Improving animal traction technology


Edited by
Paul Starkey, Emmanuel Mwenya and John Stares

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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 Dreichsel, 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


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 warm 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.

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Mr John Olupot, Uganda
Ms Lotta Sylvander, AGROTEC, Zimbabwe
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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.

"Improving animal traction technology"
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### Acronyms and abbreviations

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

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

*Photograph opposite*
Participants at the First ATNESAs Workshop, Lusaka, Zambia

"Improving animal traction technology"