

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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Paul Starkey, Emmanuel Mwenya and John Stares (editors)



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(ACP–EU Lome Convention)
Wageningen, The Netherlands



1994

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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 donor-assisted 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 Sicheмба, 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 Sicheмба, 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 warmly 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

Dr T E Simalenga, ATNESA Chair, *Tanzania*

Dr A A Aganga, *Botswana*

Ato Kebede Desta, *Ethiopia*

Mr Manfred Guntz, *GTZ, Germany*

Dr Pascal Kaumbutho, *Kenya*

Mr Emmanuel Mwenya, *Zambia*

Mr Raymond Nazare, *Zimbabwe*

Mr John Olupot, *Uganda*

Ms Lotta Sylwander, *AGROTEC, Zimbabwe*

Mr Paul Starkey, *Technical Adviser, UK*

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.

ATNESA Steering Committee Members and Network Contacts, 1994

Dr T E SIMALENGA (*ATNESA Chair*)
Training Officer, AGROTEC
PO Box BW 540, Borrowdale, Harare
ZIMBABWE

Tel: + 263-4-860009
Fax: + 263-4-860009
Tlx: 24668 UNDEV ZW

Dr (Mrs) Adeolu Ademitu AGANGA
Senior Lecturer
Department of Animal Health and Production
Botswana College of Agriculture,
Private Bag 0027, Gaborone, BOTSWANA

Tel: + 267-352381
Fax: + 267-314253
Tlx: 2752 SACCAR BD

Ato KEBEDE DESTA (*ENAT Secretariat*)
Agricultural Implements and Equipment Division
Rural Technology Promotion Department
Ministry of Agriculture
PO Box 7838, Addis Ababa, ETHIOPIA

Tel: + 251-1-513753
Fax: + 251-1-512345
Tlx: 21390 ET

Mr Emmanuel MWENYA
National Animal Draft Power Coordinator
Agricultural Engineering Section
Department of Agriculture
PO Box 50291, Lusaka, ZAMBIA

Tel: + 260-1-252824
Fax: + 260-1-262820
Tlx: 43950 ZA

Mr John OLUPOT
National Animal Traction Coordinator
Ministry of Agriculture
PO Box 102, Entebbe, UGANDA

Tel: + 256-42-20981
Fax: + 256-42-21047
Tlx: 61287 UG

Mr Manfred GUNTZ
GTZ Dep 421
Deutsche Gesellschaft für Technische Zusammenarbeit
D-65726 Eschborn, GERMANY

Tel: + 49-6196-791340
Fax: + 49-6196-797130
Tlx: 4075010 D

Ms Lotta SYLWANDER
Socio-Economist, AGROTEC
PO Box BW 540, Borrowdale, Harare
ZIMBABWE

Tel: + 263-4-860009
Fax: + 263-4-860009
Tlx: 24668 UNDEV ZW

ATNESA Technical Adviser
Mr Paul H STARKEY
Animal Traction Development
Oxgate, 64 Northcourt Avenue
Reading RG2 7HQ, UNITED KINGDOM

Tel: + 44-1734-872152
Fax: + 44-1734-314525
E-mail: P.H.Starkey@reading.ac.uk
Tlx: 94011615 OXEN G

Invited resource person (First ATNESA Chair)
Mr Raymond NAZARE
Chief Agricultural Engineer
Agritex Institute of Agricultural Engineering
PO Box 330, Borrowdale, Harare
ZIMBABWE

Tel: + 263-4-725936
Fax: + 263-4-725342
Tlx: 22455 ZW

Invited resource person (KENDAT Chair)
Dr Pascal KAUMBUTHO, Chair,
Kenya Network for Draught Animal Technology
(KENDAT)
Department of Agricultural Engineering
University of Nairobi
PO Box 30197, Nairobi, KENYA

Tel: + 254-2-593465
Fax: + 254-2-593465

SANAT contact
Mr A B D JOUBERT
Secretary, South Africa Network on Animal Traction
(SANAT)
Faculty of Agriculture, University of Fort Hare
Private Bag X1314 Alice, Ciskei
SOUTH AFRICA

Tel: + 27-404-22085
Fax: + 27-404-31730

ATNET contact
Animal Traction Network Tanzania (ATNET) Secretariat
Department of Agricultural Engineering
Sokoine University of Agriculture
PO Box 3003, Morogoro, TANZANIA

