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Animal Traction: An Annotated Bibliographic Database

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International Livestock Centre for Africa

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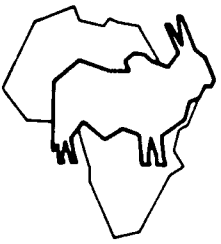

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CONTENTS

Introduction v
Acknowledgements viii
Obtaining copies of documents ix
Information on the computer database x
Bibliographic index 1
General works 1
Draft animals in farming systems around the world 20
Activities of research and development projects 52
Economic studies of animal traction 83
Social implications of animal traction 93
Management and training of draft animals 96
The health and husbandry of draft animals 102
Breeding of draft animals 105
Use of female draft animals 107
Nutrition and feeding of draft animals 109
Physiology of work and energy expenditure 116
Power output and draft forces 121
Harnessing systems and yokes 127
Transport and packing 132
Implements and equipment 137
Field operations 165
Water-raising systems and animal-powered gears 171
Animal power in forestry 175
Subject index 179
Author index 185
Country index 195
List of acronyms and abbreviations 199

INTRODUCTION

Animal traction is an important technology that is growing in importance in sub-Saharan Africa. For this reason it has been selected as one of the research thrusts of the International Livestock Centre for Africa (ILCA).

In 1983, ILCA published its first animal traction bibliography (Goe M.R. and Michael Hailu, 1983. Animal traction: A selected bibliography). At the time, it was the most comprehensive bibliography available on the subject. However, as information exchange relating to animal traction improved during the 1980s, there was an increase in the number of documents known to exist on the subject. Furthermore, an increasing number of new reports and scientific papers relating to animal traction were being produced. There was a clear need to produce a new animal traction bibliography. Moreover, it was felt that a new bibliography should have annotations, to provide more guidance on the content and level of documents, than can be gathered from their titles. Finally, it was intended to present the information not only as a printed book, but also as a computer database that could be used by the increasing number of research organizations in Africa that have desktop computers.

Planning the new animal traction bibliography and database started in 1986, and most data were entered in 1988 and 1989, both in Addis Ababa and in Reading. The main bibliographical database at ILCA is kept on a mainframe computer, using the program "MINISIS" While this is a powerful database program, it is only used by a few information centres in Africa. A breakthrough in the spread of bibliographic databases came in 1986, when the United Nations Educational, Scientific and Cultural Organization (UNESCO) issued a bibliographic database program called "CDS-ISIS" that could be used on ordinary "IBM compatible" desktop personal computers. This program was issued without charge to appropriate organizations in countries affiliated to UNESCO, and was therefore affordable by the increasing number of research organizations in Africa that were using personal computers. Since data could be easily transferred between MINISIS and CDS-ISIS, the CDS-ISIS program was considered very suitable for disseminating the new animal traction database. The compatibility is such that approximately half the entries in the current animal traction database were entered in Reading using CDS-ISIS and half were entered into the mainframe version in Addis Ababa. In the course of preparation, data were often transferred between the different programs. Further information on the CDS-ISIS database is provided in a following section.

The documents included in this bibliography and database originated from a variety of sources, but all are now available as "hard copies" and/or microfiches in the ILCA Library. A large number of both published and unpublished documents came from the collection built up over recent years by Paul Starkey (specialist in animal traction and an ILCA consultant). Copies of all these documents have been supplied to the ILCA library. Similarly, documents collected by Michael Goe (formerly an animal scientist at ILCA) have been provided to the ILCA Library. The Albert R. Mann Library of Cornell University, USA, assisted ILCA by carrying out a literature search from its databases and by providing photocopies of some papers. Many other documents have been obtained by the ILCA Library from numerous different sources over the past 15 years.

In order to keep this document and database manageable, efforts have been made to reduce unnecessary duplication. Thus, when documents are known to be available in more than one language, only one entry has been made, based on the English language edition. In this entry it is indicated that other language versions are available, through the use of bold-type-language abbreviations at the end of the citation. These may be followed by italic abbreviations indicating the language of summaries. Thus **En, Fr** indicates a publication available in both English and French, while **De** (En, Fr) indicates a German-language publication with English and French summaries. In this way it should be possible to use the English publication details to trace similar documents in the other languages. Whenever practicable, the exact titles of French editions are stated and the ISBN/ISSN are provided.

There are some cases where similar or identical papers have been published by the same authors in more than one source. In cases where there is one main, easily accessible, definitive version, that one has been included, and the other(s) left out. However, in cases where a long report has been edited into a journal article of the same title, both have been included, so people requiring more detailed information may trace the original document. In cases where one paper has been edited in different ways, or where different people would find one or other of the alternatives easier to trace, separate entries have been maintained.

Within individual document entries, the publication details have been presented in a form compatible with the ILCA system of reference citations (author, date, source and publisher, page numbers and languages). In this way it is intended to make it easy for researchers to cite references in the ILCA standard form simply by copying out the information presented here. Those obtaining the database in CDS-ISIS format will be able to import an ASCII file with relevant references directly into their wordprocessors. In using the bibliographic citations as references, most of the publication details should be included in the order given, but some details (such as translated titles, numbers of figures and tables, and ISBN/ISSN) and the abstract can be excluded. Anonymous publications are listed here as "Anon." for clarity, but when citing such references, it may be preferable to consider the publishing organization as an author.

This present bibliographic database is not the only initiative to improve animal traction information exchange through the production of bibliographies. The French organization CIRAD (Centre de coopération internationale en recherche agronomique pour le développement) is also active in this area, and is publishing a series of three animal traction bibliographies in cooperation with CTA (Technical Centre for Agricultural and Rural Cooperation, The Netherlands). The compilers of this present bibliography have been in close contact with the compilers of the CIRAD/CTA bibliographies, and consider the initiatives to be complementary. This database has been prepared in English, while that of CIRAD is in the French language. Although some documents are cited in both the ILCA and the CIRAD/CTA publications, the CIRAD initiative has concentrated on French language publications. There are presently no plans to make the CIRAD database available in CDS-ISIS format, but the CIRAD documentalists have kindly agreed that entries from their bibliographies may be translated for inclusion in the ILCA database. While no CIRAD abstracts were included in this present edition, it is possible that these could be included in future editions or supplements.

It is intended to update the animal traction bibliographic database regularly, and, subject to the availability of resources, annual supplements may be produced, both in printed form and on diskette. A full update is envisaged after five years. For this reason, the compilers would welcome being informed of any errors in this edition, so that these may be corrected in

future editions. Furthermore, they would welcome copies of any documents relating to animal traction that were not included in this edition, for possible inclusion in the supplements and subsequent edition. Copies of documents may be sent to the Librarian at ILCA and/or to Paul Starkey at the Centre for Agricultural Strategy, University of Reading RG6 2AT, UK.

Paul Starkey, Sirak Teklu and Michael R. Goe

March 1991

ACKNOWLEDGEMENTS

The publication of this book and database was made possible by the work of the Training and Information Department of ILCA, under the leadership of Dr. Michael Smalley (and formerly Michael Hailu).

Particular thanks are due to the Head of the Information Processing Unit, Marcos Sahlu, who, from the outset, was involved in coordinating and overseeing the various aspects of the work.

Thanks are also due to Getachew Bulfeta, who was responsible for transforming data between ILCA's mainframe computer and the CDS-ISIS format used on personal computers.

Appreciation also goes to ILCA's Librarian, Woizero Azeb Abraham, and her team for coping with the large number of documents involved, and for overseeing the important work of the microfiching unit.

Great appreciation is due to the many colleagues and organizations who provided the numerous documents on which this bibliography is based, whether they were initially provided to Paul Starkey, to Michael Goe, or to the ILCA Library.

A large number of the entries and abstracts were prepared by Mrs. Freda Miller, of the Centre for Agricultural Strategy, of the University of Reading, and particular thanks go to her for her hard work, and to the Centre for Agricultural Strategy for releasing her to undertake this work. Appreciation is also due to Malcolm Starkey for his assistance with data entry.

Finally acknowledgement is made to the whole team of ILCA indexers and cataloguers who are responsible for preparing the inputs into the main ILCA bibliographic database (of which animal traction forms one subset).

OBTAINING COPIES OF DOCUMENTS

The documents cited in this bibliography are available on microfiche, and copies may be requested from the ILCA Library, at the address given below. Microfiches are an economical way of reproducing and transmitting documents, and machines that allow people to read microfiches are increasingly available in libraries throughout the world. For people requiring "hard copies" of documents, a maximum of 30 photocopied pages may be requested from the ILCA Library.

The Library
International Livestock Centre for Africa
P.O. Box 5689
Addis Ababa
Ethiopia.

INFORMATION ON THE COMPUTER DATABASE

For organizations using the CDS-ISIS program, this bibliography is available from ILCA on "IBM-compatible" computer diskettes. Those requesting the bibliography on diskette are asked to specify which type of diskette they require (360kb or 1.2Mb 5.25" diskettes; 720kb or 1.4Mb 3.5" diskettes). They should also specify which version of CDS-ISIS they are using (the database is available in formats compatible with either the original version 1, or the upgraded version 2.3 which was issued in 1989). The CDS-ISIS program and all associated files occupy about 500 kb of hard disk space. The animal traction database masterfile occupies about 2Mb of hard disk space, and an extra 1Mb of hard disk space is required to store the "link" and "inverted" files that allow rapid searches from several different fields, giving a total of 3.5 Mb of hard disk space for the program, database and link files. A simple manual has been prepared to explain how to install and use the animal traction database.

Organizations carrying out work on animal traction that do not yet make use of bibliographic databases, may wish to obtain a copy of the CDS-ISIS program, so that they may make use of this animal traction database. When correctly installed on an IBM-compatible computer with a hard disk, CDS-ISIS allows researchers to search for a wide variety of information, such as subjects, key words, titles, authors and countries either separately or in various combinations. For example, a search of the word "harness" on the present database will yield 85 references, while a search of the word "buffalo" will yield 76 references. Combining a search of "harness" and "buffalo" will provide five references relating to the harnessing of buffaloes. Similarly, there are 258 references using the word "power" in the title, or as a keyword, and 30 using the word "cow". A search for both words will rapidly identify six references that are concerned with the working power of cows (and also the effect of draft work on bovine reproduction). When the database is correctly installed, such searches are almost instantaneous, and the full references, together with the abstracts can be immediately displayed on the screen. Alternatively, they may be sent to a printer or output as a file that can be edited within a word-processing program. Sufficient information is displayed on the screen or in the output, to allow the original documents to be traced, and their ILCA reference numbers are provided to facilitate requests for microfiche copies.

Copies of the CDS-ISIS program, which is needed to access the animal traction database, may be requested from UNESCO in Paris. Organizations in Africa and international agricultural research centres may request copies from the Internationai Council for Research in Agroforestry (ICRAF), in Nairobi. The addresses are given below. UNESCO holds the copyright for the CDS-ISIS program, and users will be asked to sign a licensing agreement. Depending on the organization requesting the program, and the policies prevailing at the time of request, a small charge may be imposed to cover costs of distributing CDS-ISIS (materials, handling etc.), but the issue of cost should not discourage organizations interested in CDS-ISIS from making enquiries to the suppliers. The program comes with a detailed manual.

Addresses:

For obtaining the CDS-ISIS program needed to run the animal traction database:

International Council for Research in
Agroforestry (ICRAF), ICRAF House
P.O. Box 30677, Nairobi, Kenya
(Telex 22048; Fax 52-10-01)

United Nations Educational, Scientific and
CulturalOrganization (UNESCO)
Paris, France.

For obtaining the animal traction database:

Library and Documentation Service
International Livestock Centre for Africa
P.O. Box 5689, Addis Ababa, Ethiopia.
(Telex 21207 ILCA ET; Fax (251-1) 61-18-92)

BIBLIOGRAPHIC INDEX

GENERAL WORKS

0001 Alexandratos, N.; Bruinsma, J.; Hrabovszky, J. 1982. **Power inputs from labour, draught animals and machines in the agriculture of the developing countries.**
European Review of Agricultural Economics (Netherlands), v. 9, p. 127–155, 7 fig., 5 tables; 10 ref., ISSN 0165–1587. **En** (En)
☐*Describes a model developed and used to estimate power input requirements by source for increasing agricultural production in 90 developing countries. Defines production increases for 28 crops each grown in one or more of six classes of rainfed and irrigated land at specified yield levels. Concludes that mechanization should advance most rapidly in higher-income developing countries (Latin America, Near East) and that in all regions animal traction would be replaced by machinery.*
Mic.No: 80175

0002 Anderson, F.M. 1982. **Annex C3. Draught animal power in Africa: An overview.**
FAO, Rome (Italy). In: Report of the Expert Consultation on appropriate use of animal energy in agriculture in Africa and in Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982, 6p. **En**
☐*Reviews the existing situation regarding DAP in Africa and constraints to its future development. Concludes that while past efforts to develop DAP in Africa have had limited success, the proper design and execution of new DAP-related technologies can contribute to increased farm production and improvements in the quality of life of the farmer.*
Mic.No: 80875

0003 Anderson, F.M. 1985. **Draught animal power systems in sub-Saharan Africa: Their production impact and research needs.**
ACIAR, Canberra (Australia). In: Draught animal power for production, ACIAR Workshop on Draught Animal Power for Production, Townsville (Australia), 16p., 3 ref. **En**
☐*Discusses the main effects of draft animal power on agricultural production, analyzing effects on labour use, area cultivated, crop yield and crop mix; describes draft oxen breeds used in Africa and major supply sources of oxen; and outlines problems of access to credit for the purchase of draft implements and technology, and draft animal power (DAP) needs.*
Mic.No: 35218

0004 Anderson, F.M.; Wilson, R.T. 1985. **On-farm experiments with ruminant animals.**
In: Crop and livestock production research for communal areas. Review of past relevant research and 1984/85 on-farm research programme, Farming Systems Research Meeting, Harare (Zimbabwe), 24–26 Sep 1984. Zimbabwe Agricultural Journal – Special Report, no. 1, p. 53–57 **En**
☐*Discusses the need for, problems and focus of on-farm experiments with livestock, outlining specific requirements related to forage production, draft animal utilization, animal nutrition, byproduct utilization, production of cattle and small ruminants and farm energy production and use.*
Mic.No: 67829

0005 Anderson, F.M.; Abiye Astatke. 1985. **Pond excavation using oxen-drawn scoops in rural Ethiopia: The experience of two peasants associations in the Debre Berhan area.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 12p., 4 tables; ref. **En**
☐*Reports on the excavation of ponds using oxen-drawn scoops in the Debre Berhan area of Ethiopia by the farmers of peasants' associations. Discusses the principal objective of the proposed work with oxen-drawn scoops in the peasants' associations and determines the suitability of the technology for use by farmers, technical performance rates of the scoops under farm conditions, and organizational and other factors. Summarizes the overall programme and gives suggestions regarding a national programme of pond excavation using draft oxen.*
Mic.No: 85117

0006 Anon. 1972. **Manual on the employment of draught animals in agriculture.**
FAO, Rome (Italy), 244p., 8 plates, 174 illus., 4 tables; 57 ref. **En**
☐*Presents guidelines on the use of draft animals for agricultural development in tropical Africa, mentioning available species and breeds; choice and management of animals; animal-drawn implements for different agricultural operations; the role of rural artisans in the manufacture, maintenance and repair of the implements; and the economic*

aspect of agricultural mechanization. Includes appendices indicating a simple method of calculating the cost of using draft animals in tropical countries.
Mic.No: 00111

0007 Anon. 1974. **Aide-mémoire du moniteur de culture attelée. (Notes on animal traction)**
Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France); France. Ministère de la Coopération, 197p., illus. **Fr**
☐*This expanded version of a publication originally produced to meet the needs of workers in Niger but now adapted for wider use contains sections on draft animals (traditional use in tropical Africa and Madagascar, feeding, training, health and yokes and harnesses), animal draft equipment and its uses, maintenance of equipment and engineering aspects and organization of training programmes.*
Mic.No: 80877

0008 Anon. 1975. **Manuel de culture avec traction animale. Techniques rurales en Afrique. (Manual for cultivation with animal traction. Rural techniques in Africa)**
Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France); Institut d'Elevage et de Médecine Véterinaire des Pays Tropicaux, Maisons-Alfort (France); France. Ministère de la Coopération, 336p., 180 fig.; 50 ref. **Fr**
☐*An introduction covering the history and present state of animal traction in tropical Africa and Madagascar and its place in agriculture as a whole and discussing reasons for not passing directly from hand cultivation to mechanization, is followed by sections on draft animals (species and races, choice of animal, health, weight of equipment, training, housing, feeding, manure production and harnessing), animal draft equipment, water-lifting, rural craftsmen and their role in maintaining and improving animal draft equipment and economic aspects.*
Mic.No: 80907

0009 Anon. 1977. **Report of the rural technology meet for East, West, central and southern Africa.**
Commonwealth Secretariat, London (UK). Rural Technology Meet for East, Central and Southern Africa, Arusha (Tanzania), 29 Aug–9 Sep 1977, 114p., fig.; ref. **En**
☐*Proceedings of a meeting organized by the Commonwealth Secretariat in collaboration with the Tanzanian Government at which 85 delegates from 14 countries discussed the appropriate technology for agriculture and rural industry in developing countries. Over 100 implements manufactured or in participating countries were tested and discussed.*
Mic.No: 80844

0010 Anon. 1978. **Manual on the employment of draught animals in agriculture.**
FAO, Rome (Italy); Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France), 261p., ISBN 92-5-100458-7 **En**
☐*Describes characteristics of bovidae and equidae used as draft animals, with particular reference to their pathology, feeding, working power, training and harnessing; reviews agricultural operations including land preparation, plowing, sowing, harvesting and transportation for which working animals can be employed. Also reviews criteria for the organization of rural handicraft for the manufacture, maintenance and repair of animal-drawn farm implements and harnesses. Discusses economic aspects of the use of working animals in tropical agriculture including comparative analysis of costs and returns and cost estimate methods.*
Mic.No: 80708

0011 Anon. 1979. **Report of the West Africa Rural Technology Meeting.**
Commonwealth Secretariat, London (UK). West Africa Rural Technology Meeting, Yundum (Gambia), 14–22 May 1979, 111p., fig., tables; ref. **En**
☐*Contains a background paper on the Rural Technology Programme of the Food Production and Rural Development Division of the Commonwealth Secretariat, summaries of appropriate technology work carried out in West Africa and invited lead papers on aspects of implementation of rural technology programmes.*
Mic.No: 80845

0012 Anon. 1981. **The water buffalo: New prospects for an underutilized animal.**
National Academy Press. Washington, D.C. (USA), 116p., 56 photographs, 6 tables; 200 ref. **En**
☐*Presents information on the water buffalo, with reference to carcass characteristics and meat quality, milk yield and composition, possibility of using it as a work animal, its adaptability and heat tolerance, nutrition in relation to growth rate, efficiency of digestion and feed preferences, reactions to some specific diseases and parasites, reproductive traits, management aspects, and effects of wallowing and grazing habits on the environment. Includes recommendations for further research.*
Mic.No: 30054

0013 Anon. 1981. **Substantive preparations for the conference report**

of the ad hoc working group on draught animal power.
UN, New York (USA), 66p., 12 fig., 3 tables; numerous ref. **En**
☐*Reports findings of an ad hoc working group on draft animal power (DAP), showing its importance for agricultural development and identifying problems. Evaluates the economic and social impact of introducing DAP, especially on employment opportunities, savings, crop yield and pressure on land. Presents recommendations for the design, development, testing and research work on agricultural implements for draft animal power, animal-drawn vehicles, harnesses and hitching devices, breeding programmes, draft animal management and other related projects, particularly in developing countries.*
Mic.No: 18374

0014 Anon. 1981. **Animal traction in sub-Saharan Africa. (Utilisation de la traction animale en Afrique au Sud du Sahara)**
ILCA, Addis Ababa (Ethiopia). ILCA Bulletin(Bulletin du CIPEA), no. 14, 18p., 3 fig., 20 tables; 29 ref. **En, Fr**
☐*Discusses the use of animal traction for agriculture in sub-Saharan Africa, evaluating its actual and prospective contribution, bio-climatic, traditional and historical factors influencing ways in which animal traction is used and constraints arising from the characteristics of local breeds, equipment, feed resources, farmers' attitudes, as well as management and financing. Assesses effects of development efforts on productivity, farm income and overall economic development.*
Mic.No: S-49 No. 14

0015 Anon. 1982. **National seminar on draught animal power system in India. Seminar papers. Vol. I & II.**
Indian Inst. of Management, Bangalore. National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, v.p., 65 fig., 203 tables; 268 ref. **En**
☐*Presents a collection of seminar papers on various issues related to the use of draft animal power in India, particularly on the draft capacity of various types of animals, availability of bovine feed, nutritional status and utilization of working bullocks in some parts of the country, and performance of animal-drawn vehicles and harnesses as well as animal-powered implements and equipment.*
Mic.No: 30073

0016 Anon. 1982. **Report of the FAO expert consultation on appropriate use of animal energy in agriculture in Africa and Asia. (Rapport de la Consultation d'Experts de la FAO sur l'utilisation rationnelle de l'énergie animale en agriculture en Afrique et en Asie)**
FAO, Rome (Italy). FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982, 44p. **En, Fr**
☐*Presents the report of an FAO Expert Consultation on the use of draft animals in Africa and Asia, with particular reference to the management and utilization of draft animals, viz cattle, buffaloes, yaks, camels and equines; and the improvement of draft quality of animals through breeding, nutrition, health care and the manufacture of efficient equipment for working animals. Includes recommendations on the appropriate use of draft power in rural development.*
Mic.No: 31225

0017 Anon. 1982. **Workshop on water buffalo research in Sri Lanka, November 24–28, 1980. Recommendations and abstracts.**
Swedish Agency for Research Cooperation with Developing Countries, Stockholm. Workshop on Water Buffalo Research in Sri Lanka, Peradeniya (Sri Lanka), 24–28 Nov 1980. SAREC Report (Sweden), 40p., ISSN 0348–2626. **En**
☐*Summarizes papers presented at a workshop on buffaloes, particularly regarding management, utilization, socio-economic aspects, nutrition, environmental physiology, reproduction and health. Includes recommendations adopted by the workshop on future research.*
Mic.No: 30542

0018 Anon. 1983. **Renewable sources of energy. Volume V. Draught animal power.**
FAO, Rome (Italy); UN, Bangkok (Thailand). Economic and Social Commission for Asia and the Pacific, 116p., 28 ref. **En**
☐*Examines the use of and constraints to draft animal power (DAP), the prospects for its modernization and the current state of the art in selected member countries of the Economic and Social Commision for Asia and the Pacific; outlines the scope for cooperation among developing countries and survey findings on DAP institutions in ESCAP countries.*
Mic.No: 86964

0019 Anon. 1984. **Draught Animal News, no. 2.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine, 14p., 1 table, 4 photographs; ref. **En**
☐*Briefly summarizes draft animal research at the Centre for Tropical Veterinary Medicine, Edinburgh (UK) (food intake by draft animals, energy costs of carrying loads, heat dissipation by working animals and influence of work on milk production, fertility and nutritional requirements of draft cows), University of East Anglia, School of De-*

velopment Studies, Norwich (UK) and by various organizations in countries including Poland (use draft dairy cows in Silesia), Costa Rica, India, Sri Lanka, Bangladesh, China, Kenya and Australia. Lists recent publications.
Mic.No: 80886

0020 Anon. 1985. **Draught Animal News, no. 3.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine, 16p., 1 table, 4 photographs; ref. **En, Es, Fr**
☐*Briefly summarizes current research projects relating to draft animals at the Centre for Tropical Veterinary Medicine, Edinburgh (UK) (food intake by draft animals, physiological adaptations to work and techniques for measuring energy expenditure in the field) and by other organizations in various countries including Costa Rica, Mexico, Bolivia (development of a new yoke), Peru (log hauling by oxen), India, Nepal, Zambia and Kenya. Lists recent publications.*
Mic.No: 80885

0021 Anon. 1985. **La culture avec traction animale. (Cropping with animal traction)**
Afrique Agriculture (France), no. 122, p. 16–21, illus.; ref., ISSN 0337–9515. **Fr**
☐*Outlines the level and success of animal traction in sub-Saharan Africa, based on a study of the availability of work animals and suitable implements in some African countries. Discusses the future of animal traction in the region.*
Mic.No: 80739

0022 Anon. 1985. **Quelques aspects historiques des échecs et des succès de l'introduction et du développement de la traction animale en Afrique subsaharienne. (Historical aspects of successes and failures in introduction and development of animal traction in sub-Saharan Africa)**
Afrique Agriculture (France), no. 122, p. 16–21, ISSN 0337–9515. **Fr**
☐*Presents notes on the introduction and development of animal traction in sub-Saharan Africa, with particular reference to animal-drawn implements used in francophone countries in the region.*
Mic.No: 80468

0023 Anon. 1986. **Draught Animal News, no. 5.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine, 25p., 4 photographs, 1 table; ref. **En**
☐*Briefly describes draft animal research from the Centre for Tropical Veterinary Medicine, Edinburgh (UK) (food intake by draft animals, heat tolerance) and from various organizations in countries including Costa Rica (use of oxen in forestry) Bolivia, Nepal, India (use of elephants in forestry), Sierra Leone (draft oxen), Zimbabwe, Botswana (draft animal management for early plowing, importance of livestock within the total farming system) and Zaire (ox traction). Includes details of an ergonometer developed at CTVM. Lists recent publications.*
Mic.No: 80887

0024 Anon. 1988. **Harnessing working horses for the future.**
Royal Agricultural Society of England, Stoneleigh. National Agricultural Centre. Conference jointly organised by RASE and ADAS in association with Centre for Agricultural Strategy, University of Reading, Stoneleigh (UK), 6 Apr 1988, 52p. **En**
☐*Contains the following papers mainly relevant to UK: A review of working horses and their potential for work; training men and women for work with horses; living horse power – harness, hitches and modern machinery; working horses in agriculture, horticulture and forestry; working horses in an urban setting; history with a future (describes a project to explore the potential use of heavy horses).*
Mic.No: 80375

0025 Anon. 1988. **Animal power: Outdated or underestimated?**
Spore (Netherlands), no. 18, p. 4–6, 4 ref. **En**
☐*Discusses the advantages of introducing animal traction in developing countries, outlining the importance of a tradition of animal husbandry in the acceptance of the introduction of animal traction.*
Mic.No: P00516

0026 Anon. s.d. **Animal traction.**
FAO, Rome (Italy), 16p. **En**
☐*Shows the many possible ways mules and camels are used in North Africa, types of plows used, various tillage implements and their manner of use and requisite daily care to be given to animals.*
Mic.No: 80837

0027 Anon. s.d. **Animal traction and agricultural mechanisation research in SADCC.**
Southern African Center for Cooperation in Agricultural Research, Gaborone (Botswana). Workshop on Animal Traction and Agricultural Mechanisation Research in SADCC, Maputo (Mozambique), 10–13 Aug 1987, v.p., fig., tables; ref. **En**
☐*Contains an overview of the current status of animal traction in Africa and research needs, and country papers on animal traction in Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe.*
Mic.No: 80835

0028 Anon. s.d. **Animal traction: The development and operation of a pan-African research network.**
ILCA, Addis Ababa (Ethiopia), 4p., 1 table **En**
□*Outlines the importance of animal traction in African farming systems and proposes the establishment of a pan-African animal traction research network to be coordinated by ILCA. Presents the indicative operating cost estimates of the network for a three-year programme.*
Mic.No: 18799

0029 Anon. s.d. **Culture attelée en Afrique tropicale. Etudes de cas. (Animal traction in tropical Africa. Case studies)**
s.n., s.l., 95p., 2 fig., 9 tables; 117 ref. **Fr**
□*Presents a case study on the possibilities and limitations of animal traction in tropical Africa, with particular reference to the association among agriculture, animal husbandry and animal traction in the region; also examines economic, social and structural issues in the introduction of animal traction.*
Mic.No: 00626

0030 Anon. s.d. **Draught Animal News, no. 4.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine, 24p., fig., 3 tables; 10 ref. **En**
□*Presents accounts of the use of draft animals in agriculture, water pumping and small-scale transport in the United Kingdom, Central America, Africa, North America and Sri Lanka.*
Mic.No: 82106

0031 Anon. s.d. **Mechanization of agriculture in tropical Africa.**
FAO, Rome (Italy). Agricultural Services Div. Seminar on Mechanization in Africa, Bambey (Senegal), 25–29 Jan 1971, 19p., 2 tables **En**
□*Discusses the state of agricultural mechanization in tropical Africa, evaluating progress in the supply and utilization of agricultural machinery, semi-mechanical farm equipment and working animals in each country. Also discusses social and economic conditions, infrastructure and training necessary for mechanization.*
Mic.No: 80721

0032 Anon. s.d. **The role of animals in draught and transport.**
CAB, Slough (UK). CAB Annotated Bibliography, no. 267, v.p. **En**
□*Presents an annotated listing of references on various aspects of the use of animals in draft and transport.*
Mic.No: 02912

0033 Anon. s.d. **The use of cattle, buffalo and camels for draft, 1933–1974.**
CAB, Slough (UK). Commonwealth Bureau of Animal Breeding and Genetics Annotated Bibliography (UK), no. 304, 11p. **En**
□*Presents an annotated listing of references on various topics related to the use of cattle, buffaloes and camels for work.*
Mic.No: 02926

0034 Bartlett, J.; Gibbon, D. 1984. **Animal draught technology. An annotated bibliography.**
Intermediate Technology Publications Ltd. London (UK), 76p., ISBN 0–946688–31–1 **En**
□*Reviews literature concerned with factors affecting the choice of animal traction technology both at the national level and at the level of individuals or groups of farmers with limited resources; examines case studies that may indicate the reason for limited or widespread adoption of animal draft technologies; and reviews the state of knowledge on animal power and its efficiency and management in farming.*
Mic.No: 34277

0035 Bell, R.D. 1987. **Mechanising small farms: Choices in developing countries.**
Span (UK), v. 30(1), p. 11–13, 3 photographs; 8 ref. **En**
□*Discusses which types of equipment can be most effective in mechanizing small farms and factors governing the adoption of such innovations.*
Mic.No: 80184

0036 Bigot, Y. 1985. **La culture avec traction animale: quelques aspects historiques des échecs et des succès de l'introduction et du developpement de la traction animale en Afrique subsaharienne. (Cultivation with animal traction: Some historical aspects of successes and failures in the introduction and development of animal traction in sub-Saharan Africa)**
Journée d'Etude sur la culture avec traction animale, Antony (France), 7 Mar 1985. Afrique Agriculture (France), no. 122, p. 16–21, 1 table, 3 photographs, ISSN 0337–9515. **Fr**
□*Discusses the recent introduction of animal traction into sub-Saharan Africa compared with thousands of years of use in other parts of the world, together with preconditions for its successful development.*
Mic.No: 80118

0037 Bigot, Y. 1988. **Rapport de synthèse 1985 des travaux de recherche sur la mécanisation agricole en Afrique subsaharienne. (Synthesis report of research on agricultural mechanization in sub-Saharan Africa, 1985)**

Raymond, G. (ed.). In: Economie rurale en zone de savane, 7. Séminaire d'Economie et Sociologies Rurales, Montpellier (France), 15–19 Sep 1986, p. 102–108, 5 ref., ISBN 2-87614-019-5 **Fr** (Fr En)

□*Briefly summarizes French (CIRAD) research in West Africa and Madagascar in 1985. Gives details of publications including a bibliography on animal traction, articles on the history of animal traction in Guinea and the relationship between farming systems and mechanization in general. New research in Burkina Faso and Senegal is briefly described.*
Mic.No: 80768

0038 Bigot, Y. s.d. **La traction animale et les relations agriculture-élevage en Afrique subsaharienne. (Animal traction and relations between crop and livestock production in sub-Saharan Africa)**
Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier (France). Dept. Systèmes Agraires. In: Relations agriculture-élevage, 2. Séminaire du Département Systèmes Agraires du CIRAD sur les Relations Agriculture – Elevage, Montpellier (France), 10–13 Sep 1985. Collection Documents Systèmes Agraires (France), no. 4, p. 240 **Fr**(En Es Fr)

□*Analyzes the usual pattern of animal traction utilization, i.e. bovine traction leading to intensive cultivation, forage introduction and manure production.*
Mic.No: 39150

0039 Binswanger, H.P. 1984. **Agricultural mechanization: A comparative historical perspective.**
IBRD, Washington, D.C. (USA).
Mechanization of Small-scale Farms – Economic and Social Implications, Hangzhou (China), 22–26 Jun 1982. World Bank Staff Working Paper, no. 673, 80p., 3 fig., 24 tables; 71 ref. **En**(En Es Fr)

□*Provides a detailed comparative historical review of patterns of agricultural mechanization by operation, emphasizing similarities and differences in patterns of adoption across developed and developing countries. Discusses policy implications for developing countries and China.*
Mic.No: 80871

0040 Bodet, P. 1987. **Animal energy – an introductory review. (L'énergie animale. Exposé liminaire général)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 63, p. 2–6, 7 plates; 5 ref. **En**

□*Reviews the advantages of and constraints to the use of draft animal power, along with explanations of how efficient utilization of this energy system, associated with good agricultural techniques, helps in training small farmers to adopt light mechanization, enabling them to integrate animal husbandry with crop production.*
Mic.No: 80532

0041 Burchaus, E.-M. s.d. **Animal power for easy farming.**
s.n., s.l., 3p., 2 photographs **En**

□*Discusses the need for the introduction of animal power in agriculture in developing countries, describing the role of women in agricultural production and the benefits they can derive from the introduction of animal traction.*
Mic.No: 80033

0042 Campbell, R.S.F. 1989. **Draught animal power to 2020.**
Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 18–23, 2 graphs, 2 tables; 9 ref., ISBN 1-86320-003-7 **En** (En)

□*Discusses the role of the draft animal in producing the food necessary to sustain 7 billion people in 2020, 3 billion of these in Asia, constraints to agricultural production, draft animal health, objectives of the draft animal system, the draft animal environment in 2020 and future draft animal systems. Concludes that whether animals and oil are reinforced by other forms of energy, new methods must be found to support and feed the human race; however, draft animals will be of importance for many years but must become more numerous, better managed, healthier, multipurpose, support more complex and stable cropping systems and generate more money for their owners.*
Mic.No: 80923

0043 Casse.; Garin.; Dumas. 1965. **Bilan des expériences de culture attelée en Afrique occidentale d'expression française Guinée excepté. Tome 1 à 3. (Results of trials on animal traction in francophone West Africa excluding Guinea. Volumes 1 to 3)**
Bureau pour le Développement de la Production Agricole, Paris (France); Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France), 619p., fig., illus., map **Fr**

□*Reports on completed and on-going animal traction work in Francophone West Africa, excluding Guinea, with notes on conclusions drawn and future prospects of these activities. Examines the agricultural, animal husbandry, technical and economic aspects of animal traction.*
Mic.No: 00616

0044 Cauvet, C. 1925. **Le chameau. (The camel)**

Librairie J.-B. Baillière et Fils. Paris (France), 784p., 13 illus., 8 tables **Fr**
□*Studies in detail the behaviour, husbandry, nutrition and diseases of camels.*
Mic.No: 08771

0045 Chivers, K. 1988. **History with a future: Harnessing the heavy horse for the 21st century.**
Shire Horse Society. Peterborough (UK), 234p., 32 plates, 2 figures, 12 tables; ref. **En** (En)
□*Report of an investigation commissioned by the Shire Horse Society into whether in the future it is possible that heavy horses may have a positive role to play in the life and work of the UK and, if so, what needs to be done to fit them for the part. A summary of conclusions, recommendations and action is included concerning the role of heavy horses in agriculture, other land-based industries (forestry), urban haulage, employment, amenity, heritage and recreation.*
Mic.No: 80959

0046 Cockrill, W.R. 1967. **The water buffalo.**
Scientific American (USA), v. 217(6), p. 118–125, 1 drawing, 1 map, 4 photographs **En**
□*Discusses the geographical distribution of various breeds of water buffaloes, with notes on breeding systems, population, behaviour and utilization as working animals in rice fields.*
Mic.No: 80719

0047 Cockrill, W.R. 1968. **Is there a future for the water buffalo?**
Ceylon Veterinary Journal, v. 14(3), 3p. **En**
□*Describes the uses of water buffaloes as milk and meat producers and as working animals.*
Mic.No: 80710

0048 Cockrill, W.R. 1974. **The water buffalo. The working buffalo.**
Cockrill, W.R. (ed.). In: The husbandry and health of the domestic buffalo, p. 313–328, 21 ref. **En**
□*Assesses the utilization of the water buffalo as a working animal, presenting data on its use in rice fields, and its working capacity.*
Mic.No: 80701

0049 Cockrill, W.R. 1976. **The buffaloes of China.**
FAO, Rome (Italy), 108p. **En**
□*Discusses the history, breeding methods and husbandry of swamp buffaloes in China and their use as working animals. Includes population figures and photographs.*
Mic.No: 80704

0050 Copland, J.W. 1985. **Draught animal power for production.**
ACIAR, Canberra (Australia). International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, 170p., fig., tables; ref., ISBN 0–949511–17–X **En**
□*Presents workshop papers on draft animal power use, particularly on the socio-economics of draft power, work physiology, nutrition of working animals, genetics and animal breeding, reproduction, health, and engineering systems for draft power.*
Mic.No: 80652

0051 Creasey, J.S. 1974. **The draught ox.**
Institute of Agricultural History, Reading (UK); Museum of English Rural Life, Reading (UK), 8p., 15 ref. **En**
□*A short account of the history of the use of oxen for farm work in the UK prepared as an introduction to an exhibition entitled The Draught Ox held at the Museum of English Rural Life, Reading (UK) in Jul-Sep 1974.*
Mic.No: 80377

0052 Creasey, J.S. 1977. **The draught ox.**
Heavy Horse Magazine (UK), p. 26–29, 4 photographs **En**
□*A short historical account of the use of draft oxen for farm work in the UK originally published as an introduction to an exhibition entitled The Draught Ox held at the Museum of English Rural Life, Reading (UK) Jul-Sep 1974.*
Mic.No: 80378

0053 Dalzell, R. 1977. **Buffaloes on oil palm estates in Malaysia.**
Planter (Malaysia), v. 53(615), p. 258–266, 7 ref. **En**
□*Discusses the possibility of using buffaloes for work on oil palm estates in Malaysia, outlining the availability of buffaloes, selection criteria, veterinary care required and sources of supply.*
Mic.No: P00508

0054 Dima, S.A.; Amann, V.F. 1975. **Small holder farm development through intermediate technology.**
East African Journal of Rural Development (Kenya), v. 8(1,2), p. 215–245, tables; 29 ref. **En**
□*Assesses the impact of using oxen power and low-cost intermediate technology accessories to determine the optimum loan package for the oxen mechanization system and to evolve simple farm plans for smallholders using oxen and available farm resources; includes suggestions for the manufacture of implements, training, improvement of husbandry practices, marketing and credit facilities, and maintenance systems.*
Mic.No: 80727

0055 Falvey, J.L.; Chau Ba Loc. 1989. **Draught animals in national livestock planning.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3-7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 300-303, 9 ref., ISBN 1-86320-003-7 **En** (En)
☐*Discusses the need for agricultural development planning to include the critical role of draft animal power (DAP) in agricultural production. Proposes means of integrating DAP into national plans through additional investigations and modifications to project formulation by interrelated agencies within their existing modes of operation.*
Mic.No: 80950

0056 Falvey, J.L. s.d. **An introduction for working animals.**
MPW Australia, Melbourne (Australia), 196p., fig., tables, plates; ref., ISBN 1-86252-992-2 **En**
☐*Describes how various animal species (cattle, buffalo, horses, donkeys, mules, camels, elephants, yak) became a power source for various societies; discusses the use of each major animal species according to contributions, and outlines the future outlook for working animals.*
Mic.No: 39012

0057 Fujioka, K. 1987. **Draught animal power - 25 years of experience in French-speaking Africa. (La culture attelée. Réflexions sur 25 ans d'experience en Afrique francophone)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 63, p. 40-44, illus., ISSN 0049-8025. **En, Fr**
☐*Reviews reasons for the success or failure of draft animal use in French-speaking African countries where the technology was introduced in the 1960's. Includes suggestions for increasing its acceptance.*
Mic.No: 80480

0058 Gefu, J.O.; Otchere, E.O.; Gwani, E.S.; Ahmed, H.U. 1988. **Draught animal power research and development in Nigeria: A bibliography.**
Ahmadu Bello Univ., Shika (Nigeria). National Animal Production Research Inst., 23p. **En**
☐*Presents references on draft animal power research and development in Nigeria covering the period between 1925 and 1988.*
Mic.No: 85991

0059 Gifford, R.C. 1986. **The selection and use of animal draught technology.**
GATE (Germany, F.R.), no. 86/4, p. 28-30, 1 photograph **En** (En Es Fr)
☐*Stresses that mechanization and introduction of draft animals must be appropriate for the agricultural system in use and must not be considered in isolation from other fundamental technological features of the system, that sufficient draft implements exist already without the need for the development of new ones, and that action should be based on what is feasible taking farmers' current knowledge as a starting point.*
Mic.No: 80183

0060 Goe, M.R.; McDowell, R.E. 1980. **Animal traction: Guidelines for utilization.**
Cornell Univ., Ithaca, N.Y. (USA). Program in International Agriculture. Cornell International Agriculture Mimeograph (USA), no. 81, 84p., 21 tables; 386 ref. **En**
☐*Provides guidelines for the use of animals for traction, describing physical principles involved and their effects on animal performance; examines the power developed by draft animals during maximum pulling trials under field conditions and the effects of body size on working efficiency; discusses tests of draft capabilities of animals for maximum output and working potential in warm climates; compares draft and packing performance of various species and nutrient requirements of draft animals; includes data on cattle employed for traction in Africa and Asia.*
Mic.No: 18031

0061 Goe, M.R.; Michael Hailu. 1983. **Animal traction. A selected bibliography.**
ILCA, Addis Ababa (Ethiopia). Documentation Services, 42p. **En**
☐*Presents a listing of literature on various aspects of animal traction and working animals including works on topics such as economics of animal traction, integrated crop-animal agriculture, management of working animals, draft performance as well as design, construction and use of implements.*
Mic.No: 31255

0062 Goe, M.R. 1983. **Current status of research on animal traction. (Etat actuel des recherches sur la traction animale)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 45, p. 2-17, 12 plates, 6 tables; 43 ref., ISSN 0049-8025. **En, Fr**
☐*Discusses technical aspects involved in the use of animal power, particularly mentioning nutrient requirements of animals for maintenance, work and growth; optimum rates of growth; crossbreeding between either indigenous or improved types; castration and training of animals; and the design of improved yoke, harness and implements.*
Mic.No: 29267

0063 Goe, M.R.; Gryseels, G. 1983. **Animal traction: A technology for smallholder farmers.**
Courier (Belgium), no. 82, p. 56–58 **En**
☐*Discusses the advantages of animal traction as a means of improving agricultural productivity in Africa, identifying areas where pertinent research and planning are needed; includes recommendations.*
Mic.No: 65229

0064 Goe, M.R. 1990. **Overcoming constraints to animal traction through a collaborative research network.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 136–143, ISBN 92-9081-046-7
☐*Briefly reviews the status of animal traction in sub-Saharan Africa, giving estimates of the numbers and types of draft animals in different countries. Mentions the objectives of the animal traction thrust of ILCA and discusses the benefits of developing an animal traction network.*
Mic.No: 82229

0065 Goel, B.B.P.S.; Singh, K.B. 1982. **Contribution of animate energy.**
Bio-Energy Re-News (India), v. 1(3), p. 29–35, 4 tables; 7 ref. **En**
☐*Discusses the potential role of energy from animal sources in meeting the consumption needs of agriculture and the rural household sector in India.*
Mic.No: 86291

0066 Hart, E. 1979. **The heavy horse.**
Shire Publications Ltd. Princes Risborough (UK). Shire Album (UK), no. 39, 32p., 40 photographs; 15 ref, ISBN 0-85263-452-8 **En**
☐*Describes and illustrates breeds of heavy horses currently used in the UK. Lists heavy horse societies and places to visit.*
Mic.No: 80887

0067 Hart, E. 1981. **The harness horse.**
Shire Publications Ltd. Princes Risborough (UK). Shire Album (UK), no. 53, 32p., 37 photographs, 2 drawings, ISBN 0-85263-504-4 **En**
☐*Describes breeds of harness horse, harnessing methods, vehicles, competitions and driving organizations in UK.*
Mic.No: 80847

0068 Henderson, A.J. 1977. **Farming with animal power.**
FAO, Rome (Italy). Economic and Social Policy Dept.; Institut Africain pour le Développement Economique et Social, Abidjan (Côte d'Ivoire). FAO Economic and Social Development Series, no. 3/14, 57p., illus., ISBN 92-5-100157-X **En**
☐*Presents teaching material for animal-powered farming.*
Mic.No: 80716

0069 Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.) 1989. **Draught animals in rural development.**
ACIAR, Canberra (Australia). International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, 347p., drawings, photographs, tables; ref., ISBN 1-86320-002-7 **En** (En)
☐*Proceedings of a conference attended by 127 participants, organized to review the progress and relevance of research on draft animals since 1985, to review global research priorities and to recommend future directions for research for the ACIAR Draught Animal Power (DAP) subprogramme. Introductory papers on DAP to 2020 and the ACIAR DAP Project are followed by papers under the following section headings: regional emphasis and progress in DAP reasearch; farming systems research relating to DAP; draught animal production: nutrition and physiology; draught animal production: reproduction, breeding and selection; draught animal production: health, training and management; engineering aspects of DAP; economics of draft animal power.*
Mic.No: 80922

0070 Howard, C.R. 1980. **The draft ox. Management and uses.**
Zimbabwe Rhodesia Agricultural Journal, v. 77(1), p. 19–34, 18 plates, 14 fig., 2 tables; 7 ref., ISSN 0035-4686. **En**
☐*Discusses the uses and management of draft oxen, examining their work capacity, selection and training for various operations, different types of yokes and farm implements used, feed rations for oxen and operations in which draft animals can be used economically.*
Mic.No: 27294

0071 Hueist, H. von. 1975. **The role of farm mechanization in developing countries.**
FAO, Rome (Italy). Meeting on Farm Equipment Innovations for Agricultural Development in Rural Industrialization, Ngoro (Kenya), 19 Aug 1975, 11p. **En**
☐*Reviews the role of modern farm machinery and equipment in the evolution of agricultural production in developing countries.*
Mic.No: 80717

0072 Inns, F. 1980. **Animal power in agricultural production systems with special reference to Tanzania. (L'énergie animale dans les systèmes de production agricole, spécialement en Tanzanie)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 34, p. 2–10, 4 fig., 3 tables, 11 photographs; 10 ref., ISSN 0049–8025. **En, Fr**
□*Discusses the basis of mechanized farming, benefits of animal traction over tractor power, characteristics of draft animals (horses, oxen, donkeys, camels), methods of using them (work potential, harnesses and control), farming systems, machinery and transport.*
Mic.No: 80438

0073 Jeanrenaud, J.P.; Barton, D.; Gibbon, D. 1982. **Draught animal power.**
East Anglia Univ., Norwich (UK). School of Development Studies. School of Development Studies Discussion Paper (UK), no. 125, 20p., 3 fig., 3 tables; 44 ref. **En** (En)
□*Reviews the historical role of draft animals in agriculture, with reference to the "ox-versus-horse debate", and discusses the present status of animal draft, particularly in relation to alternative technology options, i.e. tractors.*
Mic.No: 31657

0074 Kjaerby, F. 1983. **Problems and contradictions in the development of ox-cultivation in Tanzania.**
Scandinavian Inst. of African Studies, Uppsala (Sweden); Centre for Development Research, Copenhagen (Denmark). CDR Research Report (Denmark), no. 66, 163p., fig., tables; 107 ref., ISSN 0080–6712. **En**
□*Traces the development of ox cultivation in Tanzania, mentioning the evolution of land-use systems; the process of intensifying labour and land use in terms of productivity; general conditions of labour productivity in ox cultivation; agropastoralism as the most common land-use system in which ox-plowing was used; historical development of ox-plowing in some parts of the country; socio-economic effects of ox-plowing in comparison with hoe cultivation; agricultural mechanization policies of the government during the 1960's and 1970's; and recorded ox equipment in the country.*
Mic.No: 31534

