNIFEM	United Nations Development Fund for
SAFGRAD		T INTO A	Women, New York, USA
SAFIM	Development, Burkina Faso Southern African Farming Implements	UNZA UPROMA	University of Zambia, Lusaka Unité de Production de Matériel Agricole,
SALIM	Manufacturers, South Africa	UPROMA	Togo
SD	Standard deviation	US\$	United States dollar
SDP	Smallholder Development Project	USA	United States of America
SEMA	Secteur expérimental de modernisation	USAID	United States of America  United States Agency for International
	agricole, Senegal	COM	Development, Washington DC, USA
SFMP	Small Farm Mechanization Programme,	VAP	Village Agricultural Programme
	Nakuru, Kenya	VITA	Volunteers in Technical Assistance, USA
Siammco	Soroti Agricultural Implement Machinery	W	watt (unit of power)
a.p. 1	Manufacturing Company, Uganda	WAATN	West Africa Animal Traction Network
SIDA	Swedish International Development	WACU	West Acholi Cooperative Union Ltd, Uganda
SIDO	Authority, Stockholm, Sweden Small Industrial Development Organization	WADA	Wum Area Development Authority,
Siscoma	Société Industrielle Sénégalaise de		Cameroon
Biscomu	Constructions Mécaniques et de Matériels	WAFSRN	West African Farming Systems Research
	Agricoles, Senegal		Network
Sismar	Société Industrielle Sahélienne de	Z\$	Zimbabwe dollar
	Mécaniques, de Matériels Agricoles et de	ZAFFICO	Zambia Forestry and Forest Industries
	Représentations, Senegal	705	Corporation
SKF	Name of a multinational engineering and	ZCF	Zambia Cooperative Federation
CMECNA	bearing company, based in Sweden	7V	(FS: Financial Services Division) Zambian Kwacha
SMECMA	Société Malienne d'Etude et de Construction	ZK 77 <i>K</i>	Zamoian Kwacna Zana za Kilimo, Mbeya, Tanzania
	de Matériel Agricole, Mali	ZZK	Zana za Kinnio, wiocya, Tanzania

Photograph opposite
Participants at the First ATNESA Workshop, Lusaka, Zambia