Tel: + 255-56-3259
Fax: + 255-56-3599
Tlx: 55308 UNIVMOG TZ

Acronyms and abbreviations

ACEMA	Association Euro-Africaine des Centres de Mécanisation Agricole, Cameroon and France	CEEMAT	Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, France
ACIAR	Australian Centre for International Agricultural Research, Australia	CFA	West African franc
ACIAR-DAP	ACIAR Draught Animal Power Project, Townsville, Australia	CGOT	Compagnie générale des oléagineux tropicaux, France
ACP	Africa, Caribbean and Pacific	CIAE	Central Institute of Agricultural Engineering, Bhopal, India
ACREMA	Atelier de Construction et de Réparations de Matériel Agricole, Niger	CIDA	Canadian International Development Agency, Hull, Quebec, Canada
ADB	African Development Bank	CIDARC	Centre d'Information et de Documentation en Agronomie des Régions Chaudes, Montpellier, France
ADD	Agricultural Development Division	CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico
ADMARC	Agricultural Development and Marketing Corporation, Malawi	CIPEA	Centre International pour l'Elevage en Afrique (ILCA), Ethiopia
ADP	Animal Draft Power (Animal Draught Power)	CIRAD	Centre de coopération internationale en recherche agronomique pour le développement, France
ADPRDP	Animal Draft Power Research and Development Project (subsequently Programme), Magoye, Zambia	cm	centimetre (unit of length)
AED	Agricultural Extension Department	CMA	Christian Mission Aid, Kenya
AES	Agricultural Engineering Section, Department of Agriculture	CMDT	Compagnie Malienne pour le Développement des Textiles, Mali
AETC	Agricultural Engineering Training Centre, Zimbabwe	CMG	crushed maize grain
AFRC	Agriculture and Food Research Council, UK. AFRC-Engineering: AFRC Institute of Engineering Research (formerly NIAE, now Silsoe Research Institute), Silsoe, UK	ConTil	Conservation Tillage for Sustainable Crop Production Systems Project, Zimbabwe
AFVP	Association Française des Volontaires du Progrès, France	COOPIBO	Coopération au Développement Ibo, Belgium (NGO)
AGROTEC	Agricultural Operations Technology for Small Holders in East and Southern Africa, Zimbabwe	CTA	Technical Centre for Agriculture and Rural Cooperation, The Netherlands
AGS	Agricultural Services Division of FAO, Italy	CTVM	Centre for Tropical Veterinary Medicine, Edinburgh, UK
AIRIC	Agricultural Implement Research and Improvement Centre, Nazareth, Ethiopia	CUSA	Credit Union and Savings Association
ALDEP	Arable Lands Development Programme, Botswana	DANIDA	Danish International Development Agency
AMRDU	Agricultural Machinery Research and Development Unit, Zambia	DAP	draft (or draught) animal power
APTP	Animal Power Technology Project (GATE/GTZ regional project)	DGIS	Directorate General for Development Cooperation, Ministry of Foreign Affairs, The Hague
ARAP	Accelerated Rainfed Arable Programme, Botswana	DM	dry matter
ARDU	Arsi Rural Development Unit, Ethiopia	dN	decanewton (unit of force approximately equivalent to 1 kg weight)
ARMA	Cellule de l'Artisanat Rural et Machinisme Agricole, Niger	DRP	Drought Relief Programme, Botswana
ARNAB	African Research Network for Agricultural Byproducts, Addis Ababa, Ethiopia	DVTCS	Department of Veterinary and Tsetse Control Services
AT	animal traction; appropriate technology	EC	European Community
ATIP	Agricultural Technology Improvement Project, Botswana	ECF	East Coast Fever
ATNESA	Animal Traction Network for Eastern and Southern Africa	ETSP	Extension Training Support Programme, Zambia
ATNET	Animal Traction Network Tanzania	ENDA	Environment and Development in the Third World (international NGO)
ATOL	Aangepaste Technologie Ontwikkelingslanden, Leuven, Belgium	FAO	Food and Agriculture Organization of the United Nations, Rome, Italy
BBF	Broad-bed and furrow (system of cultivation)	FCFA	West African franc
BDPA	Bureau pour le Développement de la Production Agricole, France	FFW	Food for Work
BTC	Botswana Technology Centre, Botswana	FINNIDA	Finnish International Development Agency, Finland
Camartec	Centre for Agricultural Mechanization and Rural Technology, Tanzania	FIT	Farm Implements and Tools Project, The Netherlands
CBPP	Contagious Bovine Pleuropneumonia	FMDU	Farm Machinery Development Unit, Botswana
		FMU	Farm Machinery Unit, Malawi
		FSR	Farming Systems Research
		FSRU	Farming Systems Research Unit, Zimbabwe

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

Acronyms and abbreviations

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

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