0075 Kline, C.K.; Green, D.A.G.; Donahue, R.L.; Stout, B.A. 1969. **Agricultural mechanization in equatorial Africa.**
Michigan State Univ., East Lansing (USA). Inst. of International Agriculture. Institute of International Agriculture Research Report (USA), no. 6, 593p., 137 fig., 101 tables; 511 ref. **En** (En)
□*Presents a study undertaken to identify and analyse farming systems in tropical Africa, types of tools and equipment utilized, factors and conditions favouring various forms of mechanization, agricultural engineering problems to be solved; to make an economic appraisal of the problems inherent in selective mechanization; and to develop a series of generalizations as the basis for future planning. Includes recommendations.*
Mic.No: 08245

0076 Kristoferson, L.; Bokalders, V.; Newham, M. 1984. **Draught animal power.**
Kristoferson, L.; Bokalders, V.; Newham, M. In: Renewable energy for developing countries: A review. Volume D: Solar, wind, hydro etc., v.p., fig., tables; ref. **En**
□*Assesses the draft animal power resource base in developing countries, examines available harnessing devices and ways of improving them, and discusses the use of working animals in farming, logging, and water-drawing operations. Describes the infrastructure needed for the proper use of draft animal power, and the economics of animal traction*
Mic.No: 82273

0077 Kumwenda, W.F. 1987. **Utilization of animal draught power in tropical agriculture.**
s.n., s.l. 11. Annual meeting of the Association for the Advancement of Science of Malawi, Bunda (Malawi), 10–11 Apr 1987, 8p., 1 fig., 1 table; 2 ref. **En** (En)
□*Describes limitations of hand hoes and tractors and benefits of animal traction. Stresses the importance of training farmers and extension workers and strong, active cooperation between researchers, manufacturers, credit institutions, extension workers, animal health workers and farmers in achieving efficient use of animal power. Suggests ways of improving the profitability of animal traction.*
Mic.No: 80448

0078 Kundu, P.B. 1982. **Draught animal power, its use and better utilization as the source of additional energy.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 7p. **En**
□*Discusses the use of draft animal power (DAP) in India, outlining its advantages over mechanization, and ways of improving the productivity of working animals, particularly through breeding, improved feeding and management practices and better health control.*
Mic.No: 80610

0079 Langdon, J. 1986. **Horses, oxen and technological innovation. The use of draught animals in English farming from 1066 to 1500.**
Past and Present Publications, Cambridge University Press. Cambridge (UK), 315p., fig., tables; ref., ISBN 0-521-26772-2 **En**
□*Assesses the significance of the introduction of the work horse into English farming between 1066 and 1500.*
Mic.No: 80878

0080 Lassailly, F. 1985. **Culture et traction animale. (Cultivation and animal traction)**
Inter-Tropiques (France), no. 12, p. 16-17, 1 illus., 1 table, ISSN 0755-6152. **Fr**
□*Outlines briefly the advantages of animal-powered farming, especially within the framework of the integration of agriculture and animal husbandry, and in the general process of mechanization.*
Mic.No: 66797

0081 Lhoste, P. 1986. **L'utilisation de l'énergie animale en Afrique intertropicale. (Use of animal power in inter-tropical Africa)**
Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). In: Méthodes pour la recherche sur les systèmes d'élevage en Afrique intertropicale, Atelier: Méthodes pour la Recherche sur les Systèmes d'Elevage en Afrique Intertropicale, Mbour (Sénégal), 2-8 Feb 1986, p. 373-406, 1 map, 8 tables, 2 fig.; 29 ref., ISBN 2-85985-122-4 **Fr**
□*Reviews the importance and diversity of use of animal energy throughout the world and Africa and animal traction as an integrating factor between crop and animal production. Concludes that use of animal energy is progressing in Africa, that attention should be paid to the diversity of traditional methods which should be evaluated within the framework of the existing farming system. Proposes an integrated approach as the animal, a source of energy for agriculture, is also a consumer of agricultural products, can provide manure, milk, meat etc. and animal energy is directly linked to human work providing a route for progressive development.*
Mic.No: 80905

0082 Makin-Taylor, D.C. 1972. **The use of draught animals in agriculture and forestry.**
s.n., s.l., 19 p. **En**
□*Discusses the use of working animals in agricultural and forestry operations, outlining management and harnessing techniques, implements for animal traction and the economics of draft-oxen use.*
Mic.No: 20105

0083 Marti, A.; Allafort, M.T.; Bigot, Y. 1985. **La traction animale. Bibliographie. (Animal traction. A bibliography)**
Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières, Paris (France). Mémoires et Travaux de l'IRAT (France), no. 10, 194p., ISBN 2-901987-11-7 **Fr**
□*Presents a listing of references on animal traction covering topics such as the history of animal traction, mechanization policies, management of working animals, cultivation techniques, farm implements, credit and some case studies.*
Mic.No: 36089

0084 Marti, A.; Second, C. 1988. **Traction animale et développement agricole des régions chaudes. Bibliographie annotée. Expériences et bilan. (Animal traction and agricultural development in the hot regions. Annotated bibliography: Experiences and evaluation)**
Centre Technique de Coopération Agricole et Rurale, Wageningen (Pays-Bas); Institut de Recherches Agronomiques Tropicales et des Cultures Vivrières, Paris (France), 254p., ISBN 2-87614-017-9 **En**
□*Presents an annotated listing of 323 animal traction documents, based on French-language publications. Within the broad theme of the economics of animal traction, it also details references on farming systems and project experiences.*
Mic.No: 86088

0085 Mason, I.L. 1981. **The agricultural potential of minor species of farm livestock in the Old World.**
FAO, Rome (Italy). In: Animal genetic resources conservation and management. Proceedings of the FAO/UNEP technical consultation, FAO/UNEP Technical Consultation on Animal Genetic Resources Conservation and Management, Rome (Italy), 2-6 Jun 1981. FAO Animal Production and Health Paper, no. 24, p. 364-381, 4 fig., 7 tables; 19 ref., ISBN 92-5-101118-4 **En** (En Es Fr)
□*Describes the agricultural potentials and geographical distribution of large domesticated mammals in Africa and Asia, with particular emphasis on donkeys, mules, Bali cattle, camels, elephants, mithun, reindeer and yak.*
Mic.No: 82033

0086 Matlon, P.J. 1983. **The technical potential for increased food production in the West African semi-arid tropics.**
ICRISAT, Ouagadougou (Burkina Faso). Conference on Accelerating Agricultural Growth in Sub-Saharan Africa, Victoria Falls (Zimbabwe), 29 Aug-1 Sep 1983, 49p., 2 tables; 70 ref. **En**
□*Examines the technical potential for increased agricultural production in the West African semi-arid tropics (WASAT) and analyzes the principal factors determining the rate and feasibility of*

such growth. A review of currently-available technologies showed the existence of marginally profitable animal traction systems which would permit the expansion of cultivated area per worker.
Mic.No: 80242

0087 Mattick, A.; Sum, M. 1989. **The role of the mule as a draught animal.**
East Anglia Univ., Norwich (UK), 129p., tables, photographs, illus.; 31 ref. B.Sc. **En** (En)
☐*Briefly reviews the significance of draft animal power in world agriculture and highlights the possible role of mules; goes on to describe mules, their breeding, occurrence throughout the world, training and management requirements, nutrition and health and harnessing. Gives information on working mules in Tunisia and Mexico (personal observation), USA (forestry) and experimental work carried out with mules at the Rural Technology Unit, University of East Anglia and at the Shuttleworth College (UK). Presents a brief literature review and discusses constraints to the use of mules for draft work. Makes recommendations for further research.*
Mic.No: 80535

0088 McDowell, R.E. 1977. **Ruminant products: More than meat and milk.**
Winrock International Livestock Research and Training Center, Morrilton, Arkansas (USA), 28p., 10 tables, 12 plates; 94 ref. **En**
☐*Discusses the use of ruminants in agriculture, cartage and transport and as sources of non-food products such as wool, hair, hides and pelts, as well as animal wastes which can be used for fertilizer, methane gas and fuel production. Also discusses other uses of ruminants, particularly as stored capital, in maintaining overall ecological balance and in pest control.*
Mic.No: 09052

0089 McKenzie, F. 1974. **Contribution of working animals for power, herding, protection, and pleasure.**
Cole, H.H. (ed.); Ronning, M. (ed.). In: Animal agriculture. The biology of domestic animals and their use by man, W.H. Freeman and Company. San Fransisco (USA), p. 113–126, 13 plates; 8 ref., ISBN 0–7167–0791–8 **En**
☐*Describes the characteristics and use by man of several species of working animals, particularly horses, donkeys, mules, oxen, yak, water buffaloes, deer, moose, camels, llama, alpaca, elephants and dogs.*
Mic.No: 82100

0090 Moigne, M. le. 1980. **Animal-draft cultivation in francophone Africa. (Culture attelée en Afrique francophone)**
ICRISAT, Patancheru, AP (India). In: Proceedings of the International Workshop on Socioeconomic Constraints to Development of Semi-arid Tropical Agriculture, Hyderabad (India), 19–23 Feb 1979, p. 213–220, 9 tables **En, Fr** (En Fr)
☐*Discusses the history, relative importance and factors determining the spread of animal-draft cultivation in francophone Africa, with data on expected yield increase and equipment standards.*
Mic.No: 82095

0091 Monnier, J. 1972. **Relations entre mécanisation, dimensions et systèmes d'exploitation. (Relationships among mechanization, farm size and farming system)**
Machinisme Agricole Tropical (France), no. 38, p. 33–44, 7 plates, 7 tables; 13 ref. **Fr** (Fr)
☐*Presents a model which permits the determination of the best system of production based on analysis of the relationship among the various factors of production including implements and associated investments.*
Mic.No: 80766

0092 Monnier, J. 1984. **Pour un nouveau développement de la culture attelée en régions tropicales. (Possible development of animal traction in the tropics)**
Machinisme Agricole Tropical (France), no. 88, p. 3–17, 12 plates; 55 ref. **Fr** (En, Es, Fr)
☐*Discusses possible development in animal traction for farming in tropical countries, based on successful experiences from Senegal, Côte d'Ivoire and Madagascar. Examines causes for the decline of animal traction use in most African countries and presents recommendations for improvement.*
Mic.No: 80630

0093 Munzinger, P. 1982. **Development and situation of animal traction in Africa and conditions limiting further promotion. (La traction animale en Afrique: situation, perspectives et facteurs limitants)**
Munzinger, P. (ed.). In: Animal traction in Africa, p. 15–61, 1 map, 7 fig., 5 tables, ISBN 3–88085–133–6 **En, Fr**
☐*Discusses the development of animal traction in various African countries, outlining the position of draft animals within the framework of the development of agricultural mechanization. Lists national and international organizations involved in the spread and support of the use of draft animals, manufacturers of animal-drawn implements and references of related literature, reports and projects. Includes a checklist for planning development projects involving the use of draft animals.*
Mic.No: 80651

0094 Munzinger, P. (ed.) 1982. **Animal traction in Africa. (La traction animale en Afrique)**

GTZ, Eschborn (Germany, F.R.), 490p., 55 fig., 76 tables; 206 ref. **En, Fr**
☐*Surveys the development of animal traction in African countries, discussing conditions limiting and factors influencing the use of draft animals; animal husbandry and health aspects, especially related to the use of draft cattle; and various types of harnesses and implements. Presents four case studies to illustrate promotional approaches for the use of draft animals in Africa; and includes bibliography on general literature, articles and project studies on animal traction in Africa.*
Mic.No: 30734

0095 Nair, K.N. s.d. **Animals and tractors in agrarian economics: An analysis of some issues concerning the cultivation techniques in agriculture.**
Preston, T.R. (ed.); Davis, C.H. (ed.); Dolberg, F. (ed.); Haque, M. (ed.); Saadullah, M. (ed.). In: Maximum livestock production from minimum land. Proceedings of the third seminar, 3. Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 13–18 Feb 1982, p. 217–235, 2 tables; 14 ref. **En**
☐*Traces the evolution of cultivation techniques in developed and developing countries and the socio-economic and institutional factors conditioning them, using the French and American experiences and comparing them with those observed in some Asian countries.*
Mic.No: 82080

0096 Nolle, J. 1989. **L'accident de civilisation. (The accident of civilization)**
Jean Nolle. Paris (France). La Conférence de Carpentras sur: L'Agriculture Biologique, 26 Nov 1988, 45p., ISBN 2950363504 **Fr** (Fr)
☐*Discusses the problems that have befallen agriculture worldwide due to various 'revolutions' (mechanical, chemical and genetic) and increasing mechanization. Expounds his MAMATA (Machinisme Agricole Moderne à Traction Animale) philosophy with its three components of simplicity of design, multipurpose use and standardization of components. Applauds the current move towards promoting and improving animal traction especially by using multipurpose implements.*
Mic.No: 80960

0097 Orev, Y. 1972. **Animal draught in West Africa.**
World Crops (UK), p. 236–237, ISSN 0043-8391. **En**
☐*Discusses the almost total lack of draft animals and wheeled vehicles in West Africa, but warns against over-emphasizing the need for animal power as a step towards mechanization.*
Mic.No: 80273

0098 Pereira de Rezende, C.A. 1985. **Uso de bovinos em tracao animal. (Use of cattle for animal traction)**
Boletim Tecnico da Escola Superior de Agricultura de Lavras (Brazil), no. 7, 13p., 1 fig., 1 table, 4 drawings; 8 ref. **Pt**
☐*Briefly describes use of oxen for animal traction in Brazil and discusses work capacity, animal health, advantages and disadvantages, training, feeding, yokes and harnessing.*
Mic.No: 80398

0099 Perkins, J.A. 1975. **The ox, the horse, and English farming, 1750–1850.**
New South Wales Univ. (Australia). School of Economics. School of Economics Working Paper in Economic History (Australia), no. 3/1975, 21p., ref. **En**
☐*Discusses the decline and eventual disappearance of the ox as a team animal in English farming and its replacement by horses.*
Mic.No: 80376

0100 Pingali, P.L.; Bigot, Y.; Binswanger, H.P. 1985. **Agricultural mechanization and the evolution of farming systems in sub-Saharan Africa.**
IBRD, Washington, D.C. (USA). Agriculture and Rural Development Dept., 275p., 15 fig., 46 tables; 252 ref. **En**
☐*Discusses issues related to agricultural mechanization in sub-Saharan Africa, examining factors involved in the decision regarding the use of the plow, or animal- or tractor-drawn implements; assesses prospects and problems of implementing projects on animal draft power and the potential for tractor use.*
Mic.No: 34877

0101 Pingali, P.L. 1987. **From hand tillage to animal traction: Causes and effects and the policy implications for sub-Saharan African agriculture.**
ILCA, Addis Ababa (Ethiopia). African Livestock Policy Analysis Network. ILCA/ALPAN Network Paper, no. 15, 25p., 1 fig., 4 tables; ref. **En**
☐*Identifies conditions affecting the transition from hand tillage to animal traction and further transition to tractors. Asseses causes, effects and policy implications for sub-Saharan African agriculture.*
Mic.No: S-53 No. 15

0102 Poats, S.V.; Lichte, J.A.; Oxley, J.; Russo, S.L.; Starkey, P.H. 1985. **Animal traction in a farming systems perspective.**
Florida Univ., Gainesville (USA). Farming Systems Support Project. Networkshop of the Farming Systems Support Project, Kara (Togo), 3–

8 Mar 1985. FSSP Network Report (USA), no. 1, 187p., 2 fig., 5 tables; ref. **En**
☐*Presents workshop papers on various issues related to animal traction in Africa, including animal traction project experiences and field trip reports from Sierra Leone, The Gambia, Burkina Faso, Senegal and Togo. Summarizes group discussions on preconditions for the successful adoption of animal traction, feed resources and animal feeding, methodologies for on-farm experimentation with animals, technology management and monitoring and evaluation of animal traction projects.*
Mic.No: 80512

0103 Pousset, J. 1982. **Le cheval: énergie douce pour l'agriculture. (The horse: Energy source for agriculture)**
Editions de la Lanterne. Besançon (France), 185p., 160 fig.; 6 ref., ISBN 2-86588-008-7 **Fr**
☐*Discusses the history of the horse, the present-day draft horse, how to choose and manage draft horses, traditional implements, harnessing, modern horse draft equipment and harnesses, operations for which horses can be used, animal traction compared with mechanical traction and animal traction in the Third World.*
Mic.No: 80899

0104 Ramaswamy, N.S. 1980. **Animal energy in agriculture and transportation.**
Commerce Annual Number (Philippines), p. 57-65, 1 table **En**
☐*Reviews the use of draft animals in India and includes information on market value of animal-drawn vehicles, bullock-cart economies, improving efficiency and cart modernization and effective use and care of draft animals with particular emphasis on animal welfare.*
Mic.No: 80359

0105 Ramaswamy, N.S. 1980. **Guidelines for a technical survey on draught animal power. Prepared for an FAO consultancy as background paper on draught animal power for the UN Conference on New and Renewable Sources of Energy.**
FAO, Rome (Italy), 35p., 8 tables **En**
☐*Presents guidelines for a survey on draft animal power including the following sections: importance, species and breeds of draft animals; husbandry, breeding and feeding; diseases and veterinary services; farming operations using animal power; logging; transport; institutions responsible for draft animal power development and training facilities; slaughter techniques and facilities; special comments.*
Mic.No: 82252

0106 Ramaswamy, N.S. 1981. **Draught animal power in the Third World.**
Urja (India), p. 26-37, 76, 3 tables, 14 photographs **En**
☐*Reviews draft animal power (DAP) as an appropriate technology for the Third World, its benefits, magnitude and future projections, neglect of DAP systems, reasons for low productivity (outmoded and primitive implements and poor harnessing techniques) and upgrading and modernization of DAP.*
Mic.No: 80360

0107 Ramaswamy, N.S. 1982. **Appendix C2. Draught animal power in the developing countries with specific reference to Asia.**
FAO, Rome (Italy). In: Report of the FAO Expert Consultation on appropriate use of animal energy in agriculture in Africa and in Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15-19 Nov 1982, 7p., 1 table **En**
☐*Discusses DAP as an appropriate technology for developing countries, other benefits from draft animals, competition of animals for land, importance and magnitude of DAP, projections towards the year 2000 and reasons for the present low productivity of DAP in the Third World. Summarizes the main problems which have to be solved if use of DAP is to be improved in Asia.*
Mic.No: 80874

0108 Ramaswamy, N.S. 1983. **Draught animal power system.**
Urja (India), p. 211-223, 15 photographs, 3 tables, 7 drawings **En**
☐*Discusses draft animal power (DAP) as an appropriate technology for the Third World, reviews magnitude of its use, defines a sub-system approach (animal, hardware and infrastructure), and constraints to and measures for upgrading DAP.*
Mic.No: 80361

0109 Ramaswamy, N.S. 1984. **Draught animal power in the developing countries with specific reference to India.**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15-19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 140-142, ISBN 92-5-001474-0 **En**
☐*Discusses the advantages of draft animal power (DAP) use in developing countries, outlining reasons for its low productivity, constraints to its development and future prospects. Summarizes some of the main problems that need to be tackled if DAP is to be improved in some Asian countries.*
Mic.No: 82245

0110 Ramaswamy, N.S. 1985. **Draught animal power – socioeconomic factors.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 20–25, 3 tables; 3 ref. **En**
☐*Discusses socio-economic issues related to draft animal power (DAP) use in developing countries, with particular reference to attempts at modernizing DAP, improving animal-drawn vehicles and implements, and the extent of dependence on DAP.*
Mic.No: 80655

0111 Ramaswamy, N.S. s.d. **A technical note on draught animal power system.**
Indian Inst. of Management, Bangalore, 38p., fig., tables, ref. **En**
☐*Discusses the concept of draft animal power (DAP) as a source of renewable energy and as an appropriate technology for small- and marginal-scale farmers and its relevance to current and future World Bank projects. Reviews DAP in the Third World, defines DAP terminology and sources of power in various countries and specific problems in some countries and areas considered suitable for up-grading in DAP. Presents action plans for upgrading the DAP system and guidelines for a survey of DAP in various annexes.*
Mic.No: 80872

0112 Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.) 1988. **Economie de la mécanisation en région chaude. (Economics of mechanization in a hot region)**
Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier (France). Mission Economie et Sociologie Rurales. Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, 415p., ISBN 2-87614-026-8 **Fr**
☐*Main topics were: history of mechanization, equipment, machinery and agricultural practices; productivity and farm management; agricultural income and financing of mechanization; machinery commodity systems; social changes linked with mechanization and their influence on land use; draft animal management; mechanization strategy. Twelve papers are abstracted separately.*
Mic.No: 80406

0113 Raymond, G. (ed.) 1988. **Economie rurale en zone de savane. (Rural economy in a savanna zone)**
Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier (France). 7. Séminaire d'Economie et Sociologie Rurales, Montpellier (France), 15–19 Sep 1986, 257p., fig., tables, maps; ref., ISBN 2-87614-019-5 **Fr**
☐*Contains a section on animal traction and mechanization from which papers by P. Lhoste, M. Berger et al., H. Guibert and Y. Bigot are abstracted separately.*
Mic.No: 80910

0114 Reddy, C.V. 1982. **Role of draught animals as alternative energy sources in agriculture.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 8p., 2 tables; 3 ref. **En**
☐*Discusses the use of working animals as alternative sources of energy for agriculture in India, comparing the extent of use of animal and mechanical power for agriculture in several countries, the relative efficiency of animals and tractors, factors affecting the amount of energy produced by an animal, the amount of feed consumed by draft animals as a function of size and type of work, and the use of dung for fuel.*
Mic.No: 82248

0115 Rouge, B. 1958. **Cours de machinisme agricole. 1ère partie: Energie et moteurs. (Training course on agricultural machinery. Part 1. Energy and motors)**
Centre d'Apprentissage Agricole de Kolo (Niger), 26p. **Fr**
☐*Studies different types of energy and motors, as well as their operation and utilization, with particular reference to human, animal, hydraulic, wind, thermal and electrical energy.*
Mic.No: 75431

0116 Sargent, M.W.; Lichte, J.A.; Matlon, P.J.; Bloom, R. 1981. **An assessment of animal traction in francophone West Africa.**
Michigan State Univ., East Lansing (USA). Dept. of Agricultural Economics. MSU African Rural Economy Program Working Paper (USA), no. 34, 101p., tables; ref. **En**
☐*Discusses animal traction in francophone West Africa, describing the characteristics of a model farming system based on the use of draft animal technology, the history of the introduction of draft animal power in the region and expected technical and economic benefits from the adoption of animal traction as suggested by results of trials in research stations. Analyzes 27 animal traction projects in West Africa, with particular reference to characteristics of the package introduced by each project, institutions and services supporting animal traction, and the impact of project interventions at farm and project levels.*
Mic.No: 30753

0117 Sasimowski, E. 1987. **Poland. Use, production and breeding of draught horses. (Pologne. Utilisation, production et sélection des chevaux de trait: étude monographique)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 63, p. 31–39, 13 fig., 3 tables; 1 ref., ISSN 0049–8025. **En, Fr**
□*Discusses Poland's experience with the use of horses for draft purposes, outlining work carried out regarding the selection, breeding, management and use of horses.*
Mic.No: 80478

0118 Schmidt Leplaideur, M.-A. s.d. **Des charrues et des boeufs. (Plows and oxen)**
Inter-Tropiques (France), no. 17, p. 8–11, 5 photographs; 2 ref. **Fr**
□*Discusses constraints to the successful development of animal traction in regions of the world where its use is not traditional, and operations for which it is best suited.*
Mic.No: 80117

0119 Sharma, K.C. 1982. **Some aspects of draught animal power for agriculture.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 14p., 3 tables **En**
□*Studies the availability and requirement of draft animal power (DAP) in India and the problems associated with its utilization, and suggests solutions to overcome them, particularly research, establishment of DAP stations, modification and improvement of animal-drawn implements, provision of credit, and proper management of animals.*
Mic.No: 80687

0120 Sigaut, F. 1988. **Coup d'oeil sur l'histoire à long terme de la mécanisation en agriculture. (A glimpse at the history of agricultural mechanization)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 53–65, ISBN 2–87614–026–8 **Fr**
□*Chronicles agricultural mechanization from primitive hand tools to modern machinery and discusses the relevance of past experience to the current situation in the Third World.*
Mic.No: 82067

0121 Skromme, L.H. 1980. **Appropriate agricultural mechanization in the developing countries.**
IBRD, Washington, D.C. (USA). Agriculture and Rural Development Dept. In: Proceedings of the Agricultural Sector Symposia, Agricultural Sector Symposia, Washington, D.C. (USA), 7–11 Jan 1980, p. 424–449, 18 ref. **En**
□*Discusses research being carried out, and the development of appropriate technology to improve mechanization of agricultural operations in developing countries, with particular reference to the role of international research centres, and the use of working animals, especially oxen, for cultivation in World Bank-financed projects in Côte d'Ivoire.*
Mic.No: 82093

0122 Smith, A.J. 1981. **The role of draught animals in agricultural systems in developing countries.**
Spedding, C.R.W. (ed.). In: Vegetable productivity, Macmillan, London (UK), p. 247–262, 10 tables; 22 ref. **En**
□*Discusses issues related to draft animal use in developing countries, particularly efficiency of work output, power developed, food consumption, advantages as compared to manual labour, and factors determining number of cattle required per 100 ha. of land.*
Mic.No: 57911

0123 Smith, A.J. 1981. **Draught animal research. A neglected subject. (Recherches sur l'énergie animale. Un domaine délaissé)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 40, p. 43–48, 9 plates, 1 table; 16 ref., ISSN 0079–8025. **En, Fr**
□*Reports on the widespread use of animals for draft purposes in different countries, outlining feed requirements and factors influencing efficiency of draft animals such as types of harnesses and equipment used, and health and physical condition of the animals; emphasizes the need for further research.*
Mic.No: 28771

0124 Smith, A.J. 1984. **Work animals in developing countries. Possibilities for improvement.**
Span (UK), v. 27(1), p. 24–29, 3 plates; 6 ref., ISSN–584–8024. **En**
□*Describes the existing situation in the management and use of working animals in developing countries, and explores possibilities for improvements in harnessing techniques, nutrition, animal type and health.*
Mic.No: 80756

0125 Smith, A.J. 1990. **Using science to understand the biological constraints that limit work animal productivity.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Work-

shop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 156–160, ISBN 92-9081-046-7
□*Briefly discusses work on animal traction being undertaken at the Centre for Tropical Veterinary Medicine of Edinburgh University. Notes that the nutrition of working animals can be limited by the low intake of poor quality diets. Discusses the value of measuring work output. Suggests that research is needed to identify and quantify the fitness of draft animals and assesses the heritability of draft traits.*
Mic.No: 82230

0126 Starkey, P.H. 1984. **Draught animal programmes. The need for information exchange.**
Sierra Leone Work Oxen Project, Freetown, 4p. **En**
□*Studies the use of draft animals, considered as important but neglected aspect of international agricultural development, and the interest in the potential for animal traction; and examines the need for greater information exchange between all those involved in draft animal programmes.*
Mic.No: 87326

0127 Starkey, P.H. 1984. **The neglected science of bullock-tech.**
R T Journal (India), p. 9–12 **En** (En)
□*Emphasizes the need for information exchange on an international basis to promote animal traction.*
Mic.No: 80314

0128 Starkey, P.H. 1985. **Animal traction in a farming systems perspective.**
Florida Univ., Gainesville (USA). Farming Systems Support Project. FSSP Newsletter (USA), v. 3(2), p. 6–8, 2 photographs **En**
□*Summarizes the FSSP West African Networkshop held in Togo, 3–8 March 1985, from the point of view of the Sierra Leone Work Oxen Project.*
Mic.No: 80475

0129 Starkey, P.H. 1985. **Animal traction networking activities in Africa and Asia.**
Nepal. Ministry of Agriculture. Dept. of Agriculture; Indonesia. Ministry of Agriculture. Agency for Agricultural Research and Development; IRRI, Manila (Philippines). Rice Farming Systems Network. In: Proceedings of the 2nd monitoring tour. Crop-livestock systems research. Nepal and Indonesia, 2. Crop-Livestock Systems Research Monitoring Tour – Nepal and Indonesia, s.l., 18–31 Aug 1985, p. 664–668, 13 ref. **En**
□*Reviews activities in the development of networks for improved liaison and information exchange relating to animal traction research, extension and training in Africa and Asia.*
Mic.No: 82086

0130 Starkey, P.H. 1985. **Animal traction research and extension in Africa. An overview.**
Nepal. Ministry of Agriculture. Dept. of Agriculture; Indonesia. Ministry of Agriculture. Agency for Agricultural Research and Development; IRRI, Manila (Philippines). Rice Farming Systems Network. In: Proceedings of the 2nd monitoring tour. Crop-livestock systems research. Nepal and Indonesia, 2. Crop-Livestock Systems Research Monitoring Tour – Nepal and Indonesia, s.l., 18–31 Aug 1985, p. 646–656 **En**
□*Surveys the present use of draft animals in Africa taking into consideration historical, geographical and research aspects. Outlines future needs and direction of research and extension.*
Mic.No: 82083

0131 Starkey, P.H. 1985. **Some organizations concerned with animal traction research and development in sub-Saharan Africa.**
IBRD, Washington, D.C. (USA). Agricultural Research Unit. IBRD Discussion Paper, 49p. **En**
□*Presents an annotated listing of institutions directly or indirectly involved in animal traction work in sub-Saharan Africa.*
Mic.No: 80998

0132 Starkey, P.H. 1985. **Programme de traction animale. Nécessite d'un échange d'information. (Animal traction programme. The need for an exchange of information)**
Machinisme Agricole Tropical (France), no. 91, p. 69–71 **Fr** (En Es Fr)
□*Discusses the need for cooperation and improvement in the exchange of information on animal traction in developing countries.*
Mic.No: 39278

0133 Starkey, P.H. 1986. **Animal power in Africa: Perspectives, preconditions, priorities.**
GATE (Germany, F.R.), no. 86/4, p. 3–8, 3 photographs **En** (En Es Fr)
□*Discusses preconditions for the success of draft animal power and key services required for it to become an appropriate sustainable technology for intensifying agriculture and raising living standards of farmers in Africa.*
Mic.No: 80116

0134 Starkey, P.H. 1986. **Draught animal power in Africa. Priorities for development, research and liaison.**

Florida Univ., Gainesville (USA). Farming Systems Support Project. FSSP Networking Paper (USA), no. 14, 40p., ref. **En** (En)
☐*Discusses the history and extent of use of draft animals in Africa, preconditions and constraints that need to be considered if draft animal power development programmes are to succeed, and implications of the constraints for policies at national or project levels. Presents specific suggestions for priority areas of research along with appropriate methodologies, and appraises the role of various bodies involved in implementing draft animal development programmes.*
Mic.No: 82242

0135 Starkey, P.H. 1987. **Animal power in southern Africa. A report of a SACCAR workshop on animal traction.**
GATE (Germany, F.R.), no. 87/4, p. 32–33 **En** (En)
☐*Briefly reports on a SACCAR workshop on animal traction and agricultural mechanization research in SADCC held in Maputo, Mozambique, 10–13 August 1987 where contributions focussed on equipment, animal requirements, training needs and policy considerations.*
Mic.No: 80102

0136 Starkey, P.H. 1988. **Animal traction directory: Africa.**
Friedr. Vieweg Sohn. Braunschweig, Weisbaden (Germany, F.R.), 151p., ref., ISBN 3-528-02038-5 **En**
☐*Provides information on the status of animal traction in each country in Africa, with details of the numbers and types of draft animals and the implements in use in each country. Gives addresses of organizations involved in animal traction in each country, including government ministries, development projects, universities, manufacturers and aid agencies. Cites many references giving further information.*
Mic.No: 85013

0137 Starkey, P.H.; Faye, A. 1988. **Animal traction for agricultural development in West Africa. Report of the Third West African Animal Traction Workshop.**
GTZ, Eschborn (Germany, F.R.); German Appropriate Technology Exchange, Eschborn (Germany, F.R.); Réseau Ouest Africain sur la Traction Animale, Dakar (Sénégal). 3. Regional Workshop of the West African Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, 35p., 27 fig. **En**
☐*Summary report of a workshop together with an evaluation and intended to serve as a basis for forthcoming activities of the West African Animal Traction Network. Contains summaries of networking announcements and full addresses of organizations and participants involved.*
Mic.No: 80861

0138 Starkey, P.H. 1988. **The introduction, intensification and diversification of the use of animal power in West African farming systems: implications at farm level.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 97–115, 65 ref., ISBN 3-528-02047-4 **En**
☐*Reviews animal traction in Africa from historical, geographical and numerical perspectives and describes the range of operations for which draft animals are used. A discussion of the influences of promotional schemes and research programmes on the present situation (citing examples from Ethiopia, North Africa, Asia and The Gambia) shows the importance of farmer initiative in the development of animal traction. Discusses problems involved in the intensification and diversification of animal traction.*
Mic.No: 82005

0139 Starkey, P.H.; Starkey, M.P. 1988. **Workshop evaluation.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development in West Africa, 3. Regional Workshop of the West African Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 11–22, 27 fig. **En**
☐*Analyzes evaluation forms completed by workshop participants concerning technical content, organization and management, participants, open response questions (most and least useful aspects and improvements) and other comments and presents the results in the form of histograms.*
Mic.No: 80862

0140 Starkey, P.H. 1989. **Harnessing and implements for animal tarction.**
Friedr. Vieweg & Sohn. Braunschweig, Weisbaden (Germany, F.R.), 245p., photographs, diagrams, tables; ref., ISBN 3-528-2053-9 **En**
☐*Provides a detailed review of yokes and harnessing systems, and discusses their relative advantages and disadvantages. Describes and reviews a wide range of animal-drawn implements and carts, with many illustrations. Discusses selection and manufacture of harnessing systems and implements, and ways of assessing draft and working rates. Provides details of organizations working in these areas.*
Mic.No: 80965

0141 Starkey, P.H. 1990. **Animal traction for agricultural development: Production, impact, profitability and constraints.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction

Network, Saly (Senegal), 7–12 Jul 1988, p. 90–114, ISBN 92-9081-046-7 **En**
☐*Provides a broad overview of animal traction for agricultural development in West Africa, drawing on many publications of the West Africa Animal Traction Network. Discusses agricultural production using draft animals, with reference to extensification, animal nutrition and use of females. Reviews the impact of animal traction on societies and the environment. Discusses the profitability of animal traction, and the importance of support services. Considers the constraints to animal traction and the interaction between them and concludes the many technical and social constraints can be overcome by the farmers themselves, when profitability is high. Notes that there are mutually reinforcing beneficial interactions between animal traction, animal-drawn carts and agricultural production.*
Mic.No: 82046

0142 Starkey, P.H. (ed.); Ndiame, F. (ed.) 1988. **Animal power in farming systems.**
Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, 363p., fig., tables, maps, photographs; ref., ISBN 3-528-02047-4 **En, Fr**
☐*These proceedings of the Second West Africa Animal Traction networkshop entitled "The introduction, intensification and diversification of the use of animal power in West African farming systems: implications at farm level" contain a summary of networkshop activities, principal recommendations of discussion groups and of the workshop as a whole and edited versions of papers circulated or presented at the workshop (all of which are abstracted separately).*
Mic.No: 85012

0143 Starkey, P.H. (ed.); Faye, A. (ed.) 1990. **Animal traction for agricultural development.**
Technical Centre for Agricultural and Rural Cooperation, Ede-Wageningen (Netherlands). 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, 475p., ISBN 92-9081-046-7**En, Fr**
☐*Presents, in the first part, a summary of the activities, conclusions and evaluation of the third workshop of the West Africa Animal Traction Network (in both English and French). In the second part, there are edited papers prepared for the workshop, 30 papers in English and 29 in French with abstracts in both languages. The papers are grouped in terms of West African overviews, economic issues, implement development and country experiences. Papers discuss the impact of animal traction, and the constraints, in Senegal, The Gambia, Sierra Leone, Togo, Zambia, Kenya and Tanzania. Other papers discuss animal traction experiences in Morocco, Benin, Guinea, Ghana, Brazil and India.*
Mic.No: 80700

0144 Sundaresan, D. 1979. **The role of improved buffaloes in rural development.**
Indian Dairyman, v. 31(2), p. 73–78 **En**
☐*Discusses superiority of buffaloes over cows as producers of milk and meat and as draft animals, examining potentials for their improvement.*
Mic.No: 80722

0145 Travis, L. 1988. **Mules as draught animals.**
Heavy Horse World (UK), v. 2(4), p. 16–17, 3 illus., ISSN 0951-2640. **En**
☐*Describes the physical characteristics of mules, their temperament and suitability for draft work, one of their most important attributes being versatility.*
Mic.No: 80545

0146 Uzureau, C. 1974. **Animal draught in West Africa.**
World Crops (UK), p. 112–114, 1 table; 1 ref., ISSN 0043-8391. **En**
☐*Describes draft animals and cultivation equipment available in Senegal, Mali and Benin, outlining advantages, problems and future prospects of animal draft cultivation in West Africa.*
Mic.No: 00384

0147 Vietmeyer, N. s.d. **Draft power: The forgotten energy source.**
Topic (USA), no. 146, p. 25–27, 3 illus. **En**
☐*Discusses the vital role of animal traction as an energy source, constraints to its further development, benefits of improving the design of animal draft implements and yokes and limitations to draft power.*
Mic.No: 80119

0148 Watson, P. 1983. **Animal traction.**
Artisan Publications. Summit, NJ (USA), 151p., 98 fig., 10 tables; numerous ref. **En**
☐*Presents guidelines on the use of animal traction in small farm operations, discussing such aspects as draft animal selection, training and husbandry; use of yokes, harnesses and hitches; field operations and implements; economic and technical assistance; and extension of animal traction. Includes appendices with information on the nutritional requirements of work animals, methods of controlling various diseases affecting them, and ways of maintaining workshop and spare part inventories and animal traction instruction forms; identifies animal breeds used for power in Africa.*
Mic.No: 32245

0149 Zarembka, D. 1969. **The oxen: A neglected innovation in East Africa.**
s.n., s.l. Conference of the East African Agricultural Economics Society, s.l., Jun 1969, 7p. **En**
□*Discusses the advantages of using oxen in farm operations in East Africa, outlining the existing systems of tilling the ground, viz. complete hoe cultivation, oxen plowing with hoe weeding, oxen plowing and weeding, and cart and tractor plowing with hoe weeding. Includes brief descriptions of cases where tractors may be introduced.*
Mic.No: 58606

DRAFT ANIMALS IN FARMING SYSTEMS AROUND THE WORLD

0150 Abiye Astatke. 1985. **Animal traction research in Ethiopia.**
ILCA, Addis Ababa (Ethiopia). Workshop on Review of the Status of Livestock, Pasture and Forage Research in Ethiopia, Addis Ababa (Ethiopia), 8–10 Jan 1985, 7p., 5 ref. **En**
□*Discusses animal traction research in Ethiopia with emphasis on the power source, the equipment used and soil cultivation in traditional smallholder farming systems; outlines ILCA's role in research on the Ethiopian highlands.*
Mic.No: 34278

0151 Addrah, E.C.C. 1979. **Culture attelée en République Populaire du Bénin. (Animal traction in the People's Republic of Benin)**
Ecole Inter-Etats des Sciences et Médecine Vétérinaires de Dakar (Sénégal), 166p., 21 fig., 23 tables; 29 ref. D.V.M. **Fr**
□*Discusses the advantages and work on the introduction and development of animal traction in Benin, with particular reference to different types of implements used, types of animals available for work and their management, economic factors, social consequences and future prospects of animal traction.*
Mic.No: 60991

0152 Ali, I. 1977. **Bullock power and implements for small and marginal farms.**
Allahabad Farmer (India), v. 48(1), p. 73–80, 3 fig.; 8 ref. **En**
□*Discusses the possibility of increasing productivity from small and marginal farms in India through efficient use of bullock power and widespread adoption of improved implements. Emphasizes the need for effective transfer of technology and recommends effective demonstration, development of improved implements, provision of liberal credit facilities and subsidies as well as field work by academic institutions as essential measures.*
Mic.No: P00523

0153 Alkali, M.M. 1969. **Mixed farming – need and potential.**
In: Livestock development in the dry and intermediate savanna zones, s.n., s.l. Conference on Livestock Development in the Dry and Intermediate Savanna Zones, Zaria (Nigeria), 16–18 Jun 1969, p. 36–48, 14 ref. **En**
□*Discusses the use of animals for meat, manure and work in northern Nigeria, with reference to the history of mixed farming in the country, zones suitable for mixed farming, and the need for mechanization; includes comments on the need for increasing and maintaining soil fertility, and problems inhibiting the adoption of mixed farming on a large scale.*
Mic.No: 20145

0154 Anderson, F.M. 1982. **Animal traction in the Ethiopian highlands. (Traction animale dans les hauts plateaux éthiopiens)**
ILCA Newsletter (CIPEA Actualites), v. 1(2), p. 3–4, 1 photograph, 1 table, ISSN 0255–0024 (E) and ISSN 0255–0032 (F). **En, Fr**
□*Discusses the use of oxen for draft in the Ethiopian highlands, and research activities undertaken on the animal traction component of the agricultural systems.*
Mic.No: 66195

0155 Anderson, F.M.; Gryseels, G.; Durkin, J.W. 1986. **Factors affecting smallholder grain production in the Ethiopian highlands.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme. OAU/SAFGRAD International Drought Symposium on Food Grain Production in the Semi-arid Regions of Africa, Nairobi (Kenya), 19–23 May 1986, 20p., 2 fig., 7 tables; 5 ref. **En** (En)
□*Discusses factors influencing grain production in a representative and risky farming system in the Ethiopian highlands, with quantitative evidence of the critical contribution of draft oxen to farm grain production by comparing yield and area cultivated between farmers who are ox owners and those who are not.*
Mic.No: 38445

0156 Anon. 1965. **La culture attelée et la modernisation rurale dans le Nord Cameroun (Enquête novembre 1964 – mars 1965). (Animal traction and rural modernization in North Cameroon. Surveys between 1964 and March 1965)**
Bureau pour le Développement de la Production Agricole, Paris (France), 318p., 147 tables, 8 illus., 21 maps **Fr**
□*Examines the principal directions taken by rural modernization efforts in north Cameroon since 1963, particularly regarding the extension of*

animal traction and its impact. Includes general information on the conditions of animal production, agriculture and various aspects of rural modernization.
Mic.No: 20779

0157 Anon. 1967. **The report of the Gambia ox-ploughing survey.**
Wye College, Ashford (UK). Exploration Society, 77p., 50 tables, maps; 14 ref. **En**
□*Presents results of a survey to compare the productivity of agriculture practised by traditional hand-cultivating farmers with that of farmers who had attended a Mixed Farming Centre where, taking a pair of oxen with them, they had been trained in the use of ox plows and shown the advantages of improved agricultural techniques such as use of fertilizers and seed dressings. Concluded that continuation of these centres and the oxenization scheme was the correct strategy for The Gambia at the time.*
Mic.No: 80430

0158 Anon. 1974. **Rapport sur le développement de l'élevage et de la culture attelée dans les zones d'accueil de Landa Pozenda, Boufale et Ossacre. (Report on the development of animal husbandry and animal traction in Landa Pozenda, Boufale and Ossacre)**
Togo. Ministère de l'Economie Rurale, 82p., tables **Fr**
□*Examines the development of animal husbandry in Landa Pozenda, Boufale and Ossacre in Togo, considering measures to be taken regarding the husbandry, health, nutrition, watering and marketing of animals; includes notes on the development of animal traction in the three regions under consideration.*
Mic.No: 76191

0159 Anon. 1974. **Basic data tables to study of constraints, including food aid, on agriculture in the Republic of Botswana.**
FAO, Rome (Italy); WFP, Rome (Italy), 89p., chiefly tables **En**
□*Presents tables with data obtained from a survey of agricultural households in selected areas of Botswana, particularly on cropping information, type of claim to draft power (ownership, exchange, hire etc.), food availability, labour, land, equipment and livestock.*
Mic.No: 57117

0160 Anon. 1976. **Livestock development survey, Sri Lanka. Vol. 1. Integrated development programme for the dry zone.**
FAO, Rome (Italy). FAO Technical Report, no. 4, 124p. **En**
□*Presents an integrated approach to agricultural development in the dry lands of Sri Lanka, assessing economic aspects of producing tree crops, rice and other food crops in association with livestock, and discusses feed, milk and meat, sheep, goat, pig and poultry production with particular reference to problems of small-scale farmers and dry farming. Includes surveys of cattle, buffaloes and other working animals.*
Mic.No: 80705

0161 Anon. 1977. **The water buffalo – a project sponsored by the Australian Freedom from Hunger Campaign.**
FAO, Rome (Italy). FAO Animal Production and Health Paper, no. 4, 283p., 21 fig., 22 tables; 137 ref., ISBN 92-5-100108-1 **En**
□*Discusses the importance of the water buffalo for some Asian, Far and Near Eastern, European and Latin American countries, describing its worldwide distribution and assessing its potential as a major source of farm power, milk and quality meat. Proposes to increase farm level output from the buffalo through programmes of improved feeding, management and conservation, use of selected germplasm, and research on the biological and socio-economic problems limiting efficiency of production. Includes specialized studies on disease conditions, gene identification, available breeds and their improvement, and the effect of environmental and other factors on buffalo production.*
Mic.No: 18980

0162 Anon. 1979. **Proceedings of the sixth scientific conference of the Tanzania Society of Animal Production. Vol. 6, 1979.**
Tanzania Society of Animal Production, Morogoro. 6. Scientific Conference of the Tanzania Society of Animal Production, Iringa (Tanzania), 29-31 May 1979, 211p., fig., tables; ref. **En**
□*Presents papers on livestock production and management in Tanzania including papers on range management, beef feedlot, foot-and-mouth disease, dairy cattle importation, meat goat production, animal power in agricultural production system, alkali treatment of low quality roughages, and evaluation of pasture grass and legume mixtures; includes recommendations.*
Mic.No: 38205

0163 Anon. 1981. **Report on the Nzaui/Machakos farming systems study, November 1980 to February 1981.**
Agricultural Mechanisation Station, Nakuru (Kenya), v.p., 16 tables **En**
□*Reports findings of an exploratory survey carried out among Nzaui/Machakos farmers in Kenya, particularly regarding household structures, farming and cropping objectives and constraints, as well as demand for mechanization and factors influencing*

it. Includes tables detailing financial cost to the farmer and social cost to the country's economy of using work oxen.
Mic.No: 59617

0164 Anon. 1981. **A compendium of background papers. Highlands Programme.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 43p., 1 map, 5 fig., 40 tables; ref. **En**
☐*Reviews ILCA's highland research programme in Ethiopia, describing agricultural systems and research operations at Debre Zeit and Debre Berhan, and proposes improvement of traditional systems through crop and forage trials, research on animal traction, testing of innovations at farm level, cattle breeding, dairy production and better labour/land use; outlines major constraints to farming systems, with recommendations for future livestock/crop production systems.*
Mic.No: 18098

0165 Anon. 1981. **Improving the management of India's deep black soils.**
ICRISAT, Patancheru, A P (India). Seminar on Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, New Delhi (India), 21 May 1981, 106p., fig., tables, photographs, maps; ref. **En**
☐*Proceedings of a seminar organized by the Indian Department of Agriculture and Cooperation in collaboration with ICAR and ICRISAT containing nine presented papers two of which (Virmani et al. and Ryan et al.) are abstracted separately.*
Mic.No: 80663

0166 Anon. 1982. **Bullock power survey.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 9p., 1 table **En**
☐*Presents results of surveys undertaken in various parts of India to determine trends in the use of bullock power, possibility of replacing bullock power by machines and the breed of bullocks used for work purposes.*
Mic.No: 80663

0167 Anon. 1983. **Regional Project on Farm Tool and Equipment Technology, Basic Needs and Employment. ILO/FIN/78/RAF/2. Appropriate farm equipment technology for the small-scale traditional sector. The case of Kenya (Country Profile 2).**
ILO, Geneva (Switzerland), 81p., 16 tables; 23 ref., ISBN 92-2-103612-X **En**
☐*Reviews the role of agriculture in the Kenyan economy, and the development, local manufacture and application of appropriate farm equipment technology including animal traction under the headings: farm equipment innovations; supply, demand and marketing of farm tools and equipment/implements; local manufacture of farm tools and equipment/implements; industrial and mechanization policy and strategy; constraints to the wider use of farm equipment innovations; institutional support and infrastructure.*
Mic.No: 80808

0168 Anon. 1983. **Regional Project on Farm Tool and Equipment Technology, Basic Needs and Employment. ILO/FIN/78/RAF/2. Appropriate farm equipment technology for the small-scale traditional sector. The case of Sudan (Country Profile 4).**
ILO, Geneva (Switzerland), 64p., 1 fig., 9 tables; 20 ref., ISBN 92-2-103609-X **En**
☐*Includes a short section on animal traction in which yields and economic aspects of animal traction are compared with traditional farming methods.*
Mic.No: 80807

0169 Anon. 1983. **ALDEP: Special studies conducted in 1982/83.**
Botswana. Ministry of Agriculture. Arid Lands Development Programme Monitoring Unit, 99p. **En**
☐*Presents results of studies conducted in Botswana on different segments of the Arid Lands Development Programme (ALDEP) in 1982/83 covering the 1982 ALDEP survey, the extension assistance scheme, water tank usage in the Pelotshetla area and the destumping scheme.*
Mic.No: 80021

0170 Anon. 1984. **Programa de desenvolvimento da tracao animal. (Animal traction development programme)**
Secretaria da Agricultura, Parana (Brazil), 15p., 2 fig., 4 tables **Pt**
☐*Discusses draft animal use in Parana State (Brazil). Includes information on numbers of draft animals and types and numbers of animal draft equipment available.*
Mic.No: 80196

0171 Anon. 1984. **Les animaux de trait dans le département de Dosso. (Work animals in Dosso District)**
Niger. Ministère du Développement Rural. Projet de Développement Rural de Dosso, 41p., tables **Fr**
☐*Presents findings of a survey on the estimated number of draft animals and their characteristics in the Dosso District of Niger.*
Mic.No: 76047

0172 Anon. 1986. **Excess manufacturing capacity and farm equipment needs in Kenya.**
ILO, Geneva (Switzerland); Kenya. Ministry of Agriculture and Livestock Development. National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Nairobi (Kenya), 15–18 Oct 1985, 113p., fig., tables, photographs; ref., ISBN 92-2-105484-5 **En** (En)
☐*Includes opening addresses, eleven papers and closing addresses covering: demand/supply relationships and marketing of farm equipment; evaluation of farm equipment innovations; constraints to the wider use of farm equipment innovations; policy dimensions; local manufacture, trade and distribution of farm tools and implements; institutional support and infrastructure. A paper on ox-drawn equipment by G. Muchiri et al. is abstracted separately.*
Mic.No: 80810

0173 Anon. 1986. **Initiatives for farm equipment programmes in Botswana: Improving co-ordination.**
ILO, Geneva (Switzerland); Botswana. Ministry of Agriculture. National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Gaborone (Botswana), 3–5 Dec 1985, 118p., 2 fig., 10 tables, 1 graph; 10 ref., ISBN 92-2-105485-3 **En**
☐*Presents two opening addresses, 14 papers, one closing address and a technical background paper from a national workshop jointly implemented by ILO and the Botswana Ministry of Agriculture and financed by the Government of Finland covering: demand/supply relationships and marketing of farm equipment; evaluation of farm equipment innovations; constraints to wider use of farm equipment innovations; policy dimensions; local manufacture, trade and distribution of farm tools and implements; institutional support and infrastructure. Three papers are abstracted separately.*
Mic.No: 80830

0174 Anon. s.d. **Animal traction in Upper Volta. (La traction animale en Haute-Volta)**
FAO, Rome (Italy), v.p., 197 photographs **En, Fr**
☐*Illustrates the use of draft animals in farming operations by two brothers farming in Burkina Faso. Charts their progress from traditional farmers using hand tools to successful use of draft animals and their equipment which led to an improved standard of living for their families and stimulating rural craftsmen to satisfy their equipment needs.*
Mic.No: 31605

0175 Anon. s.d. **La mécanisation agricole au Rwanda: compte rendu. (Agricultural mechanization in Rwanda: Meeting report)**
Université Nationale du Rwanda, Butare. Faculté d'Agronomie. 1. Colloque National sur la Mécanisation Agricole au Rwanda, Butare (Rwanda), 15–21 Avr 1985, 611p., fig., tables; ref. **Fr**
☐*Presents a collection of technical papers from the first national symposium on agricultural mechanization in Rwanda, dealing with mechanization under different farming systems, machinery and implements available in the country.*
Mic.No: 37585

0176 Baconawa, E.T. 1984. **The Philippine carabao as a work animal.**
FAO – Asian Livestock, v. 9(6), p. 55, 66–67, 1 table **En**
☐*Discusses briefly the status of carabao use for work in the Philippines, outlining the country's agricultural situation and action taken by the government to encourage the use of the carabao for work.*
Mic.No: 80032

0177 Bah, M.S. 1985. **Issues involved in the comparison of ox-traction and power tillers in Sierra Leone.**
FAO, Njala (Sierra Leone). FAO Seminar, Njala (Sierra Leone), 11–13 Sep 1985, 6p., 6 ref. **En**
☐*Discusses the benefits of using animal traction as opposed to power tillers together with constraints to the development of animal traction.*
Mic.No: 80318

0178 Baker, R.; White, P. 1983. **An evaluation of policy toward agricultural technology choice for power in Zambia.**
East Anglia Univ., Norwich (UK). School of Development Studies. School of Development Studies Discussion Paper (UK), no. 121, 24p., 6 tables **En**
☐*Reviews the origins of the tractor bias in policy in Zambia and illustrates the significance of choice of technology as a more meaningful basis for decision making and resource allocation in terms of changing the stagnation prevalent in the rural farm sector, with emphasis on reasons why the government continues to pour resources into the tractor-farming group. Emphasizes the need for a two-pronged, phased policy of putting tractor-farming on a profitable basis and the diffusion of ox ownership and use.*
Mic.No: 32689

0179 Bako, S.; Ingawa, S.A. 1990. **Animal traction in Nigeria: Impact, constraints and current initiatives.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional

Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 366–369, 23 ref., ISBN 92-9081-046 7 **En** (En)
☐*Reviews the current animal traction situation in Nigeria and constraints to its further development. Concludes that animal traction is spreading to new users and its use by traditional users is intensifying, that awareness of animal traction is high but knowledge regarding animal handling and use and care of equipment is lacking, that animal traction currently has an economic advantage over tractorization although farmers still maintain they cannot afford animals, plows and other equipment, and that supply of such equipment is limited. Recommends collection of animal traction data from Nigeria, loan schemes and more local manufacture of equipment.*
Mic.No: 82035

0180 Balo, M.R. 1985. **La culture attelée au Cameroun. (Animal traction in Cameroon)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 30–32, 2 tables **Fr**
☐*Briefly describes the animal traction situation in Cameroon and numbers and types of draft animals and animal draft equipment are tabulated.*
Mic.No: 80231

0181 Bangura, A.B.; Allagnat, P.; Starkey, P.H. 1986. **Animal traction in Guinea. Report of a visit to study the present state of draught animal utilisation and research in Guinea. (La traction animale en Guinée. Rapport sur la mission d'étude de l'utilisation actuelle et des recherches de la traction animale en Guinée)**
Sierra Leone. Ministry of Agriculture and Forestry, 38p., 8 tables, 2 maps; 4 ref. **En, Fr** (En Fr)
☐*Reports on a study of the present state of animal draft utilization and research in Guinea carried out by the Sierra Leone Work Oxen Project. Includes recommendations for promoting animal traction in Guinea and discusses how Sierra Leone can benefit from Guinean experience and how both countries can benefit from mutual exchange of research results, staff and equipment and from coordination of research and animal health programmes.*
Mic.No: 80299

0182 Bangura, A.B. 1988. **The utilization and management of draft animals at farm level.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 293–298, 5 ref., ISBN 3-528-02047-4 **En** (En)
☐*Reviews the use of draft animals in Sierra Leone for primary cultivation, ridging, seeding, weeding, harvesting, gear systems and transport and their management, primarily nutrition, housing and health.*
Mic.No: 82024

0183 Bankole, I.A. 1982. **Contribution à l'étude de la culture attelée dans la province de l'Oueme. (Contribution to the study of animal traction in Oueme province)**
Collège Polytechnique Universitaire, Abomey-Calavi (Bénin), 97p., 2 tables, 2 maps; 11 ref. Mémoire de Fin d'Etudes (Production Animale). **Fr**
☐*Describes the human and environmental situation of Oueme Province in Benin; and discusses the introduction of animal traction in the Province, indicating the advantages of animal traction to smallholders and proposals for its improvement.*
Mic.No: 60935

0184 Bansal, R.K.; Kshirsagar, K.G.; Sangle, R.D. 1985. **Efficient utilization of energy with an improved farming system for selected SAT regions.**
American Society of Agricultural Engineers, St. Joseph. Summer Meeting, American Society of Agricultural Engineers, East Lansing, Michigan (USA), 23–26 Jun 1985. ASAE Paper (USA), no. 85-1021, 17p., 1 fig., 6 tables; 21 ref. **En** (En)
☐*Describes an improved technology developed by ICRISAT for management of Vertisols utilizing oxen and wheeled toolcarriers and presents results of on-farm verification trials.*
Mic.No: 80348

0185 Bansal, R.K.; Klaij, M.C.; Serafini, P.G. 1988. **Animal traction in improved farming systems for the semi-arid tropics: The ICRISAT experience in India and West Africa.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 139–147, 1 fig., 4 tables; 12 ref., ISBN 3-528-02047-4 **En**
☐*Examines the use of animal traction and its equipment in India and West Africa. Concludes that as an isolated technique animal traction has had little effect on farmer efficiency but that when it has been combined with improved biological and chemical technology, appropriate soil management techniques and adapted equipment there are substantial and sustainable increases in production. The importance of networking is stressed.*
Mic.No: 82009

0186 Baron, S. 1968. **Cheaper than tractors.**

Ceres. FAO Review, v. 1(2), p. 34–38, 4 photographs, ISSN 0009–0395. **En, Es, Fr**
☐*Describes experiences in the utilization of working animals for farming in Benin.*
Mic.No: 80720

0187 Bembridge, T.J. 1987. **Aspects of cattle production in Transkei.**
Suid-Afrikaanse tydskrif Veck., v. 17(2), p. 74–78, 2 fig., 6 tables; 24 ref. **En** (En Af)
☐*Discusses importance and problems of cattle production in Transkei and includes data on numbers and patterns of ownership of oxen.*
Mic.No: 80114

0188 Bembridge, T.J. 1987. **Crop farming system constraints in Transkei: Implications for research and extension.**
Development Southern Africa, v. 4(1), p. 67–89, 7 fig., 3 tables; 19 ref. **En** (En)
☐*Discusses results of a farming systems research study focussing on problem identification, diagnosing constraints and making recommendations on institutional and technological changes aimed at improving the impact of research and extension on crop farming systems in Transkei. Problems include shortages of draft animals and implements.*
Mic.No: 80113

0189 Benoit-Cattin, M. 1979. **La mécanisation des exploitations agricoles au Sénégal. Le cas des unités expérimentales du Sine Saloum. (Farm mechanization in Senegal. The case of experimental units of Sine Saloum)**
Machinisme Agricole Tropical (France), no. 65, p. 44–50, 5 illus., 4 tables **Fr** (En Es Fr)
☐*Presents technical proposals made by agronomists for the intensification of agriculture by developing appropriate cultivation methods and the use of oxdrawn implements on experimental farms in Sine Saloum, Senegal.*
Mic.No: 19516

0190 Benoit-Cattin, M. s.d. **Type d'exploitation et niveaux d'équipement dans l'unité expérimentale du Sud Sine Saloum au Sénégal. (Type of farming system and levels of equipment in the experimental units of Southern Sine-Saloum in Senegal)**
Séminaire sur la Mécanisation des Exploitations Individuelles des Pays Chauds. 12. Mécanisation et Agro-socio-économie, Paris (France), 28 Feb–1 May 1977, 10p., 5 tables; 6 ref. **Fr** (Fr)
☐*Characterizes the type of farming system and implements used on cooperative farms which constitute the southern Sine Saloum experimental unit in Senegal, based on agricultural and socioeconomic research, with particular reference to mechanization and animal traction.*
Mic.No: 40607

0191 Bigot, Y.; Anne, S. 1974. **Référence d'utilisation des animaux et du matériel agricole de traction attelée en milieu rural. (Use of animals and animal traction equipment in a rural environment)**
Centre National de Recherches Agronomiques, Bambey (Sénégal), 6p., 3 tables **Fr**
☐*Reports on the use of animal traction and animal draft equipment by experimental units and the scheme in southern Sine-Saloum. Includes data on operations carried out by oxen, horses and donkeys in Koumbidia and Thysse, time taken for these operations by the different species and land areas worked.*
Mic.No: 80277

0192 Bigot, Y.; N'Daw, P.; Pretot, C. 1976. **Structure de production et évolution de la mécanisation chez les premiers planteurs de coton en culture attelée dans le nord-ouest de la Côte d'Ivoire. (Production systems and the development of mechanization by the major cotton growers using animal draft power in the north-west of Côte d'Ivoire)**
Cahiers Ivoiriens de Recherche Economique et Sociale, v. 11/12, p. 7–27, tables; 9 ref. **Fr**
☐*Describes effects of the agricultural extension service on production of cotton and use of draft animals in northwestern Côte d'Ivoire, examining changes in farming systems, area under cotton and other food crops and labour requirements of farmers who had received oxen.*
Mic.No: 80724

0193 Bigot, Y. 1979. **L'introduction de la culture attelée en pays Senoufo (Nord-Ouest de la Côte d'Ivoire). (The introduction of animal traction in Senoufo country, northwestern Côte d'Ivoire)**
Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris (France); Centre Voltaique de la Recherche Scientifique, Ouagadougou. In: Maîtrise de l'espace agraire et développement en Afrique tropicale. Logique paysanne et rationalité technique, Colloque de Ouagadougou, Ouagadougou (Burkina Faso), 4–8 Dec 1978. Mémoires ORSTOM (France), no. 89, p. 529–536, 7 tables; 5 ref., ISBN 2–7099–0556–6 **Fr** (En Fr)
☐*Evaluates attempts at introducing animal traction in the cotton growing regions in northwestern Côte d'Ivoire, describing the agrarian structure, the modalities and rationale of introducing animal traction, and farmers' response, particularly in Bagoue region; recommends a revision of approaches used.*
Mic.No: 82267

0194 Bigot, Y. 1983. **Projet de recherche sur la mécanisation agricole en Afrique subsaharienne. Rapport de mission**

effectuée en Guinée Forestière et en Haute Guinée. (Research project on agricultural mechanization in sub-Saharan Africa. Report of mission undertaken in Guinée Forestière and Haute Guinée)
Banque Mondiale, Washington, D.C. (Etats-Unis d'Amérique). Département du Développement Agricole et Rural, 39p., 17 tables, 1 map; 12 ref. **Fr** (Fr)
☐*Presents results of a survey of villages in Guinee Forestiere and Haute Guinee to study the extent of mechanization and use of animal traction and the relationships between animal traction and social and farming systems.*
Mic.No: 80301

0195 Bigot, Y. 1988. **Un siècle d'histoire d'une technologie agricole: la traction animale en Guinée. (A century of an agricultural technology: Animal traction in Guinea)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 36–52, 5 tables; 26 ref., ISBN 2-87614-026-8 **Fr**
☐*Describes the history of development of animal traction in Guinea, problems involved, and constraints to its future development. Discusses animal traction in sub-Saharan Africa in the light of experience in Guinea.*
Mic.No: 82071

0196 Binechin, B.D. de; Malcoiffe, C.; Hayes, J.A. de. 1971. **Données actuelles sur l'association de l'agriculture et de l'élevage en Haute-Volta. (Current data on the crop–livestock integration in Upper Volta)**
Organisation Commune Africaine et Malgache, Yaoundé (Cameroun); Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). In: Colloque sur l'Elevage, Colloque sur l'Elevage, N'djamena (Tchad), 8–13 Dec 1969, p. 268–286, 6 graphs, 11 tables **Fr**
☐*Discusses the utilization of livestock for animal traction and farmyard manure production in Burkina Faso, and crop-livestock integration, with particular reference to forage crop and range management; includes annexes on the chemical analysis of farmyard manure, forages and silage.*
Mic.No: 80657

0197 Binswanger, H.P.; Virmani, S.M.; Kampen, J. 1980. **Farming systems components for selected areas in India: Evidence from ICRISAT.**
ICRISAT, Patancheru, AP (India). ICRISAT Research Bulletin, no. 2, 40p., 15 tables, 1 map; 13 ref. **En**
☐*Summarizes conclusions drawn from seven years of soil and water management research in the Farming Systems Program of ICRISAT. Tabulated data includes information on working capacity of bullocks with wheeled toolcarriers for various operations on broadbeds and furrows and flat planted fields.*
Mic.No: 17424

0198 Bisson, P.; Diomande, V. 1988. **La stratégie ivoirienne en matière de mécanisation agricole. Le cas de la zone de savane en Côte d'Ivoire. (The agricultural mechanization strategy of Côte d'Ivoire. The case of the savanna zone)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 359–367, ISBN 2-87614-026-8 **Fr**
☐*Describes the mechanization of agriculture in Côte d'Ivoire including promotion of animal traction.*
Mic.No: 82073

0199 Blench, R.M. 1987. **Social determinants of animal traction in centr... Nigeria. Report to: Agricultural Research Unit, the World Bank and the International Livestock Centre for Africa.**
IBRD, Washington, D.C. (USA). Agricultural Research Unit, 30p., 5 tables; 27 ref. **En**
☐*Presents results of a study and survey of plowing along the southern frontier in Nigeria where farmers who were successfully using plows, those who had formerly used plows but had stopped and those who had never used a plow were interviewed in order to define reasons for the inadequate expansion of animal traction. Concludes that animal traction could succeed in a far wider geographical area than at present, the main constraint being disease. Considers that camel traction is likely to spread of its own accord in the next few years and that priority should be given to provision of loans for camels and not just for oxen. Discusses the possibility of using donkeys on light sandy soils.*
Mic.No: 80229

0200 Blondin, M. 1968. **Culture attelée. (Animal traction)**
Union Nigérienne de Crédit et de Coopération, Niamey, 45p. **Fr**
☐*Discusses briefly issues in the introduction of animal traction in traditional farming systems in Niger, examining the role of labour, land, animals and implements in this endeavour.*
Mic.No: 75444

0201 Boniface, B. 1985. **L'expérience de culture par traction animale au**

Burkina Faso. (Experience with animal-powered cultivation in Burkina Faso)
Centre National d'Equipement Agricole, Ouagadougou (Burkina Faso). Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985, 10p. **Fr**
☐*Reviews the history, promotion and future of animal traction in Burkina Faso and discusses problems in management of draft animals (training, health, feeding).*
Mic.No: 80370

0202 Boniface, B. 1985. **La culture avec traction animale: quelques expériences pays par pays. Burkina-Faso. (Cultivation with animal traction: Country experiences. Burkina Faso)**
Journée d'Etude sur la Culture avec Traction Animale, Antony (France), 7 Mar 1985. Afrique Agriculture (France), no. 122, p. 23–24, 1 photograph, ISSN 0337–9515. **Fr**
☐*Reviews the history of introduction of animal traction in Burkina Faso, the current animal draft situation, constraints and future prospects. Describes the work of the Centre National d'Equipement Agricole in developing and adapting durable animal draft implements with emphasis on multipurpose equipment.*
Mic.No: 80839

0203 Boniface, B. 1985. **Burkina Faso. "Il a fallu rechercher des équipements adaptés". (Burkina Faso. "Research for better adapted implements required")**
Afrique Agriculture (France), no. 122, p. 23–24, ISSN 0337–9515. **Fr**
☐*Outlines briefly attempts made to introduce animal traction in Burkina Faso, indicating constraints and limitations to its use in the country.*
Mic.No: 80121

0204 Bonnabaud, R. 1970. **Projet pour le développement de la recherche agronomique et de ses applications dans le bassin du Fleuve Sénégal. Note sur la culture attelée et l'association agriculture-élevage au Sénégal. (Development project for agronomic research and its applications in the Senegal River basin. Note on animal traction and crop-livestock integration in Senegal)**
FAO, Rome (Italy), 22p. **Fr**
☐*Discusses economic and sociological aspects of the utilization of donkeys, cattle and horses in agriculture, with data on draft power, training and proposed health control measures.*
Mic.No: 80707

0205 Bordet, D. 1985. **Une tentative de développement de la culture attelée au Nicaragua. (An attempt to develop animal traction in Nicaragua)**
Machinisme Agricole Tropical (France), no. 91, p. 33–36 **Fr**
☐*Discusses the history of animal traction in Nicaragua, involvement of CEEMAT in development of animal traction equipment and initiation by Jean Nolle in 1982 of toolbar production, but raises doubts over the future of toolcarrier production and indeed of their desirability.*
Mic.No: 80217

0206 Boudet, G. s.d. **Association agriculture-élevage. (Crop-livestock integration)**
Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). s.n., s.l., 11p. **Fr**
☐*Analyzes issues involved in the association between agriculture and animal husbandry in tropical and subtropical Africa, examining animal traction activities, major factors in the association, the utilization of farmyard manure and livestock nutrition.*
Mic.No: 11804

0207 Briat, M. 1985. **La culture attelée en riziculture pluviale et irriguée. (Animal powered cultivation in rainfed and irrigated rice production)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 49–52, 1 photograph **Fr**
☐*Discusses the suitability of animal traction for production of irrigated and rainfed rice in West Africa.*
Mic.No: 80333

0208 Brin, E. 1987. **Report on blacksmith activities in the Bombali District. Organisation of training programme.**
Sierra Leone Work Oxen Project, Freetown, 8p., 1 table **En**
☐*Following a survey of blacksmiths in the Mbole Valley in which their work was found to be generally of mediocre quality, proposes the introduction of a training programmme.*
Mic.No: 80321

0209 Brownbridge, J.M. 1974. **L'agriculture. (Agriculture)**
OXFAM, Kinshasa (Zaïre). In: Deuxième rapport de l'Equipe de Conseillers de l'Oxfam au Zaïre, p. 70–116 **Fr**
☐*Discusses increasing yields obtained by applying simple improved cultural methods, particularly furrowing, crop association and the use of fertilizers and improved seeds; and studies the role of farmer training, extension of innovations, use of animals*

for work and proper use of hand tools in agricultural development.
Mic.No: 23134

0210 Bujarbaruah, K.M. 1982. **"Why and how" of animal power in North Eastern Region.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 8p., 3 tables **En**
☐*Examines the availability of working animals in the North Eastern Region of India, outlining their use in agricultural operations, transport and draft, and assesses possible ways of using them for the benefit of farmers engaged in agricultural operations.*
Mic.No: 80692

0211 Bunyavejchewin, P.; Chantalakhana, C. 1989. **Overview of research on animals in Southeast Asia.**
Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 36–45, 2 tables; 65 ref., ISBN 1-86320-003-7 **En** (En)
☐*Highlights the role of draft animals as power sources for rural agricultural systems in Southeast Asia. Reviews past draft animal research under the headings socio-economics, breed improvement, reproductive physiology and AI, nutrition, environmental physiology, health and engineering. Concludes that information on DAP is lacking in the region and outlines future research needs.*
Mic.No: 80925

0212 Coppock, D.L.; Ellis, J.E.; Swift, D.M. 1986. **Livestock feeding ecology and resource utilization in a nomadic pastoral ecosystem.**
Journal of Applied Ecology (UK), v. 23(2), p. 573–583, 4 fig., 27 ref., ISSN 0021-8901. **En** (En)
☐*Determines the degree to which camels, cattle, goats, sheep, and donkeys provide complementary options for resource use. Quantifies seasonal patterns of forage selection, diet diversity and habitat use for each livestock species and for the average aggregate holdings of four Ngisonyoka families, in Kenya.*
Mic.No: 81057

0213 Croxton, S. 1989. **The potential for using animal traction to cultivate wadi soils.**
s.n., s.l. Intermediate Technology Development Group, Inter-Project Meeting, Darfur (Sudan), 13 Jun 1989, 6p., 6 ref. **En** (En)
☐*Discusses the potential for using animal power for cultivation in the wadis of Darfur, Sudan, and major constraints. Concludes that there is great scope for cultivating wadi soils with animals as an interim and appropriate technology although current knowledge of suitable practices and implements is limited. Considers that further research should involve farmers and local artisans so that appropriate modifications to existing designs and practices can develop.*
Mic.No: 80544

0214 Diop, A.T. 1989. **L'utilisation de la traction asine pour la fauche des parcours naturels. (Utilization of donkey power for mowing natural pastures)**
Institut Sénégalais de Recherches Agricoles Dakar, 11p., 7 tables, 4 drawings, 1 photograph; 4 ref. **Fr** (Fr, En)
☐*Presents results of trials using donkeys for mowing during hay making in the silvopastoral zone of Senegal. Concludes that these Ajuria mowing machines formerly used with oxen in the 1960s should be reconditioned and that they would be suitable for use with a pair of donkeys after modifications to the shaft and the wheels.*
Mic.No: 80551

0215 Domingo, M. s.d. **La traction animale au Togo. (Animal traction in Togo)**
Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier (France). Dept. Systèmes Agraires. In: Relations agriculture-élevage, 2. Séminaire du Département Systèmes Agraires du CIRAD sur les Relations Agriculture – Elevage, Montpellier (France), 10–13 Sep 1985. Collection Documents Systèmes Agraires (France), no. 4, p. 244–245, 1 table **Fr** (En Es Fr)
☐*Describes an animal traction project involving 4,195 pairs of oxen dispersed throughout Togo and initiated as a political effort to meet food self-sufficiency needs, with emphasis on training, maintaining and following up of draft oxen, and provision of credit.*
Mic.No: 82088

0216 Dossou, R. 1974. **Rôle de la culture attelée dans la production de viande. (Impact of animal traction on meat production)**
s.n., s.l., 40p., 6 tables, 1 graph; 7 ref. Mémoire de Fin d'Etudes (Elevage). **Fr**
☐*Examines the impact of animal traction on beef production in Benin, analyzing the genetic improvement, fattening and health care of cattle herds.*
Mic.No: 60906

0217 Edwards, R. 1986. **The importance of livestock within the total farming system.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine. Draught Animal News (UK), no. 5, p. 19 **En**
☐*Describes the objectives of the Integrated Farming Pilot Project set up to test new systems of crop production and livestock management in Botswana in farm trials, to pilot a new integrated approach to agricultural development in the area and identify inputs necessary to introduce the new technologies.*
Mic.No: 80828

0218 Fall, A.; Ndiame, F. 1988. **La mécanisation de la riziculture en Basse-Casamance. (Mechanization of rice farming in Lower Casamance)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 319–329, 5 tables, 1 map; 18 ref., ISBN 2–87614–026–8 **Fr**
☐*Divides the Basse Casamance region into 4 zones in terms of future potential for draft animal use in rice production and discusses economic and political constraints.*
Mic.No: 80406

0219 Farrington, J.; Abeyratne, F. 1982. **Farm power in Sri Lanka.**
Reading Univ. (UK). Dept. of Agricultural Economics and Management. Reading University, Department of Agricultural Economics and Management Development Study (UK), no. 22, 272p., numerous fig., tables; 92 ref. **En** (En)
☐*Reports findings of a comprehensive field study carried out in Sri Lanka on the current use patterns of draft power and their effects in dry zone colonisation schemes. Discusses historical policy trends and current patterns of resource allocation in agriculture; presents data on the stock of draft power and on the ways in which power is used and its impact on crop production; and assesses the impact of mechanization on labour-use, and the role of access to draft power and to other productive resources in generating personal incomes and wealth.*
Mic.No: 34028

0220 Farrington, T.; Riches, C.R. 1983. **Draught power in Botswana. 1. The draught power problem in perspective. 2. The design and testing of solutions.**
CIMMYT, Mexico City (Mexico). Eastern and Southern Africa Economics Programme. In: Networkshop on draft power and animal feeding, Networkshop on Draft Power and Livestock Feeding in Eastern and Southern Africa, Mbabane (Swaziland), 4–6 Oct 1983, 27p., 10 tables; 31 ref. **En**
☐*Attempts to put Botswana's draft power problem into perspective, providing background information on the physical environment, the crop and livestock sectors, and their relationship to off-farm income, and identifying the underlying causes and extent of the draft power problem in communal areas of Botswana. Approaches the design and testing of solutions which address draft power problems from three angles, viz. increased efficiency of draft use, substitution of animal draft by tractor power and improved draft animal nutrition; examines these separately using experimental data.*
Mic.No: 82260

0221 Faye, A.; Niang, L.; Sarr, D.Y.; Thiam, A. 1986. **Etude monographique de la communauté rurale de Kaymor. (Monograph on the rural community of Kaymor)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Sénégal), no. 86–4, 118p., 21 fig., 10 tables, 4 maps **Fr** (Fr)
☐*Presents results of a socio-economic study of the Communauté Rurale de Kaymor (19 500 ha) in S.E. Sine-Saloum, giving details of its social and economic structure, available resources (manpower, land, fertilizers, seeds, agricultural equipment and draft animals) and agricultural systems.*
Mic.No: 80785

0222 Faye, A.; Havard, M. 1987. **Eléments d'analyse de la situation actuelle de la culture attelée au Sénégal: perspectives d'études et de recherches. (Current state of animal traction in Senegal: Research prospects)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Sénégal), no. 87–1, 22p., 1 fig., 3 tables, 1 map; 6 ref. **Fr** (Fr)
☐*Discusses the effect of the suspension of the Programme Agricole in 1981 on the further development of animal traction in Senegal and lists numbers of cultivators, seeders, carts, harvesters, horses, donkeys and oxen. Eight zones of Senegal are distinguished in terms of draft animals and available equipment.*
Mic.No: 80781

0223 Faye, A. 1988. **Le rôle du cheval dans le développement de la traction animale et son impact sur l'évolution de l'agriculture en zone sahélo-saharienne du Sénégal: exemple de l'Unité Expérimentale de Thysse Kaymor Sonkorong dans le sud du Bassin Arachidier. (The role of the horse in the development of animal traction and its impact on agricultural development in Sahel-Sahara zone of Senegal: The case of the Unite Experimentale de Thysse Kaymor Sonkorong in the south of the Groundnut Basin)**

Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p.153–164, 1 fig., 1 map, 1 table; 11 ref., ISBN 2-87614-026-8 **Fr**

☐*Discusses historical aspects of the development of horse traction in Senegal, its impact on current farming systems, working performance and reproductive capacity of the horse and research needs, in the light of experience in the Sine-Saloum region.*
Mic.No: 82068

0224 Faye, A. 1989. **Le rôle du cheval dans le développement rural en zone sahélo-soudanienne de Sénégal: l'exemple du Sud du bassin Arachidier. (The role of the horse in the rural development in the southern Sahélo-Sudanian zone of Senegal: The example of the southern Groundnut Basin)**
Cahiers de la Recherche Développement (France), no. 21, p. 19–29, 1 map, 2 graphs, 6 tables; 19 ref., ISSN 0760-5790. **Fr** (Fr)

☐*Discusses the role of horses (and donkeys) in promoting agricultural development through the use of animal traction in Senegal and the fact that the horse still remains the favourite draft animal in the Bassin Arachidier despite efforts to introduce oxen and problems associated with use of horses.*
Mic.No: 80920

0225 Fielding, D. 1987. **Donkeys in Africa.**
Edinburgh School of Agriculture (UK). Colloquium on: The Exploitation of Animals in Africa, Aberdeen (UK), 23–24 Mar 1987, 13p., tables, maps, ref. **En** (En)

☐*Reviews numbers, distribution and utilization of donkeys in Africa and factors determining extent of their use. Contrasts arguments for and against future increased use of donkeys and makes recommendations for possible technical initiatives. Draws attention to the need for more reliable data on the donkey and its contribution as a power source. Considers that a major factor limiting the use of donkeys is their low socio-economic status, but concludes that they justify greater development and research attention as a source of animal power for agriculture and rural transport.*
Mic.No: 80380

0226 Flora, C.B. (ed.) 1984. **Animals in the farming system.**
Kansas State Univ., Manhattan (USA). Kansas State University's 1983 Farming Systems Research Symposium: Animals in the Farming System, Kansas (USA), 31 Oct–2 Nov 1983. Kansas State University Farming Systems Research Paper Series (USA), no. 6, 924p., fig., tables; ref. **En**

☐*Contains 48 papers; three relevant to animal traction by F.M. Anderson, G. Gryseels and W.K. Jaeger are abstracted separately.*
Mic.No: 80908

0227 Fort, J. 1973. **Mécanisation des pratiques agricoles traditionelles en zone sahélienne du nord. (Mechanization of traditional agricultrural practices in the northern Sahelian zone)**
Machinisme Agricole Tropical (France), no. 41, p. 31–39, 3 fig., 1 table, 6 photographs **Fr** (Fr)

☐*Includes a description of camel harnessing systems for tine cultivation in the Tahoua area of Niger.*
Mic.No: 80262

0228 Fournier, A. 1972. **La culture attelée au Nord-Cameroun. (Animal traction in North Cameroon)**
Cameroun Agricole, Pastoral et Forestier, no. 132, p. 13–24, 1 table; 28 ref. **Fr**

☐*Reviews the development of animal traction in North Cameroon and the current situation. Concludes that it is regressing, draft equipment is under-utilized and animals are tending to be used for meat. Discusses means of overcoming existing constraints not only to development of animal traction but to the modernization of the rural economy in general.*
Mic.No: 80233

0229 Francis, P.A. 1988. **Ox draught power and agricultural transformation in northern Zambia.**
Agricultural Systems (UK), v. 27(1), p. 35–49, 5 fig., 7 tables; 6 ref., ISSN 0308-521X. **En** (En)

☐*Discusses the conditions under which draft oxen have been adopted in Mpika District, Zambia, their impact on resource use and productivity, and the implications for further agricultural change. Assesses the effect of oxenization on labour allocation and the timeliness of key operations.*
Mic.No: 38951

0230 Francis, P.A. s.d. **The impact of ox draught power on small scale agriculture in Mpika district, northern Zambia.**
ILCA, Ibadan (Nigeria). Humid Zone Programme, 39p., 2 maps, 4 graphs, tables; 1 ref. **En** (En)

☐*Examines the actual performance of the earliest beneficiaries of the ox-supply programme in Mpika District, Zambia. Compares resource allocation by ox-owning households with a control group of households reliant on hand cultivation, with emphasis on labour. Lists survey methods and the ox-supply programme. Discusses the area, its farming system and oxenization; the allocation of labour time, and sources of labour; and assesses financial implications.*
Mic.No: 39849

0231 Frankenberger, T.R. 1986. **Integrating livestock into farming systems research: An example from north Kordofan, Sudan.**
Human Organization (USA), v. 45(3), p. 228–238, 5 tables, 1 map; 42 ref., ISSN 0018–7259. **En** (En)
☐*This study of some of the major issues associated with farming systems research approaches to livestock production in Sudan deals briefly with numbers and types of animals used for transport and carrying goods in the north Kordofan region and suggests that introducing animal traction would result in reduction in herd size and increase animal quality.*
Mic.No: 80264

0232 Gefu, J.O.; Ahmed, H.U.; Otchere, E.O.; Olorunju, S.A.S. 1990. **Observations on animal power utilization in the farming systems of northern Nigeria.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 382–386, 3 tables; 7 ref., ISBN 92–9081–046–7 **En**
☐*Presents data from a preliminary survey of animal traction users in three states in northern Nigeria. Results showed that farmers using animal traction tended to be young and worked 1–7 oxen (mean 2.6). Points out that implement designers should bear in mind that most farmers work oxen in pairs. Includes information on cost of animals, training, feeding, size of farm, hiring out of working oxen by farmers with small farms, income and working life of the animal. Concludes that the usefulness and appropriateness of animal traction cannot be underestimated and that its unexplored potential, if carefully researched in terms of farmers' needs will lead to an unprecedented increase in rural income and improved nutrition for Nigeria.*
Mic.No: 82226

0233 Getachew Asamenew; Jutzi, S.; Abate Tedla; McIntire, J.; Ikavalko, E. 1988. **Improved draught power use for increased food and feed production on Ethiopian highland Vertisols.**
ILCA, Addis Ababa Ethiopia. Highlands Programme. 2. National Livestock Improvement Conference, Addis Ababa (Ethiopia), 23–25 Feb 1988, 10p, 1 fig., 2 tables; 6 ref. **En** (En)
☐*Presents and discusses the effects of animal power use for improved soil surface drainage on food and feed production on the Vertisols of the Ethiopian highlands. Examines the on-farm technology validation programme at ILCA; describes crop/livestock interactions in these Vertisol areas; highlights the seasonal pattern of draft-oxen use; and assesses the economic impact of animal power use for surface drainage.*
Mic.No: 39942

0234 Gill, G.J. 1981. **Farm power in Bangladesh. Volume 1. A comparative analysis of animal and mechanical farm power in Bangladesh.**
Reading Univ. (UK). Dept. of Agricultural Economics and Management. Reading University, Department of Agricultural Economics and Management Development Study (UK), no. 19, 248p., ISBN 0–7049–0695–3 **En**
☐*Presents findings of field studies conducted in Bangladesh on the relative advantages and disadvantages of tractorisation and the use of draft animals. Areas studied include the existing draft power situation and the extent to which the land tenure situation is conducive to mechanized cultivation; sample farmers' views on tractorization; the impact of mechanization on land productivity; the direct and indirect impact of mechanization on employment; and hire charges.*
Mic.No: 33730

0235 Goe, M.R. 1987. **Animal traction on smallholder farms in the Ethiopian highlands.**
Cornell Univ., Ithaca, NY (USA), 380p., fig., tables, plates; ref. Ph.D. **En** (En)
☐*Presents results of a study on the organization of animal traction, particularly working regimes of oxen during the plowing and threshing seasons; force and power output of teams when tilling under various agronomic conditions; design and mechanics of the local plow; type, quantity and nutritive value of feed resources and farmers' decisions regarding their allocation and yearly budgeting; fluctuations in oxen weights during working and non-working periods; relationship between body weight and work output; ability of supplied feeds in meeting energy requirements of oxen; and work contributions of other livestock, on 24 smallholder farms employing a pair of indigenous oxen in the Debre Berhan area, Ethiopia.*
Mic.No: 37682

0236 Goe, M.R. 1987. **World Bank appraisal mission multistate agricultural project II. Kwara and Niger States, Nigeria. Animal traction for smallholder cultivation.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 44p. **En** (En)
☐*Reports on a mission intended to appraise animal traction component for smallholder cultivation. Indicates that animal traction can play an important role in increasing food production at the smallholder level in Kwara and Niger States of Nigeria. Discusses agriculture, livestock management, feed resources, animal diseases, soils and vegetation. Includes note on credit, training and farm equipment.*
Mic.No: 39243

0237 Gregoire, R. 1976. **La culture attelée en zone soudano-sahélienne.**

(Animal traction in the Sudano-Sahelian zone)
UNESCO Courrier, v. 37, p. 31–34 **Fr**
☐*Discusses prospects of animal traction in the Sudano-Sahelian zone of Africa, estimating supply and demand of cattle, horses and donkeys and emphasizing the need for adequate feeding and improved veterinary care.*
Mic.No: 80726

0238 Gryseels, G.; Anderson, F.M. 1983. **Research on farm and livestock productivity in the central Ethiopian highlands: Initial results, 1977–1930. (Recherche sur la productivité de l'agriculture et de l'élevage dans les hauts plateaux du centre d'Ethiopie: résultats des premières années, 1977–1980)**
ILCA, Addis Ababa (Ethiopia). ILCA Research Report(Rapport de Recherche du CIPEA), no. 4, 52p., 3 fig., 43 tables; 32 ref., ISBN 92-9053-044-8 (E) and ISBN 92-9053-067-6 (F) **En, Fr** (En Fr)
☐*Describes the Ethiopian highlands assessing their potential for improved agricultural production; reports ILCA's studies on the traditional smallholder production system of the highlands; and analyzes productivity aspects of the system's crop and livestock components. Discusses the approach to farming systems research (FSR) along with the implications for adoption of the approach and its results by a national agency, some research experiences and the outlook for future research. Includes results of research on innovations consisting of improved forage/dairy cow package, improved animal traction and the cultivation of valley bottoms.*
Mic.No: 33227

0239 Gryseels, G.; Goe, M.R. 1984. **Energy flows on smallholder farms in the Ethiopian highlands. (L'utilisation de l'énergie par les exploitants des hauts plateaux éthiopiens)**
ILCA Bulletin(Bulletin du CIPEA), no. 17, p. 2–9, 2 fig., 6 tables; 23 ref., ISSN 0255-0016 (F) and ISSN 0255-0008 (E). **En, Fr** (En)
☐*Studies energy flows on typical smallholder farms around Debre Zeit and Debre Berhan in the Ethiopian highlands, describing the farming system resource base and intermediate roles of resources such as animal traction. Discusses energy aspects of the household system and prospects for improvement in energy use, especially with respect to animal traction, fuel consumption, wind energy, solar energy, biogas, thermal and hydroelectric power, and geothermal energy.*
Mic.No: 78873

0240 Gryseels, G.; Abiye Astatke; Anderson, F.M.; Getachew Asamenew. 1984. **The use of single oxen for crop cultivation in Ethiopia. (L'utilisation de la charrue à un boeuf en Ethiopie)**
ILCA, Addis Ababa (Ethiopia). ILCA Bulletin (Bulletin du CIPEA), no. 18, p. 20–25, 1 fig., 3 tables; 5 ref., ISSN 0255-0008 (E) and ISSN 0255-0016 (F). **En, Fr** (En)
☐*Reports experiences with on-farm trials to assess the use of single oxen for work on mixed smallholder farms in the central highlands of Ethiopia, with particular reference to draft power and agricultural production, design and testing of the single-ox technique, and results obtained during the 1983 crop year and future prospects with respect to feed requirements and advantages of using the single ox.*
Mic.No: 33130

0241 Gryseels, G. 1984. **On-farm animal traction research: Experiences in Ethiopia with the introduction of the use of single oxen for crop cultivation.**
Flora, C.B. (ed.); Nichols, P.P. (comp.). In: Animals in the farming system. Proceedings of a symposium, 3. Annual Farming Systems Research Symposium, Kansas (USA), 31 Oct–2 Nov 1983. Farming Systems Research Paper Series (USA), no. 6, p. 419–430, 3 fig., 1 table; 4 ref. **En** (En)
☐*Reports on ILCA's on-farm animal traction trials carried out in the highlands of Ethiopia, focussing on the technical and economic efficiency of using a single ox for crop cultivation instead of the more traditional cropping system with oxen working in pairs. Assesses the outlook for adoption of such a new technology in light of experience acquired by the Highlands Programme through the farming systems research approach.*
Mic.No: 78623

0242 Gryseels, G.; Anderson, F.M.; Durkin, J.W.; Getachew Asamenew. 1986. **Draught power and smallholder grain production in the Ethiopian highlands. (Traction animale et production céréalière dans les petites exploitations des hauts plateaux éthiopiens)**
ILCA Newsletter (CIPEA actualités), v. 5(4), p. 5–7, 2 tables, 1 fig.; ref., ISSN 0255-0024 (E) and ISSN 0255-0032 (F). **En, Fr**
☐*Investigates the impact of draft power availability on grain production on smallholder farms in the Ethiopian highlands based on analysis of data collected by ILCA around Debre Berhan and Debre Zeit, especially on effects of ox holding on area cultivated and on net cereal production.*
Mic.No: 68275

0243 Guzman, M.R. de Jr. 1979. **An overview of recent developments in buffalo research and management in Asia.**

ASPAC, Taipei City (Taiwan). Food and Fertilizer Technology Centre. Seminar on Increasing Buffalo Production for Small Farms, Bangkok (Thailand), 27-31 Mar 1979. ASPAC/FFTC Extension Bulletin (Taiwan), no. 124, 20p., 28 ref. **En**

□*Summarizes major research findings on the potential of the buffalo, identifying constraints limiting the productivity of the water buffalo; reviews the status of buffalo production and management practices in Asia; and stresses the importance of formulating breeding programmes to improve the capacity of the water buffalo for draft, milk and meat production.*

Mic.No: 17303

0244 Guzman, M.R. de Jr. 1984. **Prospects and problems of swamp buffalo development in Asia.**

ASPAC, Taipei City (Taiwan). Food and Fertilizer Technology Centre. ASPAC/FFTC Extension Bulletin (Taiwan), no. 211, 16p., 1 fig., 2 tables; 35 ref. **En** (En)

□*Discusses various uses of the water buffalo in the agriculture of South East Asia, and its potential as a source of farm power, meat and milk. Identifies problems in buffalo development which are associated with government policies, and suggests measures for improved buffalo production.*

Mic.No: 80636

0245 Havard, M. 1985. **La culture avec traction animale: quelques expériences pays par pays. Sénégal. (Cultivation with animal traction: Country experiences. Senegal)**

Journée d'Etude sur la Culture avec Traction Animale, Antony (France), 7 Mar 1985. Afrique Agriculture (France), no. 122, p. 27-28, 1 table, 1 photograph, ISSN 0337-9515. **Fr**

□*Discusses the situation regarding animal draft equipment in Senegal, constraints to the diffusion of equipment and action priorities.*

Mic.No: 80660

0246 Havard, M. 1985. **Les matériels et les techniques de mise en valeur des ressources energétiques disponibles en milieu rural au Sénégal. (Equipment and techniques for the improved use of energy resources available in Senegal)**

Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Sénégal), no. 1985, 18p., 28 fig., 12 tables; 34 ref. **Fr**

□*Discusses the possibility of using available energy sources to satisfy the needs of the rural population of Senegal and analyzes animal draft techniques and equipment available and their suitability for rural regions.*

Mic.No: 80771

0247 Havard, M.; Faye, A. 1988. **Eléments de la situation actuelle de la culture attelée au Sénégal: perspectives d'études et de recherches. (The present status of animal traction in Senegal: Research prospects)**

Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19-25 Sep 1986, p. 241-252, 2 fig., 3 tables, 1 map; 6 ref., ISBN 3-528-02047-4 **Fr**(Fr)

□*Development of animal traction in Senegal has ceased during the last 5 years due to economic factors. Describes the present situation in terms of numbers and types of animal-drawn implements and draft animal species and divides the country into 8 zones based on animal traction. Concludes that research should aim at improving feeding, health and performance of draft animals.*

Mic.No: 82020

0248 Havard, M.; Mbengue, H.M. 1988. **Une réflexion insuffisante sur les orientations de la mécanisation au Sénégal. Quelques exemples concrets. (Comments on the orientation of mechanization in Senegal. Some tangible examples)**

Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12-16 Sep 1988, p. 72-78, 2 tables; 4 ref., ISBN 2-87614-026-8 **Fr** (Fr)

□*Discusses political and economic aspects of mechanization in Senegal and concludes that there is no structure or organization which has an overall picture of mechanization throughout the country.*

Mic.No: 82091

0249 Hodjakpodji, C. 1982. **Incidences de la traction animale sur le développement de l'élevage bovin dans la province du Borgou. (The impact of animal traction on cattle production in Borgou province)**

Collège Polytechnique Universitaire, Abomey-Calavi (Bénin), 60p., 9 tables; 19 ref. Mémoire de Fin de Cycle (Production Animale). **Fr**

□*Outlines briefly the agricultural potentials of Borgu in Benin, with regard to availability of cultivable land and animal and human resources, and discusses ox cultivation, mentioning veterinary, husbandry and socio-economic aspects along with indication of possibilities for improvement in animal traction for an integrated rural development.*

Mic.No: 60934

0250 Hussain, A.A.M. 1981. **Draught power requirements in Bangladesh.**

Jackson, M.G. (ed.); Dolberg, F. (ed.); Davis, C.H. (ed.); Haque, M. (ed.); Saadullah, M. (ed.). In: Maximum livestock production from minimum land. Proceedings of a seminar, Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 2–5 Feb 1981, p. 342–347, 3 tables; 4 ref. **En**

☐*Discusses briefly draft power requirements in Bangladesh, identifying major sources of farm power and providing data on total, mechanical and animal power available for agriculture in developing countries in general and in Bangladesh, in particular.*

Mic.No: 82079

0251 Huybens, E. 1987. **Les possibilités de l'extension de la traction animale dans la sous-préfecture de Bangouya, Guinée-Conakry. Rapport d'une mission effectuée pour ACT Novembre 1987. (Possibilities for introducing animal traction in the Bangouya subprefecture, Guinea-Conakry. Report of a mission undertaken for ACT, Nov 1987)**

ACT, Brussels (Belgium), 48p., 3 fig., 2 maps, 9 tables, 5 photographs; 32 ref. **Fr**

☐*A brief history of animal traction in Guinea is followed by discussion of animal traction in the Bangouya sub-prefecture including factors affecting its profitability and its economic effects, and description of an animal traction project.*

Mic.No: 80790

0252 Hyernaud, J. 1966. **Boeufs et vaches à Agoudou-Manga (République Centrafricaine). (Oxen and cows in Agoudou-Manga, Central African Republic)**

Institut Africain pour le Développement Economique et Social, Abidjan (Côte d'Ivoire). Document Agricole (Côte d'Ivoire), no. 2, 127p. **Fr**

☐*Presents a historical account of experiences in rural development and constraints to animal traction work at Agoudou-Manga in the Central African Republic.*

Mic.No: 38765

0253 Jaeger, W.K. 1984. **Animal traction and resource productivity: Evidence from Upper Volta.**

Flora, C.B. (ed.); Nichols, P.P. (comp.). In: Proceedings of Kansas State University's 1983 farming systems research symposium: Animals in the Farming Systems, Manhattan, Kansas (USA), 31 Oct–2 Nov 1983. Farming Systems Research Paper Series (USA), no. 6, p. 431–460, 1 fig., 15 tables; 6 ref. **En**

☐*Presents results of a study combining a season-long farm production survey with farmer interviews to measure effects of animal traction on resource use and productivity, particularly on acreage, yield, total crop production, labour use and farm income in the villages of Nedogo and Diapangou in Burkina Faso. Includes cost/benefit analysis of animal traction work in the areas.*

Mic.No: 80511

0254 Jana, D.N.; Chaudhuri, D. 1985. **Bullock power in India.**

World Review of Animal Production (Italy), v. 21(4), p. 61–65, 2 tables, 2 photographs; 17 ref. **En**

☐*Reviews the present status of bullock power utilization in India, research and development needed to improve the use of bullock power (improved implements and carts, breeding and animal care, reduction of non-working time and collection of data on draft power) and results of current research.*

Mic.No: 80389

0255 Jannaud, G.; Kellermann, J. 1967. **La mécanisation de l'agriculture en République Centrafricaine. (Agricultural mechanization in the Central African Republic)**

Secrétariat d'Etat aux Affaires Etrangères charge de la Coopération, Paris (France); République Centrafricaine. Ministère du Développement, 320p., 23 fig., tables; 52 ref. **Fr**

☐*Analyzes animal traction work carried out in the Central African Republic, particularly regarding working animals, animal-drawn implements, human and agronomic factors, working time, and the profitability of farming with animals as compared with other systems of farming. Examines technical and economic aspects of "Operation Bokassa" which had as its objective the introduction of mechanized farming on virgin lands.*

Mic.No: 00406

0256 Jourdain, G.; Fofana, A. 1952. **Le boeuf de labour dans la région de Mopti (Soudan). (The plow-ox in Mopti region)**

Bulletin des Services de l'Elevage et des Industries Animales de l'Afrique Occidentale Française (Sénégal), v. 5(2–4), p. 59–64 **Fr**

☐*Presents notes on the selection, management and utilization of work oxen in the Mopti region of Mali, along with indications of veterinary measures that could be undertaken by the Service de l'Elevage.*

Mic.No: 28524

0257 Jutzi, S.; Mesfin Abebe. 1986. **Improved agricultural utilization of Vertisols in the Ethiopian highlands. An inter-institutional approach to research and development.**

ILCA, Addis Ababa (Ethiopia). Highlands Programme. 1. IBSRAM Networkshop in Africa on Improved Vertisol Management, Nairobi (Kenya), 1–6 Dec 1986, 9p., 3 tables; ref. **En** (En)

□*Describes a multidisciplinary research training and outreach operation for the improved management and utilization of highland Vertisols, jointly run by ILCA, ICRISAT and national research institutions in Ethiopia. Includes an outline of main characteristics of these Vertisols and alternative land use techniques, particularly use of animal-powered devices for surface soil drainage, tillage and crop planting, development of new cropping system on drained soils, crop protection and improved management of plant nutrients.*
Mic.No: 37741

0258 Jutzi, S.; Getachew Asamenew; Abate Tedla; Abiye Astatke. 1987. **Intermediate technology for increased food and feed production from deep black clay soils in the Ethiopian highlands.**
FAO, Rome (Italy). In: Improving food crop production on small farms in Africa, FAO/SIDA Seminar on Increased Food Production through Low-Cost Food Crops Technology, Harare (Zimbabwe), 2–17 Mar 1987, p. 373–383, 8 tables; 21 ref. **En** (En)
□*Discusses intermediate technology for increased food and feed production from deep black clay soils (Vertisols) in the Ethiopian highlands. Presents examples of improved soil/water/nutrient management on Vertisols discussing tillage and animal-powered surface drainage and its effect on crop yields and labour use, potentialities, and nutrient utilization and management. Also discusses briefly the relevance of low external input technologies for smallholder subsistence farming, and crop–livestock interactions in Vertisol management.*
Mic.No: 39585

0259 Katsina, A.L. 1990. **A note on the draft animal used in northern Nigeria.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 381, ISBN 92-9081-046-7 **En**
□*Discusses the use of horses, donkeys, camels and cattle as draft animals in northern Nigeria. Constraints include lack of funds, dry season feed shortage, inadequate extension services and unsuitable soils.*
Mic.No: 82238

0260 Kayumbo, A.K. 1987. **Agromechanisation policy and strategy.**
ILO, Geneva (Switzerland); Tanzania. Ministry of Agriculture and Livestock Development. In: In quest of agricultural mechanisation policy and strategies in the United Republic of Tanzania, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Dar-es-Salaam (Tanzania), 8–10 Oct 1985, p. 31–34, ISBN 92-2-105482-9 **En**
□*Discusses power sources in Tanzanian agriculture (engine, animal, wind, water and solar energy), mechanization and choice of technology (stressing use of intermediate technology).*
Mic.No: 80816

0261 Kayumbo, A.K. 1987. **Constraints to the wider use of farm equipment in the rural areas.**
ILO, Geneva (Switzerland); Tanzania. Ministry of Agriculture and Livestock Development. In: In quest of agricultural mechanisation policy and strategies in the United Republic of Tanzania, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Dar-es-Salaam (Tanzania), 8–10 Oct 1985, p. 35–39, ISBN 92-2-105482-9 **En**
□*Discusses factors affecting intensification of the use of farm equipment innovations and limitations to the widespread use of improved hand tools, animal draft technology (plows and other animal-powered implements), other farm equipment in the intermediate technology category, irrigation implements and equipment and rural transport.*
Mic.No: 80817

0262 Kibria, Q.G. 1981. **Maximum livestock production from minimum land in Bangladesh from a planning point of view.**
Jackson, M.G. (ed.); Dolberg, F. (ed.); Davis, C.H. (ed.); Haque, M. (ed.); Saadullah, M. (ed.). In: Maximum livestock production from minimum land. Proceedings of a seminar, Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 2–5 Feb 1981, p. 527–540, 10 ref. **En**
□*Discusses ways of improving livestock productivity in Bangladesh to meet protein and draft power requirements, considering measures such as increasing feed and fodder supplies, genetic improvement of animals, improved management and care in livestock rearing, improved animal health and supply of credit to farmers, and launching of livestock insurance programmes.*
Mic.No: 82078

0263 Kibria, Q.G. s.d. **Draught animal power for crop production and use of cows.**
Preston, T.R. (ed.); Davis, C.H. (ed.); Dolberg, F. (ed.); Haque, M. (ed.); Saadullah, M. (ed.). In: Maximum livestock production from minimum land. Proceedings of the third seminar, 3. Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 13–18 Feb 1982, p. 201–205 **En**
□*Discusses ways of overcoming the shortage of animal power during peak cropping periods in*

Bangaladesh, especially through the introduction of single-animal harnesses with the use of local improved cattle breeds, crossbred cattle and locally available buffaloes.
Mic.No: 82082

0264 Kirk, M. 1987. **Animal traction in north Cameroon.**
Gottingen Univ. (Germany, F.R.). Inst. of Rural Development. ILCA-Animal Traction Thrust Planning Conference, Addis Ababa (Ethiopia), 7-11 Sep 1987, 13p., 8 ref. **En**
☐*Reviews animal traction in north Cameroon in terms of its diffusion, present degree of utilization and resulting improvements in labour allocation and timeliness of operations, increases in profitability, and changes in the agrarian structure.*
Mic.No: 82241

0265 Kirk, M. 1988. **Technological innovations and changes in agrarian structures. The diffusion of animal traction in Cameroon and Togo.**
Quarterly Journal of International Agriculture (Germany, F.R.), v. 27(1), p. 52-63, 16 ref., ISSN 0049-8599. **En** (De En)
☐*Discusses changes resulting from the mechanization of smallholder farms through the use of animal traction, using empirical studies from central Togo and northern Cameroon to examine institutional factors that encourage the adoption of new technology, transformation processes in the agrarian structure that initiate diffusion of new technology, i.e. labour relations and control over land, and the role of land management. Briefly outlines the main features of an agrarian structure that will be established at the end of the transformation process provoked by technological innovation.*
Mic.No: 80042

0266 Krantz, B.A. 1980. **Technological packages and approaches to management for rainfed agriculture in semi-arid tropics.**
IBRD, Washington, D.C. (USA). Agriculture and Rural Development Dept. In: Proceedings of the Agricultural Sector Symposia, Agricultural Sector Symposia, Washington, D.C. (USA), 7-11 Jan 1980, p. 1-34, 4 fig., 3 tables; 38 ref. **En** (En)
☐*Reviews the climate, soils and agricultural production systems of the semi-arid tropics in Africa, Latin America and India; and outlines the goals and organization of farming systems research, major production constraints and their alleviation through research and action programmes such as erosion control measures and improved animal traction equipment; includes notes on the role of ICRISAT and future lines of research.*
Mic.No: 82092

0267 Kumwenda, W.F.; Kunkwenzu, E.; Chimganda, D. 1987. **Research on the use of draught animal power and mechanization in Malawi.**
Chitedze Agricultural Research Station, Lilongwe (Malawi). Workshop on Animal Traction and Agricultural Mechanisation Research in SADCC, Maputo (Mozambique), 10-14 Aug 1987, 8p., 3 tables; 3 ref. **En** (En)
☐*Outlines the current state of mechanization in Malawi, use of draft animal power, on-going and proposed research and extension. Lists organizations working on animal traction.*
Mic.No: 80105

0268 Landais, E. 1980. **L'élevage bovin dans les zones tropicales du sud-Tchad. (Cattle production in the tropical areas of southern Chad)**
Côte d'Ivoire. Ministère de la Recherche Scientifique. Comité Général d'Organisation; Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). In: Les recherches de l'élevage bovin en zone tropicale humide, 1. Colloque International sur les Recherches de l'Elevage Bovin en Zone Tropicale Humide, Bouake (Côte d'Ivoire), 18-22 Apr 1977, p. 13, 3 maps, 5 tables **Fr**
☐*Discusses the profitability of various cattle breeds in Southern Chad as working animals, dairy cattle and beef cattle; and factors in breeding development, particularly sedentarization and transhumance; inculudes maps showing distribution of glossina.*
Mic.No: 82265

0269 Laurent, C.K. 1968. **The use of bullocks for power on farms in northern Nigeria.**
Ibadan Univ. (Nigeria). Dept. of Agricultural Economics. Bulletin of Rural Economies and Sociology (Nigeria), v. 3(2), p. 235-262, 3 tables; 10 ref. **En**
☐*Presents findings of a survey carried out in northern Nigeria on the use of bullocks for farm power, discussing data on type and costs of bullocks, maintenence costs of bullocks, implements used, working capacity of the animals and estimated costs of farming land with bullocks.*
Mic.No: P00558

0270 Lewis, J. 1979. **The status of the ox-drawn plow in Dukolomba.**
AID Program Evaluation Discussion Paper, no. 6, p. 79-83 **En**
☐*Problems involved in the introduction of animal traction are discussed with farmers questioning the technological, environmental and socio-economic advantages of animal traction over traditional hoe cultivation.*
Mic.No: 80770

0271 Lexa, J.P. 1985. **Some aspects of the mixed farming systems in the family sector of Mozambique.**
Timberlake, J. (ed.); Jordao, C. (ed.). In: Selected papers from the livestock production seminar, Livestock Production Seminar, Maputo (Mozambique), 2–7 Dec 1985, p. 218–239, 6 tables **En** (En)
☐*Describes and analyses characteristics of traditional mixed farming systems in Mozambique, viz geographical distribution of cattle and growth in numbers, ownership of cattle and herd size, use of animal traction and land use.*
Mic.No: 82107

0272 Lhoste, P. 1982. **L'évolution de la culture attelée au Sine-Saloum (1970–1981). (The development of animal traction in Sine Saloum, 1970–1981)**
Sénégal. Ministère de l'Enseignement Supérieur et de la Recherche Scientifique; Institut Sénégalais de Recherches Agricoles, Dakar, 11p., 4 fig., 2 tables; 10 ref. **Fr** (Fr)
☐*Analyzes issues related to the development of animal traction in Sine Saloum, Senegal, with particular reference to developments in the use of cattle for work, the husbandry of working animals, harnessing and equine herds.*
Mic.No: 30549

0273 Lhoste, P. 1983. **Développement de la traction animale et évolution des systèmes pastoraux au Sine-Saloum, Sénégal (1970–1981). (Development of animal traction and evolution of pastoral systems in Sine Saloum, Senegal, 1970–1981)**
Revue d'Elevage et de Médecine Vétérinaire des Pays Tropicaux (France), v. 36(3), p. 291–300, 1 map, 3 tables, 3 graphs; 15 ref, ISSN 0035–1865. **Fr**(En Es Fr)
☐*Discusses factors involved in the rapid development of animal traction in the Sine Saloum region of Senegal from 1970 to 1980, primarily the integration of animal production with crop farming, the use of oxen for meat production and of cows for draft.*
Mic.No: 80776

0274 Lhoste, P. 1987. **L'association agriculture-élevage. Evolution du système agropastoral au Sine-Saloum (Sénégal). (Crop-livestock integration. Development of the agropastoral system in Sine Saloum, Senegal)**
Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France), 320p., 41 fig., 33 photographs, 50 tables; 210 ref., ISBN 2–85985–136–4 **Fr**
☐*Discusses historical aspects and methodologies involved in studying livestock production systems in West Africa, gives a detailed account of the development of livestock production in an agropastoral system in the Sine Saloum region of Senegal and discusses the future of the association between livestock and crop production.*
Mic.No: 80906

0275 Lhoste, P. 1988. **Trajectoire des exploitations pour la traction animale au Sine-Saloum, Sénégal. (Evolution of the use of animal traction in Sine Saloum, Senegal)**
Raymond, G. (ed.). In: Economie rurale en zone de savane, 7. Séminaire d'Economie et Sociologies Rurales, Montpellier (France), 15–19 Sep 1986, p. 40–49, 5 fig., 2 tables **Fr** (En)
☐*Data from a dichronic study of 30 farms in the Sine Saloum region of Senegal were used to plot a trajectory of the evolution of animal power for each farm. Discusses the use of this method of forecasting for developing possible alternatives and suggesting future action.*
Mic.No: 80787

0276 Lianabo, S. 1986. **Farming systems research and extension: Introducing oxen cultivation in Zairian farming systems.**
Georgia Univ, Athens (USA), 119p., 7 fig., 14 tables; ref. M.Sc. **En** (En)
☐*Analyzes the potential for the introduction of oxen cultivation technology within a Zairian farming system in Mbanza Ngungu District by assessing its appropriateness and potential influence on the prevailing farming system; includes cost/benefit analysis of the technology.*
Mic.No: 39079

0277 Lippitz, K. 1982. **Fundamental aspects of ecology and crop growing relevant to the use of draught animals. (Aspects agronomiques et ecologiques de la culture attelée)**
Munzinger, P. (ed.). In: Animal traction in Africa, p. 225–266, 5 fig., 2 tables, ISBN 3–88085–133–6 **En, Fr**
☐*Discusses the basic framework related to ecology and crop production in the use of draft animals in the tropics and subtropics, with emphasis on the use of draft oxen for various activities such as land clearing, soil tillage, erosion control, soil conservation, maintenance of soil fertility, pasture establishment and fodder growing; outlines several cultivation techniques.*
Mic.No: 80697

0278 Manigui, A.S.; Medenou, K.C. 1986. **La culture attelée en République Populaire du Bénin. Etat actuel et perspectives. (Animal traction in the République Populaire du Bénin. Current status and future prospects)**

Bénin. Ministère de Développement Rural et de l'Action Cooperative. Notes Techniques sur l'Elevage (Bénin), no. 3.1.1, 118p., 23 tables; 12 ref. **Fr** (Fr)
☐*Reviews the use of animal traction in Benin (most advanced in Borgou and Atacora Provinces), identifies problems and constraints to its rapid development and, following a study of economic aspects, makes recommendations to overcome these.*
Mic.No: 80343

0279 Mathieu, P. 1959. **La traction bovine. (Cattle traction)**
Bulletin d'Information de l'INEAC, p. 231–238, 1 table, 10 photographs **Fr**
☐*Reports on initial field trials using oxen or cows for animal traction at the Centre Zootechnique, Luvironza, Rwanda. Training handlers often proved more difficult than training oxen.*
Mic.No: 80432

0280 Maynard, T.G. 1983. **Ground preparation and planting – a key constraint for ox cultivators in Zambia.**
Mount Makuku Research Station, Chilanga (Zambia). Networkshop on Draught Power and Animal Feeding in Eastern and Southern Africa, Mbabane (Swaziland), 4–6 Oct 1983, 9p., 1 fig.; 8 ref. **En**
☐*Describes constraints on the productivity of farming systems in the Chipapa area of Zambia where there are difficulties in planting sufficient maize at the beginning of the rainy season. Discusses technologies to reduce the constraints including increasing soil water-holding capacity by winter plowing and speeding up planting.*
Mic.No: 80457

0281 Mbengue, H.M.; Havard, M. 1986. **Résultats de l'enquête sur la technologie post-récolte des céréales (mil, maïs, sorgho) dans les regions de Diourbel et Thies. (Investigation into post-harvest technology for cereals (millet, maize, sorghum) in the Diourbel and Thies regions)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Sénégal), no. 86–8, 40p., 2 fig., 18 tables, 2 maps; 13 ref. **Fr** (Fr)
☐*Gives results of an informal preliminary investigation and of a questionnaire into the operations involved from harvesting to consumption of the main cereals of the Thies and Diourbel regions of Senegal (835 enterprises) and the level of mechanization.*
Mic.No: 80778

0282 McIntire, J.; Gryseels, G. 1987. **Crop–livestock interactions in sub-Saharan Africa and their implications for farming systems research.**
Experimental Agriculture (UK), v. 23(3), p. 235–243, 2 tables; 8 ref., ISSN 0014-4797. **En** (En Es)
☐*Describes herding and farming environments and the relative importance of crops and livestock in sub-Saharan Africa.*
Mic.No: 81062

0283 Mirchaulum, P.T. 1976. **The diffusion of the ox-plough innovation in Longuda District of Gongola State, Nigeria.**
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Geography. Ahmadu Bello University, Department of Geography Occasional Paper (Nigeria), no. 6, 59p., 10 fig., 6 tables; ref. **En** (En)
☐*Discusses the introduction, adoption and spread of the ox-plow in Longuda District in Nigeria. Analyses some of the factors which have influenced its diffusion as well as the temporal and spatial patterns of diffusion.*
Mic.No: 37319

0284 Morin, J.-P. 1985. **Réhabilitation de la traction animale en France. (Rehabilitation of animal traction in France)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 47–48 **Fr**
☐*Describes work carried out by CEP (Comité d'Etudes et de Propositions pour le Développement des Activités Paysannes) in Savoy (France) in association with farmers, researchers and developers when it was found major obstacles to the rehabilitation of horse draft in France were difficulties in obtaining correct harnesses and equipment. Reports on the development of a simple, light harness and the ATSOU wheeled toolcarrier with three-point linkage. Discusses promotion, financing and future of animal traction in France.*
Mic.No: 80215

0285 Mudimu, G.D. 1983. **The draught power problem in Zimbabwe: An extensionist's view of the causes, effects and solution.**
CIMMYT Netwokshop on Draft Power and Livestock Feeding in Eastern and Southern Africa, Mbabane (Swaziland), 4–6 Oct 1983, 15p., 1 fig., 5 tables; 7 ref. **En**
☐*Examines the draft power problem in the communal areas of Zimbabwe by analyzing data on availability and distribution of cattle, cattle ownership patterns, draft-land size relationships and the use of female animals for work; outlines factors contributing to the problem such as reduction in cattle numbers due to drought and war, increases in the numbers of cultivators, slow rate of increase of the cattle population, and low reproductive rate*

animals; and indicates briefly strategies adopted by farmers to alleviate the problem.
Mic.No: 82261

0286 Muiruri, H.K. 1983. **A description of a local farming system (in Kenya) focusing on draft power and animal feed problems.**
Egerton College, Njoro (Kenya). Networkshop on Draft Power and Animal Feeding in Eastern and Southern Africa, Mbabane (Swaziland), 4–6 Oct 1983, 12p., 2 graphs; 8 ref. **En**
☐*Describes the current farming systems of the Mutukario region of Kenya and discusses the potential use of animal traction. Concludes that animal power can substantially decrease human labour times, will increase the area cultivated and that the animals will produce substantial amounts of manure during their lifetime and meat at the end of it. Discusses working ability of cattle.*
Mic.No: 80431

0287 Muller, H.E. 1986. **Zugtiernutzung in Zambia – Einfuhrung und Ausbreitung einer technologischen Innovation. (Utilization of draft animals in Zambia: introduction and spread of a technological innovation)**
Internationale Afrikaforum (Germany, F.R.), v. 22(2), p. 175–182, 8 ref. **De**
☐*Discusses the process of communication of innovations using the history of the adoption of animal traction in Zambia.*
Mic.No: 80745

0288 Munzinger, P. 1987. **Etude sur la traction animale dans la Préfecture de Kissidougou/Guinée. (Study on animal traction in the Kissidougou Prefecture, Guinea)**
Gesellschaft für Agrarprojekte in Ubersee, Hamburg (Germany, F.R.), 52p., 3 fig., 6 tables, 1 map, 17 photographs; 6 ref. **Fr**
☐*Brief section on the history of animal traction and agricultural mechanization in Guinea followed by detailed work on the current animal traction situation in Kissidougou Prefecture and moves towards mechanization. Makes recommendations to encourage animal draft use in the region.*
Mic.No: 80303

0289 Musa, H.L. 1988. **Animal power utilization for agricultural production in Nigeria.**
Ahmadu Bello Univ., Shika (Nigeria). National Animal Production Research Inst. Pastoralism Conference, Zaria (Nigeria), 26–29 Jun 1988, 20p., 4 tables; 9 ref. **En**
☐*Reviews the history of animal traction in Nigeria and how initial problems were overcome, breeds currently involved, costs and economic benefits of animal traction, the role of animal traction in Nigeria's agricultural development and lessons learnt in developing and introducing new techniques at the farm level.*
Mic.No: 80225

0290 Musa, H.L. 1989. **The place of animal traction power in Nigeria's agricultural development and future prospects.**
Nigeria. Federal Dept. of Agriculture and Rural Development. Animal traction research network protocol planning meeting (ILCA), Addis Ababa (Ethiopia), 8–15 May 1989, 14p., 1 diagram; 4 ref. **En** (En)
☐*Reviews the development of animal traction in Nigeria from its introduction by the British as an integral component of the Mixed Farming System in 1928 and reasons for its success. Stresses the importance of promoting the development and local manufacture of equipment for cattle, donkeys, horses and camels, the strengthening of the rural economy and creation of the necessary capital and management skills for larger investment in advanced technologies. Considers that with the development of appropriate tools and technology, mechanization using animals is possible and profitable even on derived savanna regions. Presents data on performance of imported single- and multipurpose toolbars at Samaru, Zaria.*
Mic.No: 80520

0291 Musangi, R.S. 1975. **The role of ruminant livestock in mixed farming in tropical Africa. (Le rôle du cheptel ruminant dans l'agriculture mixte en Afrique tropicale)**
Journal of the Association for the Advancement of Agricultural Sciences in Africa (Ethiopia), v. 2(suppl. 2), p. 281–283, 2 ref., ISSN 0044–9482. **En** (En Fr)
☐*Discusses the contribution of ruminant livestock to mixed farming in tropical Africa, especially through the utilization of farm pasture roughages and crop byproducts, provision of farmyard manure and animal proteins, and as work animals.*
Mic.No: 13175

0292 Mwinjilo, M.L. 1987. **The role of animal draught in smallholder production systems in Malawi.**
Malawi Univ., Lilongwe. Dept. of Agricultural Engineering. Workshop on Animal Traction and Agricultural Mechanisation Research in SADCC, Maputo (Mozambique), 10–14 Aug 1987, 8p., 9 ref. **En**
☐*Discusses the importance of agriculture in the Malawi economy, government schemes to promote animal traction through ox-training centres and*

provision of draft animals and implements on credit and constraints to animal traction development.
Mic.No: 80104

0293 Nair, K.N. 1977. **Size and tilization of draught animals in Kerala.**
Indian Journal of Agricultural Economics, v. 32(4), p. 117–130, 11 tables, ISSN 0019–5014. **En**
☐*Attempts to explain some of the factors responsible for the exceptionally small number of draft animals per hectare of cropped area in Kerala, India, and for its decline over time.*
Mic.No: 80634

0294 Nauleau, G.; Berger, M. 1988. **Le conseil de gestion de l'exploitation agricole et ses satellites. (Farm management)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 217–225, 1 fig., ISBN 2–87614–026–8 **Fr**
☐*Discusses the modernization of agriculture in Burkina Faso and includes the possibility of combining small tractors with animal traction.*
Mic.No: 82239

0295 Ndiame, F.; Coulibaly, D.; Fall, A. 1990. **Rôle de la mécanisation dans l'intensification de l'agriculture en Basse Casamance. (The role of mechanization in the intensification of agriculture in Lower Casamance)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 192–200, 1 map, 7 tables; 13 ref., ISBN 92–9081–046–7 **Fr**
☐*Discusses farming techniques currently used by farmers in the Basse-Casamance region (Senegal) and associated constraints and analyzes economic and technical effects of technological innovation on animal draft equipment. Presents suggestions for helping solve farmers' problems in the region and for integration of animal traction into farming systems.*
Mic.No: 82061

0296 Ndiaye, A.L.; Dawa, O. 1984. **Crop rotation, in the context of combined agriculture and livestock-raising, to improve animal production.**
Bunting, A.H. (ed.); Bunting, E. (ed.). In: The future of shifting cultivation in Africa and the task of universities, International Workshop on Shifting Cultivation: Teaching and Research at University Level, Ibadan (Nigeria), 4–9 Jul 1982, p. 98–108, 3 tables; 13 ref., ISBN 92–5–102092–2 **En**
☐*Discusses the advantages of mixed farming generally and in African traditional production systems in particular, arguing that crop production can benefit from animal husbandry in terms of plant nutrients from manures and power for field work and transport, and that conversely crop production can provide forage and crop residues and by-products for animal feed. Indicates the need to resolve difficulties related to animal diseases, management practices, breeding and to the development policies and practices of governments.*
Mic.No: 82272

0297 Nguyen, B.P. 1974. **Advance towards self-sufficiency in draft power, develop cattle production for both draft power and breeding in the Delta.**
Central Agricultural Commission, Hanoi (North Vietnam). Nhan Dan (North Vietnam), p. 2–4 **Vn**
☐*Assesses possibilities of increasing cattle production in the Red River delta, Vietnam, where low mechanization entails wide use of draft power.*
Mic.No: 80730

0298 Nhieu, J.T. van. 1982. **Animal traction in Madagascar. (La culturer attelée à Madagascar)**
Munzinger, P. (ed.). In: Animal traction in Africa, p. 427–449, 2 illus., 5 fig., 1 table, ISBN 3–88085–135–6 **En, Fr**
☐*Discusses the use of animals for agricultural operations in Madagascar, mentioning available breeds of draft animals, their selection and management, types of draft equipment used for soil tillage, sowing, weeding and harvesting, distribution channels of equipment to farmers, and general observations regarding the use of animal traction.*
Mic.No: 80694

0299 Niang, M.; Havard, M. 1988. **La culture attelée au Sénégal. Les recherches sur la traction bovine. Textes du diaporama. (Animal traction in Senegal. Research on cattle traction. Text accompanying slide presentation)**
Institut Sénégalais de Recherches Agricoles, Dakar, 17p. **Fr**
☐*Text accompanying a slide presentation on draft oxen research in Senegal.*
Mic.No: 80289

0300 Nourrissat, P. 1965. **La traction bovine au Sénégal. (Cattle traction in Senegal)**
Agronomie Tropicale (France), v. 20(9), p. 823–853, 22 tables; 8 ref. **Fr** (En Es Fr)

□*Discusses the economic, technical and psychological advantages and disadvantages of animal traction use in Senegal, outlining factors that need to be considered in the choice of working animals, particularly breed, age and sex. Examines in detail the proper nutrition and care of working animals, and proposes practical solutions to problems related to housing and manure production. Assesses the prices, advantages and disadvantages of the double head-yoke and other available equipment*
Mic.No: 4073

0301 Nsibande, J.M. 1987. **Draught animal power in Swaziland.**
s.n., s.l. Workshop on Animal Traction and Agricultural Mechanisation Research in SADCC, Maputo (Mozambique), 10–14 Aug 1987, 5p. **En**
□*Describes the current livestock and draft animal situation in Swaziland, a major problem being the supply of adequate feed during the dry season.*
Mic.No: 80108

0302 Odell, M.L. 1980. **Planning for agriculture in Botswana. A report on the arable lands survey.**
Institute of Development Management, Botswana Lesotho and Swaziland, Gaborone (Botswana); Botswana. Ministry of Agriculture. Div. of Planning and Statistics, v.p., 28 tables **En**
□*Summarizes data on the status of arable agriculture in ten districts of Botswana, particularly on household structure and characteristics, access to implements, agricultural practices employed, availability and use of draft power, extension contact, labour resources and inputs, land holding and improvements, water resources depended upon and average yields obtained by the households surveyed.*
Mic.No: 57533

0303 Oli, K.P. s.d. **Draught animals in the hill agriculture system.**
Morel, A.M. (ed.); Oli, K.P. (ed.). In: Livestock in the hills of Nepal, 1. Seminar on Livestock in the Hills of Nepal, Dhankuta (Nepal), 5–7 Feb 1985, p. 29–49, 3 tables; 25 ref. **En**
□*Discusses findings of a baseline survey regarding draft animals in four districts of Nepal, with particular reference to the role of draft animals in the farming systems, work performance of animals under different conditions as well practical aspects of training, management and use of work animals.*
Mic.No: 82271

0304 Otchere, E.O.; Ahmed, H.U.; Olorunju, S.A.S.; Kallah, M.S. 1988. **Utilization and management of work oxen in a Guinea-savanna environment in Nigeria: initial survey results.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 233–237, 2 fig., 5 tables; 5 ref., ISBN 3-528-02047-4 **En** (En)
□*Data obtained in a preliminary survey on work oxen utilization and management in 300 farming households that use animal traction are given and cover breed and sex of cattle used, source of animals and age at entry, length of training and useful life, and maintenance. Dry season feeding problems are stressed.*
Mic.No: 82019

0305 Petheram, R.J.; Thahar, A.; Bernsten, R.H. 1985. **Socio-economic aspects of draught animal power in Southeast Asia, with special reference to Java.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 13–19, 5 tables; 39 ref. **En**
□*Discusses draft animal power (DAP) generally and describes socioeconomic features common to DAP enterprises in South East Asia, illustrating important variations between DAP enterprises by examining the case of DAP in Java and in three villages with differing farming systems. Also discusses socioeconomic implications in designing DAP research and appropriate approaches to research in South East Asian villages.*
Mic.No: 80686

0306 Polikhronov, D.S. 1976. **Buffalo production.**
FAO, Rome (Italy), p. 29–43 **En**
□*Presents part of a report dealing with buffaloes as sources of milk and meat, and as working animals, discussing aspects of breeding, feeding, and agricultural training.*
Mic.No: 80706

0307 Polikhronov, D.S. 1976. **Report on the livestock development survey, Indonesia. Buffalo production.**
FAO, Rome (Italy). FAO Technical Report, no. 8, 44p. **En**
□*Presents recommendations for breeding, increasing meat and milk yield and improving the performance of the buffalo as a working animal in Indonesia and includes detailed descriptions of proposed UNDP-assisted development projects.*
Mic.No: 80703

0308 Posner, J.L.; Kamuanga, M.; Sall, S. 1985. **Les systèmes de production**

en Basse-Casamance et les stratégies paysannes face au déficit pluviométrique. (Production systems in Lower Casamance and rural strategies in the face of drought)
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Travaux et Documents (Sénégal), no. 4, 33p., fig., 3 tables, 1 map; 8 ref. **Fr** (Fr)
☐*Discusses problems caused by decreasing rainfall during the last 15 years leading to food shortage in Senegal. Suggests that the area north of the Casamance with its abundance of plateau land and draft animals could be used to produce groundnuts, millet or maize and that in the area to the south rice production should be intensified.*
Mic.No: 80780

0309 Prinz, D.; Rauch, F. 1987. **The Bamenda model. Development of a sustainable land-use system in the highlands of west Cameroon.**
Agroforestry Systems (Netherlands), v. 5(4), p. 463–474, 8 fig., 1 table; ref., ISSN 0167–4366. **En** (En)
☐*Describes the "Bamenda model" farming system, an ecologically stable and economically attractive land use system developed in the Cameroon that consists of the introduction of draft oxen, implementation of integrated plant nutrition systems, erosion control with contour bunds, avoidance of soil-inverting, plowing and integration of trees and bushes into the farming system.*
Mic.No: 80643

0310 Qiang, W.M. 1985. **Research on Chinese yellow cattle used for draught in the People's Republic of China.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 32–34, 1 table **En**
☐*Discusses briefly the role of Chinese yellow cattle in the country's agriculture and reviews work done to improve their performance.*
Mic.No: 80680

0311 Rakotovaovahy, M.R. 1985. **Situation de la culture attelée à Madagascar. (The status of animal traction in Madagascar)**
Journée d'Etude sur la Culture avec Traction Animale, Paris(France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 31–32, 2 tables **Fr**
☐*Gives data on numbers and types of animal draft equipment in Madagascar.*
Mic.No: 80812

0312 Rakotovaovahy, M.R. 1985. **Madagascar. "Un effort est amorcé pour relancer la culture attelée". (Madagascar. "Renewed efforts to promote animal traction")**
Afrique Agriculture (France), no. 122, p. 25, ISSN 0337–9515. **Fr**
☐*Examines efforts to promote animal-powered farming in Madagascar, with particular reference to animal-drawn implements for tillage, cultivation and transport.*
Mic.No: 80122

0313 Rakotovoavahy, M.R. 1985. **La culture avec traction animale: quelques experiences pays par pays. Madagascar. (Cultivation with animal traction: Country experiences. Madagascar)**
Journée d'Etude sur la Culture avec Traction Animale, Antony (France), 7 Mar 1985.Afrique Agriculture (France), no. 122, p. 25, 1 table, 1 photograph, ISSN 0337–9515. **Fr**
☐*Briefly discusses the current state of animal traction in Madagascar and constraints to its development. Describes recent initiatives in provision of animal draft equipment and promotion of small-scale local manufacture.*
Mic.No: 80658

0314 Rao, A.R.; Singh, I.J. 1977. **Bullocks – the mainstay of farm power in India.**
Lockeretz, W. (ed.). In: Agriculture and energy. Proceedings of a conference, p. 597–606, 4 tables; 7 ref. **En**
☐*Assesses the extent to which the power needs of small- and medium-sized holdings in India can be met by animal and human power, using available data on livestock and the rural work force. Presents comparative costs of cultivation with small power tillers and bullocks. Includes suggestions for improving the efficiency with which human and animal power are used.*
Mic.No: 80088

0315 Rauch, F. 1986. **Draught animals prepare way for new cultivation systems.**
GATE (Germany, F.R.), no. 86/4, p. 20–22, 1 fig., 1 photograph **En** (En Es Fr)
☐*Describes the introduction of draft oxen in the North-West Province of Cameroon under a German-Cameroonian Technical Cooperation Scheme in 1974–5 and the introduction a few years later of a new system of permanent cultivation to replace the traditional fallow system and intended to prevent soil erosion. Discusses the current situation regarding animal draft and the heavy demand for work oxen.*
Mic.No: 80821

0316 Reh, I. 1982. **Zur bedeutung der rindfleischerzeugung als neben-**

produkt du zugrinderhaltung in kleinbauerlichen betrieben westafrikas, dargesteilt am beispiel der region Sine-Saloum in Senegal. (The importance of beef production as a byproduct of smallholder animal traction enterprises in West Africa)
Technische Univ., Berlin (Germany, F.R.). Inst. fur Tierproduktion. Arbeit aus dem Institut für Tierproduktion des Technischen Universitat Berlin (Germany, F.R.), no. 111, 164p., 5 fig., 30 tables; 65 ref. Dr. Sc. Agr. **De** (De En)
☐*Assesses possibility of utilizing draft cattle for the production of cheap beef, as a byproduct of work, by comparing productivity, in terms of weight gain, mortality, calving rate and calving interval, of working and non-working cattle on smallholder farms, estimating beef production potential, in terms of live weight, carcass weight and dressing percentage and prices, from draft and herd cattle, and comparing the economics of beef production from the two herds.*
Mic.No: 35354

0317 Renaut, G. 1966. **Contribution au développement de la culture atlelée en Côte d'Ivoire. (The development of animal traction in Côte d'Ivoire)**
Machinisme Agricole Tropical (France), no. 15, p. 34–45, 2 fig., 9 tables **Fr** (En Fr)
☐*Describes the rationale behind the choice of animal traction for mechanizing farming operations in the Korhogo district, Côte d'Ivoire. Reviews types of animals and harnesses used, crops grown, cropping patterns, implements used and time taken for each cultural operation and establishes operating costs using draft animals. Stresses the need for good extension workers.*
Mic.No: 80796

0318 Reynolds, L. 1988. **The relevance of animal traction to the humid zone.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p.119–124, 27 ref., ISBN 3-528-02047-4 **En**
☐*Discusses animal, financial and social factors involved in the development of animal traction in the humid zone of Africa. Problems arising are discussed and it is suggested that these will be fewer where farmers are already familiar with handling cattle, in the derived savanna rather than the forest zone, where additional land is available and where the infrastructure exists to market a cash crop and provide necessary inputs.*
Mic.No: 82007

0319 Robinson, D.W. 1977. **Preliminary observations on the productivity of working buffalo in Indonesia.**
Centre for Animal Research and Development, Bogor (Indonesia). CARD Research Report (Indonesia), no. 2, 16p., 8 tables; ref. **En, In** (En In)
☐*Reports findings of a survey undertaken between September and December 1975 among 600 farmers who use buffaloes in 12 provinces of Indonesia, in order to obtain information on a wide range of topics relating to reproduction, nutrition, diseases, sociology and the work of both the farmer and his animals.*
Mic.No: 10141

0320 Robinson, G. 1987. **Animal traction in Angola. Project UNO/ANG/001/UNE.**
FAO, Rome (Italy), 85p., 9 fig., 4 tables, 10 photographs, 1 graph, 7 maps **En** (En)
☐*Presents basic information on animal traction in Angola including numbers of draft oxen and numbers and types of plows. Makes recommendations for programmes for EDAs (Estacoes de Desenvolvimento Agricola) concerning promotion of animal traction and suggests that such activities should be centred in the southern provinces. Proposes alternative projects concentrating on introducing animal traction to new areas, developing new or more suitable equipment for local needs, improving factory production of equipment or setting up village-level artisan production units, and improving distribution of equipment and spare parts.*
Mic.No: 80451

0321 Rocha, A. 1987. **The importance of animal power in a mixed farming system of the traditional sector of southern Mozambique.**
Instituto de Producao Animal, Maputo (Mozambique). SADCC Workshop on Animal Traction and Agricultural Mechanization Research, Maputo (Mozambique), 10–14 Aug 1987, 12p., 4 tables; 8 ref. **En** (En)
☐*Presents data showing the importance of animal power in traditional mixed farming systems typical of large areas of southern Mozambique. Suggests ways of improving the productivity of such systems and possible areas of adaptive research.*
Mic.No: 80452

0322 Rollinson, D.H.L.; Nell, A.J. s.d. **The present and future situation of working cattle and buffalo in Indonesia.**
UNDP, Washington, D.C. (USA), 40p., tables; 14 ref. **En**
☐*Presents detailed information on the current situation of draft cattle and buffalo in Indonesia and recommends studies in the following areas: Use of cattle and buffalo for land preparation, local customs and working practices, age of animal at first use and slaughter, costs at various ages, repro-*

ductive patterns, sale of bulls, numbers of animals used for transport and initiation of a programme to improve breeding efficiency and reduce mortality of young stock. Suggests that provincial inspectors should include data on draft animals in their reports.
Mic.No: 80386

0323 Rossier, E.; Jego, Y. 1985. **Note sur l'utilisation de la traction chevaline en France. Premiers résultats d'enquêtes. (Note on the use of draft horse in France. Preliminary results of survey)**
Centre d'Etude et de Recherche sur l'Economie et l'Organisation des Productions Animales, Paris (France), 29p., 9 fig., 2 tables; 24 ref. **Fr**
☐*Discusses animal traction throughout the world and in France in particular, characteristics of operations using working horses, advantages and disadvantages of horse traction and future prospects for working horses in France.*
Mic.No: 80423

0324 Rukandema, M.; Mavua, J.K.; Audi, P.O. 1981. **The farming system of lowland Machakos District, Kenya. Report of farm survey results from Mwala location.**
Dryland Farming Research and Development Project, Machakos (Kenya). UNDP/FAO/GK Dryland Farming Research and Development Project Technical Report (Kenya), no. 1, 43p., 44 tables **En**
☐*Presents results of surveys carried out in the lowland Machakos District of Kenya, including a small amount of data on ownership of working oxen and equipment and labour inputs by oxen. Concludes that draft oxen are underutilized being mainly used for soil preparation.*
Mic.No: 80270

0325 Saadullah, M.; Barton, D. 1986. **Draught animal power in Bangladesh.**
Appropriate Technology (UK), v. 13(1), p. 19–20, 3 tables, 1 photograph, 1 drawing; 2 ref., ISSN 0305–0920. **En**
☐*Discusses the condition of draft animals in Bangladesh (where livestock compete directly with people for food) and potential improvements to animal draft technology in terms of animal nutrition and harnessing. Suggests that the amount of draft power currently available in Bangladesh could be met by halving the number of draft animals, doubling their weight and using them as single draft units.*
Mic.No: 80390

0326 Sabi, I. 1990. **La culture attelée au Togo: données statistiques. (Animal traction in Togo: Statistical data)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, 1 map, 1 table, ISBN 92–9081–046–7
☐*Provides results of surveys of farms using animal traction in the Kara, Savanes and Centrale regions of Togo in 1986/87. In general farms have twice the area of food crops (maize, sorghum, millet, rice, beans, and groundnuts) than cash crops (mainly cotton). In Kara and Centrale regions mouldboard plows are used for tillage, and carts are quite widely used. By contrast, in the Savanes region ridgers are predominantly employed and carts are quite rare.*
Mic.No: 82232

0327 Sahu, S.D. 1982. **Draught animal power potential of N.E.H. region.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 10p., 2 fig., 3 tables; 3 ref. **En**
☐*Assesses the existing draft animal power/machine system in the North Eastern Hills Region of India, with emphasis on the correlation between available power per unit area and food grain production in the region, as well as fuel energy and manure potential of draft animals in the region. Includes survey results on requirements of total power and contribution by draft animals to the cultivation of two paddy crops annually under valley-and conditions.*
Mic.No: 80611

0328 Salle, B. 1972. **L'emploi de la traction animale et du petit matériel agricole dans le Tadla. (The use of animal traction and farm implements at Tadla)**
Machinisme Agricole Tropical (France), no. 37, p. 43–47, 1 fig., 2 tables, 6 photographs **Fr**
☐*Evaluates soil preparation equipment, seeders and groundnut lifters for use with mules in the Tadla region of Morocco.*
Mic.No: 80274

0329 Santoso; Sumanto; Perkins, J.; Petheram, R.J. 1987. **An agro-economic profile of Tanjungwangi Village, Subang – with emphasis on draught animal rearing.**
James Cook Univ., Townsville (Australia). Draught Animal Power Project. DAP Project Bulletin (Australia), no. 2, p. 4–28, 7 fig., 13 tables, 6 photographs, 2 maps; 11 ref. **En**
☐*Describes Tanjungwani village, Java, in terms of the main characteristics considered important in understanding the role and management of draft animals and in evaluating opportunities for im-*

proving their contribution to farming systems, using data from 1985 official statistics or village records but mainly surveys of all cattle rearers (38 cattle, 33 buffalo) and non-rearers in Aug–Sep 1986. Proposes ideas for trials of possible improvements in the village including storage of rice straw, introduction of forage crops, improving animal health, improved implements and using draft animals for activities other than tillage.
Mic.No: 80364

0330 Santoso; Sumanto. 1989. **Descriptive research on draught animal power systems.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 94–100, 11 diagrams, 7 tables; 13 ref., ISBN 1-86320-003-7 **En** (En)
☐*Reviews research on the description (or diagnosis) of farming systems with particular reference to draft animal power (DAP) with most examples coming from Indonesia. Suggests a list of headings for an agroeconomic profile of a farming systems research (FSR) site in Java. Stresses that sound descriptive research of DAP systems depends not only on involvement of specialists but also on participation and trust of farmers in diagnosing problems.*
Mic.No: 80931

0331 Sarkar, J. 1981. **Improved utilisation of animal draught power in Bangladesh.**
Jackson, M.G. (ed.); Dolberg, F. (ed.); Davis, C.H. (ed.); Haque, M. (ed.); Saadullah, M. (ed.). In: Maximum livestock production from minimum land. Proceedings of a seminar, Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 2–5 Feb 1981, p. 348–356, 1 table; 4 ref. **En**
☐*Assesses the magnitude of animal power use in Bangladesh, stressing the need for additional power use and discussing ways of improving utilization of existing capacity to increase productivity. Suggests diversifying the uses of draft animals, and the adoption of improved designs of harnesses, carts, plows and implement.*
Mic.No: 80616

0332 Sarr, D.M. 1990. **Post-cultivation constraints to increasing productivity using animal traction in The Gambia.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 308–309, ISBN 92-9081-046-7 **En**
☐*Discusses constraints to adoption of animal traction packages in The Gambia, results of user surveys and the role of women, peasant and elite farmers. All types of farmers tended to cultivate larger areas than they could manage when it came to harvesting and post-harvest processing because of the relative ease of land preparation and seeding. Suggests that countries like The Gambia can learn from the successes of other Third World countries (e.g. China, India, Pakistan) in adopting animal traction.*
Mic.No: 82064

0333 Sathasivampillai, R. 1972. **Farm power and machinery in crop production, Sri Lanka.**
FAO, Rome (Italy). 7. Session of the IRC Working Party on Agricultural Engineering Aspects of Rice Production, Storage and Processing, Bangkok (Thailand), 3–6 Nov 1972, 6p. **En**
☐*Describes the use of working animals and farm machinery, especially tractors, in crop production in Sri Lanka.*
Mic.No: 80711

0334 Scherrer, ' s.d. **Développement de la culture attelée au Niger. Compte rendu de mission du 29 Mai au 25 Juin 1966. (Development of animal traction in Niger. Mission report, 29 May – 25 June 1966)**
Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France), 48p. **Fr**
☐*Studies the development and use of animal traction for tillage, weeding, harrowing, sowing and harvesting, examining the potential of implements used by farmers in Niger.*
Mic.No: 75379

0335 Shankar, J.; Parmar, D.J. 1982. **Draught animal power utilization in J & K State.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 12p., 6 tables; 5 ref. **En**
☐*Presents results of a survey conducted to determine the use of draft animal power (DAP) in Jammu and Kashmir State of India, with emphasis on energy consumption patterns for various applications, inputs to DAP in the form of feed, related human labour and grazing periods, and outputs from DAP in terms of utilization hours; assesses the unutilized DAP potential.*
Mic.No: 80664

0336 Shulman, R. 1979. **Strategy for the advancement of animal traction in Mali.**

USAID, Bamako (Mali), 5p., tables; ref. **En** (En)
□*Describes economic benefits of animal traction in Mali and discusses improvements in soil condition and weed control technology, livestock acquisition and management practices, provision of training and extension activities, and appropriateness and supply of equipment to further its adoption.*
Mic.No: 39779

0337 Shumba, E. 1985. **Animal and human power in communal agriculture.**
Zimbabwe Science News, v. 19(3,4), p. 32–34, 4 tables; 5 ref. **En**
□*Discusses the nature of the human and cattle power problem, farmer management strategies and the time requirement for the major operations in groundnut and maize production, based on an assessment survey conducted during the 1983/84 season in Magwende, Zimbabwe.*
Mic.No: 80508

0338 Shumba, E. s.d. **The crop–livestock interrelationship and farmer adaptation to problems of reduced cattle numbers and lack of dry season feed in communal areas of Zimbabwe.**
Agronomy Inst., Causeway (Zimbabwe), 15p., 8 tables; 16 ref. **En**
□*Presents results of a survey in Mangwende using responses from 80 farmers and discusses relationships between cattle ownership and crop production, trends in cattle numbers, farmer management strategies to counteract falling animal numbers, and areas of research to improve the role of cattle in communal area farming systems (dry season feed and falling herd size).*
Mic.No: 80454

0339 Singa, D.D. 1982. **Sources of potential animal power for Malawi's agricultural sector. Fact and figures.**
Conference of the Association for the Advancement of Science of Malawi, Lilongwe (Malawi), 21 Dec 1982. 15p., 8 tables; 23 ref. **En** (En)
□*Reviews relative merits of different sources of animal power, viz horses, oxen, water buffaloes, camels and donkeys, and mechanization of smallholder farms in Malawi on the basis of technical, socioeconomic and environmental factors.*
Mic.No: 55094

0340 Singa, D.D. 1983. **Sources and utilization of power and equipment for Malawi's agricultural sector.**
CIMMYT Networkshop on Draft Power and Livestock Feeding in Eastern and Southern Africa, Mbabane (Swaziland), 4–6 Oct 1983, 20p., 7 tables; 6 ref. **En** (En)
□*Examines the farm mechanization situation in Malawi, with a brief description of the country's agricultural system, availability of farm power and equipment and related problems; discusses the use of animal powered equipment as a solution to low agricultural productivity resulting from low level of mechanization, outlining action being taken with regard to the development of hand tools and animal powered equipment.*
Mic.No: 82262

0341 Singh, D.; Singh, V.K.; Singh, R.K. 1982. **Use pattern and factors of low productivity of draught animal power in Uttar Pradesh.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 7p., 2 tables **En**
□*Examines factors causing low productivity of draft animal power (DAP) in Uttar Pradesh, India, by analyzing farm structure, availability and maintenance cost of draft animal power under different size groups of farms as well as utilization of draft animal labour days.*
Mic.No: 80691

0342 Siriweera, W.I. 1989. **The role of draught animals in a rural society: The case of the buffalo in Sri Lanka.**
Peradeniya Univ. (Sri Lanka). Dept. of History, 20p., 4 tables; 5 ref. **En**
□*Reviews the history of use of buffaloes as draft animals in Sri Lanka, the shift towards mechanization, disadvantages of tractorization and advantages of draft animal power (DAP), improvement of draft animals, ownership and utilization patterns, management and feeding, problems of buffalo rearing and recent trends in DAP. Concludes that escalating cost of tractors, spare parts and fuel at a time of major land development programmes make the maintenance and improvement of draft animals imperative for Sri Lankan agriculture.*
Mic.No: 80524

0343 Siriweera, W.I. 1989. **Role of draught buffalo in rural Sri Lanka.**
Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 46–52, 4 tables; 5 ref., ISBN 1-86320-003-7 **En** (En)
□*Describes the historical role of buffaloes in Sri Lankan agriculture, the shift towards mechanization in the late 1940s, disadvantages of tractorization and the current reverse trend towards draft animals particularly in new colonization schemes in dry and*

intermediate zones. Discusses the problem that as the person/land ratio becomes smaller with smaller grazing grounds for draft animals, DAP will be limited in countries like Sri Lanka. Concludes that research should continue into supplementary animal feeds, e.g. urea-enriched paddy straw, which must be available at an affordable price, and that common grazing grounds should be established.
Mic.No: 80926

0344 Sizilande, B.J. 1980 **Use of work oxen as a source of power in units 23 and 24, Lilongwe Land Development Programme.**
Bunda College of Agriculture, Lilongwe (Malawi), 13p., 9 tables; 10 ref. B.Sc. (Agriculture). **En** (En)
☐*Reports findings of a survey on the use of draft oxen in two units of the Lilongwe Land Development Programme area in Malawi, with particular reference to differences in farm size, ownership of livestock, family size, crop output and income on farms which own oxen and on those which do not, uses of oxen for transport and cultivation, and problems of ox-draft.*
Mic.No: 55163

0345 Sleeper, J.A. 1979. **Ox-cultivation in Sudano-Sahelian West Africa.**
Livestock International (UK), no. 33, p. 10–13, 1 map, 1 table; 15 ref., ISSN 0306–8560. **En**
☐*Discusses the advantages of ox-power in the Sudano-Sahelian zone of West Africa, outlining trends in its use and constraints due to inadequate feed supply; recommends forage cultivation in crop rotations and/or a system of deferred grazing on local village reserves as a solution to dry season feeding problems.*
Mic.No: 28765

0346 Smid, J. 1982. **Use of draught oxen in northern Ghana. (Traction bovine dans la région septentrionale du Ghana)**
Munzinger, P. (ed.). In: Animal traction in Africa, p. 453–476, 4 photographs, 1 table; 6 ref., ISBN 3–88085–133–6 **En, Fr**
☐*Discusses the use of draft oxen in northern Ghana, outlining natural, structural and economic conditions prevailing in the region, and the objectives, programmes and activities of agricultural stations set up under the Ghanaian-German Agricultural Development Project (GGADP) as implementing institutions for the use of draft oxen at local level.*
Mic.No: 80690

0347 Smith, T.L. 1972. **The improvement of the ways of farming in Brazil.**
International Review of Modern Sociology (USA), v. 2(2), p. 190–196, 3 ref. **En**
☐*Describes six major farming systems in Brazil, namely, river-bank planting, felling and burning, hoe culture, rudimentary and advanced plowing which rely on animal power and mechanized farming, analyzing the extent to which they are employed.*
Mic.No: 82060

0348 Sonko, M.L. 1990. **Disponibilité des animaux de trait et les contraintes structurelles en Basse Casamance. (Availability of work animals and structural constraints in Lower Casamance)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 294–303, 1 fig., 1 map, 6 tables, ISBN 92–9081–046–7 **Fr**
☐*Presents results of surveys into numbers of draft animal available in various districts of the Basse-Casamance region (Senegal) carried out among 375 farmers in 8 villages. Animals used were mainly trypanotolerant N'Dama cattle (85.4%) with a few horses (8.6%) and donkeys (6%). Divides the region into 3 zones in terms of no, poor or good uses of animal traction and discusses means of improving the situation.*
Mic.No: 82060

0349 Sonko, M.L. s.d. **Traction animale et travail animal au Sénégal: le cas du nord-est de la Basse-Casamance. (Animal traction and animal power in Senegal: The case of the north-east Lower Casamance)**
Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier (France). Dept. Systèmes Agraires. In: Relations agriculture-élevage, 2. Séminaire du Département Systèmes Agraires du CIRAD sur les Relations Agriculture – Elevage, Montpellier (France), 10–13 Sep 1985. Collection Documents Systèmes Agraires (France), no. 4, p. 252–259, 1 map, 5 fig., 6 tables **Fr** (En Es Fr)
☐*Analyzes the evolution of animal traction in Lower Casamance, Senegal, in order to clarify the process of its integration into the farming system, considering herd development and the environment, and characterizing the farms according to draft stock, draft equipment and animal labour needs.*
Mic.No: 82089

0350 Soumare, S. 1984. **Rapport d'activité des essais villageois: campagne 1983. (Report of village trials, 1983)**
CIPEA, Bamako (Mali). Programme des Zones Aride et Semi-Aride. CIPEA Mali Document de Programme, no. AZ 114, 12p., 2 tables **Fr** (Fr)

□*Analyzes village trials conducted at Dalongue-bougou in Mali in 1983 on the supplementary feeding of work-oxen and on cowpea agronomy, discussing results on weight gain, yield improvement, work output and the economics of supplementary feeding.*
Mic.No: S-90 No. AZ114

0351 Spencer, D.S.C. 1986. **Agricultural research in sub-Saharan Africa: Using the lessons of the past to develop a strategy for the future.**
ICRISAT, Patancheru, AP (India). Economics Unit. ICRISAT Economics Unit Progress Report, no. 71, 51p., 3 fig., 5 tables; 73 ref. **En**
□*Examines different models or typologies of agricultural development from the point of view of their relevance for agricultural policy in sub-saharan Africa, discusses past performance of agricultural research and critically evaluates technological innovations (including attempts to introduce animal traction), and defines the elements of a modern agricultural research strategy (including improvement of existing animal draft implements and harnessing techniques rather than development of new ones).*
Mic.No: 80869

0352 Spencer, D.S.C. 1988. **Farming systems in West Africa.**
Starkey, P. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 91–96, 2 tables; 9 ref., ISBN 3-528-02047-4 **En**
□*Defines the terms Farming Systems Research and Extension (FSR/E) and Research with a Farming Systems Perspective (RFSP). Describes the conditions under which animal traction could fit in with existing farming systems in West Africa given the agro-ecological and socio-economic variability of the region and discusses the possibility of successfully introducing animal traction to the region on a large scale.*
Mic No: 82003

0353 Spurgeon, D. 1982. **Using livestock to pull up small farm productivity.**
International Agricultural Development (UK), v. 2(10), p. 20–22, 3 photographs, ISSN 0261-4413. **En**
□*Reviews the activities of the ILCA Highlands Programme at Debre Zeit, Ethiopia, with particular reference to attempts at increasing earnings from livestock to stimulate improved food grain production on mixed farms; and the use of crossbreds and cows for traction.*
Mic.No: 29351

0354 Starkey, P.H. 1982. **N'Dama cattle as draught animals in Sierra Leone. (Les bovins N'Dama. Animale de trait en Sierra Leone)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 42, p. 19–26, 15 fig., 3 tables; 9 ref., ISSN 0049-8025. **En, Fr**
□*Discusses the history, potentials and constraints on the development of draft animal projects in Sierra Leone, outlining techniques in the training and management of work oxen, feed requirement and work capacity of animals, particularly of N'Dama breeds, and technical and economic advantages resulting from the use of draft oxen.*
Mic.No: 28637

0355 Starkey, P.H. 1984. **N'Dama cattle – a productive trypanotolerant breed. (Les bovins N'dama – race trypanotolérante productive)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 50, p. 2–15, 8 tables, 7 photographs; 28 ref., ISSN 0041-6436. **En, Fr** (En)
□*Describes the N'Dama cattle breed, with particular reference to its origins, physical characteristics, distribution, productivity under different management levels, milk yield, reproductive performance, viability and overall production, growth rates and productivity as compared to other breeds, beef characters, trypanotolerance and resistance to other diseases, physiological adaptation, and use as draft animals.*
Mic.No: 65597

0356 Starkey, P.H. 1984. **The use of draught animal power in the Kasai Occidental and Kasai Oriental regions of Zaire.**
Overseas Development Administration, London (UK), 40p., 9 fig., 1 map **En** (En Fr)
□*Evaluates two OXFAM-funded draft animal projects in Kasai Oriental and Kasai Occidental in Zaire, namely Project Nkata and Project Rural based at Masuika and Mbujimai respectively. Describes the work of the two projects in the introduction of draft animals and the production of equipment. Discusses other draft animal projects in the country with information on the technical, social, economic and environmental aspects, and working methodologies as well as the interest of some aid donors and commercial firms in developing animal traction in Zaire. Includes specific recommendations concerning equipment evaluation and production, extension activities and research programmes.*
Mic.No: 35675

0357 Starkey, P.H. 1984. **Upland rice cultivation in Sierra Leone using draught animal power.**

International Rice Commission Newsletter, v. 33(1), p. 27–29, ISSN 0538–9550. **En**
□*Reviews the results of trials at Njala University College in which draft oxen were used for plowing, harrowing, seeding, weeding and additional operations for upland rice production.*
Mic.No: 80313

0358 Starkey, P.H.; Apetofia, K.V. 1985. **Animal traction in Togo.**
Nepal. Ministry of Agriculture. Dept. of Agriculture; Indonesia. Ministry of Agriculture. Agency for Agricultural Research and Development; IRRI, Manila (Philippines). Rice Farming Systems Network. In: Proceedings of the 2nd monitoring tour. Crop-livestock systems research. Nepal and Indonesia, 2. Crop–Livestock Systems Research Monitoring Tour – Nepal and Indonesia, s.l., 18–31 Aug 1985, p. 660–663 **En**
□*Surveys the use of animal traction in Togo and describes activities and research methodologies of organizations and projects engaged in its development.*
Mic.No: 82085

0359 Starkey, P.H.; Apetofia, K.V. 1986. **Integrated livestock systems in Nepal and Indonesia. Implications for animal traction programs in West Africa.**
Florida Univ., Gainesville (USA). Farming Systems Support Project. FSSP Network Report (USA), no. 3, 64p., 19 fig., 57 ref. **En**
□*Presents details of the Second Crop–Livestock Research Monitoring Tour of Nepal and Indonesia organized by IRRI, the Department of Agriculture of Nepal and the Ministry of Agriculture of In donesia, highlighting points of particular relevance to animal traction programmes in West Africa. Includes papers presented by West African participants in the tour.*
Mic.No: 80618

0360 Starkey, P.H. 1989. **Farming systems research relating to draught animal power: An overview.**
Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 82–93, 45 ref., ISBN 1–86320–003–7 **En** (En)
□*Introduces the topic of farming systems research (FSR), reviews some farming systems programmes involving animal traction and discusses some of the implications of applying FSR principles and techniques to animal traction studies.*
Mic.No: 80930

0361 Stephen, J. 1984. **Draught power problems and related research in Botswana, Lesotho and Swaziland.**
CIMMYT, Mexico City (Mexico). Eastern and Southern Africa Economics Programme. CIMMYT Networking Consultancy Report, no. 3, 125p., 8 tables; 11 ref. **En**
□*Examines the draft power problems and related research in Botswana, Lesotho and Swaziland, describing the physical, social and animal power situation in areas selected for study by the Agricultural Technology Improvement Project. Includes country reports outlining component research carried out and underway.*
Mic.No: 82246

0362 Subandriyo; Sitorus, P.; Zulbandi, M.; Roesyat, A. 1979. **Performance of Bali cattle as work animals and milk and beef producers.**
Indonesian Agricultural Research and Development Journal, v. 1(1, 2), p. 9–10, 4 fig. **En**
□*Discusses the work performance and productivity of Bali cattle, outlining the breed's characters and results of crossbreeding with other cattle.*
Mic.No: 80750

0363 Subrahmanyam, K.V.; Ryan, J.G. 1975. **Livestock as a source of power in Indian agriculture: A brief review.**
ICRISAT, Patancheru, AP (India). Economics Dept. ICRISAT Occasional Paper, no. 12, 30p., 1 fig., 11 tables; 28 ref. **En**
□*Reviews the importance and limitations of the use of animal power in India, discussing the distribution and pattern of utilization throughout the country, and the economics of bullock power use.*
Mic.No: 80627

0364 Sumanto; Santoso; Petheram, R.J.; Perkins, J.; Nana; Rusastra, I.W. 1987. **An agro-economic profile of Padamulya village, Subang – with emphasis on draught animal rearing.**
James Cook Univ., Townsville (Australia). Draught Animal Power Project. DAP Project Bulletin (Australia), no. 4, p. 2–29, 10 fig., 13 tables, 8 photographs, 2 maps **En**
□*Describes Padamulya village, Java, in terms of main characteristics considered important in understanding the role and management of draft animal enterprises and in evaluating opportunities for improving their contribution to farmers' income, data being derived from 1985 official statistics, some from surveys of rearers of cattle and buffalo and non-rearers in Aug–Sep 1986 and some from continuous monitoring of 30 enterprises. Lists topics requiring further data collection and proposes initial ideas for trials for possible improvements to farming systems in the village (including alternative yokes and harnesses, storage of rice straw, planting forage crops, improved implements and animal health).*
Mic.No: 80366

0365 Sumberg, J.; Gilbert, E. 1988. **Draft animals for crop production in the Gambia.**
s.n., s.l., 23p., 2 fig., 13 tables; 28 ref. **En** (En)
□*Provides data and analysis related to animal traction in The Gambia based on 1986/87 and 1987/88 National Agricultural Sample Surveys, describing the history of animal traction in the country, current populations and distribution of draft animals and animal-drawn equipment. Explores the relationship between the level of animal-powered mechanization and crop production activities, and outlines implications for research and development policy and programmes.*
Mic.No: 80023

0366 Tacher, G.; Nicolas, F.; Lachaux, P. 1970. **Les bovins de culture attelée au Tchad. (Draft cattle in Chad)**
Machinisme Agricole Tropical (France), no. 29, p. 15–18, 2 photographs **Fr** (En)
□*Describes the rapid increase in animal traction in Chad over the last 10 years shown by spectacular rises in numbers of plows and oxen, but stresses problems particularly in animal health and management.*
Mic.No: 80804

0367 Tacher, G.; Lachaux, P.; Nicolas, F. 1971. **Les "bovins" de culture attelée au Tchad. (Cattle for animal traction in Chad)**
Organisation Commune Africaine et Malgache, Yaoundé (Cameroun); Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). In: Colloque sur l'élevage, Ndjamena (Chad), 8–13 Dec 1969, p. 252–267, 3 tables; 27 ref. **Fr**
□*Examines the development of animal traction in Chad, with data on different animal diseases, the economic aspect, role of the rearing service, and future prospects.*
Mic.No: 80667

0368 Tapson, D. 1988. **Mechanization or animal draft?**
Appropriate Technology Newsletter (South Africa), v. 5(2), p. 1–3, 2 photographs **En**
□*Discusses reasons for the low level of animal draft in South Africa and suggests that this is due to its inefficiency in use of labour and performance. Suggests that the ICRISAT toolbar has great potential for use in the region.*
Mic.No: 80836

0369 Taregue, A.M.M. 1985. **Draught animal power in Bangladesh: An appraisal.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 165–166, 1 table; 5 ref. **En**
□*Reviews the draft animal power situation in Bangladesh, discussing briefly the population and status of draft animals, the land-use pattern and availability of feedstuffs.*
Mic.No: 80653

0370 Tchougoune, M. 1990. **Contraintes à l'utilisation de la traction animale au Niger. (Constraints to animal traction use in Niger)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 408–412, 2 tables, ISBN 92-9081-046-7
□*Discusses reasons for the slow growth of animal traction in Niger. Suggests the constraints include the high cost of implements, limited access to credit and the low profitability of crop production. Other constraints cited include inadequate training of extension workers, difficulties in maintaining and repairing implements, soil degradation and problems of animal health and husbandry.*
Mic.No: 82235

0371 Tembo, S. 1989. **Draught animal power research in Zimbabwe: Current constraints and research opportunities.**
Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 61–68, 7 tables, 1 graph; 25 ref., ISBN 1-86320-003-7 **En** (En)
□*Highlights how lack of draft animal power (mainly oxen) has become critical to crop productivity in Zimbabwe's communal lands. Outlines DAP research at the Univeristy of Zimbabwe and proposes an interdisciplinary approach to investigate complementary factors involved in alleviating identified constraints. Discusses research aimed at reducing draft power requirements through innovative tillage methods and implements with low draft energy requirements and improving the available draft power through improved nutrition regimes and strategic working of the animal.*
Mic.No: 80928

0372 Tesfaye Zegeye; Mulugetta Mekuria; Dixon, J. 1979. **Farming systems project survey – Bako mixed farming zone (October–November 1977).**

Institute of Agricultural Research, Addis Ababa (Ethiopia), 24p., 18 tables **En**
☐*Presents the report of a multidisciplinary farming systems survey conducted in Bako area, Ethiopia, with reference to farm size, draft animals, vaccination, factors leading to diminished livestock number; problems of sorghum production, protein consumption, and grain storage. Outlines research priority in animal and crop production.*
Mic.No: 17104

0373 Toulmin, C. 1982. **The effect on yields of millet of manuring and of ox-plough ownership.**
s.n., s.l., 8p. **En**
☐*Details findings of a study carried out to determine the impact of manuring on the short-cycle millet variety and the effects of ox-plow ownership on yields of the longer-cycle millet variety, using data collected from two mixed farming villages of central Mali.*
Mic.No: 80044

0374 Weil, P.M. 1970. **Chapter 7. The introduction of the ox plow in central Gambia.**
McLoughlin, P.F.M. (ed.). In: African food production systems. Cases and theory, Johns Hopkins Press. Baltimore (USA), p. 229-263, fig., 1 map **En**
☐*Analyzes the social and economic effects of the introduction of the ox plow in central Gambia, focusing on the activities of the Mixed Farming Centre earlier known as the Ox Plowing Schools, factors working for the acceptance of the plow, and effects of acceptance on production and land use.*
Mic.No: 77235

0375 Wevers, J.D.A.; Dibbits, H.J. 1977. **Agricultural mechanization in northern Nigeria.**
Landbouwkundig Tijdschrift (Netherlands), v. 89(7), p. 233-241, 10 ref. **Nl**
☐*Discusses trends in agricultural mechanization in northern Nigeria, evaluating the relative importance of animal power and small and large tractors. Includes data on time required for various tillage operations, yields of maize in relation to tillage practices and costs of oxen, animal-drawn implements and tractors plus implements.*
Mic.No: 80723

0376 Whalley, J.; Abiye Astatke. s.d. **Animal traction in Ethiopia and ILCA's research programme in animal traction.**
ILCA, Addis Ababa (Ethiopia), 7p., 1 table **En**
☐*Discusses the history of the use of domestic animals to provide tractive power for cultivation in Ethiopia, outlining major drawbacks and ILCA'S attempts to develop a more efficient traction system that would allow better utilization of available resources.*
Mic.No: 30526

0377 Wiggins, L.L.; Evans, C.L. s.d. **Mule power in Ethiopian agriculture.**
College of Agriculture and Mechanical Arts, Alemaya (Ethiopia). College of Agriculture and Mechanical Arts Experiment Station Bulletin (Ethiopia), no. 15, 18p., fig. **En**
☐*Analyzes work done at the Jimma Agricultural Technical School, Ethiopia, to adapt mules and suitable implements to Ethiopian agriculture, with particular reference to the selection, training, feeding and general care of mules; includes an assessment of the economic advantages of using mules for work and simple equipment adapted for mules.*
Mic.No: 03373

0378 Wilson, R.T. 1978. **Studies on the livestock of southern Darfur, Sudan. V. Notes on camels.**
Tropical Animal Health and Production (UK), v. 10, p. 19-25, 1 graph, 4 tables; 21 ref., ISSN 0049-4747. **En** (En Es Fr)
☐*Presents observations on the population, growth, body weight, carcass composition, and work performance of camels in southern Darfur, Sudan, with notes on offtake, slaughtering method, animal diseases and pests.*
Mic.No: 82090

0379 Wilson, R.T. 1978. **Studies on the livestock of southern Darfur, Sudan. VI. Notes on equines.**
Tropical Animal Health and Production (UK), v. 10, p. 183-189, 1 graph, 3 tables; 12 ref., ISSN 0049-4747. **En** (En Es Fr)
☐*Presents information on equines in southern Darfur, Sudan, particularly regarding their use for transportation, in fuel supply, and in domestic water distribution; also discusses population structure, growth, body weight and economic role.*
Mic.No: 82090

0380 Wilson, R.T. 1986. **Central Mali: Cattle husbandry in the agropastoral system. (Mali central - L'élevage bovin en régime agropastoral)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 58, p. 23-30, 8 fig., 6 tables; 7 ref., ISSN 0049-8025. **En, Fr** (En)
☐*Describes cattle husbandry in the agropastoral system of central Mali, discussing data on the management systems and ownership patterns, herd demography, and productivity including repro-*

ductive performance, growth, weight, traction and meat and milk production.
Mic.No: 68366

0381 Yang-Lian, F. 1984. **The use of draught cattle in China.**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 21–29, 10 tables; 6 ref., ISBN 92-5-001474-0 **En** (En Fr)
☐*Examines the availability of draft animals, particularly yellow cattle, buffaloes and the yak, in China, and assesses their work capacity for different types of activity and their energy requirements.*
Mic.No: 80594

0382 Zerbo, D. 1986. **La traction animale au Mali. (Animal traction in Mali)**
Mali. Ministère de l'Agriculture, 40p., 9 tables, 1 graph, 16 drawings; 9 ref. **Fr**
☐*Reports on the current state of animal traction in Mali, main types of animal draft equipment used (illustrated), forges and the production of animal draft equipment, and financial and administrative aspects.*
Mic.No: 80249

0383 Zerbo, D.; Kantao, A. 1987. **Traction animale au Mali. (Animal traction in Mali)**
Mali. Ministère de l'Agriculture, 28p., 4 tables, 1 graph, 14 drawings **Fr**
☐*Brief acccounts of the geography of Mali and of the historical background to the development of animal traction are followed by details of types and numbers of animal-drawn implements (illustrated) and draft animals used. Data are given on costs of producing sorghum, groundnuts, rice and maize using draft animals. Problems associated with draft animals are discussed.*
Mic.No: 80245

0384 Zerbo, D.; Kantao, A. 1988. **Traction animale au Mali. (Animal traction in Mali)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 175–181, 1 fig., 4 tables, ISBN 3-528-02047-4 **Fr**
☐*Brief accounts of the geography of Mali and of the historical background to the development of animal traction are followed by details of types and numbers of animal-drawn implements and draft animals used. Data are given on the costs of producing sorghum, groundnuts, rice and maize using draft animals. Problems associated with draft animals are their high initial cost, provision of adequate feed during drought and animal health.*
Mic.No: 82014

ACTIVITIES OF RESEARCH AND DEVELOPMENT PROJECTS

0385 Abiye Astatke; Taddesse Tessema. 1985. **Report on a visit to Hararghe from October 21 to 27, 1985 to assess the construction of ponds using animal power.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 6p., 1 table **En**
☐*Reports on a visit made to Hararghe Province, Ethiopia, by the Highland Programme team of ILCA, to investigate the progress in the utilization of animal-drawn scoops distributed in the Province by the Ministry of Agriculture for the construction of ponds.*
Mic.No: 35476

0386 Abiye Haile Selassie; Cossins, N.J. 1985. **Use of ox-drawn scoops for pond maintenance in the southern Ethiopian rangelands. (L'excavateur à traction bovine pour l'entretien des mares des parcours du sud-éthiopien)**
ILCA Newsletter (CIPEA actualités), v. 4(1), p. 5–6, 2 photographs; 2 ref., ISSN 0255-0024 (E) and ISSN 0255-0032 (F). **En, Fr**
☐*Reports the initial results of a trial conducted to study the feasibility of using ox-drawn scoops for desilting ponds in the Ethiopian highlands.*
Mic.No: 66207

0387 Allagnat, P. 1985. **Des boeufs et des hommes. Développement de la traction animale dans la Vallée Mabole, Sierra Leone. Texte du montage diapositive (version française) réalise à partir d'un travail au sein du Work Oxen Project. (Oxen and men. Development of animal traction in the Mabole Valley. Text accompanying a slide presentation prepared on site at the Work Oxen Project)**
Groupe de Recherche et d'Echanges Technologiques, Paris (France), 10p. **Fr**
☐*Text to accompany a slide presentation on animal traction compared with traditional methods of cultivation in the Mabole Valley of Sierra Leone.*
Mic.No: 80325

0388 Allagnat, P. 1985. **Introduction de la culture attelée et évolution des systèmes d'exploitation dans la Vallée Mabole (Sierra Leone). (Introduction of animal traction and development of farming systems in the Mabole Valley, Sierra Leone)**

Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 44–46, 2 tables, 1 photograph **Fr**
□*Presents results of a study carried out by the Sierra Leone Work Oxen Project to investigate the economic and social impact of animal traction on peasant smallholdings.*
Mic.No: 80793

0389 Amadou, A. 1981. **Rapport de stage: étude des problèmes et des obstacles majeurs à l'introduction de la traction animale pour les travaux agricoles dans la zone du Projet Productivité Tahoua. (Report of a training course – study of problems and major obstacles to the introduction of animal traction for agricultural use in the Tahoua project zone)**
Université de Niamey (Niger). Ecole Supérieure d'Agronomie, 34p., 10 ref. **Fr**
□*Analyzes problems and obstacles related to the introduction of animal traction as a way of improving agricultural productivity, examining the possibilities of diffusing animal traction technology in rural areas.*
Mic.No: 75957

0390 Anderson, F.M. 1984. **An overview of ILCA's animal traction research in Ethiopia.**
Flora, C.B. (ed.); Nichols, P.P. (comp.). In: Animals in the farming system. Proceedings of a symposium, 3. Annual Farming Systems Research Symposium, Kansas (USA), 31 Oct–2 Nov 1983. Farming Systems Research Paper Series (USA), no. 6, p. 178–183, 1 ref. **En** (En)
□*Summarizes ILCA's basic and applied research on different aspects of the use of draft animals in the highlands of Ethiopia, especially regarding suitability testing of different implements for use with indigenous oxen, comparison in performance and feed requirements of local and crossbred oxen, evaluation of crossbred cows for both work and milk production, use of a modified plow to be drawn by a single ox, and pond excavation with metal scoops using only oxen power.*
Mic.No: 78622

0391 Anon. 1973. **Projet d'opération de vulgarisation de la culture attelée et d'animation rurale dans l'Adamaoua. (Extension project for animal traction and rural development in Adamoua)**
s.n., s.l., 65p., 49 tables, 4 maps **Fr**
□*Studies rural development, with particular reference to animal traction activities, in eight sectors grouped under three zones at Adamaoua in Cameroon, in order to address development problems in general and to encourage and prepare national institutions necessary for development.*
Mic.No: 20804

0392 Anon. 1973. **A preliminary assessment of the requirements for the supplementary supply of seed and draught oxen in the drought afflicted areas of Tigre, Wollo and Northern Shoa for the 1966 E.C. crop season (1974 G.C.).**
Ethiopia. Ministry of Agriculture. Planning and Programming Dept., 18p. **En** (En)
□*Presents a preliminary assessment of the requirements for the supplementary supply of seed and draft oxen in the drought-affected areas of Tigre, Wollo and northern Shoa in Ethiopia, for the 1966 E.C. crop seasons. Identifies inputs necessary to bring production to normal and indicate to government the estimated requirements of seed and draft oxen, so as to take immediate steps to allocate funds and to put in hand the necessary procurement and administrative measures.*
Mic.No: 37774

0393 Anon. 1974. **Dryland Farming Research Scheme. Third annual report: Agronomy.**
Agricultural Research Station, Gaborone (Botswana), 29p. **En**
□*Summarizes results of trials carried out by the Dryland Farming Research Scheme of Botswana in its third year of activity and the final year of Phase 1, particularly regarding trials on tillage and planting practices, and animal-drawn toolcarrier research and development.*
Mic.No: 57317

0394 Anon. 1974. **Note introductive au développement de la production bovine en vue de son utilisation pour la traction animale. (Introductory note on the development of production of cattle for animal traction)**
FAO, Rome (Italie), 17p., 1 fig. **Fr**
□*Studies the development of animal production, especially production of N'Dama and Borgou cattle, for work in Benin, with notes on measures that need to be taken.*
Mic.No: 61033

0395 Anon. 1976. **Dryland Farming Research Scheme (DLFRS), Botswana. Initial scientific report Phase II, December 1976.**
UK. Ministry of Overseas Development; Agricultural Research Station, Gaborone (Botswana), 138p., 15 fig., 4 maps; tables **En**
□*Reports on the scientific aspects of the initial year of activity (July 1975 to 1976) of the Dryland Farming Research Team in Botswana, with particular reference to studies on agricultural engineering, crop physiology and climate, agricultural systems using oxen, and animal-drawn equipment development.*
Mic.No: 57322

0396 Anon. 1977. **Projet de développement de la culture attelée et de la production animale, Bénin. Conclusions et recommandations du projet. Rapport terminal. (Project for the development of animal traction and animal production, Benin. Project conclusions and recommendations. Final report)**
FAO, Rome (Italy). Agriculture Dept, 37p., ref. **Fr**
☐*Presents data and recommendations for the development of crop cultivation using draft animals, especially oxen, improvement of production and marketing of livestock and meat, and for the preparation of training courses and fellowships on the use, maintenance and repair of agricultural machine tools and farm implements; includes bibliography.*
Mic.No: 80713

0397 Anon. 1977. **Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana. Report No. 1. Animal draft systems study.**
Botswana. Ministry of Agriculture. Evaluation of Farming Systems and Agricultural Implements Project, 167p., fig., tables, photographs; ref. **En**
☐*Presents results of farm trials in which tillage using the Versatool, Makgonatsotlhe, AMP (autumn mouldboard plowing) and SMP (summer mouldboard plowing) systems were compared. Discusses engineering aspects of the two toolcarriers.*
Mic.No: 80825

0398 Anon. 1977. **Report no. 1: Animal draft systems study.**
Agricultural Research Station, Gaborone (Botswana), 167p., 8 fig., 78 tables, 27 plates **En**
☐*Presents results of trials carried out in Botswana to determine the advantages of using an animal draft minimum tillage crop production system under extensive farm conditions, to identify areas for further research, and to examine the durability and ease of the toolcarrier and identify modifications necessary in design or technique.*
Mic.No: 57639

0399 Anon. 1978. **Un exemple de mécanisation réussi: Le projet FAO d'assistance à la culture attelée en Haute Volta. (An example of successful mechanization: The FAO project on ox cultivation in Upper Volta)**
Afrique Agriculture (France), no. 32, p. 28–31, 3 illus. **Fr**
☐*Discusses technical assistance by the FAO for animal traction in Burkina Faso, with notes on various uses of draft animals, adaptation of agricultural equipment to local conditions, and the supply of oxen.*
Mic.No: 10219

0400 Anon. 1978. **Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana. Report no. 2. Animal draft systems study.**
Botswana. Ministry of Agriculture. Evaluation of Farming Systems and Agricultural Implements Project, 106p., fig., tables, photographs; ref. **En**
☐*Describes the evaluation in Botswana of two improved farming systems using the Versatool and Makgonatsotlhe toolcarriers compared with the traditional autumn mouldboard plow (AMP) system.*
Mic.No: 80826

0401 Anon. 1979. **Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana. Report no. 3.**
Botswana. Ministry of Agriculture. Evaluation of Farming Systems and Agricultural Implements Project, 46p., 5 fig., 33 tables; 6 ref. **En**
☐*Gives results of field trials in Botswana in which improved farming systems (Makgonatsotlhe, EFSAIP, SAFIM and plow planting by hand every third furrow) were compared with broadcast-sown control plots of sorghum.*
Mic.No: 80827

0402 Anon. 1980. **Sri Lanka – final report.**
FAO, Rome (Italy). International Scheme for the Coordination of Dairy Development; FAO, Rome (Italy). International Meat Development Scheme, 109p., 1 map, 9 tables **En**
☐*Presents report prepared by the International Scheme for the Coordination of Dairy Development and the International Meat Development Scheme on livestock production in Sri Lanka, mentioning the general livestock policy, the availability and utilization of genetic and feed resources, the animal health situation, education, training, research and extension activities and the development of draft animals and the dairy and meat industries; includes project proposals for various action programmes to be pursued by the Government.*
Mic.No: 17834

0403 Anon. 1981. **Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana. Report no. 5, 1980–81.**
Botswana. Ministry of Agriculture. Div. of Agricultural Research, 149p., 20 photographs, 9 fig., 81 tables **En**
☐*Reports on the activities of the Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP) in Botswana, particularly regarding work on the evaluation of animal draft systems, intercropping systems, and the development of different farm machinery and equipment.*
Mic.No: 30580

0404 Anon. 1981. **Ideas that work.**
SENELA (Gambia), no. 18, p. 16–17, 2 photographs **En**
☐*Describes Action Aid field demonstrations for women involved in rainfed rice production in which a toolbar designed for a single donkey was adapted so that a Sine hoe could be drawn by a pair of donkeys and a pair of donkeys successfully drew a mouldboard plow attached to the Occidentale hoe. Notes that a package of 2 donkeys, an Occidentale weeder and plow and separate seeder costs less than half that of a similar ox-based package.*
Mic.No: 80789

0405 Anon. 1981. **ILCA quinquennial review. Consultancy reports on animal traction and human nutrition.**
ILCA, Addis Ababa (Ethiopia), v.p., fig., tables; ref. **En**
☐*Reports on visits to ILCA's Highlands Programme in Ethiopia in order to appraise results of research on animal traction and advise on further research as well as to advise on the design and analysis of nutrition surveys in ILCA's socio-economic studies in Mali.*
Mic.No: 18648

0406 Anon. 1982. **Etude d'un système technique de production en culture attelée. Ferme d'Angaradebou: Rapport campagne 1981. (Study of a production system using animal power. Angaradebou Farm: Report of activities, 1981)**
Bénin. Ministère de l'Enseignement Supérieur et de la Recherche Scientifique. Direction de la Recherche Coton et Fibres, 48p., 22 tables **Fr**
☐*Analyzes the setting up of an experimental farm at Angaradebou in central Benin which uses animal traction on 8 hectares of land, examining animal traction and manual work carried out on the farm as well as human labour requirements.*
Mic.No: 60812

0407 Anon. 1982. **ILCA Debre Berhan Research Station. Annual Report 1981.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 116p., 50 tables **En**
☐*Describes research activities and results obtained at the ILCA Debre Berhan Research Station in Ethiopia during 1981, with particular emphasis on systems research and studies on livestock, cereals, and forage agronomy. Brief section on the animal traction programme outlines the objectives and results of experiments on cow and oxen traction, feed regimes of draft animals and on power output of different types of draft animals.*
Mic.No: 80974

0408 Anon. 1982. **Projet de développement de la culture attelée sur les périmètres irrigués. Rapport général sur la situation du projet au 31 Décembre 1981. Prévisions de réalisation pour l'année 1982. (Project on development of animal traction in irrigated areas. General report on the status of the project up to 31 December 1981. Forecasts for 1982)**
Niger. Ministère du Développement Rural. Office National des Aménagements Hydro-Agricoles, 17p. **Fr**
☐*Reports on technical and financial aspects of operations concerned with the setting up of animal traction projects in irrigated areas in Niger.*
Mic.No: 76046

0409 Anon. 1982. **Evaluation of animal production operations financed by the European Community. Synthesis report.**
Sotesa International, Italy, 124p., 91 ref. **En**
☐*Presents results of the evaluation of 17 European Community financed animal production operations involving the development of traditional and modern livestock production systems, draft animal operations, meat processing and marketing and health protection activities. Focusses on the importance of management and organization problems over technical solutions adopted in light of experience gained in Africa.*
Mic.No: 57428

0410 Anon. 1983. **Regional Project on Farm Tool and Equipment Technology, Basic Needs and Employment. ILO/FIN/78/RAF/2. Appropriate farm equipment technology for the small-scale traditional sector. The case of Botswana (Country Profile 1).**
ILO, Geneva (Switzerland), 102p., 3 fig., 30 tables, 4 maps; 35 ref., ISBN 92-2-103608-1 **En** (En)
☐*Describes the agriculture and economy of Botswana including patterns of farm implement use and discusses the following topics: evaluation of farm equipment innovations; supply, demand and distribution of farm tools and implements; local manufacture of farm tools and implements; industrial and mechanization policy and strategy; constraints to wider use of farm equipment innovations; institutional support and infrastructure.*
Mic.No: 80834

0411 Anon. 1983. **Regional Project on Farm Tool and Equipment Technology, Basic Needs and Employment. ILO/FIN/78/RAF/2. Appropriate farm equipment technology for the small-scale traditional sector. The case of Tanzania (Country Profile 3).**

ILO, Geneva (Switzerland), 123p., 34 tables; 40 ref., ISBN 92-2-103610-3 **En**
□*Reviews the rural economy, environment and farming practices of Tanzania and discusses the following topics: evaluation of farm equipment innovations; supply, demand and marketing of farm tools and implements; local manufacture of farm tools and implements; industrial and mechanization policy and strategy; constraints to wider use of farm equipment innovations; institutional support and infrastructure. Concludes that oxenization and a mix of oxen and traditional implements provide the best alternative for most farmers.*
Mic.No: 80819

0412 Anon. 1983. **Regional Project on Farm Tool and Equipment Technology, Basic Needs and Employment. ILO/FIN/78/RAF/2. Appropriate farm equipment technology for the small-scale traditional sector. The case of Zambia (Country Profile 5).**
ILO, Geneva (Switzerland), 106p., 31 tables, 4 maps; 49 ref., ISBN 92-2-103611-1 **En**
□*Gives background information on Zambian agriculture followed by detailed chapters on: evaluation of farm equipment innovations; supply, demand and marketing of farm tools and implements; local manufacture of farm tools and implements; industrial and mechanization policy and strategy; constraints to wider use of farm equipment innovations; institutional support and infrastructure. Concludes that an integrated approach to research and extension would markedly increase production.*
Mic.No: 80820

0413 Anon. 1983. **Introduction of animal traction. Document with background information to prepare main options for Mwanga Project, Tanzania.**
Aangepaste Technologie Ontwikkelingslanden, Leuven (Belgium), 28p., 2 tables; 2 ref. **En**
□*Describes the possible effects of the introduction of animal traction on traditional farming practices in Tanzania, agricultural activities which could be mechanized (with possible schemes), provision, maintenance and repair of implements, animal husbandry and veterinary and economic aspects.*
Mic.No: 80436

0414 Anon. 1985. **Expérience de la DRSPR en matière de culture attelée en zone Mali-Sud. (Experiences of the DRSPR in animal traction in southern Mali)**
Mali. Ministère de l'Agriculture, Volet Fonsebougou. Div. de Recherches sur les Systèmes de Production Rurale, 47p., 9 fig., 17 tables **Fr**
□*Describes the role of the DRSPR in the promotion of animal traction research in Mali-Sud including animal training, health and animal-drawn equipment.*
Mic.No: 80255

0415 Anon. 1985. **Animal draught power.**
Zambia. Ministry of Agriculture and Water Development, 162p., 1 fig., 46 tables **En** (En)
□*Presents a strategy for development of animal draft power in Zambia including an investment programme for 1986-90 and specific plans for each province.*
Mic.No: 80461

0416 Anon. 1985. **Report of joint inter-agency mission on the preparatory work for the establishment of an African Regional Network for agricultural tools and equipment. Sudan, Ethiopia, Tanzania, Zambia, Botswana and Kenya. 26 January-9 March 1985.**
ILO, Geneva (Switzerland); FAO, Rome (Italy), 126p. **En**
□*Describes the purposes and terms of reference of the mission and gives details of visits to 6 countries. Concludes that: agriculture is limited by use of multipurpose traditional hand tools; animal draft equipment other than plows is scarce; there is potential for a cheap, light plow with a range of animal-drawn implements; mechanical power technology should complement not compete with ox-cultivation; agricultural extension services should be strengthened; there is a lack of well-defined national agricultural mechanization policies; manufacturing capacity is poor and commercialization of effective prototypes has not occurred. Identifies a wide range of areas for mutually beneficial TCDC activities among Network participating countries and recommends that the thrust of Network activities would be on mechanization technology appropriate to specific country situations. The six countries visited had agreed to participate in the Network and it was recommended that Zimbabawe and Uganda be asked to join.*
Mic.No: 80901

0417 Anon. 1985. **Kenya: Appropriate water harvesting methods gain ground.**
Intermediate Technology Development Group, Ardington (UK). Intermediate Technology News (UK), 1p., 2 photographs **En**
□*Describes the introduction of draft animals (mainly donkeys but some camels) into the Turkana region of Kenya for bund creation and maintenance and for field cultivation. Discusses the initiation of local production of animal draft implements and harnesses.*
Mic.No: 80163

0418 Anon. 1987. **Documentation of the Animal Traction Thrust Planning Workshop for the period 1988-92 on the basis of the goal-oriented project planning (GOPP) method.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme. ILCA Animal Traction Thrust Planning Conference, Addis Ababa (Ethiopia), 7-11 Sep 1987, 41p., fig., tables **En**
☐*Assesses the adaptation and testing of low-cost implements project planning matrix (PPM), introduction of draft animal power (DAP) into areas without traditional DAP use, draft animal working efficiency at low feeding levels, integration of draft animal technologies in mixed crop-livestock production systems, and alternative sources and use of draft animals. Shows the hierarchy of PPM's in the Research Department, and project planning matrix of the Animal Traction Thrust.*
Mic.No: 39747

0419 Anon. 1987. **Extract from the Animal Draught Power Report presented to the National Workshop on Farm Tools and Equipment Technology.**
Zambia. Ministry of Agriculture and Water Development. Agricultural Engineering Section; ILO, Geneva (Switzerland). National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Lusaka (Zambia), 26-28 Nov 1985, p. 35-55, 12 tables **En** (En)
☐*Suggests that animal draft projects which have proved viable economically and acceptable to Zambian farmers over the last 20 years should be integrated into a single programme. Discusses supply and demand of draft oxen and animal-drawn equipment, economic aspects, promotion of rural artisans such as blacksmiths, development of equipment for farming systems, improved animal management and use of cows as draft animals.*
Mic.No: 80823

0420 Anon. 1987. **In quest of agricultural mechanization policy and strategies in the United Republic of Tanzania.**
ILO, Geneva (Switzerland); Tanzania. Ministry of Agriculture and Livestock Development. National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Dar-es-Salaam (Tanzania), 8-10 Oct 1985, 74p., 12 tables; 4 ref., ISBN 92-2-105482-9 **En**
☐*Reports on the first of a series of national workshops implemented by the ILO and Tanzanian Ministry of Agriculture and Livestock Development and financed by the Finnish Government which covered: Demand/supply relationships and marketing of farm equipment; evaluation of farm equipment innovations; constraints to the wider use of farm equipment innovations; policy dimensions; local manufacture, trade and distribution of farm tools and implements; institutional support and infrastructure. Four papers are abstracted separately.*
Mic.No: 80814

0421 Anon. 1987. **Research proposals of the ANTRAC Working Group, prepared for discussion at the ARAB meetings April 13th-16th at Sapu Agricultural Station.**
Gambian Agricultural Research and Diversification Project, Cape St. Mary. Animal Traction Working Group, 8p. **En**
☐*Following an extensive literature review and rapid reconnaissance survey the multidisciplinary animal traction (ANTRAC) working group put forward research proposals in the following fields: supply of equipment and credit; health and nutrition (establishment of an effective animal health data collection system and a multidisciplinary Animal Feed and Nutrition task force to coordinate research on forage production, feed conservation, feed analysis and animal feeding trials); extension methodology; a draft cow (N'Dama) feasibility study; evaluation of fertilizer applicator and a furrow-opener for the Super Eco seeder; post-harvest processing; mechanization of rice production; cottonseed processing; ridge cultivation and water-lifting.*
Mic.No: 80292

0422 Anon. 1987. **Structural readjustments and Zambia's self-reliance in farm equipment.**
ILO, Geneva (Switzerland); Zambia. Ministry of Agriculture and Water Development. National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Lusaka (Zambia), 26-28 Nov 1985, 140p., 1 fig., 12 tables; 27 ref., ISBN 92-2-105483-7 **En** (En)
☐*Issues discussed in this workshop, the second in a series implemented by ILO and the Zambian Ministry of Agriculture and Water Development and financed by the Government of Finland, were: demand-supply relationships and marketing of farm equipment; evaluation of farm equipment innovations; constraints to the wider use of farm equipment innovations; policy dimensions; local manufacture, trade and distribution of farm tools and implements; institutional support and infrastructure. Two papers are abstracted separately.*
Mic.No: 80822

0423 Anon. 1987. **Force animale.**
Projet pour la Promotion de la Traction Animale, Atakpame (Togo). Force Animale (Togo), no. 1, 20p., drawings **Fr**
☐*This first issue of an extension publication devoted to the promotion of animal traction contains articles on the importance of prophylaxis in animal health, a brief report on a meeting on the subject of animal traction held on 18 February 1987*

and short technical reports on plows and ridge cultivation.
Mic.No: 80799

0424 Anon. s.d. **Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana. Report no. 7, 1982–83.**
Botswana. Ministry of Agriculture. Div. of Agricultural Research, 129p., 12 photographs, tables; ref. **En**
☐*Reports on the work carried out by the Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP) in Botswana during the 1982/83 season, especially on agricultural engineering, countrywide testing of Sebele Planters, ox cultivation, field trials on improved cultivation systems, fodder production, comparative study of draft systems and time of planting observations.*
Mic.No: 85524

0425 Anon. s.d. **Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana. Report no. 8. Part II: Summary 1976–1984.**
Botswana. Ministry of Agriculture. Div. of Agricultural Research, 403p., fig., tables; ref. **En**
☐*Summarizes eight seasons work by the EFSAIP in Botswana from 1976 to 1984, especially regarding machinery development, animal draft systems study, witchweed and insecticide investigations, fodder production and use, sorghum/cowpea intercropping, equipment testing, time of planting observations, economics of smallholder crop production, and farmer resource survey.*
Mic.No: 35716

0426 Anon. s.d. **Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana. Report no. 6, 1981–82.**
Botswana. Ministry of Agriculture. Div. of Agricultural Research, 188p., 16 illus., 72 tables; 8 ref. **En**
☐*Reports on the activities of the Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP) in Botswana during the 1981/82 season, especially on agricultural engineering, countrywide testing of Sebele Planters, animal traction, ox cultivation, field trials of improved traditional systems, intercropping trials, witchweed counter measures, and the production of fodder crops for cattle.*
Mic.No: 33038

0427 Anon. s.d. **Farm management studies. Sedibeng Experimental Unit Farms, six-year report, 1965/66–1970/71.**
Botswana. Ministry of Agriculture. Div. of Planning and Statistics, v.p., 18 tables **En**
☐*Summarizes findings from two experimental farms established at Sedibeng in Botswana, one employing tractor and the other ox draft, in order to compare costs of ox and tractor cultivation, yields of various crops, breakdown of capital and recurrent costs, crop labour requirements, profitability of crop production and optimum cropping system, and output, costs and receipts from rearing cattle.*
Mic.No: 11132

0428 Anon. s.d. **Production d'animaux de trait et formation à la culture attelée (Phase I). (Production of work animals and training on animal traction, Phase I)**
Bénin. Ministère des Fermes d'Etat, de l'Elevage et de la Pêche, 21p. **Fr**
☐*Describes the activities of an animal traction operation in Benin, regarding the training of farmers and the production of working animals through a cattle reproduction project.*
Mic.No: 60808

0429 Anon. s.d. **Projet bilatéral de culture attelée intégrée en République Populaire du Benin: Phase no. 1. (Bilateral project on integrated animal traction in the People's Republic of Benin. Phase I)**
21p., 2 tables **Fr**
☐*Discusses animal traction activities in Benin, with particular reference to the training of farmers and attempts at solving the problem of the shortage of working animals through a cattle reproduction project.*
Mic.No: 60864

0430 Anon. s.d. **Projet de développement rural du Borgou. Annexe 5. Culture attelée. (Rural development project of Borgou. Annex 5. Animal traction)**
Bénin. Ministère de Développement Rural et de l'Action Cooperative, 16p., 5 tables **Fr**
☐*Describes an animal traction project at Borgou in Benin whose objectives are to overcome constraints to oxen cultivation, to intensify the animal traction programme through the manufacture and acquisition of implements and techniques, and to ensure the profitability of using animals for work.*
Mic.No: 60827

0431 Anon. s.d. **Proposal to the EEC for financial support of an animal traction research network and a forage research network in sub-Saharan Africa.**
ILCA, Addis Ababa (Ethiopia), 18p. **En**
☐*Presents specific proposals for the development and operation of sub-Saharan research networks on animal traction and forage, to be funded by the*

EEC and coordinated by ILCA; includes details of the objectives, staff requirement, operation and costs of each component.
Mic.No: 34912

0432 Anon. s.d. **Recherches d'accompagnement I.R.C.T. Culture attelée, Tchamba. (Rapport 1979). (I.R.C.T. applied research on animal traction at Tchamba. Report for 1979)**
Institut de Recherches du Coton et des Textiles Exotiques, Lomé (Togo). Station d'Anie-Mono, v.p., tables **Fr**
□*Studies technical aspects of animal traction applied at Tchamba in central Togo, outlining major observations on animal traction and manual work and results obtained.*
Mic.No: 76160

0433 Anon. s.d. **Report on the rapid reconnaissance survey/literature review conducted in January/February 1987 to identify research priorities.**
Gambian Agricultural Research and Diversification Project, Cape St. Mary. Animal Traction Working Group, 12p., 6 ref. **En**
□*Summarizes the findings of a literature review and rapid reconnaissance survey carried out by the ANTRAC Working Group in 1987 under the following headings: ownership and use of animal traction; draft animal health; nutrition; draft animal supply; production focus areas (a)transport, (b)rice cultivation, (c)ridge cultivation, (d)fertilizer application, (e)water-lifting and (f)post-harvest processing); institutional support; acid de-linting of cotton seeds.*
Mic.No: 80295

0434 Apetofia, K.V. 1988. **Introduction de la traction animale dans les systèmes d'exploitation agricole au Togo: le problème de l'approvisionnement en animaux de trait. (The introduction of animal traction in the farming systems of Togo: The problem of availability of working animals)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19-25 Sep 1986, p. 353-360, ISBN 3-528-02047-4 **Fr** (Fr)
□*Problems in the availability of draft animals in Togo are discussed and solutions suggested.*
Mic.No: 82031

0435 Arpaillange, J. 1985. **Impact de deux décennies de culture attelée au Bénin. Rapport de stage du 17 juin au 14 septembre 1985. (Impact of two decades of animal traction in Benin. Report of a training course, 17 June to 14 September 1985)**
UNDP, Cotonou (Benin), 22p., 1 table **Fr**
□*Reviews the progress made by animal traction in Benin in the twenty years following the harnessing of the first pair of oxen at Angaradebou. Recommends the formation of a Centre National de Machinisme Agricole et de Formation en Culture Attelée to promote animal traction on a large scale and to improve the testing of draft equipment and its adaptation to suit the needs of users and to open the way for small-scale manufacturing.*
Mic.No: 80345

0436 Bangura, A.B. 1985. **A study mission on the Animal Traction Programme in Togo.**
Sierra Leone Work Oxen Project, Freetown, 12p., 1 table; 3 ref. **En**
□*Reports on an exchange visit to Togo to study the organization pattern for the development of animal traction, extension methodology, training, animal health, nutrition and husbandry, draft animal research, equipment and credit.*
Mic.No: 80324

0437 Bangura, A.B. 1990. **Constraints to the extension of draught animal technology in the farming systems of Sierra Leone.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 324-327, ISBN 92-9081-046-7 **En** (En)
□*Briefly describes the introduction of work oxen technology to Sierra Leone in the 1920s and the role of the Work Oxen Programme from 1980. Discusses socio-ethnological factors, nature of the terrain, logistics, availability of animals, diversification of animal traction operations, animal health and investment capital. Concludes that there is great potential for use and extension of draft animal technology throughout the country but that lack of good veterinary services, inadequate credit schemes and insufficient support for recurrent costs are major constraints.*
Mic.No: 82117

0438 Bangura, J.V. 1985. **La culture avec traction animale: quelques expériences pays par pays. Sierra Leone. (Cultivation with animal traction: Country experiences. Sierra Leone)**
Journée d'Etude sur la Culture avec Traction Animale, Antony (France), 7 Mar 1985. Afrique Agriculture (France), no. 122, p. 29, ISSN 0337-9515. **Fr**
□*Describes the Centre d'Equipement at Rolako, Sierra Leone, which aims to satisfy local demand for plows and other animal draft equipment, maintain existing equipment, to collaborate with local*

blacksmiths, and to evaluate and develop improved equipment.
Mic.No: 80661

0439 Bangura, J.V. 1985. **Sierra Leone. "La pratique des réparations de charrues doit être encouragée". (Sierra Leone. "The practice of repairing plows must be encouraged")**
Afrique Agriculture (France), no. 122 , p. 29–30, ISSN 0337–9515. **Fr**
☐*Describes briefly the workshop at the Centre d'Equipement de Rolako in Sierra Leone, with particular emphasis on the role of the workshop in the maintenance of farm implements.*
Mic.No: 80625

0440 Bansal, R.K. 1986. **Farm machinery research at ICRISAT.**
RNAM Newsletter (Philippines), no. 25, p. 19, 2 photographs **En**
☐*Briefly describes farm equipment research at ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) (India) which includes evaluation of options for improved animal draft equipment and integration of the more promising ones into more productive and stable farming systems. Describes research and progress in development of wheeled toolcarriers.*
Mic.No: 80205

0441 Barreaud, D. 1990. **L'approvisionnement en animaux de trait: contrainte pour l'extension de la traction animale en Sierra Leone. (The supply of work oxen: Constraints to the extension of animal traction in Sierra Leone)**
Starkey, P.H (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 332–333, ISBN 92–9081–046–7 **Fr**
☐*Discusses problems raised by difficulties in obtaining draft animals in certain regions of Sierra Leone due to lack of local markets and recent attempts by the Work Oxen Project to supply small farmers with a pair of oxen. Stresses that long-term solutions must be found to this problem if Sierra Leone's use of animal traction is to become more than marginal.*
Mic.No: 82118

0442 Barwell, I. 1983. **The real test for technology: Can local manufacturers use it? (La technologie à l'épreuve: les fabricants locaux peuvent-ils l'utiliser?)**
Ceres. FAO Review, v. 16(1), p. 35–37, 1 photograph, ISSN 0009–0379. **En, Fr**
☐*Discusses obstacles to the acceptance of new agricultural technology by the farmer, including lack of credit and extension services and sometimes inappropriate technology. Describes development, introduction and manufacture of the Nikart animal-drawn toolcarrier in India and design modifications.*
Mic.No: 80201

0443 Bell, R.D. s.d. **Report on a visit to Botswana, 24–30 January 1977.**
National Inst. of Agricultural Engineering, Silsoe, Bedford (UK). Overseas Dept., 31p. **En**
☐*Reviews the agricultural engineering aspects of the Dry Land Farming Research Scheme in Botswana, assessing the state of development of animal-drawn toolbars in the country, and presenting an initial assessment of the need for threshing and storage of cereals to complement the work of cereal production.*
Mic.No: 57353

0444 Bigot, Y. 1983. **La culture attelée et ses limites dans l'évolution des systèmes de production en zones de savanes de Côte d'Ivoire. (Animal traction and its limitations in the evolution of production systems in the savanna regions of Côte d'Ivoire)**
Machinisme Agricole Tropical (France), no. 84, p. 44–52, 1 fig., 3 tables, 5 photographs, 1 map; 26 ref. **Fr**(En Es Fr)
☐*Analyzes unsuccessful attempts to introduce animal traction into the savanna regions of the Côte d'Ivoire and reasons for failure. Discusses development of animal traction from 1971, constraints to its further development and its relationship with animal production and breeding.*
Mic.No: 80795

0445 Bigot, Y.; Monnier, J.; Landais, E.; Mandjoba, C. 1983. **La culture attelée en Côte d'Ivoire. De la croissance cotonnière au développement agricole des régions d'élevage bovin. (Animal traction in Côte d'Ivoire. From cotton production to agricultural development in cattle producing areas)**
Côte d'Ivoire. Ministère de l'Agriculture, 250p., tables **Fr**
☐*Describes the increase in animal traction in northern Côte d'Ivoire over the last ten years and in particular the relation between crop and animal production. Proposes means of promoting animal traction not only in the cotton-growing regions but for rice, yams and groundnuts.*
Mic.No: 80331

0446 Bizimana, A. 1985. **Essais effectués sur la traction animale au projet DERVAM. Développement rural des vallées de Mutara. (Animal traction trials**

undertaken by projet DEVRAM. Rural development in the Mutara valleys)
Université Nationale du Rwanda, Butare. Faculté d'Agronomie. 1. Colloque National sur la Mécanisation Agricole au Rwanda, Butare (Rwanda), 15–21 Apr 1985, p. 67–95, 4 tables, 2 photographs; 9 ref. **Fr**
☐*Reviews animal traction in Africa and compares the characteristics of animal traction with those of tractor cultivation and traditional manual methods. Describes animal traction research in Rwanda in general and field trials using Ankole cattle in particular.*
Mic.No: 80433

0447 Bordet, D. 1988. **From research on animal-drawn implements to farmers appropriation: Successes and failures of development experience in Senegal.**
Agricultural Engineering International Conference, Paris (France), 2–5 Mar 1988. International Journal of Agricultural Engineering Research (UK), 26p., 53 ref. **En** (En Fr)
☐*Reviews animal draft equipment produced in Senegal over the last 40 years and identifies 80 single-purpose and 10 multipurpose implements. Estimates level of technical adequacy and acceptance by farmers for each one and discusses reasons for successes and failures (of wheeled toolcarriers in particular). Defines the role of research and development organizations and industrial and small-scale manufacturers in the development of appropriate implements.*
Mic.No: 80401

0448 Bowers, R.D. 1983. **Accelerated development of mechanization based on animal power.**
Tanzania. Ministry of Agriculture. Agricultural Planning and Marketing Div., 7p. **En**
☐*Details specific measures to be taken to promote animal traction in Tanzania primarily ensuring adequate supplies of ox plows, demonstrating the Government's committment to animal power, introducing other implements and promoting use of cattle carts. Describes research into and development of animal draft equipment.*
Mic.No: 80437

0449 Braun, H.J. 1967. **Niger. Le développement de la culture attelée au Niger. Rapport au gouvernement. (Niger. The development of animal traction in Niger. Report to the Government)**
FAO, Rome (Italy), 30p., 1 map, 2 tables **Fr**
☐*Presents report of a UNDP project in Niger for the development of cultivation systems using working animals for plowing, with data on body condition of animals, farm equipment, and farmers' agricultural training, especially in the use of farm machinery. Presents recommendations for agricultural mechanization, new agricultural equipment, rural extension, mixed cropping and working animal supply.*
Mic.No: 80709

0450 Chabala, C. s.d. **Aspects of the draft power constraint on maize production in Recommendation Domain No.5 Kabwe Rural District, Zambia.**
Adaptive Research Planning Team, Kabwe (Zambia), 11p., 3 tables **En**
☐*Gives background information on the geography and socio-economic environment of Recommendation Domain 5, Kabwe Rural District, Central Province of Zambia followed by data on farming systems, maize cultivation practices, factors limiting increased production and the draft power problem (mainly training of oxen and personnel).*
Mic.No: 80456

0451 Chani, P.A. 1990. **A note on animal traction research and development activities in The Gambia.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 306–307, 5 ref., ISBN 92-9081-046-7 **En**
☐*Describes past research in The Gambia which concentrated on comparing animal draft eqipment with traditional methods resulting in the introduction in 1975 of a range of equipment well suited to oxen, horses and donkeys. Recent initiatives included formation of a multi-disciplinary committee to review mechanization-related constraints existing in The Gambia's crop production systems and to formulate appropriate research programmes to overcome the constraints and increase potential for use of animal traction. Outlines an action plan for 1987–90 proposed following an informal survey of the animal traction situation throughout the country.*
Mic.No: 82115

0452 Chepete, E.M.; Mase, C.L. 1987. **Animal traction and agricultural mechanization research in Botswana.**
s.n., s.l. Workshop on Animal Traction and Agricultural Mechanization Research in SADCC, Maputo (Mozambique), 10–14 Aug 1977, 18p., 4 fig., 4 tables; 5 ref. **En**
☐*Briefly reviews agricultural production in Botswana and discusses policies and plans pertaining to agricultural mechanization, current mechanized techniqes used in agriculture, agricultural mechanization research, development, extension and training, and manufacture, distribution and maintenance of agricultural equipment.*
Mic.No: 80107

0453 Chiteta, K. 1990. **A note on the impact of animal traction in Zambia.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 450–451, ISBN 92-9081-046-7 **En** (En)
□*Discusses the increased importance of livestock production in Zambia since Independence in 1964 and impact of animal traction which aroused interest in small-scale farmers to value oxen more than bulls as assets. Government encouragement of small-scale farmers to use animal power resulted in increased area cultivated, higher crop yields and reduced labour costs, whereas tractor mechanization and complex implements resulted in high costs to farmers. Discusses the profitabiltiy of animal traction.*
Mic.No: 82044

0454 Chiumia, R.B.C. 1981. **An investigation into acceptance of oxenization in Lilongwe Land Development Programme area.**
Bunda College of Agriculture, Lilongwe (Malawi), 11p., 11 tables; 7 ref. B.Sc. (Agriculture). **En** (En)
□*Presents findings of a survey conducted in one of the units of the Lilongwe Land Development Programme, Malawi, in order to investigate reasons why some farmers have work oxen while others do not, with particular emphasis on farm size, transport problems and the wealth of the farmers.*
Mic.No: 55136

0455 Diallo, A.K. 1988. **L'équipement de la traction animale au niveau de l'Institut des Sciences Agro-zootechniques (ISAF). (Animal traction equipment at the Institut des Sciences Agro-zootechniques (ISAF))**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 161–164, 1 table, ISBN 3-528-02047-4 **Fr**
□*Animal traction research carried out by the ISAF includes draft animal improvement (crossing native N'Dama cattle with introduced breeds), testing new equipment and developing use of single animals.*
Mic.No: 82071

0456 Dibbits, H.J. 1987. **The state of the National Animal Draught Power Programme in Zambia.**
Department of Agriculture, Lusaka (Zambia). Animal Draught Power Programme. Workshop on Animal Traction and Agricultural Mechanization Research in SADCC, Maputo (Mozambique), 10–14 Aug 1987, 8p., 3 fig.; 8 ref. **En**
□*Describes the integrated approach of the Zambian Government Animal Draft Power Programme involving various departments within the Ministry of Agriculture and Water Development in particular, operating at both national and regional level. Gives details of interests and priorities in the fields of research, training, coordination, harnessing systems, donkeys, implements, ox carts, credit supply and village blacksmiths.*
Mic.No: 80106

0457 Dibbits, H.J.; Sindazi, M. 1990. **Historical and present constraints to the use of animal traction in Zambia.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 444–449, 1 table; 4 ref., ISBN 92-9081-046-7 **En** (En)
□*Argues that development of farm mechanization in Zambia has been disturbed by an invasion of foreign ox-drawn implements and farm machinery; local craftsmen were not trained to bridge the gap between locally available and imported technology; little was done to develop ox-drawn equipment; and extension was geared to techniques used mainly by the large-scale commercial sector. Suggests that other constraints to animal traction include lack of high quality implements (due to poor steel and lack of good designs); a pricing policy which made imported implements cheaper than those locally produced; lack of investment in research and development; lack of credit and in some regions scarcity of cattle. Current government policy in terms of farm power and mechanization aims at assisting the small-scale farmers, and the National Animal Draught Power Development Programme is attempting to overcome the various constraints.*
Mic.No: 82045

0458 Dicko, M.S. 1986. **On-station research on draught animals: An example from Niger.**
Kearl, S. (ed.). In: Livestock in mixed farming systems: Research methodologies and priorities. Proceedings of a workshop, Workshop on Livestock in Mixed Farming Systems: Research Methodologies and Priorities, Addis Ababa (Ethiopia), 24–27 Jun 1985. FSSP Network Report (USA), no. 2, p. 19–26, 1 graph, 2 tables; 9 ref. **En**
□*Discusses the programme of the animal traction research project at ILCA–Niger. Presents results of a study undertaken to assess time saved in soil preparation by using donkeys and a pair of oxen instead of using manual labour.*
Mic.No: 80986

0459 Doerksen, A.; Janzen, N.; Kroeker, D.; Rempel, E. 1986. **Oxenization: An appropriate technology for smallholder farms of Mbeya Region, Tanzania. Project design and plan of operation prepared for the Canadian Economic Development Agency.**
Mennonite Economic Development Associates, Winnipeg (Canada), 69p., 15 fig., 5 tables, 5 maps **En**
☐*Describes the oxenization project for the Mbeya Region of Tanzania which aims at developing a marketable interrow cultivator, facilitating the design and entrepreneurial production and marketing of ox carts, designing and test-marketing ox-drawn equipment and promoting the integration of animal traction and improved farming systems for the smallholder. Includes illustrations of equipment.*
Mic.No: 80444

0460 Donovan, G. 1985. **Draught animal power: Project considerations – A synopsis.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 163–164 **En**
☐*Outlines briefly the most important points that should be considered to achieve success with draft animal components in development projects.*
Mic.No: 80654

0461 Eyre, C.V. 1980. **Village-based farmer training. The Gambia, 1977–80 (a report to the British High Commissioner).**
s.n., s.l., 3p. **En**
☐*Reports on the success of village-based farmers' training centres in The Gambia, the only problems being absenteeism of students in the afternoons, difficulties in some villages of watering large numbers of animals, and the inability of farmers after training to buy a full set of Siscoma implements.*
Mic.No: 80298

0462 Fall, A. 1987. **Eléments de méthodologie et d'analyse pour les enquêtes sur le matériel de culture attelée: l'expérience de la Basse-Casamance. (Methodology for and analysis of animal traction equipment surveys: The Lower Casamance experience)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Senegal), no. 87–5, 33p., 4 fig., 1 map; 5 ref. **Fr**
☐*Presents data from an inventory of hand tools and animal draft equipment carried out by l'Equipe de Recherche sur les Systèmes de Production de Djibelor in the Basse Casamance region of Senegal, discusses the methodology used and makes recommendations on sampling techniques and variables for use in future surveys.*
Mic.No: 80783

0463 Fall, A. 1990. **Adoption et principales contraintes à la diffusion des équipements de traction animale en Basse-Casamance. (Adoption and major constraints to the introduction of animal traction equipment in Lower Casamance, Senegal)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 267–275, 1 map, 2 graphs, 1 table, ISBN 92–9081–046–7 **Fr** (Fr)
☐*Discusses mechanization of farming operations in the Basse Casamance region of Senegal, identifies four zones in terms of draft animal use and concludes that geographical differences offer opportunities for different farming systems. Discusses various credit supply systems which remain the main means of supplying farmers with draft animals and equipment.*
Mic.No: 82055

0464 Fall, A. 1990. **Eléments de méthodologie et d'analyse pour les enquêtes sur le matériel de culture attelée: Expérience de la Basse-Casamance. (Methodology for the inventory and analysis of animal draft equipment: Experience from Lower Casamance, Senegal)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 276–283, 4 fig.; 4 ref., ISBN 92–9081–046–7 **Fr**
☐*Describes methodology behind an inventory of animal traction equipment and hand tools for farming based on experience in the Basse-Casamance region of Senegal.*
Mic.No: 82058

0465 Fischer, R. 1986. **Adapting training in appropriate technology to a conventional training centre.**
GATE (Germany, F.R.), no. 86/4, p. 23–25, 2 photographs **En**
☐*Describes the work of the Zimbabwe Agricultural Engineering Training Centre (AETC) which serves large- and small-scale producers providing courses in both tractor and animal power. Gives details of animal power courses and discusses their main aims and preliminary results.*
Mic.No: 80453

0466 Goe, M.R.; Abiye Astatke. 1989. **Development of draught animal power systems in Ethiopia.**

Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 69–77, 47 ref., ISBN 1-86320-003-7 **En** (En)

□*Describes the current role of animal power in Ethiopia which is mainly confined to primary and secondary tillage using a* maresha *(ard) plow pulled by a pair of animals, usually oxen; donkeys, horses and mules are used for packing and riding. Although research into development of implements to replace the* maresha *for primary cultivation and to develop implements for secondary cultivation (with lesser emphasis on transport, operation of rotary-powered machinery, water-lifting, earth-moving and land-shaping) began in the 1950s, evaluation at the smallholder level has been minimal and hence adoption of new implements by farmers has been poor due to cost and problems with maintenance and spare parts; research into the animal component (management, nutrition, physiology) has only recently received attention.*

Mic.No: 80929

0467 Gryseels, G.; Anderson, F.M. 1983. **Farming systems research in ILCA's highlands programme.**

Florida Univ., Gainesville (USA). Farming Systems Support Project. FSSP Newsletter (USA), v. 1(3), p. 7–10, 2 photographs, 1 table **En**

□*Examines farming systems research in ILCA's Highlands Programme, with an overview of some initial results of on-farm studies and examples of other research activities including the use of single oxen.*

Mic.No: 78689

0468 Harouna, S.A.S.; Imboden, R. 1988. **Développement et adaptation de l'équipement de traction animale aux conditions locales du Département de Niamey. (Development and adaptation of animal traction equipment to conditions at the Département de Niamey)**

Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn, Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 151–160, ISBN 3-528-02047-4 **Fr**

□*Describes the role of l'Artisanat Rural et du Machinisme Agricole in Niamey, Niger, in promoting animal traction and stresses the importance of cooperation between manufacturers, researchers and users. Modifications made to improve the Arara toolbar are described.*

Mic.No: 82010

0469 Hartmann, K. 1987. **The state of agro-mechanisation in Tanzania.**

s.n., s.l. 7. DLG Symposium on Mechanization, Frankfurt (Germany, F.R.), 20–23 Nov 1987, 14p., 6 tables **En** (En)

□*Reviews the present state of agro-mechanization in Tanzania and describes the national agricultural machinery and equipment manufacturing industry together with support institutions and two new regional centres. Discusses national agro-mechanization policy which gives priority to mechanizing the small farmer by introducing improved draft animal equipment.*

Mic.No: 80442

0470 Haugh, H.; Gerner-Haugh, I. 1982. **Promotion of draught-animal traction in Mali through the supply of simple agricultural equipment. (Encouragement de l'utilisation de la traction bovine au Mali par la fourniture de matériels agricoles simples)**

Munzinger, P. (ed.). In: Animal traction in Africa, p. 405–423, 4 photographs, 1 chart, 1 table, ISBN 3-88085-133-6 **En, Fr**

□*Discusses attempts in Mali to promote animal traction, outlining social, environmental and technical conditions prevailing in the country and on individual farms as well as the availability of credit facilities; outlines targets of agricultural policy as defined in the 1973–78 five-year plan and the establishment, responsibilities and activities of the "Direction Nationale de Formation et Animation Rurale".*

Mic.No: 80699

0471 Havard, M. 1986. **Les conclusions des expérimentations (1950–1985) sur les semis en culture attelée des principales espèces cultivées. (Conclusions of experiments (1950–1985) on the sowing of the major cultivated species)**

Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Sénégal), no. 86–10, 95p., 12 fig., 25 tables, 2 maps; 68 ref. **Fr**

□*Gives details and illustrations of seeders tested; analyzes the use of the Super Eco seeder for the principal crops of the area; lists numbers of seeders available and their use by the rural population and suggests directions for future research.*

Mic.No: 80784

0472 Havard, M. 1987. **Comment évolue le niveau d'équipement en culture attelée des paysans du Sine-Saloum depuis l'arrêt du Programme Agricole en 1980? (How has the use of animal-drawn cultivation equipment by farmers in Sine Saloum changed since the suspension of the Programme Agricole in 1980?)**

Institut Sénégalais de Recherches Agricoles, Dakar, 22p., 4 tables, 2 maps; 5 ref. **Fr**
□*A study in the Sine Saloum region of Senegal of the effects of the suspension in 1980 of the Programme Agricole showed that the amount of animal traction equipment available had not fallen due to the skill of local craftsmen but that its condition was deteriorating. Recommendations are made to ensure the future development of animal traction.*
Mic.No: 80291

0473 Havard, M. 1987. **L'apport de la recherche en machinisme à la mécanisation de l'agriculture au Sénégal. (The role of research in the mechanization of Senegalese agriculture)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Senegal), no. 87-4, 55p., 2 maps, 3 tables; 25 ref. **Fr** (Fr)
□*Discusses the role of research in promoting animal traction by testing and improving equipment and by coordinating the various groups concerned (manufacturers, developers, users etc).*
Mic.No: 80782

0474 Havard, M. 1987. **La mécanisation agricole face à un changement de politique d'équipement. Le cas de la mise en place de la Nouvelle Politique Agricole (NPA). (Agricultural mechanization in the face of changing policy. The case of the Nouvelle Politique Agricole (NPA))**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Note d'Information (Sénégal), no. 87-7, 15p., 1 map, 2 tables; 6 ref. **Fr** (Fr)
□*Discusses the objectives of the Nouvelle Politique Agricole in promoting mechanization through animal traction and maintaining levels of capital invested in animals and animal traction equipment.*
Mic.No: 80287

0475 Havard, M. 1990. **Application d'une méthode simple de suivi et d'évaluation de la culture attelée au Bassin Arachidier, Sénégal. (The application of a simple method for monitoring and evaluating animal traction in the Bassin Arachidier, Senegal)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 248-255, 1 map, 2 tables; 6 ref., ISBN 92-9081-046-7 **Fr** (En Fr)
□*Describes a research method selected and applied in the Bassin Arachidier of Senegal between 1984 and 1987 to monitor and evaluate effects of animal traction. Concludes that the method is appropriate for the region and with modification is applicable elsewhere. Results showed that the region can be divided into zones according to impact of animal traction and thus recommmendations can be made as to conditions, studies and work required for the improved use of draft animals.*
Mic.No: 82059

0476 Herault, J. 1973. **Culture attelée, Togo. Rapport de fin de Mission, Janvier 1971-Juillet 1972. (Animal traction in Togo. Final mission report, January 1971 - July 1972)**
FAO, Rome (Italie), 25p., illus., tables **Fr**
□*Describes animal traction activities, cultivation systems and in-service training in Togo.*
Mic.No: 80718

0477 Horspool, G.D. 1986. **A review of EFSAIP machinery development (1977-84) with relation to appropriate farm equipment innovation for Botswana.**
ILO, Geneva (Switzerland); Botswana. Ministry of Agriculture. In: Initiatives for farm equipment programmes in Botswana: Improving coordination, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Gaborone (Botswana), 3-5 Dec 1985, p. 31-39, 4 ref. **En** (En)
□*Discusses the original terms of reference of the Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Botswana, and explains reasons for changes in the existing systems. Describes efforts to improve the Mochudi toolcarrier, the development of the Sebele range of individual implements, the country-wide testing and farmer options.*
Mic.No: 80832

0478 Huet, P. s.d. **Compte rendu de mission. Formation et perfectionnement en machinisme agricole (culture attelée). Expérimentation. (Mission report. Training and specialization in agricultural machinery (animal traction). Experimentation)**
Union Nigérienne de Crédit et de Coopération, Niamey; Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France), 27p. **Fr**
□*Discusses issues in the training of students and refresher courses for training staff in animal traction, farm implements, testing of animal-drawn implements and corresponding farming techniques.*
Mic.No: 75446

0479 Huybens, E.; Keijzer, N.; Esbroeck, D. van; Vannoppen, J. 1987. **L'introduction de la traction bovine dans la région de Mbuji Mayi (Zaïre). Rapport d'une recherche sur les effets de l'introduction de la traction**

bovine par le Projet Rural et sur les possibilités et les limites de l'extension du programme. (The introduction of cattle traction in the Mbuji Mayi region, Zaire. Report of research on the effects of the introduction of cattle traction by the Projet Rural and possibilities and limitations to the extension of the programme)
South Research, Heverlee (Belgium), 212p., 10 fig., 36 tables, 8 graphs, 1 map; 24 ref. **Fr** (Fr)
□*Provides a background section on the geography and sociology of the Mbuji Mayi region of Zaire, followed by detailed sections on the programme of animal traction introduction in the region. Discusses its effects on the farming systems and on women of the Luba tribe, as well as economic, strategic and methodological aspects.*
Mic.No: 85830

0480 Imboden, R.; Starkey, P.H.; Goe, M.R. 1983. **Report of the Consultancy Mission for the establishment of a Technical Cooperation among Developing Countries (TCDC) Network for development, research and training in the field of draught animal power utilization. (Rapport de la Mission de Consultation Préliminaire à l'Etablissement d'un Réseau de Coopération Technique dans les Pays en voie de Développement (TCDC) en matière de développement, recherche et formation pour l'utilisation de l'énergie animale)**
FAO, Rome (Italy), 81p. **En, Fr**
□*Reports on a joint FAO/ILCA mission to Senegal, Sierra Leone, Togo, Burkina Faso, Niger and Ethiopia to assess the possibility of setting up a TCDC network focussed on research, training and development of activities involving use of draft animal power, the overall aim of the network being to promote use of draft animal technology tailored to rural development. Authorities in countries visited were informed of the benefits of such a network and institutions working on draft power development were identified and their possible contribution to a network assessed. Makes specific recommendations for establishment of a TCDC network.*
Mic.No: 80873

0481 Islam, S.O. s.d. **Introduction of draught power technology to the SAT farmers of Magarini Settlement Project 1981-1985.**
McGowan International Pty. Ltd., Malindi (Kenya). Magarini Land Settlement Project, 11p., 6 ref. **En**
□*Reviews the activities of the Magarini Land Settlement Project in Kenya between 1981 and 1985, briefly describing land use practices in the area, advantages and disadvantages as well as draft power of horses, donkeys, oxen, camels, and mules, deficiencies of hand labour, requirements of animal training and equipment evaluation results. Discusses progress and problems encountered in the introduction of animal draft to the settlers of the Project.*
Mic.No: 80008

0482 Jaeger, R. 1988. **Le développement récent de la traction bovine au Burundi: le frein des coutumes, les craintes qu'elle suscite, les espoirs qu'elle fait naître. De muhabura aux madudus. (Recent developments in animal traction in Burundi)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12-16 Sep 1988, p. 187-201, 1 fig., tables, ISBN 2-87614-026-8 **Fr**
□*Discusses the changing role of cattle from ceremonial to draft animals during the 20 years since animal traction was introduced to Burundi. Originally confined to rice cultivation, animal traction is now also used for cotton cultivation. Data are presented comparing costs of manual labour, animal traction and motorization in cotton production. Presents results of user surveys in terms of extent to which animal traction is used, availability of animal draft equipment, feeding of draft animals, constraints to animal traction development and improvements requested by users. Discusses prospects for further development.*
Mic.No: 82076

0483 Jagne, N.T.; Basse, P.A.O. 1984. **A site visit to demonstrations in the Jah-Kunda and Sutukoba areas of the Upper River Division, 8-10 August 1984.**
s.n., s.l., 11p. **En**
□*Gives results of a questionnaire to farmers to assess current farming practices and their reaction to demonstrations of recommended practices for each crop and of visits by researchers and extension workers to assess the relevance of demonstrations to farmers, identify problems at farm level and promote an interdisciplinary approach. Concludes that implemention of demonstrated practices and extension of the area cultivated are constrained by a low level of mechanization and recommends improvements in the demonstration programme.*
Mic.No: 80297

0484 Jarju, S.M.; Sarr, D.M.; Marong, A.J. 1988. **Animal power equipment at the farm level in The Gambia.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19-25 Sep 1986, p. 165-168, 1 fig.; 2 ref., ISBN 3-528-02047-4 **En**

□*The development of animal traction in The Gambia and types of animal-drawn equipment used at farm level are described, the Sine Hoe toolbar from Senegal being the main implement used. Major problems and constraints relating to the use of animal draft equipment at field level are discussed and solutions suggested.*
Mic.No: 82012

0485 Jay, G. 1985. **Critères de réussite pour une opération de culture attelée dans une région. (Criteria for the success of a regional animal traction operation).**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 10–11 **Fr**
□*Summary of a paper outlining criteria for the success of an operation to introduce animal traction to a region. Proposes that the operation should have the following phases: diagnosis of the current situation; experimentation; extension.*
Mic.No: 80372

0486 Jutzi, S. 1987. **Animal power for improved management of deep black clay soils in sub-Saharan Africa (Phase 1: Ethiopia). Joint ILCA/ICRISAT/MOA/University of Alemaya/Addis Ababa University Research, Training and Outreach Project. Outreach sub-project Deneba/Inewari progress report March 1987.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 13p., 7 tables **En**
□*Presents the activities of the sub-project with respect to extension work and defines the relationship between outreach sub-projects with Vertisol projects. Discusses sub-project infrastructure and equipment, staffing, training of farmers and development agents.*
Mic.No: 39216

0487 Jutzi, S.; Anderson, F.M.; Abiye Astatke. 1987. **Low-cost modifications of the traditional Ethiopian tine plough for land shaping and surface drainage of heavy clay soils: Preliminary results from on-farm verification trials. (Modifications à faible coût de l'araire traditionnel éthiopien pour le terrassement et le drainage en surface de sols argileux: premiers résultats d'essais en milieu réel)**
ILCA Bulletin(Bulletin du CIPEA), no. 27, p. 28–31, 3 fig.; 10 ref., ISSN 0255–0008 (E) and ISSN 0255–0016 (F). **En** (En)
□*Describes modifications to the traditional ox-drawn ard plow (maresha) for use in the construction of terraces for soil conservation and of raised beds and furrows to facilitate drainage on heavy clay soils together with results of on-station and on-farm tests. Both modifications can be made by village craftsmen.*
Mic.No: 80806

0488 Kabeya, D.S 1990. **Expériences en traction bovine du Projet Rural Diocésain, Zaïre. (Experiences of the Projet Rural Diocesain, Zaire, in cattle traction)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 435–441, ISBN 92–9081–046–7 **Fr**
□*Describes the Projet Rural Diocesain started in 1978 with collaboration between the Catholic Diocese of Mbujimayi (Zaire) and Coopibo (Belgium) to improve the socio-economic situation of farmers by presenting them with methods and means of production and helping villages to organize themselves with the final aim of increased crop and livestock production, improved provision of drinking water and opening-up of villages. Discusses the agronomic, economic and social environment of the region, technical aspects of animal traction (oxen and equipment), farming systems, work capacity of ox-traction, ox-traction in Kasai-Oriental, problems encountered and future prospects.*
Mic.No: 82228

0489 Kamara, J.A. 1974. **Ox-ploughing in Sierra Leone.**
Starkey, P.H. In: Farming with work oxen in Sierra Leone, s.n., s.l. Meeting of Agricultural Experts of Mano River Union, (Sierra Leone), 20–23 Mar 1974, 9p., 1 table; 4 ref. **En**
□*Describes the current state of ox-plowing in Sierra Leone and constraints to its development and stresses the lack of documentation.*
Mic.No: 80322

0490 Kanu, B.H. 1985. **Animal traction. A credible technology for the Third World – the Sierra Leone experience.**
Sierra Leone Work Oxen Project, Freetown, 8p., 6 ref. **En**
□*Reviews the current state of animal traction in Sierra Leone and concludes it is a credible technology for the small-scale farmers who comprise 80% of the farming population; makes recommendations for its further development.*
Mic.No: 80319

0491 Kanu, B.H. 1988. **Animal traction development strategies in Sierra Leone.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop,

Freetown (Sierra Leone), 19–25 Sep 1986, p. 277–287, 4 tables; 7 ref., ISBN 3-528-02047-4 **En** (En)
□*Describes the development of animal traction in Sierra Leone from 1929, and the recent setting up of the Sierra Leone Work Oxen Project in cooperation with Njala University College. Explains that the Project, that receives British and French support aims at developing animal traction through research, training, publicity, equipment testing and implement production. Notes that the Project has assisted the formation of farmers' asssociations for using work oxen and has helped the Integrated Agricultural Development Projects and other organizations to develop their own work oxen programmes, with the Koinadugu project being one of the most successful.*
Mic.No: 82022

0492 Kapesebele, P.M. 1983. **Country Paper – Zambia.**
African Farming Equipment Ltd., Lusaka (Zambia). Technical Congress held in Conjunction with the Third International Fair: Technology for the People, Manila (Philippines), 23–25 Nov 1983, 35p., 6 tables; 4 ref. **En**
□*Discusses the manufacture and testing of agricultural machinery including ox-drawn equipment in Zambia and recommends that companies be given Government financial assistance to expand (although one factory satisfies local demand and exports to neighbouring countries).*
Mic.No: 80462

0493 Kasryno, F.; Rusastra, I.W.; Simatupang, P. 1989. **Effect of government policies on draught livestock development in Indonesia.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 304–308, 6 tables; 4 ref., ISBN 1-86320-003-7 **En** (En)
□*Reviews government policies affecting draft animal development in Indonesia, past performance, restrictions experienced in the application of these policies as well as policies under consideration for future adoption. Attempts to develop direction for draft animal power research which link with government policies.*
Mic.No: 80951

0494 Ker, A.D.R. 1973. **The development of improved farming systems based on ox-cultivation.**
Amann, V.F. (ed.). In: Agricultural policy issues in East Africa, p. 291–320, 6 fig., 8 tables 27 ref. **En**
□*Compares and describes ox- and tractor-based farming systems for growing cotton, groundnuts and finger millet in eastern Uganda with particular emphasis on operating times and costs of cultivation methods.*
Mic.No: 80200

0495 Kjaerby, F. 1984. **The demand for ox-ploughs, spare parts and animal drawn equipment. Annex 8:2. Farm implements for small scale farmers.**
Swedish International Development Authority, Stockholm, 54p., 6 tables **En**
□*Tabulates the regional plow population of Tanzania and discusses the distribution of plows, shares and chains, present demand for ox plows, means of meeting the demand for plows, spare parts and other implements. Also discusses ox carts, herd composition and ox availability.*
Mic.No: 80441

0496 Kjaerby, F. 1984. **Detailed descriptive report on regional visits and interviews on household tool inventories. Annex 4:1 to farm implements for small scale farmers.**
Swedish International Development Authority, Stockholm, 76p., 3 ref. **En**
□*Gives results of household tool inventories in Tanzania and comments on the general supply situation.*
Mic.No: 80440

0497 Kone, B. 1990. **La traction animale dans la zone de l'Opération Haute Vallée, Mali: utilisation et contraintes. (Animal traction in the Opération Haute Vallée zone, Mali)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 393–395, 4 tables: 8 ref., ISBN 92-9081-046-7 **Fr**
□*Describes a survey of draft animal use in villages of the Operation Haute Vallee (Mali) aimed at determining potential for and constraints to animal traction and to propose short-, medium- and long-term strategies for improving animal traction in the region. Concludes that village herds are a potential source of draft animals and a major problem is providing sufficient feed in the dry season.*
Mic.No: 82038

0498 Lacca, M.L.; Nielsen, K.; Kruit, F. 1988. **Projet UNO/NER/003/NSO. Recherche, production, formation pour l'utilisation du matériel agricole en zone sahélienne. Programme de recherche pour l'hivernage 1988. (Project UNO/NER/003/NSO. Research, production, training for the utilization of farm**

equipment in the Sahelian zone. Research programme for final ploughing, 1988)
Niger. Ministère de l'Agriculture, no. 4, 42p., 11 fig. **Fr**
☐*Describes protocols for a series of trials and demonstrations comparing performance of hand tools to that of animal traction for production of millet, cowpea and sorghum. Research will also include dynamometer tests on all forms of animal traction used and improved harnessing techniques.*
Mic.No: 80913

0499 Landais, E. (ed.) 1986. **Méthodes pour la recherche sur les systèmes d'élevage en Afrique intertropicale. (Methods for animal production research in inter-tropical Africa)**
Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). Atelier: Méthodes pour la Recherche sur les Systèmes d'Elevage en Afrique Intertropicale, Mbour (Sénégal), 2–8 Feb 1986, 733p., fig., tables; ref., ISBN 2-85985-122-4 **Fr**
☐*Contains 24 papers on animal production research in inter-tropical Africa one of which, by P. Lhoste, is abstracted separately.*
Mic.No: 80904

0500 Lawson, L.T. 1990. **Les contraintes de la culture attelée observée par la Société Togolaise de Coton. (Constraints to animal traction observed by the Société Togolaise de Coton)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 348–349, ISBN 92-9081-046-7 **Fr**
☐*Gives brief information on numbers of oxen and numbers and types of animal traction equipment in Togo in 1987–8 and discusses constraints to the adoption of animal draft technology including availablity of land, climate, vegetation, lack of livestock production and animal health. Proposes ways in which the government could promote animal traction.*
Mic.No: 82224

0501 Leaman, S. 1988. **The role of work oxen in swamp development in Sierra Leone.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 288–292, 7 ref., ISBN 3-528-02047-4 **En** (En)
☐*Following the poor success of trying to increase rice yields using a highly labour-intensive "Asian model" of swamp development, it is considered that where swamp land is plentiful, extending and improving traditional methods may have more success. Traditional systems are not dependent on fertilizer, use local seeds, and labour is the main limiting resource which the use of work oxen could relieve. The role of work oxen in these systems is discussed and the importance of designing techniques around traditional farming systems with participation of farmers is stressed.*
Mic.No: 82023

0502 Lee, P.G. 1980. **Dryland Farming Research Scheme (DLFRS), Botswana. Final scientific report of Phase II. Volume 3. Agricultural systems studies.**
Agricultural Research Station, Gaborone (Botswana); UK. Ministry of Overseas Development, 106p., 38 fig., 10 graphs, 47 tables; 10 ref. **En** (En)
☐*Reports on findings of studies on the effects of varying sorghum planting date on pest damage, crop yield and response to fertilizers; comparison of a 'versatool' animal-drawn wheeled toolcarrier and a mouldboard ox-plow and ancillary equipment; suitability and efficacy of improved farming practices; and on sorghum agronomic trials comparing different population densities, cultivars, planting dates and response to nitrogen fertilizers.*
Mic.No: 57327

0503 Legast, P. 1976. **Projet élevage Nord, Cameroun: Culture attelée et embouche paysanne dans les départements du Diamare, Margui-Wandala, Bénoué. (Northern Cameroon livestock project: Animal traction and cattle fattening by smallholders in Diamare, Margui-Wandala and Benoue districts)**
s.n., s.l., 34p., 23 tables **Fr**
☐*Examines animal traction and fattening by peasants in the Diamare, Margui-Wandala and Benoue districts of Cameroon, presenting technical, financial and economic notes, and defining objectives of extension activities regarding animal traction and cattle fattening in the three districts.*
Mic.No: 17354

0504 Lhoste, P. 1990. **Les projets de développement de la traction animale: les contraintes liées à l'animal et les voies d'intervention prioritaires. (Animal traction development projects: Constraints related to animals and priorities for improvement)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 115–123, 33 ref., ISBN 92-9081-046-7 **Fr** (Fr)
☐*Based on observations by other authors on development of animal traction over the last*

20 years and his own experience in Burkina Faso, Côte d'Ivoire, Mali and Senegal the author concludes that constraints are specifically related to the animals, as project promoters have given insufficient importance to aspects novel to the farmer like animal health, housing, training, harnessing and management. Proposes priorities for improving the situation in regions where animal traction is new. Suggests that in the semi-arid Sahel region, priority be given to feeding, choice of species, harnessing and animal health; and in the Sudan region priority be given to trypanotolerance, feeding, health and development of production systems.
Mic.No: 82048

0505 Lichte, J.A. 1985. **Togo animal traction development, Project number 693-0218.**
USAID, Washington, D.C. (USA), 70p. **En**
□*Reports on a project aimed at supporting PROPTA (Projet pour la Promotion de la Traction Animale) in its efforts to coordinate, harmonize and restructure animal traction-related policies and extension efforts throughout Togo and reinforcing through the PCA (Projet Culture Attelée) the DRDRs (Direction Régionale de Développement Rural) in the Savanes and Kara regions through support focussed on the extension of animal traction in areas not served by other donors, and on applied research.*
Mic.No: 80797

0506 Litschauer, J.G.; Matswe, S. 1983. **1982 ALDEP program: Baseline data and evaluation.**
Botswana. Ministry of Agriculture. Arid Lands Development Programme Monitoring Unit, 90p., 46 tables; 2 ref. **En**
□*Evaluates the 1981-2 Arable Lands Development Program (ALDEP) and includes data on the draft animals used by participating farms, and on credit packages for draft power and implements.*
Mic.No: 80100

0507 Losch, B. 1988. **L'expérience du Projet Motorisation Paysanne en Côte d'Ivoire. (The experience of the Projet Motorisation Paysanne in Côte d'Ivoire)**
Cahiers de la Recherche Développement (France), no. 18, p. 1-13, 2 maps, 1 table; 13 ref. **Fr** (En Es Fr)
□*Describes the national scheme for the promotion of mechanization in agriculture and includes a brief section on the promotion of better harnessing techniques and modified Ariana-type plows.*
Mic.No: 80329

0508 Lyimo, E.S. 1987. **Demand supply analysis: Marketing and distribution.**
ILO, Geneva (Switzerland); Tanzania. Ministry of Agriculture and Livestock Development. In: In quest of agricultural mechanisation policy and strategies in the United Republic of Tanzania, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Dar-es-Salaam (Tanzania), 8-10 Oct 1985, p. 15-23, 9 tables, ISBN 92-2-105482-9 **En**
□*Examines efforts made by the government-owned Ubungo Farm Implements to provide farmers with the equipment necessary to improve labour efficiency and notes achievements in manufacturing of hoes and plows.*
Mic.No: 80815

0509 Mack, R.-P. 1984. **The impact of the introduction of work-oxen within the frame of the Integrated Rural Development Program (IRDP) in the North-West-Province of Zambia. Consultancy for the German Agency for Technical Cooperation.**
GTZ, Berlin (Germany, F.R.), 81p., 16 tables **En**
□*Reports results of a monitoring scheme to evaluate the Work Oxen Project of the Integrated Rural Development Programme in North-Western Province, Zambia and concludes that no fundamental changes have to be made. Discusses problems including a shortage of plows and suggests possible solutions.*
Mic.No: 80460

0510 Madeley, J. 1987. **How oxen draughted up sustainable agriculture.**
International Agricultural Development (UK), v. 7(2), p. 13, 16, 1 photograph, ISSN 0261-4413. **En**
□*Describes the success of the Cameroon Government training courses to introduce farming families to animal traction, to develop and introduce appropriate equipment and to promote farming techniques such as intercropping, use of legumes and new crops.*
Mic.No: 80801

0511 Martin, A.; Gibbon, D. 1987. **Turkana Waterharvesting Project. A review for OXFAM and ITDG.**
OXFAM, Oxford (UK), 80p., 10 tables, 1 map; 23 ref. **En** (En)
□*Evaluates the OXFAM/ITDG Waterharvesting Project in Turkana, Kenya in which there is strong emphasis on animal traction. Concludes that: there is a need for access to tools, equipment and raw materials already available in the area; local repair capacity should be developed; local hiring initiatives should be supported; a range of appropriate equipment should be developed and the use of different combinations of draft animals, including camels should be tested.*
Mic.No: 80516

0512 Matlon, P.J.; Vierich, H.; McIntire, J. 1981. **Annual report of ICRISAT/ Upper Volta Economics Program. 1981.**
ICRISAT, Ouagadougou (Burkina Faso). Economics Programme, 74p., 6 fig., 25 tables; ref. **En**
☐*Includes results of a study in Nakamtenga and Nabitenga in which traditional hand-tooled cultivation was compared with animal traction in terms of labour use and income.*
Mic.No: 80241

0513 Matlon, P.J.; Vierich, H. 1982. **Rapport annuel de l'ICRISAT, Haute-Volta. Programme économie, 1982. (Annual report of ICRISAT, Upper Volta, Economics Programme, 1982)**
ICRISAT, Ouagadougou (Burkina Faso). Economics Programme, 97p., 8 fig., 34 tables, 1 map **Fr**
☐*Includes information on the increasing use of draft oxen and donkeys and draft equipment (notably plows and carts) and the consequences of the adoption of animal draft technology.*
Mic.No: 80240

0514 Meijer, R.A. 1985. **The development of ox-drawn farming equipment in Kenya. Performance and farmers' acceptance trials programme of the long rains 1984.**
Wageningen Agricultural Univ. (Netherlands), 102p., ref. **En**
☐*Briefly discusses agriculture in Kenya and in the Machakos district and some aspects of ox-power, and then gives details of ox-drawn implements, technical alterations in the design and production method of the Combi Plow implement, and implements trials during the long rains of 1984.*
Mic.No: 80267

0515 Merafe, Y. 1981. **Background to the development of arable agriculture in Botswana: A review of the adoption of the Integrated Farming Pilot Project.**
Wisconsin Univ., Madison (USA), 143p., 5 fig., 11 tables; 47 ref. M.Sc. (Agricultural Economics). **En** (En)
☐*Reports findings of a survey undertaken in Botswana to study the adoption of the Intergrated Farming Pilot Project by farming households, with particular reference to data on the demographic characteristics, structure, composition and size of the farming households, settlement pattern, livestock distribution, land holding, draft power and implement use, as well as cropping patterns.*
Mic.No: 57294

0516 Mettrick, H. 1978. **Oxenisation in The Gambia.**
UK. Ministry of Overseas Development; Department of Agriculture, Cape St. Mary (Gambia), 68p., 1 map; 6 tables; ref. **En** (En)
☐*Assesses effectiveness of the scheme for the development of ox-drawn animal traction in The Gambia, with particular reference to supply and appropriateness of equipment and supply of livestock, government agricultural policies, credit supply, role of Mixed Farming Centres, local fabrication of implements, impact on production, spread, costs and benefits, social aspects, role of aid, and factors favouring adoption.*
Mic.No: 50105

0517 Moens, A.; Wanders, A.A. 1985. **Etude des besoins en matériels agricoles de culture attelée au Mali. (Requirements for animal-powered cultivation equipment in Mali)**
Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France). Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985, 6p., 3 tables; 1 ref. **Fr**
☐*Discusses the importance of planning equipment requirements for agriculture and presents projected requirements for draft animals and equipment for Mali.*
Mic.No: 80258

0518 Mungroop, R.R. 1987. **Résultats sur les réalisations en culture attelée dans les villages de prévulgarisation CMDT de Sikasso et Koutiala. (Results on the introduction of animal traction in Sikasso and Koutiala villages)**
Mali. Ministère de l'Agriculture, Volet Fonsebougou, 12p., 5 tables **Fr**
☐*Describes the programmes for the second year of the joint CMDT/DRSPR "village approach" activity in the Sikasso and Koutiala regions of Mali aimed at promoting animal traction through local agents, practical demonstrations etc. Tabulates operations carried out in the various villages using animal draft and includes farmer' comments on problems encountered.*
Mic.No: 80271

0519 Mungroop, R.R.; Cissoko, C.O.; Sanogo, M. 1988. **Bilan des activités en matière de culture attelée lors de la Phase III du Projet "Volet Fonsebougou" et propositions pour la Phase IV. (Animal traction activities during Phase III of the Projet "Volet Fonsebougou" and proposals for Phase IV)**
Mali. Ministère de l'Agriculture, 23p., 3 tables **Fr**
☐*This phase of the Volet Fonsebougou project includes training of young draft animals, technical aspects of yoking and harnessing, adaptation of old and testing of new animal draft equipment, post-harvest processing and equipment manufacture.*
Mic.No: 80246

0520 Munzinger, P. 1983. **Promotion for better utilization of ox-drawn implements within Liwonde Agricultural Development Division (LWADD). Report on project visit (8–17 Nov. 1983).**
s.n., s.l., 8p. **En**
□*Reports on a visit to Malawi to assess current oxenization programmes in the Liwonde Agricultural Development Division (LWADD) project area and in its ox-training centres, to evaluate available ox-drawn implements and to make proposals for a programme to promote animal traction in dryland farming, irrigation schemes and through groups and clubs (already in existence among farmers).*
Mic.No: 80447

0521 Munzinger, P. 1984. **Advisor on improved animal drawn implements: Project evaluation and proposals for future development.**
Lesotho. Ministry of Agriculture, 96p., maps, tables, drawings, photographs; 13 ref. **En**
□*Reports on a mission to evaluate the Mobile Repair Teams of the Lesotho Government Basic Agricultural Service Programme, to assess currently-used and newly-tested draft animal equipment and possibilities for local production, and to perform an economic analysis of farm mechanization in Lesotho comparing tractors with animal traction.*
Mic.No: 80111

0522 Munzinger, P. 1984. **Rapport provisoire d'une évaluation de la culture attelée dans le cadre du Projet de Développement Rural de la Région Centrale au Togo. (Provisional report on the evaluation of animal traction within the framework of the Projet de Développement Rural de la Région Centrale au Togo)**
Office Allemand de la Coopération Technique, Eschborn (Allemagne, R.F.). Projet de Développement Agricole de la Région Centrale, 11p. **Fr**
□*Reports on the existing situation regarding animal traction in the Central Region of Togo, problems and constraints to its further development and makes proposals for a programme to promote animal traction in the region.*
Mic.No: 80459

0523 Munzinger, P. 1986. **TIRDEP – Draught Animal Project. PN 77.2117. 8–01.150. Report on Project Review Mission.**
Tanga Integrated Rural Development Programme (Tanzania), 36p., 1 table, 8 photographs; 7 ref. **En**
□*Describes the origin of the TIRDEP Animal Draft Project which aims at introducing animal traction in the Tanga Region of Tanzania. Discusses the present situation and main problems, project objectives, results achieved and proposals for future project implementation. Discusses, in an appendix, reasons for the failure of the former KILIMO Draft Animal Programme.*
Mic.No: 80443

0524 Ndiame, F. 1990. **L'impact du crédit sur la traction animale: analyse critique du Crédit Spécial du Projet PIDAC en Basse-Casamance, Sénégal. (The impact of credit on animal traction: Critical analysis of the Special Credit of the PIDAC (Projet Intégré de Développement Agricole de la Casamance), Sénégal)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 284–293, 4 tables; 8 ref., ISBN 92–9081–046–7 **Fr** (En Fr)
□*Describes and analyzes the organization, implementation and performance after three years of operation of the Special Credit programme set up by PIDAC (Projet Integre de Developpement Agricole de la Casamance) with financial assistance from USAID to increase, through promotion of animal traction, agricultural productivity in the Lower Casamance region (Senegal). Survey data collected from programme managers and farmers showed that success depended on practical organization of the programme, profitability of funded activities and willingness of farmers to repay loans. Makes recommendations to improve participants' understanding of the programme, to select creditworthy farmers and to increase the efficiency of the programme.*
Mic.No: 82054

0525 Neunhauser, P. (ed.) 1977. **Possibilities of the introduction of draught animals in the North-West Province of the United Republic of Cameroon.**
Technische Univ., Berlin (Germany, F.R.). Inst. fur Sozialokonomie der Agrarentwicklung, 291p., 10 fig., 7 maps, 64 tables; ref. **En** (En Fr)
□*Reports findings of a study on the possibility of introducing draft animals in the North-West Province of Cameroon with the aim of identifying environmental, technological and socio-economic conditions necessary for its success, evaluates the draft animal training programmes of the Wum Area Development Authority (WADA, and assesses the potential for implementing the project. Includes a comparative assessment of four West African projects with the aim of introducing draft animals.*
Mic.No: 11768

0526 O'Neill, M.K.; Shapiro, B.; Imboden, R.; Batoure, I. s.d. **Monobovine et bibovine culture attelée sur les**

sols sablonneux sahéliens. (Cultivation with singles or pairs of oxen on sandy soils in the Sahel)
s.n., s.l., 10p., 3 tables; 5 ref. **Fr**
□*Presents findings of a study carried out in the Sahel to analyze the feasibility and profitability of single-ox cultivation in comparison with systems utilizing two oxen, especially in terms of crop yield.*
Mic.No: 87325

0527 Ogier, M. 1975. **Projet pour le développement de la culture attelée et de la production animale dans la République Populaire du Bénin. Etude des fabrications de matériels agricoles par la CODAMAG. (Project for the development of animal traction and animal production in the Benin People's Republic. Study on the production of agricultural implements by CODAMAG)**
FAO, Rome (Italy), v.p., 3 tables, graphs **Fr**
□*Examines the production of farm implements by CODAMAG (subsequently called COBEMAG) in Benin especially, engineering designs and specifications of farm machinery and hand tools produced during 1975 and production targets and projected output of the central workshops at Parakou for the year 1976–1977; includes drawings and budget projection.*
Mic.No: 80712

0528 Onyango, S.O. 1990. **Reducing present constraints to the use of animal power in Kenya.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 455–459, 2 photographs; 5 ref., ISBN 92-9081-046-7 **En** (En)
□*Discusses strategies for promotion of draft animal power in Kenya (selection, training and harnessing of draft animals, training farmers, design and development of suitable animal draft implements, establishment of reliable support services and increased use of donkeys) based on experiences of the Animal Draught Power Development Project (ADPDP), Nairobi.*
Mic.No: 82041

0529 Oppen, M. von; Ghodake, R.D.; Kshirsagar, K.G.; Singh, R.P. 1985. **Important programs in international agricultural research. Performance and transfer constraints of improved vertisol technology.**
Entwicklung und Laendlicher Raum (Germany, F.R.), v. 19(6), p. 11–14, 3 tables, 1 photograph; 11 ref., ISSN 0343-6462. **En**
□*Presents results of research at ICRISAT which demonstrated a viable technology for improved management of Vertisols in trials in which improved cropping systems were compared with traditional practices. Discusses economic constraints to the use of wheeled toolcarriers and stresses the importance of developing low-cost versions or alternatives.*
Mic.No: 80221

0530 Outtara, Z. 1990. **Impact de la traction animale en Côte d'Ivoire. (Impact of animal traction in Côte d'Ivoire)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 359–363, 2 tables; 6 ref., ISBN 92-9081-046-7 **Fr** (Fr)
□*Discusses the effects of animal traction on cotton production in Côte d'Ivoire where 80% of the draft oxen are located in the northern agricultural region. Animal traction has reduced time taken in various farming operations and numbers of farm workers. Animal traction is used to cultivate 25% of the cropped area in the region, and yield of cotton cultivated with animal traction averaged 1286 kg/ha compared with 1169.7 kg/ha for the national average over 10 years. In some regions animal traction has become an intermediate stage to tractorization.*
Mic.No: 82221

0531 Pathak, B.S. 1984. **Report of the Preparatory FAO Mission for the establishment of a TCDC network for research, training and development of draught animal power in Asia.**
FAO, Rome (Italy), 30p. **En**
□*Presents findings and recommendations of an FAO Mission to study the possibility of establishing draft animal power (DAP) networks on a TCDC basis in Asia. Gives details of current DAP status, DAP-related activities and institutions identified for possible participation in the network in countries visited (India, Indonesia, Pakistan, Philippines and Sri Lanka).*
Mic.No: 80388

0532 Persoons, C. 1988. **Problématique d'une étude sur la mécanisation intermédiaire au Mali et premières observations. (Study on intermediate mechanization in Mali. Preliminary observations)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet. D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 260–274, 9 tables, 1 map; 5 ref., ISBN 2-87614-026-8 **Fr**
□*Presents results of a study of a programme of intermediate mechanization started in Mali in 1977–8 in which farmers had a choice of tractor power, animal traction and hand labour. Examines, amongst other factors, the type of energy selected for various cultural operations.*
Mic.No: 82070

0533 Petheram, R.J.; Goe, M.R.; Abiye Astatke. 1989. **Approaches to research on draught animal power in Indonesia, Ethiopia and Australia.**
James Cook Univ., Townsville (Australia). Draught Animal Power Project; ILCA, Addis Ababa (Ethiopia); Research Inst. for Animal Production, Bogor (Indonesia), 115p., 56 photographs; 129 ref., ISBN 0-864433034 **En**
☐*Presents information and impressions gained by participants of a cooperative programme of visits by scientists of the ACIAR DAP Project and the ILCA Animal Traction Thrust, on the range of approaches and topics encountered in the field of draft animal power research especially in Ethiopia, Indonesia and Australia.*
Mic.No: 86296

0534 Petheram, R.J.; Sumanto; Liem, C. 1989. **Farm trials of proposed improvements to draught animal power systems: A review.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3-7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 101-109, 3 diagrams, 1 table; 48 ref., ISBN 1-86320-003-7 **En** (En)
☐*Defines the terminology related to farm trials and indicates the place of various on-farm activities in a farming systems research (FSR) procedure. Outlines a range of farm trials conducted in the field of draft animal power and comments on the value and problems of this mode of research. Recommends improved documentation of methods and results of farm trials (including failures) and greater involvement of specialists and extension workers. Makes a plea to Australian and other research organizations to recognize that farm trials are an essential part of research in small scale farming systems even if they lack the 'glamour' of other types of research.*
Mic.No: 80932

0535 Petheram, R.J.; Teleni, E.; Perkins, J.; Winugroho, M.; Hogan, J.P. 1989. **The ACIAR draught animal power project.**
Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3-7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 27-33, 1 map, 2 graphs, 2 tables; 18 ref., ISBN 1-86320-003-7 **En** (En)
☐*Describes research aimed at understanding the role of draft animals in important farming systems and the nutrition/physiology of working animals carried out at nine village sites throughout Indonesia (from Sumatra in the west to Timor in the east) and under more controlled conditions in Bogor (Java) and in Australia. Ideas for improvement of DAP systems are currently being tested on farms including adaptations of implements and other DAP technology, forages and feed preservation. Results indicate the wide scope for increasing the role of draft animals in areas where animals are common but DAP implements are little used, in transmigration areas, and where land ownership is low or where land is steep or stoney and/or infrastructure is poor.*
Mic.No: 80924

0536 Poitrineau, E. 1989. **Rapport de mission FAO/GRDR. (Report of a mission by the FAO/GRDR)**
Groupe de Recherches et de Réalisations pour le Développement Rural dans le Tiers-Monde, Paris (France), 73p., 12 drawings, 2 maps, 4 tables; 7 ref. **Fr**
☐*Reports on the current state of animal traction in Atacora, Borgou, Zou, Mono and Oueme Provinces of Benin and the progress of the Centre de Formation de Boko in promoting use of draft animals and equipment. Describes the role of COBEMAG and its regional workshops in producing animal traction equipment, discusses problems and makes recommendations.*
Mic.No: 80546

0537 Price, E.; Acebedo, V. 1983. **Integrating crops and livestock research at IRRI.**
s.n., s.l. Farming Systems Research Symposium. The Role of Animals in the Farming System: Production, Products, Processes, USA, 31 Oct-2 Nov 1983, 16p., 3 fig., 9 tables; 12 ref. **En**
☐*Describes briefly IRRI's Rice Farming Systems Program activities to support national research programs on crop-livestock systems, and presents results of crop-livestock research at IRRI. Suggests possible strategies for the development of crop-livestock systems in tropical Asia.*
Mic.No: 86963

0538 Reddy, S.K. 1988. **Use of animal power in West African farming systems: Farm level problems and implications for research. Perspectives from Mali.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19-25 Sep 1986, p. 182-190, 10 ref., ISBN 3-528-02047-4 **En**
☐*Examines on-farm problems related to the introduction of ox-drawn animal traction technology in terms of the farmer, equipmemt, animal management and cropping systems. Summarizes the role of five institutions working on animal traction research, development and extension in Mali.*

A plea is made for greater coordination and interdisciplinary effort using a farming systems approach. Problems of evaluation methodologies and technologies requiring high levels of management have been noted in recent animal traction research. Concludes that there is a need for common data sets in the design and evaluation of research to permit meaningful comparisons within and between countries.
Mic.No: 82015

0539 Remy, G. 1972. **Les leçons d'un échec: la culture attelée en pays Mossi (Haute-Volta). (Lessons from failure: Animal traction in the Mossi country (Upper Volta))**
Cahiers d'Etudes Africaines (France), v. 12(47), p. 512–519 **Fr**
☐*Describes findings of a critical study of main causes for the failure of animal traction in the Mossi country of Burkina Faso from 1962 to 1967, along with proposed solutions, particularly citing the need for analysis of soil quality, care in choice of farming systems, and knowledge of the natural environment.*
Mic.No: 26591

0540 Riches, C.R.; Horspool, G.D. 1980. **Evaluation of Farming Systems & Agricultural Implements Project (EFSAIP), Botswana. Report no. 4, 1979–80. Animal draught systems study. Agricultural engineering.**
Botswana. Ministry of Agriculture. Div. of Agricultural Research, 81p., 8 photographs, 45 tables; 25 ref. **En**
☐*Reports on the activities of the Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP) in Botswana, particularly regarding the evaluation of four improved crop production systems using animal draft, the development of different farm implements and engineering field trials.*
Mic.No: 30581

0541 Rochez, A. 1985. **Mission de consultation en culture attelée pour le Projet TCP/BEN/4404 – Consolidation du Programme de Culture Attelée. (Consultation mission on animal traction for Project TCP/BEN/4404. Consolidation of the animal traction programme)**
FAO, Rome (Italy), 14p. **Fr**
☐*Reports on a mission to review the development of animal traction in Benin following national and externally aided projects and the success of the animal traction training centre at Boko. Outlines a 5-year programme of animal traction development.*
Mic.No: 80344

0542 Rochez, A. 1985. **Première mission DALARS de consultation en culture attelée dans la région de la Kara. Rapport de mission. (First consultation mission by DALARS on animal traction in the Kara region. Mission report)**
FAO, Rome (Italy), 33p., tables **Fr**
☐*Reports on a mission aimed at discovering the reasons for the halt in development of animal traction in North Togo and to determine means of restarting it and promoting it further.*
Mic.No: 80337

0543 Rochez, A. 1985. **Missions DALARS de consultation en culture attelée dans la région de la Kara. Rapport no.2. (Rapport synthétique des deux missions effectuées respectivement en septembre et en décembre 1985). (Consultation missions on animal traction in the Kara region. Report no. 2. Synthesis report of two missions undertaken in September and December 1985)**
FAO, Rome (Italy), 38p., 9 tables **Fr**
☐*Reports on two missions to Togo, to discover why the progress of animal traction in the Kara region had halted, suggest solutions, define an organization to promote animal traction and to generally restart and promote the animal traction programme and determine the economic effects of animal traction.*
Mic.No: 80338

0544 Rochez, A. 1986. **Missions de consultation en culture attelée dans la région de la Kara. Rapport no. 3. Recommandations et propositions pour la dynamisation du développement de la culture attelée dans la région de la Kara. (Consultation missions on animal traction in the Kara region. Report no. 3. Recommendations and proposals to enhance the development of animal traction in the Kara region)**
FAO, Rome (Italy), 18p., 2 fig., 3 tables **Fr**
☐*Defines constraints to the development of animal traction in the Kara region of Togo and proposes solutions.*
Mic.No: 80339

0545 Salmon, D.J. s.d. **A review of EFSAIP – the Evaluation of Farming Systems and Agricultural Implements Project in Botswana.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16–20 Jan 1979, p. 147–152, 1 fig., 4 tables; 5 ref. **En**
☐*Describes results of two seasons work carried out by the Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP) in*

Botswana on two ox-drawn reduced tillage systems developed using sweeps, chisels, locally made planters and fertilizer distributors attached to wheeled toolcarriers on a rotation of fallow, sorghum, cowpeas and sunflower. Compares results with those obtained on traditional methods of crop production.
Mic.No: 82105

0546 Sangare, M.I.; Ladrette, C.; Mungroop, R.R.; Berthe, A. 1988. **Contraintes et améliorations de la traction animale en zone Mali-Sud: l'expérience de la DRSPR. (Constraints and improvements in animal traction in the southern Mali zone: The experience of DRSPR)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 191–211, 8 fig., 4 tables, 1 map; 7 ref., ISBN 3-528-02047-4 **Fr** (Fr)
☐*Describes the development of animal traction in Mali-Sud since the 1950s. Current problems include high animal mortality due to accident or disease, feeding problems particularly during the dry season and obtaining young bullocks. Improvements proposed include growing fodder crops particularly cowpea, mineral supplementation and health treatments, improved animal training and selection from local breeds of cattle.*
Mic.No: 82016

0547 Sangare, M.I.; Traore, A. 1990. **L'impact de la traction animale: cas des prêts "Premier Equipement" dans la région Mali-Sud. (The impact of animal traction: Equipment loan in the Mali-Sud region)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 399–405, 5 tables; 9 ref., ISBN 92-9081-046-7 **Fr**
☐*Describes a programme to introduce animal traction to the Bougouni region of Mali where traditional hoe-farmers were provided with loans to purchase one or two oxen with or without a simple toolbar and a plow. Discusses constraints to development of animal traction in the region including availability of animals and equipment, training and problems with animal health.*
Mic.No: 82039

0548 Sanogo, B.; Mungroop, R.R.; Kleene, P. 1988. **Le passage de la culture manuelle à la culture attelée bovine. Cas des villages Ysban-Djirikorola en zone Mali-Sud. (The progress from manual cultivation to animal traction. The case of Yaban-Djirikorola villages in southern Mali)**
Mali. Ministère de l'Agriculture. Séminaire sur la Mécanisation Agricole, Montpellier (France), 12–16 Sep 1988, 23p., 1 fig., 12 tables, 1 map; 7 ref. **Fr**
☐*Describes progress made in promoting animal traction in southern Mali by Projet Volet Fousebougou, technical and economic constraints and animal training and presents data on operations carried out using oxen.*
Mic.No: 80347

0549 Scheinman, D. 1986. **Animal draft use in Tanga region. A descriptive and analytical study assessing the implications of past, present, and future KILIMO and TIRDEP involvement.**
GTZ, Eschborn (Germany, F.R.), 250p., 95 tables, 2 maps; 47 ref. **En**
☐*Presents findings of a study commissioned by GTZ on behalf of the Tanga Integrated Rural Development Project (TIRDEP) to assess implications of using animal traction and to evaluate its benefits particularly compared with hand hoes and tractors. Includes information on: the Project's experience in the Mwanyumba area; relationship between animal draft and local farming systems, social and demographic data from participating farmers; the ox cart; draft animal availability; animal health; training and extension; credit and risk; viability of using donkeys; viability of animal draft in the Handeni District; current tractor status in Tanga Region.*
Mic.No: 80813

0550 Scheper, W. s.d. **Evaluation of WADA and evaluation of Draught Animal Programme proposals for the North-West Province (March/April 1980). Part 1: Main Report and Annex I–IV.**
GTZ, Eschborn (Germany, F.R.), 77p., tables **En**
☐*Evaluates draft oxen training programmes in northern Cameroon and puts forward proposals for a draft animal project in the North West Province. Training programmes involve selection of trainees with the objective of training them to run a 3-ha farm growing maize, rice, soyabeans and groundnuts using ox-traction. Consideration is given to: land and labour availability; financial conditions; stock and maintenance of draft oxen for supplying to farmers; provision of WADA loans; cultivating virgin land for farming using WADA machinery and construction of access roads; intensive advisory work and provision of an animal health service.*
Mic.No: 80235

0551 Schleich, K.; Steiner, K. 1986. **Expert report on the project Pro-**

motion of Adapted Farming Systems Based on Animal Traction. PN 80.2220.2 - 01.100.
GTZ, Eschborn (Germany, F.R.), 90p., 1 map, 38 tables **En** (En)
□*Provides an agronomic and economic assessment of the farming systems promoted in the North West Province of Cameroon by the GTZ project "Promotion of adapted farming systems on the basis of animal traction" (PAFSAT) based on visits to 13 villages and project documents. Concludes that contour bunds for reducing soil erosion, planted fallows, incorporation of plant residues into the soil and crop rotation systems using farmyard manure have been quite successful and use of draft animals has enabled work to be carried out without creating new labour problems. Suggests that it is not yet possible to assess whether the overall aim of the project to propagate a permanent land-use system based on animal traction which will remain stable on a long-term basis, is succeeding.*
Mic.No: 80236

0552 Schleich, K. 1988. **Project. Promotion of adapted farming systems based on animal traction in the North West Province of Cameroon (PAFSAT/NWP) B.P.558, Bamenda.**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12-16 Sep 1988, p. 226-237, 1 fig., 5 tables, ISBN 2-87614-026-8 **En**
□*Describes a project in which the PAFSAT animal traction farming system which uses contour bunds planted with perennial crops to reduce soil erosion, annual crops (including legumes) grown in a rotation on humus-enriched soil, ox traction and encourages stabling of animals so the manure can be collected and used on the land, was introduced at 26 locations involving 680 farming families and 47 women's groups in 130 villages in the NW Province of Cameroon. Discusses problems encountered.*
Mic.No: 80077

0553 Sidibe, C. 1990. **Impact de la culture attelée dans la zone de l'Opération Haute Vallée du Niger, Mali. (Impact of animal traction in the "Opération Haute Vallée du Niger" scheme in Mali)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 388-392, ISBN 92-9081-046-7 **Fr**
□*Describes a USAID OHV (Operation Haute Vallee) project in which, over a 9-year period, 15,000 "pilot farmers" were each provided with a toolbar (with plow etc.), a seeder, a TI5 or ULV sprayer, a cart and two oxen. Discusses the success of the scheme, suggestions for extending it and new policies including support to village blacksmiths for producing and maintaining draft animal equipment.*
Mic.No: 82040

0554 Sims, B.G. 1985. **Recherche et développement en traction animale dans l'Etat de Veracruz (Mexique). (Animal traction research and development in the State of Veracruz, Mexico)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 36-41, 1 fig., 4 tables, 5 photographs **Fr**
□*Summary of the original contribution (which also had maps, drawings, a graph and 12 ref.) which describes the state of animal traction in Veracruz (Mexico), use of the Multibarra simple toolbar and the Yunticultor wheeled toolcarrier, zero tillage, production of animal draft equipment in Mexico, yokes and harnessing research, comparative measurements of power produced by different animals in various operations, and future perspectives.*
Mic.No: 80220

0555 Sims, B.G. 1988. **The Mexican small farm mechanization development programme.**
s.n., s.l. International Conference on Agricultural Engineering, Paris (France), 2-5 Mar 1988, 12p., 3 diagrams, 1 photograph; 8 ref. **En** (En)
□*Describes the UK/Mexico Small Farm Engineering Project, established in 1980, which targets farmers with limited access to capital and aims to produce low-cost equipment for local manufacture. In spite of some progress major deficiencies were lack of socio-economic analysis at an early stage and failure of official credit institutions to collaborate.*
Mic.No: 80534

0556 Sindazi, M. 1987. **Zambia's country paper: Animal draught power programme's background information.**
Department of Agriculture, Lusaka (Zambia). SADCC Workshop on Animal Traction and Agricultural Mechanization Research, Maputo (Mozambique), 10-14 Aug 1987, 7p., 3 tables; 3 ref. **En**
□*Briefly describes: agriculture in Zambia; categories of farmers and production costs (comparing tractor, ox and traditional or improved hand-hoe systems); present situation regarding animal draft; government policy and strategy; organizations involved in animal draft power, and demand for implements.*
Mic.No: 80455

0557 Smith, A.J. 1984. **Exploratory mission to study the feasibility**

of an animal draught project in Guinea Bissau.
FAO, Rome (Italy), 16p., 15 photographs; 7 ref. **En**
□*Reports on a mission designed to: evaluate the current state of animal traction in Guinea Bissau; to propose necessary measures for the reinforcement of development of animal power; the successes and failures of integrating animal traction into and to conduct equipment testing and the exploitation of low-lying areas for rice production and training of advisors; to examine the veterinary infrastructure and local conditions of animal production with a view to the experimental introduction of Asiatic buffalo and to formulate a project document to highlight ways of increasing the value of products from small interior valleys which have the greatest potential for rice production.*
Mic.No: 80330

0558 Smotzok, M. s.d. **The work-oxen project in the Integrated Rural Development Programme in the North-Western Province/Zambia.**
North West Province Rural Development Project, Kabompo (Zambia), 30p. **En**
□*Describes the setting up of the Work Oxen Project of the Integrated Rural Development Programme in North-Western Province and its involvement in work-oxen loan and training schemes, animal health and manufacture of small-scale equipment, primarily carts. Gives results of a work oxen utilization survey carried out in 1966. Discusses future prospects for animal draft in the area.*
Mic.No: 80458

0559 Soejoto, B.; McEvoy, M.G. 1989. **Indonesian smallholder cattle development project: Description of the credit component.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 316–321, 4 tables, ISBN 1-86320-003-7 **En** (En)
□*Describes the aims and results of a project started in 1981–2 to assist transmigrants in the outer islands of Indonesia to increase food crop production through the provision of access to credit to allow the purchase of a draft animal, a plow and for them to receive necessary technical support. Results show that only 25 of transmigrants have had the opportunity to obtain credit to date. Key factors are to ensure that the farmer is given an animal suitable to his requirements, that the credit package is one he can handle and understand and that in the early years, a complete package of technical services is provided, one of the most important being provision of suitable forage varieties.*
Mic.No: 80953

0560 Soko, D.L. 1990. **The impact of the oxenisation programme in the North Western Province of Zambia.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 452–454, 1 table; 5 ref., ISBN 92-9081-046-7 **En**
□*Gives background information on the geography, people and problems of the North Western Province of Zambia and discusses the impact of animal traction on transport, plowing and contract services. Presents data on numbers of ox pairs in the region and area plowed from 1980 to 1987. Constraints to animal traction include costs and dissatisfaction with contract plowing.*
Mic.No: 82043

0561 Sokona, F. 1988. **Mécanisation et transformations sociales: cas des Centres d'Animation Rurale Mixtes (CARM). (Mechanization and social transformation: The case of the Centres d'Animation Rurale Mixtes (CARM))**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 308–318, 4 tables, 3 photographs, ISBN 2-87614-026-8 **Fr**
□*Describes the successes and failures of integrating animal traction into village farming systems, and the role of the CARM training centres.*
Mic.No: 82240

0562 Sommer, W. 1987. **The impact of ox-draught power on small scale agriculture within the frame of the Integrated Rural Development Programme (IRDP) in the North-Western Province of Zambia.**
Gesamthochschule Kassel Univ., Witzenhausen (Germany, F.R.), 110p., 16 fig., 23 tables; 51 ref. **En** (De En)
□*Discusses the impact on the rural population of introduction of work oxen for land preparation and rural transport in the North-Western Province of Zambia within the framework of the Integrated Rural Development Programme together with benefits, major problems and constraints. Gives results of a work oxen utilization survey (1986–87) and of a monitoring programme during the plowing season.*
Mic.No: 80464

0563 Srivastava, N.S.L. 1989. **Research on draught animal power in India.**

Hoffmann, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 53–60, 5 tables, 1 drawing, 2 photographs; 4 ref., ISBN 1-86320-003-7 **En** (En)

☐*Discusses research into increasing the use and overall efficiency of draft animals in India to reduce pressure on other sources of energy which are becoming scarcer and costlier under the headings: draftability of animals (developing improved yokes and harnesses, energy conversion, mechanics of animal traction); quantifying and measuring fatigue; instrumentation for DAP research; increasing utilization of draft animals; improved animal drawn implements and carts; milch (cows and buffaloes) and pack animals (donkeys, mules, horses, camels and yaks) for draft; breeding for draft purposes; planning for DAP.*
Mic.No: 80927

0564 Starkey, P.H. 1979. **Draught oxen project. Background, proposals, progress.**
Njala University Coll. (Sierra Leone), 16p., 21 ref.
En (En)
☐*Reviews the current use of draft oxen in Sierra Leone and constraints to its promotion. Stresses the need for appropriate equipment, objective trials to evaluate local and imported equipment, assessment of agronomic benefits and economic aspects and the importance of the collection of source material and exchange of information.*
Mic.No: 80305

0565 Starkey, P.H. 1980. **Work oxen in Sierra Leone.**
9. Annual Conference, Kenema (Sierra Leone), Sierra Leone Agricultural Journal, v. 6(1), p. 53–58, 26 ref. **En** (En)
☐*Reviews the past and present use of work oxen in Sierra Leone, possible constraints to the development of ox-cultivation and recent proposals for a series of coordinated work-oxen trials.*
Mic.No: 80320

0566 Starkey, P.H. 1981. **Farming with work oxen in Sierra Leone.**
Sierra Leone Work Oxen Project, Freetown; Njala Univ. (Sierra Leone), 77p., fig., tables; 10 ref. **En** (En)
☐*Reports on the existing and potential use of draft animals in Sierra Leone, including details of appropriate equipment, management techniques, increase in labour efficiency in plowing and weeding, and economic advantages of oxen cultivation vs tractor and manual cultivation. Includes results of cultivation trials with groundnuts, maize, cowpeas and swamp rice.*
Mic.No: 36684

0567 Starkey, P.H. 1981. **The Sierra Leone Work Oxen Project.**
Appropriate Technology (UK), v. 8(1), p. 7–9, 4 photographs; 3 ref., ISSN 0305-0920. **En**
☐*Reviews the activities of the Sierra Leone Work Oxen Project which was initiated to investigate and develop the use of draft animals in the country, outlining earlier equipment evaluation trials and the project's external relations.*
Mic.No: 30247

0568 Starkey, P.H.; Calmels, G. 1982. **Work oxen and sustained food production.**
s.n., s.l. 11. Annual Conference of the Sierra Leone Agricultural Society, Njala (Sierra Leone), 24–27 Mar 1982, 7p., 2 fig., 1 map; 3 ref. **En** (En)
☐*Describes the work of the Sierra Leone Work Oxen Project in evaluating animal traction equipment and gives results of field trials in which ox cultivation was compared with hand cultivation for upland rice, groundnuts, cowpeas and maize.*
Mic.No: 80308

0569 Starkey, P.H. 1983. **Introducing the ox.**
Ceres. FAO Review, v. 16(6), p. 36–40, 8 photographs, ISSN 0009-0379. **En**
☐*Discusses the development of animal traction in Sierra Leone and the work of the Sierra Leone Work Oxen Project. Stresses the need for information exchange.*
Mic.No: 80791

0570 Starkey, P.H. 1983. **Proposal for a draught animal research program in Liberia.**
Sierra Leone Work Oxen Project, Freetown, 15p., 1 table **En** (En)
☐*Details proposals for a pilot research programme in which N'Dama cattle would be trained at the Central Agricultural Research Institute (CARI) and other stations throughout Liberia. Results of coordinated trials into crop production techniques, equipment evaluation, veterinary screening and economic data collection would form a detailed evaluation report to provide the information required for an extensive farmer-orientated draft animal project.*
Mic.No: 80335

0571 Starkey, P.H.; Delobre, J. 1984. **Organisation et méthodologie du programme de traction animale en Sierra Leone. (Organization and methodology of the animal traction programme in Sierra Leone)**

Machinisme Agricole Tropical (France), no. 91, p. 42–44 **Fr** (En Es Fr)
☐*Discusses the promotion and development of animal traction in Sierra Leone, with notes on equipment testing and training of animals.*
Mic.No: 36684

0572 Starkey, P.H.; Goe, M.R. 1984. **Report of the preparatory FAO/ILCA mission for the establishment of a TCDC network for research, training and development of draught animal power in Africa.**
ILCA, Addis Ababa (Ethiopia); FAO, Rome (Italy), 82p. **En**
☐*Reports on a consultancy mission undertaken in Botswana, Kenya and Tanzania to prepare for the establishment of a Technical Cooperation among Developing Countries (TCDC) Network for research, training and development in the use of draft animal power (DAP). Includes selected observations on the use of draft animals, distribution of power sources and implements, draft animal condition, timeliness and profitability of farming operations, technical personnel, scope for network participation and cooperation with SACCAR.*
Mic.No: 34930

0573 Starkey, P.H.; Kanu, B.H. 1985. **Animal traction in Sierra Leone.**
Nepal. Ministry of Agriculture. Dept. of Agriculture; Indonesia. Ministry of Agriculture. Agency for Agricultural Research and Development; IRRI, Manila (Philippines). Rice Farming Systems Network. In: Proceedings of the 2nd monitoring tour. Crop–livestock systems research. Nepal and Indonesia, 2. Crop–Livestock Systems Research Monitoring Tour – Nepal and Indonesia, s.l., 18–31 Aug 1985, p. 657–659 **En**
☐*Surveys the present use of animal traction in Sierra Leone and describes activities and research methodology of the Sierra Leone Work Oxen Project which aims at promoting the technology.*
Mic.No: 82084

0574 Starkey, P.H. 1985. **Animal power utilization in Malawi.**
FAO, Rome (Italy); UNDP, New York (USA), 26p., ref. **En**
☐*Reviews the utilization of animal power in Malawi, identifying constraints to its wider adoption and outlining research and training needs for further development. Includes a feasibility study for a UNDP-financed animal power utilization project in the country.*
Mic.No: 38236

0575 Starkey, P.H. 1986. **Strengthening animal traction research and development in The Gambia through networking.**
Gambian Agricultural Research and Diversification Project, Cape St. Mary, 33p., 18 ref. **En** (En)
☐*Report of a 2-week mission in Mar 1986 to review the progress of animal traction in The Gambia and to discuss options for combining possible GARD support in the area with regional networking activities.*
Mic.No: 80788

0576 Starkey, P.H. 1986. **Appropriate technology for Africa. An evaluation with suggestions for future initiatives. IDRC/CRDI Consultancy Mission Report.**
IDRC, Bamako (Mali), 36p., 5 ref. **En** (En)
☐*Evaluates equipment (wheeled toolcarrier and pedal-powered pump) designed in Canada for the needs of Africa and tested in Mali, and presents a justification for future animal traction research in Africa.*
Mic.No: 80252

0577 Starkey, P.H. 1988. **Networkshop programme and methodology.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Weisbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 15–20, 4 photographs, ISBN 3–528–02047–4 **En**
☐*Presents a detailed discussion of the networkshop programme as it incorporated methodological features designed to stimulate interaction that were new to some participants. Describes the introductory session, visits to the Sierra Leone Work Oxen Project and field visits, thematic presentations and discussion groups and the final discussion, recommendations and evaluation.*
Mic.No: 82001

0578 Starkey, P.H. 1988. **Draft animal power in Sierra Leone: A case history.**
AFRC Engineering, Silsoe (UK), 17p., 21 ref. **En**(En)
☐*Covers the development of animal traction in Sierra Leone from its first introduction in 1928, and discusses constraints to draft animal power together with wider implications of the Sierra Leone experience, prospects and future priority areas for research.*
Mic.No: 80794

0579 Starkey, P.H. 1988. **Animal traction research in southern Mali. Consultancy report prepared for DRSPR.**
Mali. Ministère de l'Agriculture, Volet Fonsebougou. Div. de Recherches sur les Systèmes de Production Rurale, 30p., 17 ref. **En** (En)
☐*Makes general observations on animal traction in the CMDT region of Mali followed by technical*

observations on harnessing, equipment, crop/livestock integration, animal management, health, training and utilization and choice of species. Proposes the following topics for the new animal traction research programme: monitoring of the CMDT-Blacksmith Programme; use of draft animals by women; use of draft cows; farmer trials of innovative equipment options; use of donkeys for cultivation; soil cultivation trials; review of West African experiences; and documentation of DSPR experiences.
Mic.No: 80251

0580 Thiec, G. le. 1988. **Evaluation retrospective de la vulgarisation de la culture attelée au sein d'une opération de développement rural: cas de l'Opération Arachide et Cultures Vivrières (OACV) – Mali. (Retrospective evaluation of the extension of animal traction at a rural development operation. The case of the Opération Arachide et Cultures Vivrières (OACV) in Mali)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn, Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 212–221, 1 table, ISBN 3–528–02047–4 **Fr** (Fr)
☐*Describes the introduction of animal traction by the Mali government in 1967 in the OACV scheme primarily aimed at increasing groundnut production. Equipment promoted was a simple toolbar and seeder. The success of the scheme and problems encountered are discussed.*
Mic.No: 82017

0581 Tibbs, P. 1988. **The provision of credit for the purchase of draft oxen and equipment in the Koinadugu District of Sierra Leone, 1983–1986.**
Koinadugu Integrated Agricultural Development Project, Kabala (Sierra Leone), 62p., 1 fig., 2 tables **En** (En)
☐*Chronicles the conception, instigation and operation of the Loan Scheme of the Koinadugu Integrated Agricultural Development Project (KIADP) for the purchase of draft oxen and equipment, focussing on the principles observed and problems encountered.*
Mic.No: 80328

0582 Tinker, D.B. 1989. **Draught animal power implements for use on Vertisols.**
AFRC Engineering, Silsoe (UK), 22p., 2 tables; 2 drawings; 21 ref. **En** (En)
☐*Describes the use of a broadbed-maker (BBM) designed and built by ILCA/AFRC Engineering (UK) during the 1987–88 dry season to provide surface drainage as part of ILCA's programme to increase crop production on Vertisols. Proposes two basic systems: a low-cost version based on the traditional* maresha *(plow) and the BBM and using simple sweeps and funnel seeders, and a higher-cost version using a tine-bar on the BBM which could be adapted to carry a seed and fertilizer drill as well as funnel seeders for a wider range of crops than the low-cost version. Includes proposals for minor modifications to the workshop and equipment at ILCA's Debre Zeit station and gives terms of reference for personnel starting equipment development and field trials.*
Mic.No: 80536

0583 Traoré, B. 1990. **Presentation du projet Centre d'Animation Rurale Mixte (CARM), Mali. (Introducing the RFA/CARM project)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 396–398, ISBN 92–9081–046–7 **Fr**
☐*Describes a joint German/Mali project aimed at increasing the income of small-scale farmers and improving their standard of living by promoting use of animal traction, integrating crop production with livestock production, involving women in agriculture, providing extension material, improving animal health, involving women in local crafts in small workshops (soap-making, dyeing, dressmaking, knitting), promotion of blacksmithing etc. Discusses economic, social and technical constraints to development of animal traction and future prospects.*
Mic.No: 82037

0584 Traore, M. 1988. **Mécanisation agricole et intégration agriculture-élevage dans le cadre du Projet Mali-Sud C.M.D.T. (Agricultural mechanization and the integration of agriculture and livestock production within the framework of the Projet Mali-Sud C.M.D.T.)**
Raymond, G.(ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mecanisation en region chaude, Seminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 111–131, 3 fig., 3 maps, 6 tables; 5 ref., ISBN 2–87614–026–8 **Fr** (Fr)
☐*Demonstrates how agricultural mechanization in Mali in the form of animal traction has contributed to the development of production of cotton and cereals and of settled livestock production. Discusses socio-economic changes following introduction of animal traction 30 years ago.*
Mic.No: 82075

0585 Traverse, S. 1971. **Note sur l'utilisation du N'Dama en riziculture**

Irriguée. (Notes on the use of N'Dama cattle for irrigated rice farming)
Centre National de Recherches Agronomiques, Bambey (Senegal), 4p., 1 table **Fr**
☐*Reports on work carried out at Djibelor, Senegal in which N'Dama cattle were used in the cultivation of irrigated rice. Data are given on tractive effort, training, feeding and working hours. Discusses means of promoting use of draft animals for rice cultivation in the Casamance region.*
Mic.No: 80281

0586 Vaerenbergh, R. van. 1985. **Etablissement d'un réseau de formation, de recherche et de développement en matière d'utilisation rurale de l'énergie animale. (Establishment of a network for training, research and development in the use of animal power in rural areas)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mars 1985. Machinisme Agricole Tropical (France), no. 91, p. 65–68, 2 tables **Fr**
☐*Describes current and future FAO programmes to develop networks and to promote animal traction in Africa and Asia.*
Mic.No: 80362

0587 Verbeek, A.C. 1985. **Programmes de la culture attelée. Cas des exploitations à une seule paire de boeufs: exemple d'une analyse technico-économique. (Animal traction programme. The case of farms with a single pair of oxen, technical and economic analysis)**
Mali. Ministère de l'Agriculture, 46p., 14 tables, 4 graphs; 10 ref. **Fr** (Fr)
☐*Presents a technical and economic analysis of results from 14 small farming operations in Yaban and Djirikorela villages, southern Mali each with a single pair of oxen and some form of soil tillage equipment.*
Mic.No: 80254

0588 Wagner, C.M.; Munzinger, P. 1982. **Introduction of draught animals in north-west Cameroon by the "Wum Area Development Authority". (L'introduction de la culture attelée dans le nord-ouest du Cameroun par la "Wum Area Development Authority")**
Munzinger, P. (ed.). In: Animal traction in Africa, p. 377–402, 5 photographs, 1 fig., 4 tables **En, Fr**
☐*Presents a case study of the "Wum Area Development Authority" draft animal project in Cameroon, outlining environmental, socio-economic and historical conditions prevailing in the region, training and credit components for draft animal farmers within the draft animal programme, and the profitability of using draft animals on farms as well as the relative advantages of animal traction, tractors and traditional hoe agriculture.*
Mic.No: 80619

0589 Westneat, A.S.; Klutse, A.; Amegbeto, K.N. 1988. **Features of animal traction adoption in Togo. (Caractéristiques d'adoption de la traction animale au Togo)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 331–349, 2 fig., 7 tables; 8 ref., ISBN 3-528-02047-4 **En, Fr**
☐*A brief description of the geography of Togo followed by a historical overview of the development of animal traction, the current scale of adoption and a section on farmer management in the transition zones including limits to the spread of animal traction technology and the durability of hoe farming.*
Mic.No: 82029

0590 Whalen, I.T. 1985. **Development of agricultural technology for different user categories: Some ILCA experiences.**
Rockefeller Foundation, New York (USA); ISNAR, The Hague (Netherlands). In: Women and agricultural technology: Relevance for research. Volume 2 – Experiences in international and national research. Report of a seminar, CGIAR Inter-Center Seminar on Women and Agricultural Technology, Bellagio (Italy), 25–29 Mar 1985, p. 99–112, 4 maps, 1 table; 20 ref. **En**
☐*Reviews ILCA's mandate, position, and organizational structure; discusses ILCA's experience with identification of user categories, their needs and potential; examines studies on single-ox plow in Ethiopia; and outlines opportunities for strengthening the users' perspective.*
Mic.No: 82263

0591 Wilfred, N.M. 1990. **The impact of animal traction in a permanent farming system in North-West Cameroon: The role of the PAFSAT project.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 432–434, ISBN 92-9081-046-7 **En** (En)
☐*Describes the adoption and integration of animal traction in the North West Province of Cameroon over the last 20 years where it is now used by about 700 farming families for various farming operations and transport. Discusses constraints to its further spread, not the least of which is the topography of the country. Describes measures developed by PAFSAT (Project for Promotion of*

Adapted Farming Systems Based on Animal Traction) to reduce soil erosion by introducing a new systems approach to farming. Describes the adaption of animal draft implements for local requirements and the setting up of local manufacturing and repair facilities. Notes that more farmers apply to be trained than can actually receive training each year.
Mic.No: 82227

0592 Zweier, K. 1988. **Promotion of Adapted Farming Systems based on Animal Traction in the North West Province of Cameroon. PAFSAT-Farmers' handbook.**
GTZ, Bamenda (Cameroon), 151p., illus. **En**
☐*Presents guidelines for the use of working animals in permanent farming systems in the North West Province of Cameroon, with detailed notes on the selection, training and management of draft oxen, the use of proper farming implements, and on soil management. Discusses the objectives and components of the Permanent Farming System of PAFSAT, a bilateral technical cooperation project of the Government of Cameroon and the Federal Rupublic of Germany. Includes cropping recommendations for selected crops and vegetables.*
Mic.No: 86958

ECONOMIC STUDIES OF ANIMAL TRACTION

0593 Adelhelm, R.; Schmidt, H. 1975. **Economic aspects of ox cultivation.**
Kenya. Ministry of Agriculture. Economic Planning Div., 31p, 20 tables; 7 ref. **En** (En)
☐*Discusses economic aspects of different plowing techniques on various model farms in Kenya, with particular emphasis on cost of plowing using the hoe, draft animals or tractors; includes data on labour cost and requirement, seedbed preparation, organizational aspects, and net farm income.*
Mic.No: 04039

0594 Amegbeto, K.N. 1990. **Etude comparative de rentabilité de la culture manuelle et de la culture attelée au Togo. (Comparative study on the profitability of manual methods and animal traction in Togo)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 174-185, 1 map, 15 tables, ISBN 92-9081-046-7 **Fr**
☐*Compares the profitability of enterprizes using traditional manual methods with those using animal traction in the Broukou and Kambole districts of Togo. Concludes that access to animal traction is not as easy as one is led to believe and there are numerous technical and socio-economic constraints to its adoption. Results showed that even partial use of animal traction increased the area cultivated and appeared to provide the impetus for intensification of farming with use of fertilizers and better seeds and increased yields and income.*
Mic.No: 82222

0595 Anon. 1986. **Draft oxen evaluation study report.**
Agricultural and Industrial Development Bank, Addis Ababa (Ethiopia), v.p., 2 fig., 15 tables; 13 ref. **En** (En)
☐*Presents an analysis of data on the evaluation of the Agricultural and Industrial Development Bank draft oxen loans programme. Reviews the role of oxen in the peasant farm economy of Ethiopia.*
Mic.No: 38821

0596 Badouin, R. 1988. **La problèmatique économique de la mécanisation en agriculture. (Economic aspects of agricultural mechanization)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12-16 Sep 1988, p. 2-9, ISBN 2-87614-026-8 **Fr**
☐*Discusses economic aspects of mechanization in agriculture and the choice of animal traction or motor traction to replace traditional hand cultivation.*
Mic.No: 82072

0597 Barrett, V.; Lassiter, G.C.; Wilcock, D.; Baker, D.; Crawford, E.W. 1982. **Animal traction in eastern Upper Volta: A technical, economic and institutional analysis.**
Michigan State Univ., East Lansing (USA). MSU International Development Paper (USA), no. 4, 118p., 3 fig., 41 tables, 1 map; 37 ref. **En**
☐*Analyzes the technical, economic and institutional impact of the animal traction programme, the major component of USAID assistance to the EORD Integrated Rural Development Project. Concludes that animal traction remains a moderately promising means of improving farm productivity in Burkina Faso.*
Mic.No: 82243

0598 Basuno, E. 1989. **Optimum strategies for draught animals in Subang District, Indonesia.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3-7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 110-115, 6 tables; 1 ref., ISBN 1-86320-003-7 **En** (En)

Presents results of a study in which a model developed using linear programming was used to study the effects of renting draft animals on farms currently using manual labour only to prepare irrigated land for food crops in Indonesia.
Mic.No: 80933

0599 Becker, H. 1984. **Principles of mechanization: Economic aspects of oxen mechanization in LWADD.**
Liwonde Agricultural Development Div. (Malawi). Management Unit. Liwonde Agricultural Development Division, Management Unit, Field Development Series (Malawi), v. 10, 43p., 1 fig., 18 tables; 5 ref. **En**
□*Discusses economic aspects of oxenization in the Liwonde Agricultural Development Division (LWADD) of Malawi. Concludes that due to prevailing agronomic, environmental, physical, social and economic factors, the introduction of higher levels of oxenization is not essential for achieving LWADD development objectives and that oxenization will not solve economic and agronomic problems of subsistence and commercial farms in the region.*
Mic.No: 80449

0600 Bell, R.D.; Kemp, D.C. 1988. **An assessment of some aspects of work oxen use in Sierra Leone.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 320–324, 4 tables; 5 ref., ISBN 3-528-02047-4 **En** (En)
□*Describes the Work Oxen Project which has successfully identified and alleviated some constraints to work-oxen use by provision of implements and training and extension activities. Concludes that there is potential for increased rice production by increased use of ox power but its realization depends on technical and social changes for which a major programme of trials, development and extension is needed.*
Mic.No: 82027

0601 Binswanger, H.P. 1977. **The economics of tractors in the Indian subcontinent.**
ICRISAT, Hyderabad (India). Economics Programme, 79p., 13 tables; 55 ref. **En**
□*Outlines the two opposing views on the benefit of tractors, namely, that they can be interchanged with animal power (substitution) and the switch from animal power to tractors is guided by factor prices, or that they furnish greater power, a primary constraint to agricultural production regardless of factor prices (net contribution) leading to increased benefits, reviewing survey results on the impact of tractorization on cropping intensity, yields, timeliness for field preparation and sowing, total value of crop production and labour displacement and labour use, patterns of tractor and bullock use as well as cost-benefit studies in various parts of the Indian subcontinent.*
Mic.No: 14745

0602 Binswanger, H.P.; Ghodake, R.D.; Thierstein, G.E. 1980. **Observations on the economics of tractors, bullocks and wheeled tool carriers in the semi-arid tropics of India.**
ICRISAT, Patancheru, AP (India). In: Proceedings of the international workshop on socio-economic constraints to development of semi-arid tropical agriculture, International Workshop on Socio-economic Constraints to Development of Semi-arid Tropical Agriculture, Hyderabad (India), 19–23 Feb 1979, p. 199–212, 6 tables; 16 ref. **En** (En Fr)
□*Reviews available survey evidence on the economics of tractors, bullocks and wheeled toolcarriers for semi-arid tropical India, with emphasis on cost-effectiveness, yield, improvement of cropping intensity and labour displacement.*
Mic.No: 82094

0603 Bordet, D. 1988. **Critères économiques pour la définition des choix de mécanisation. Cas de la riziculture dans les périmetres irrigués du fleuve Sénégal. (Economic criteria for defining mechanization choices. Rice cultivation in the irrigated valley of the Senegal river)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D. (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, p. 238–254, 10 tables; 5 ref., ISBN 2-87614-026-8 **Fr** (Fr)
□*Uses a model to compare the costs of rice cultivation in the irrigated valley of the Senegal river, using animal traction or motor traction for soil preparation and manual labour, semi-mechanized or completely mechanized methods for harvesting.*
Mic.No: 82074

0604 Bordet, D. 1990. **Effets dynamiques de la traction animale dans les systèmes de production. (Dynamic effects of animal traction in farming systems)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 124–135, 2 illus., 1 table; 16 ref., ISBN 92-9081-046-7 **Fr**
□*Discusses problems in an economic approach to the study of the effects of animal traction and stresses the necessity for a systematic approach. Reviews effects of animal traction on yields, area cultivated, farming systems, productivity and*

management of labour, income, social structure, development from traditional hoe cultivation and economic aspects.
Mic.No: 82049

0605 Bossi, M.T. 1985. **Analyse agro-socio-économique de la culture attelée dans l'Ord de Koudougou, au Burkina Faso. (Agro-socio-economic analysis of animal traction in the Ord de Koudougou, Burkina Faso)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 11-12 **Fr**
□*Brief summary of a paper describing a proposed study by Universita della Pace, Turin (Italy) to examine constraints to development of animal traction in Burkina Faso and to examine effects on income of farmers and economy as a whole of small-scale industrialization and a network of village artisans.*
Mic.No: 80371

0606 Corbel, H. 1986. **L'introduction de la culture attelée au niveau du paysan: implications économiques. (Introduction of animal traction at the farmer level: Economic impact)**
Koinadugu Integrated Agricultural Development Project, Kabala (Sierra Leone). Animal Power in Farming Systems, Freetown (Sierra Leone), 19-26 Sep 1986, 14p., 3 tables **Fr**
□*Reports on the successes and failures of the Loan Scheme of the Koinadugu Integrated Agricultural Development Project (KIADP) in the Kabala region of Sierra Leone.*
Mic.No: 80326

0607 Corbel, H. 1986. **Quelques considérations à propos du programme de crédit pour la diffusion de la culture attelée au Koinadugu. (Some considerations regarding the credit programme for the introduction of animal traction at Koinadugu)**
Koinadugu Integrated Agricultural Development Project, Kabala (Sierra Leone). Animal Power in Farming Systems, Freetown (Sierra Leone), 19-26 Sep 1986, 15p., 8 tables **Fr**
□*Describes the Loan Scheme of the Koinadugu Integrated Agricultural Development Project (KIADP) which was available for the purchase of draft oxen or equipment, analyzes take up of the loans and discusses effects on animal traction in the region.*
Mic.No: 80327

0608 Corbel, H. 1988. **The economics of animal power in Koinadugu District, Sierra Leone: A case study of the work oxen introduction and credit programme.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19-25 Sep 1986, p. 299-310, 1 table; 4 ref., ISBN 3-528-02047-4 **En** (En)
□*Gives information on animal power and farming systems obtained from an economic survey of three villages and by monitoring the Loan Scheme of the Koinadugu Agricultural Development Project (Sierra Leone). Problems involved in using animal power are discussed. Concludes that labour constraints and the appreciating value of oxen make animal traction potentially attractive if it can be combined with increased farm size, diversified operations and hiring out animals.*
Mic.No: 82025

0609 Crawford, E.W.; Lassiter, G.C. 1985. **Constraints on oxen cultivation in the Sahel: Comment.**
American Journal of Agricultural Economics, v. 67(3), p. 684-685, 5 ref., ISSN 0002-9092. **En**
□*Criticizes a paper which argued that lack of profitability is sufficient explanation for non-adoption of animal traction using oxen (ATO) in the Sahel, and presents alternative explanations for the non-adoption of ATO.*
Mic.No: 80599

0610 DeBoer, A.J. 1972. **Technical and economic constraints on bovine production in three villages in Thailand.**
s.n., s.l., 226p. **En**
□*Describes and analyzes cattle and buffalo production-utilization systems in three Thai villages, assessing the role of cattle in the food production-consumption complex in which they provide draft power, meat and cash income and examining relationship between cattle production and crop production practices, with particular reference to production function analysis of draft animals, description of cattle production practices and technical parameters, rates of return of cattle enterprises and construction of models.*
Mic.No: 80731

0611 Delgado, C.L.; McIntire, J. 1980. **Economic constraints on farming with plow oxen in the Sahel.**
s.n., s.l., 38p., 3 tables; 43 ref. **En**
□*Examines reasons for the failure of most farmers in the Sahel to adopt animal traction practices, outlining major economic, social and natural constraints to its adoption and analyzing differences between a system of manual and ox-draft cultivation. Describes a composite farm model of ox-draft cultivation used to assess necessary conditions and impact of economic constraints, especially labour-related problems.*
Mic.No: 50054

0612 Delgado, C.L.; McIntire, J. 1982. **Constraints on oxen cultivation in the Sahel.**
American Journal of Agricultural Economics, v. 64(2), p. 188–196, 3 tables; 17 ref., ISSN 0002–9092. **En** (En)
☐*Analyzes reasons why farmers in some areas of tse-tse-free West Africa have rapidly adopted animal traction using oxen (ATO) while most cultivators in the dry, savannah areas of the coastal states and the Sahelian nations have not. Discusses maximum potential increases in farm income and the required resource allocations stemming from the adoption of ATO.*
Mic.No: 50063

0613 Elhimdy, B.; Chiche, J. 1990. **Rentabilité de la traction animale dans les petits exploitations marocaines. (Profitability of animal traction in Moroccoan smallholdings)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 162–167, 2 maps, 5 tables; 7 ref., ISBN 92–9081–046–7 **Fr** (Fr)
☐*Discusses animal traction and motorization in Morocco and constraints to physical performance of draft animals. Compares the cost of using animal traction, tractor power or mixed traction on small (<5–ha farms) at the edge of the irrigated zone. Concludes that in Morocco traditional and modern techniques coexist perfectly and that animal traction (using donkeys, mules, horses and camels) is widespread throughout the country. Although animal performance is poorer than in other parts of the world, it remains profitable for small-scale family operations.*
Mic.No: 82053

0614 Esparon, N.M.; Sturgess, N.H. 1989. **Technical efficiency of rice production for East Javanese farmers.**
ACIAR, Townsville (Australia). ACIAR DAP Project Bulletin, no. 9, p. 20–26, 6 tables; 10 ref., ISSN 0819–2596. **En** (En)
☐*Information on levels of inputs and output for rice production for 15 villages in East Java was gathered for the PATANAS survey in 1983–4. Data was analysed from 4 vilages in which a significant number of farmers utilized animal power. Average and frontier linear production functions were fitted to cross-sectional data for each village and to panel data for one village. Results from the frontier regression indicated that farmers within a village were technically efficient in their rice production under their current level of technology.*
Mic.No: 80964

0615 Esparon, N.M. 1989. **Technical efficiency and the significance of draught animal power for rice production in Indonesian villages.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 309–315, 5 tables; 8 ref., ISBN 1–86320–003–7 **En** (En)
☐*Presents results of a study in which 11 Indonesian villages where a significant number of farmers used draft animal power (DAP) were analysed using econometric techniques to determine whether they were technically efficient in their rice-production processes and whether DAP was an important significant input in rice production. All farmers achieved a high level of technical efficiency. Discusses implications of this finding for future research and extension work.*
Mic.No: 80952

0616 Gemmill, G.T. 1971. **The economics of farm mechanization in Malawi.**
Bunda College of Agriculture, Lilongwe (Malawi), 57p., 45 tables; 38 ref. **En**
☐*Reports on costs and benefits of the Malawian programme of farm mechanization with loans for the purchase of farm implements and oxen; analyzes causes for delinquency and ineffective utilization of loan funds; compares work rates of oxen and manual labour and presents results of a survey on the organization of ox-owning farms.*
Mic.No: 55064

0617 Getachew Asamenew; Jutzi, S.; Abate Tedla; McIntire, J. 1988. **Economic evaluation of improved Vertisol drainage for food crop production in the Ethiopian highlands.**
Jutzi, S. (ed.); Haque, I. (ed.); McIntire, J. (ed.); Stares, J.E.S. (ed.). In: Management of Vertisols in sub-Saharan Africa. Proceedings of a workshop, ILCA Conference on Management of Vertisols in Sub-Saharan Africa, Addis Ababa (Ethiopia), 31 Aug–4 Sep 1987, p. 263–283, 7 tables; 4 ref., ISBN 92–9053–095–2 **En** (En)
☐*Outlines an economic evaluation of an improved surface drainage technology, using the broadbed-maker (BBM) on farm in four different Vertisol areas of the Ethiopian highlands. Presents data on crops and number of areas covered for the on-farm drainage technology, on cost structure of the BBM, and on human and oxen labour input in traditional seed covering and the construction of the BBM.*
Mic.No: 39245

0618 Ghodake, R.D. 1985. **Improved dryland technology for deep black soils: Economic evaluation and implications for credit policy.**

ICRISAT, Patancheru, AP (India). Seminar on Linking of Agricultural Research System with Commercial Banks, Puna (India), 9-12 Jul 1985, 21p., 6 tables, 1 map; 15 ref. **En**
☐*Describes the technology developed at ICRISAT for management of soil, water and crops on the basis of operational-scale watersheds of 1-25 ha which involves construction of broadbeds and furrows and use of animal-drawn wheeled toolcarriers. Presents results of on-farm verification trials and discusses the economics of the technology including costs of toolcarriers.*
Mic.No: 80358

0619 Goyal, D.; Joshi, B.R.; Taimni, V. 1981. **Comparative economics of bullock and tractor use in Rajasthan.**
Annals of Arid Zone (India), v. 20(4), p. 265-270, 4 tables; 4 ref. **En** (En)
☐*Documents time-generated growth rates of animal and tractor power crucial to the agrarian sector of Rjasthan State, India. Presents dynamic value productivity functions using bullock and tractor units as explanatory variables; and generates average and marginal rate of substitution for each region in the State in order to define relevant policy implications.*
Mic.No: 80598

0620 Hermans, C. 1985. **Modelling livestock systems in south and southeast Asia: Animal traction.**
Centre for World Food Studies, Wageningen (Netherlands), 25p., 8 fig., 5 tables; 33 ref. **En** (En)
☐*Data collected in Noakhali (Bangladesh) on liveweight, weight of different rations and working time for eight draft bulls were used to validate the SOWTV model (which includes calculations on animal traction).*
Mic.No: 80387

0621 Hopkins, E. 1972. **The response of farmers to an agricultural extension scheme: Cattle in Senegal. Final report to S.S.R.C..**
Sussex Univ., Brighton (UK). Inst. of Development Studies, 31p., 4 fig., 2 maps, 4 tables **En**
☐*Describes a project designed to study farmers' responses to an agricultural extension scheme involving introduction of bullocks as draft animals in Senegal, using data on the behaviour of farm households in a linear programming model designed to assess conditions favourable to acceptance of extension services.*
Mic.No: 80734

0622 Huybens, E. 1990. **La rentabilité du labour attelé dans la sous-préfecture de Bangouya, Guinée. (Profitability of animal-powered tillage in the Bangouya sub-prefecture, Guinea)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 168-173. 4 tables; 10 ref., ISBN 92-9081-046-7 **Fr** (En Fr)
☐*Presents findings of a study into possibilities for extending use of animal traction in the Bangouya region of Guinea, currently confined to plowing. Concludes that the only real constraint is lack of appropriate implements. Suggests that in order to increase its profitability in the region, possibilities of using animal traction for weeding and harvesting groundnuts and puddling and levelling in rice cultivation, processing agricultural products and transport should be investigated.*
Mic.No: 82051

0623 Jaeger, W.K. 1986. **Agricultural mechanization. The economics of animal draft power in West Africa.**
Westview Press. Boulder (USA), 199p., fig., tables; ref., ISBN 0-8133-7356-5 **En**
☐*Presents findings of a study on the effects of animal traction in increasing labour productivity, overcoming labour constraints, and increasing yield or area in West Africa based on farmers' subjective evaluation and results of a linear programming model of farms. Discusses policy implications of these findings for the adoption of the technology.*
Mic.No: 39596

0624 Kalla, J.C.; Joshi, B.R.; Goyal, D. 1986. **Comparative economics of traction energetics in arid areas of western Rajasthan.**
Annals of Arid Zone (India), v. 25(1), p. 61-68, 5 tables; 7 ref., ISSN 0570-1791. **En** (En)
☐*Documents and analyzes availability of animal and traction energy for the agricultural sector, and estimates the comparative economics of energy sources alternative to animal energy for arid areas of western Rajasthan, India.*
Mic.No: P00553

0625 Kinsey, B.H. 1976. **Economic research and farm machinery design in eastern Africa.**
East Anglia Univ., Norwich (UK). School of Development Studies. School of Development Studies Discussion Paper (UK), no. 10, 20p., 16 ref. **En**
☐*Discusses the relationship between economic and technical research and agricultural mechanization, need for improved machinery design, research guidelines, designing technical research to improve economic analysis (including long-term trials of power/implement combinations), effective*

reporting of research results and planning economic research to facilitate machinery design (including wheeled toolcarriers).
Mic.No: 80190

0626 Kokoye, S.J. 1990 **Impact socio-économique de la traction animale dans la province de l'Atacora, Bénin. (Socio-economic impact of the use of animal traction in Atacora province of Benin)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 186-191, 3 tables, ISBN 92-9081-046-7 **Fr** (En)
☐*Describes the introduction of animal traction to Atacora Province (Benin) since the 1960s, user training, animal draft equipment used, animal management, cultural operations carried out using animal traction and constrains to its further development.*
Mic.No: 82225

0627 McIntire, J. 1983. **Two aspects of farming in SAT Upper Volta: Animal traction and mixed cropping.**
ICRISAT, Ouagadougou (Burkina Faso). ICRISAT Economics Programme Progress Report, no. 7, 48p., 19 tables; 12 ref. **En**
☐*Presents findings of a farm management survey carried out in central Burkina Faso on animal traction and mixed cropping, describing the extent of animal traction use and its effects; compares results with those from a similar survey in eastern Burkina Faso.*
Mic.No: 80595

0628 McIntire, J. 1983. **Supply and demand hypothesis in animal traction use in Niger.**
ICRISAT, Patancheru, AP (India). ICRISAT Farming Systems Research Meeting, s.l., Aug 1983, 22p., 3 tables; 6 ref. **En**
☐*Discusses tests on hypotheses advanced to explain slow adoption of animal traction (ATR) in tropical Africa, viz lack of smiths, mechanical skills and extension and veterinary services, as well as unfamiliarity with animal care, and unprofitability of ATR, using sample data from Niger.*
Mic.No: 80037

0629 McIntire, J. 1984. **Policy environments for mechanized agriculture in sub-Saharan Africa with special reference to animal traction. (Environnements des politiques pour l'agriculture mécanisée et particulièrement la traction animale en Afrique subsaharienne)**
ILCA, Addis Ababa (Ethiopia). In: Livestock policy issues in Africa, Conference on Livestock Policy Issues in Africa, Addis Ababa (Ethiopia), 24-28 Sep 1984, 29p., 4 tables; 14 ref. **En, Fr**(En Fr)
☐*Discusses animal traction (ATR) in Africa, mentioning factors that determine its adoption, particularly population density, presence of cash crops, land abundance, tsetse pressure and soil conditions; examines the economic effects of ATR; and defines sets of agroclimatic and economic environments under which policies operate.*
Mic.No: 33742

0630 Merafe, Y.; Baker, D.; Norman, D. 1986. **Socio-economic constraints to farm equipment innovations in Botswana.**
ILO, Geneva (Switzerland); Botswana. Ministry of Agriculture. In: Initiatives for farm equipment programmes in Botswana: Improving co-ordination, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Gaborone (Botswana), 3-5 Dec 1985, p. 41-53, 1 fig., 3 tables; 6 ref. **En**
☐*Discusses the conceptual framework into which farm equipment innovations must fit and the economic, social and institutional constraints to wider adoption of farm equipment innovations including climate, lack of local manufacturers and testing, lack of demonstrated benefit to potential adopters and shortage of carts.*
Mic.No: 80833

0631 Mettrick, H.; James, D.P. 1981. **Farm power in Bangladesh. Volume 2.**
Reading Univ. (UK). Dept. of Agricultural Economics and Management. Reading University, Department of Agricultural Economics and Management Development Study (UK), no. 20, 110p., fig., tables; 15 ref. **En**
☐*The first part of this report by H. Mettrick (Some aspects of the economics of animal power) covers availability of draft animals, demand for draft power, use of draft cows, costs, and sharecropping and draft power in Bangladesh and concludes that there will be a decline in numbers of draft animals available over the next few years. The second part by P. James (Mechanisation and institutions in Noakhali) presents a detailed examination of the effects of introduction of tractors following a cyclone and tidal bore in 1970 on field cultivation and socio-economic change in two villages in Noakhali District.*
Mic.No: 80888

0632 Mishra, D.K.; Pandey, R.N.; Pandey, V.K. 1976. **Economic costs of bullock and tractor power use in Uttar Pradesh agriculture.**
Indian Journal of Agricultural Economics, v. 31(3), p. 193-199, 4 tables, ISSN 0019-5014. **En**

□*Compares the economics of bullock or tractor power use in Uttar Pradesh, India, by estimating the costs of bullock or tractor power at the farm level; by estimating and comparing the cost of draft power needed for operating the State's net cultivated area exclusively through either bullock or tractor power; and by studying the feasibility of replacing bullocks by tractors.*
Mic.No: 80605

0633 Monnier, J. 1965. **Contribution à l'étude de la traction bovine au Sénégal. 2e Partie. Interprétation des chiffres obtenus. (Study of cattle traction in Senegal. Part 2. Interpretation of data)**
Machinisme Agricole Tropical (France), no. 11, p. 15- 27, 14 tables, 4 photographs; 19 ref.
Fr (En Fr)
□*Technical problems of selecting, feeding, sheltering and harnessing draft animals are discussed and two types of rustic cattle shed described. Tabulates results of tractive and working time tests. Concludes that the optimum area to be tilled by an average family with one pair of oxen varies from 16 to 21 acres according to the implements used; this can increase to 32 acres where two pairs of cows and additional equipment are used. Economic benefits of draft animal use and means of promoting the optimum use of draft animals available are discussed.*
Mic.No: 80279

0634 Msango, A.S.D. 1980. **Determination of optimum hectarage for a pair of work oxen and a man using hand hoe.**
Bunda College of Agriculture, Lilongwe (Malawi), 20p., 2 tables; 2 illus; 13 ref. B.Sc. (Agriculture). **En** (En)
□*Presents results of a survey conducted in one of the units of the Lilongwe Land Development Programme, Malawi, to find optimum hectarage for a pair of work oxen and a man using a hand hoe, on the basis of work rates for planting, first weeding and earthing-up of maize.*
Mic.No: 55159

0635 Munzinger, P. 1982. **Micro- and macroeconomic aspects. (Aspects économiques de la culture attelée)**
Munzinger, P. (ed.) In: Animal traction in Africa, p. 269–337, 7 photographs, 2 fig., 10 tables, ISBN 3-88085-133-6 **En, Fr**
□*Discusses issues related to the economics of the use of draft animals especially under African conditions and the planning of projects aimed at introducing and promoting the use of draft animals. Describes micro- and macroeconomic effects of using animal traction; empirical findings regarding the profitability of animal traction in comparison with other levels of mechanization, and an assessment system, using economic evaluation methods and criteria in order to permit micro- and macroeconomic evaluation of animal traction.*
Mic.No: 80669

0636 Ndiame, F.; Sonko, M.L.; Fall, A.; Diouf, B. 1986. **La culture attelée dans les systèmes de production de la Basse-Casamance: aspects techniques et implications socio-économiques. (Animal traction in the production systems of Lower Casamance: Technical aspects and socio-economic impact)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Sénégal), no. 86-3, 29p., 3 fig., 9 tables, 2 maps; 12 ref. **Fr** (En Fr)
□*Animal traction is unevenly developed throughout the Lower Casamance region of Senegal, its use rarely going beyond land preparation due to poor adaption of the technology and underutilization of existing equipment. It is suggested that as annual rainfall and the length of the rainy season decline animal traction may enable a crop to succeed where traditional methods fail. Cash-flow and cost-benefit analysis identified the conditions for better use of the technology and those needed for profitable investment.*
Mic.No: 80775

0637 Ndiame, F. 1988. **Animal traction in Lower Casamance: Technical aspects and socio-economic implications. (La culture attelée dans les systèmes de production de la Basse-Casamance: aspects techniques et implications socio-économiques)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 253–262, 1 map, 4 tables; 12 ref., ISBN 3-528-02047-4 **En, Fr** (En)
□*Reasons for the relatively poor and unequal usage of animal traction in the Lower Casamance region of Senegal (it rarely goes beyond land preparation) are discussed. The impact of animal traction on labour productivity remains low and is associated with low use of existing equipment and only partial adoption of technological options available. Cash-flow and cost-benefit analyses have identified the necessary conditions for better use of the technology and to make investments in the area profitable.*
Mic.No: 82021

0638 Oluoch-Kosura, W. 1983. **An economic analysis of alternative methods of land preparation in Western Province, Kenya.**

Cornell Univ., Ithaca, NY (USA). Dept. of Agricultural Economics. Cornell International Agriculture Mimeograph (USA), no. 103, 71p., 10 tables; 54 ref. **En** (En)
☐*Examines the potential for increasing output of maize in western Kenya through levels of farm mechanization that are economically viable, by identifying the relationships that exist between mechanization and other factors of production, comparing the relative factor productivity among different forms of mechanization, and evaluating the profitability of employing different technologies for maize production.*
Mic.No: 34038

0639 Oppen, M. Von; Ghodake, K.G.; Kshirsagar, K.G.; Singh, R.P. 1985. **Socioeconomic aspects of transfer of Vertisol technology.**
ICRISAT, Patancheru, AP (India). IBSRAM/ICRISAT/SMSS Inaugural Workshop on Management of Vertisols for Improved Agricultural Production, Patancheru (India), 18–22 Feb 1985, 23p., 1 fig., 6 tables; 15 ref. **En**
☐*Discusses constraints to be overcome for wider adoption of improved Vertisol management systems, describes improved Vertisol technology which relies on broadbeds and furrows and use of ox-drawn wheeled toolcarriers, performance of the technology at ICRISAT centre, constraints to use of bullock labour and cash and credit requirements. Suggests that an important area of research is development of cheaper wheeled toolcarriers.*
Mic.No: 80355

0640 Orsini, J.P.G.; Lhoste, P.; Bouchier, A.; Faye, A.; Niang, L. 1985. **Une typologie d'exploitations agropastorales au Sine-Saloum, Sénégal. (Typology of agropastoral use in Sine Saloum, Senegal)**
Revue d'Elevage et de Médecine vétérinaire des Pays Tropicaux (France), v. 38(2), p. 200–210, 5 fig., 4 tables; 10 ref., ISSN 0035–1865. **Fr** (En Es Fr)
☐*Multivariate analysis of the results of a survey of 245 farms in Sine-Saloum, Senegal, was used to construct a typology of agropastoral farms. Discusses the functioning of the farming systems involved in terms of farm dynamics in relation to economic factors and draft animals.*
Mic.No: 80786

0641 Panin, A. 1986. **A comparative socio-economic analysis of hoe and bullock farming systems in northern Ghana.**
Georg-August-Universitat, Gottingen (Germany, F.R.), 190p., 8 fig., 48 tables; ref. Ph.D. (Agriculture). **En**
☐*Evaluates the farm-level impact of bullock traction technology in parts of northern Ghana, examining its effects on production in dryland farming systems, labour, land, crop yields, household income, productivity, utilization of farm produce, and annual cash incomes. Also assesses the impact of bullock traction experience on the farming system.*
Mic.No: 37863

0642 Panin, A. 1987. **The use of bullock traction technology for crop cultivation in northern Ghana: An empirical economic analysis. (Utilisation agricole de la traction bovine dans le Nord-Ghana: une analyse économique empirique)**
ILCA Bulletin(Bulletin du CIPEA), no. 29, p. 2–8, 11 tables; 16 ref., ISSN 0255–0008. **En, Fr** (En)
☐*Assesses the economic impact of bullock traction technology on the farming systems in northern Ghana. Compares the technical and economic aspects of the hand hoe and bullock traction technology.*
Mic.No: 80743

0643 Panin, A. 1990. **Profitability assessment of animal traction investment: The case of northeastern Ghana.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 201–207, 4 tables; 8 ref., ISBN 92–9081–046–7 **En** (En)
☐*Investment in animal traction in sub-Saharan Africa has steadily increased since the mid 1970s but farmers' adoption of the technology has been disappointing raising the question whether the investment is profitable to farmers. Shows, using data from northern Ghana, that animal traction for cropping is profitable, producing an internal rate of return of 51% and increasing average income over hoe-farming by 21%. A decrease of more than 11% in output, however, renders the investment unprofitable. Concludes that the first three years of animal traction use represent a considerable financial burden to the farmer and this coupled with risks involved in rainfed agriculture may inhibit the adoption of animal draft technology.*
Mic.No: 82223

0644 Perkins, J.; Semali, A. 1989. **Economic aspects of draught animal management in Subang, Indonesia.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 294–299, 5 diagrams; 4 ref., ISBN 1–86320–003–7 **En** (En)

□*Presents results of a study of 10-year inventories for cattle and buffalo in village households at Subang which showed that turnover was more rapid than anticipated indicating farmers' strong awareness of their non-draft value. Concludes that research which links production with draft would have greater impact and acceptability than research concentrating on draft alone.*
Mic.No: 80949

0645 Phillip, D.O.A.; Abalu, G.O.I.; Ingawa, S.A. 1988. **Economic implications of animal power at the small-scale level in the savannah zone of northern Nigeria: A linear programming simulation of farmer circumstances.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 225–232, 7 tables; 16 ref., ISBN 3-528-02047-4 **En** (En)
□*Briefly describes farming systems in northern Nigeria. Labour is the main constraint particularly during Jun-Aug. Animal traction is a possibility for removing the labour constraint yet only 5.5% of the area is cropped using animals and 86% is hand-hoed. Working with 6 sole crop enterprizes and a set of representative farmer situations, linear programming techniques were used to determine the optimal enterprise combination if animal traction were introduced on a hiring-in or borrowing basis. In the model only maize and groundnut appeared in the optimal solutions. Even when oxen were readily available at low cost, labour constraints dominated the model. This model suggests that oxen cannot fully replace manual labour at critical times.*
Mic.No: 82018

0646 Phillip, D.O.A.; Abalu, G.O.I.; Aganga, A.A.; Aduku, A.O. 1990. **Animal traction technology in northern Nigeria: A survey of constraints and a model of prospects.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 370–375, 7 tables; 5 ref., ISBN 92-9081-046-7 **En**
□*Presents methodology and results of a study based on 84 farmers in the Kadawa area to investigate long-term prospects for use of animal traction for ridging in northern Nigeria and actual and potential constraints to its wider adoption. Concludes that 22.5, 28.7 and 48.8% of the sampled farmers will be using hand hoes, tractors and animal traction, respectively, for ridging in the long-term. Major constraints to wider adoption of animal traction in the region are availability and cost of implements and the fact that most post-ridging activities are unsuitable for draft animals. Recommends that the Government provide readily accessible veterinary services for draft animals, incentives for local equipment manufacture, credit for purchase and maintenance of draft animals and equipment and support research into better breeds for draft.*
Mic.No: 82036

0647 Pollard, S.J.; Wainaina, C.K. 1982. **Oxen or tractors: Part 1.**
Livestock International (UK), v. 10(3), p. 62–63, ISSN 0306-8560. **En**
□*Presents part of a survey undertaken by Kenya's Ministry of Agriculture to examine factors influencing decisions of farmers regarding farming and household circumstances, farming methods, and problems and needs of the farmer. Compares merits of oxen and tractors in light of the above.*
Mic.No: 28774

0648 Pollard, S.J.; Wainaina, C.K. 1982. **Oxen or tractors: Part 2.**
Livestock International (UK), v. 10(4), p. 94–95, 2 tables, ISSN 0306-8560. **En**
□*Examines the relative costs of purchase, ownership and use of tractors and oxen, with particular reference to the condition of smallholders in Kenya.*
Mic.No: 28766

0649 Pollard, S.J.; Wainaina, C.K. 1982. **Oxen or tractors: Part 3.**
Livestock International (UK), v. 10(5), p. 121–122, ISSN 0306-8560. **En**
□*Compares oxen and tractors in terms of costs, availability, versatility, reliability and convenience, with particular reference to the condition of Kenyan smallholders.*
Mic.No: 28767

0650 Reddy, Y.V.R.; Rastogi, B.K. 1985. **Economics of maintenance of draught animals in arid/semi-arid tropics.**
Indian Veterinary Journal, v. 62, p. 156–161, 3 tables; 4 ref., ISSN 0019-6479. **En** (En)
□*Presents results of a study carried out in arid and semi-arid areas in India in order to determine the economics of maintaining a pair of bullocks, using data collected at 13 centres covering 80–100 farmers. Suggests the provision of gainful employment through improved dryland technology and better transportation system in order to reduce the cost of maintenance of a pair of bullocks.*
Mic.No: P00519

0651 Rossi, M.T. 1988. **Evaluation coûts/avantages de la culture attelée dans les zones d'action du Projet Nord-Togo.**

(Cost/benefit evaluation of animal traction in the action zones of the Projet Nord-Togo)
s.n., s.l., Séminaire d'Economie Rurale, Montpellier (France), 12–16 Sep 1988, 33p., 2 tables **Fr**
☐*Evaluates the costs and advantages of animal traction in the action zones of the North Togo Project.*
Mic.No: 80346

0652 Ryan, J.G.; Sarin, R. 1981. **Economics of technology options for vertisols in the relatively dependable rainfall regions of the Indian semi-arid tropics.**
ICRISAT, Patancheru, A.P. (India). In: Improving the management of India's deep black soils, Seminar on Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, New Delhi (India), 21 May 1981, p. 37–57, 5 fig., 8 tables, 1 map; 9 ref. **En**
☐*Describes research at ICRISAT on improved watershed-based technology using wheeled toolcarriers for formation of graded broadbeds and furrows and for graded distribution of seeds and fertilizer. Discusses effects of the improved technology on requirements for human and bullock labour, prospects for other regions of India and policy issues (including availability of bullock power, farmer loans, wheeled toolcarriers and training).*
Mic.No: 80866

0653 Ryan, J.G.; Oppen, M. Von. 1983. **Assessment of impact of deep Vertisol technology options.**
ICRISAT, Patancheru, AP (India). ICRISAT Economics Programme Progress Report, no. 59, 14p., 1 fig., 4 tables **En**
☐*Reports results of an on-farm experiment in Tadanpalle Village, India, to verify ICRISAT's experience with Vertisol technology options for which wheeled toolcarriers were provided free to farmers. Analyzes costs of using wheeled toolcarriers and concludes that there is considerable promise for adoption of the technology options.*
Mic.No: 80357

0654 Ryan, M.; Abeyratne, F.; Farrington, J. 1981. **Animal draught – the economics of revival.**
Agrarian Training and Research Inst, Colombo (Sri Lanka). Joint ARTI/Reading University Farm Power Study Team Occasional Publication (UK), no. 23, 213p., tables **En**(En)
☐*Discusses the erosion of the traditional role of buffaloes in paddy cultivation in Sri Lanka over the last thirty years and the increasing interest in buffaloes for small-scale farming as economic factors make maintaining the present tractor-based strategies more difficult. Data from 443 farmers and power owners (including 88 buffalo owners) at three major colonization schemes were collected in twice-weekly visits over a 14-month period (Aug 1979–Oct 1980). Analysis of tractor and buffalo operating costs provided strong economic justification for expanding animal draft. Suggests that ownership and not hiring of draft animals, should be promoted. Discusses relevant issues.*
Mic.No: 80392

0655 Sarin, R.; Ryan, J.G. 1983. **Economic assessment of improved watershed-based technology options in on-farm experiments.**
ICRISAT, Patancheru, AP (India). Economics Programme. ICRISAT Economics Programme Progress Report, no. 46, 20p., 9 tables; 4 ref. **En** (En)
☐*Examines the economics of on-farm watershed experiments, in which labour was provided using draft animals and wheeled toolcarriers, conducted by the Farming Systems Research and Economics Programs in the Akola and Sholapur regions (Maharashtra) and Mahbubnagar (Andhra Pradesh). Profits from improved watershed technology did not differ significantly from those from traditional systems. Suggests that cheaper alternatives to wheeled toolcarriers should be explored.*
Mic.No: 80351

0656 Sehara, D.B.S.; Purohit, M.L 1983. **Crop returns, human employment and resource use productivity on bullock and tractor farms in Upper Luni Basin (W. Rajasthan).**
Annals of Arid Zone (India), v. 22(1), p. 29–35, 4 tables; 4 ref., ISSN 0570–1791. **En** (En)
☐*Presents results of a study carried out in Western Rajasthan, India, to compare the economics of bullock and tractor use with regard to input use, cropping pattern, human employment, crop income and resource use productivity.*
Mic.No: 80600

0657 Singh, J.; Mathur, D.C.; Gupta, A.K. 1986. **A study on use of traction and bullock labour in cultivation of vegetable crops in Delhi.**
Agricultural Situation in India, v. 41(1), p. 29–30, 1 table **En**
☐*Discusses results obtained in a study conducted to compare costs incurred by vegetable cultivators using tractors or bullock power; also assesses economic aspects of using tractor/bullock power for land preparation.*
Mic.No: 80029

0658 Sisler, D.G. 1980. **Some economic aspects of managing land, waterpoints and arable agriculture in Botawana.**

s.n., s.l., 31p. **En**
☐*Discusses factors which contributed to the rapid increase in Botswana's national cattle herd and the implications of the expansion on national development strategy; assesses farmers' decision making relative to the use of cattle, crop land and range in the eastern hardveld, and managerial decisions of small herd owners with particular reference to the needs for draft power; examines marketing decisions as well as economic issues pertaining to water-point and management.*
Mic.No: 57207

0659 Sleeper, J.A. 1978. **An economic analysis of the role of ox-plowing and cattle feeding in the stratification of West African livestock production.**
Maryland Univ., College Park (USA). Faculty of the Graduate School, 161p., 6 fig., 21 tables; 18 ref. M.Sc. **En**
☐*Presents results of an analysis through construction of indicative budgets and herd inventory models based on review of farm management data, to determine if bovine traction and small-scale cattle feeding practices did increase net farm income, demand for immature cattle and rural meat supply in West Africa. Outlines economic factors limiting ox cultivation, measures to mitigate them and effects of its increasing adoption on demand for immatures from the north. Examines profitability and economic future of stall-feeding of cattle on small peasant farms.*
Mic.No: 15893

0660 Starkey, P.H.; Verhaeghe, H. 1981. **An economic comparison of methods of upland cultivation in Sierra Leone with special reference to the use of work oxen.**
9. Annual Conference, Inmakeni (Sierra Leone), Sierra Leone Agricultural Journal, v. 6(2), p. 108–116, 1 fig., 10 tables; 10 ref. **En** (En)
☐*Presents results of trials comparing the use of work oxen with hand and tractor operations.*
Mic.No: 80297

0661 Strubenhoff, H.W. 1987. **Problème des Ubergangs von der Handhacke zum Pflug – Eine okonomische Analyse dder Einfuhrung der tierischen Anspannung in Ackerbausysteme Togos. (Problems of moving from hand hoes to animal-drawn plows. An economic analysis of the introduction of animal traction into the farming systems of Togo)**
Technische Univ., Berlin (Germany, F.R.). Fachbereich Internationale Agrarentwicklung, Dr.Sc.Agr. **De** (Fr)
☐*Presents an economic analysis of the effects of animal traction on the farming systems of Togo.*
Mic.No: 80340

0662 Venkataram, J.V.; Ramanna, R. 1977. **Economics of power tiller vs. bullock power in preparing paddy land.**
Mysore Journal of Agricultural Sciences (India), v. 11(2), p. 239–243, 1 table; 1 ref., ISSN 0047–8539. **En**
☐*Discusses the economic and other advantages of preparing paddy land by power tillers instead of using bullock power, with particular emphasis on costs involved and the quality and quantity of work performed.*
Mic.No: 86288

SOCIAL IMPLICATIONS OF ANIMAL TRACTION

0663 Abel, N.; Gibbon, D.; Coleman, V. 1986. **The introduction of draft oxen in sub Saharan Africa: Some hidden costs.**
East Anglia Univ., Norwich (UK) School of Development Studies. Intermediate Technology Development Group Agriculture and Water Development Forum: Livestock Development in Semi Arid Areas, 27–28 Jun 1986, 23p., 11 tables **En** (En)
☐*Analyzes support systems required for animal draft technology in sub-Saharan Africa (size and structure of herd needed to reproduce the draft animals, grazing system management, economy of households for which the technology is intended and sustainability of the farming system). Suggests that failure to appreciate the complexity of such support systems can lead to incorrect assessments of the impact of draft technology including real costs and benefits of adoption and its environmental consequences.*
Mic.No: 80838

0664 Allagnat, P. 1984. **Methodology for an on-farm research. The case of a socio-economic survey on the use of ox-traction in the Mabole Valley-Sierra Leone.**
Sierra Leone Work Oxen Project, Freetown, 127p., 2 fig., 5 tables, 1 map; 30 ref. **En**
☐*Presents the methodology for a socio-economic study on the use of ox-traction in the Mabole Valley of Sierra Leone.*
Mic.No: 80311

0665 Allagnat, P.; Koroma, B. 1984. **Socio-economic survey on the use of ox traction in the Mabole Valley – Bombali District.**
Sierra Leone Work Oxen Project, Freetown, 170p., 5 fig., 86 tables; 28 ref. **En**
☐*Presents the results of case studies on five farms in the Mabole Valley and presents conclusions based on agronomic and socio-economic data obtained even though the sample size was small.*
Mic.No: 80315

0666 Bah, M.S. 1990. **Social constraints on the adoption and expansion of work oxen in Sierra Leone.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 337–341, ISBN 92-9081-046-7 **En** (En)
☐*Presents observations made during research into indigenous technical knowledge of the Fulani and general extension work in Sierra Leone. Discusses social division of labour and ethnicity, attitude towards animals (generally neglect), access to land, "company" labour, village politics and litigation, national politics, the gender issue and perception of work oxen. Concludes that sociological aspects of ox-traction should be considered as much as, if not more than, technical and economic aspects as farmers are the ultimate determiners of success and adoption of technology packages. Calls for location-specific research to avoid over-generalization.*
Mic.No: 82116

0667 Bratton, M. s.d. **Draft power, draft exchange and farmer organizations.**
Zimbabwe Univ., Harare. Dept. of Land Management. Zimbabwe University, Department of Land Management Working Paper, no. 9/84, 32p., 10 tables; 16 ref. **En**
☐*Describes the extent of draft exchange, its institutional forms, and its social and economic consequences in Zimbabwe.*
Mic.No: 86707

0668 Dronne, M. 1970. **Problèmes humains du développement de l'élevage en zone sud du Tchad. (Social problems in the development of livestock production in southern Chad)**
Machinisme Agricole Tropical (France), no. 29, p. 19–21, 1 photograph **Fr** (En)
☐*Discusses the social effects of the introduction of animal traction into southern Chad. It has allowed savings in time taken in soil preparation, planting and cultivation operations to be used for new activities like fertilizer spreading, crop protection and de-stumping, but constraints to animal traction are mainly social with farmers reluctant to try new ideas. Suggests that economic benefits should be stressed when persuading farmers to adopt the new technology and then problems involved with animal care and supply of oxen should be tackled.*
Mic.No: 80805

0669 Dronne, M. 1971. **Problèmes humains du développement de l'élevage en zone sud du Tchad. (Human problems related to animal husbandry development in southern Chad)**
Organisation Commune Africaine et Malgache, Yaoundé (Cameroun); Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). In: Colloque sur l'Elevage, Colloque sur l'Elevage, N'djamena (Tchad), 8–13 Dec 1969, p. 612–633, 1 table **Fr**
☐*Describes traditional social and modern economic motivetions in animal production in southern Chad, with reference to constraints of physical and human environment and to the role of animal traction in crop-livestock integration.*
Mic.No: 80676

0670 Gboku, M.L.S. 1983. **An investigation into the historical and socio-economic background of oxenisation in the Mabole Valley, Bombali District.**
Sierra Leone Work Oxen Project, Freetown, 107p., 4 fig., 35 tables; 20 ref. **En** (En)
☐*Gives a brief description of the history of ox traction in the Mabole Valley. Provides details of the household characteristics and farming activities of ox-owners and non ox-owners, their social and cultural heritage and economic characteristics, based on a survey of the scanty data available in libraries, project reports and administrative files and on observations, questionnaires and field work in 26 settlements. Constraints to oxenization are discussed and recommendations made in the fields of eqipment, animal health, loans and hiring, research and extension.*
Mic.No: 80309

0671 Gboku, M.L.S. 1988. **Farmer social variables influencing the adoption of agricultural innovations in Sierra Leone.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 311–319, 17 ref., ISBN 3-528-02047-4 **En**
☐*Covers the history and developent of ox traction in Sierra Leone, its role and importance in rural development and its potential and challenges. Discusses the effect of social features of farmers on their adoption of innovations giving findings from the Mabole Valley concerning the role of women and blacksmiths and the general view of farmers towards ox traction. Implications and suggestions for future research efforts are discussed.*
Mic.No: 82026

0672 Ghodake, R.D.; Ryan, J.G.; Sarin, R. 1981. **Human labour use with existing and prospective technologies in the semi-arid tropics of south India.**
Journal of Development Studies (UK), v. 18(1), p. 25–46, 4 fig., 5 tables; 24 ref., ISSN 0022-0388. **En** (En)

☐*Reports on a study on six villages in peninsular India into likely effects of introduction of land, water and crop management technology developed at ICRISAT on existing village labour-use patterns.*
Mic.No: 80870

0673 Horowitz, M.M. 1979. **The sociology of pastoralism and African livestock projects.**
AID Program Evaluation Discussion Paper, no. 6, 111p., 107 ref. **En**
☐*A brief (11p) section covers problems involved in the introduction of animal traction in Burkina Faso and Mali. Farmers questioned the technological, environmental and socio-economic benefits of animal traction compared with traditional hoe cultivation.*
Mic.No: 80769

0674 Johnston, B.F. 1980. **Socio-economic aspects of improved animal-drawn implements and mechanization in semi-arid East Africa.**
ICRISAT, Patancheru, AP (India). In: Proceedings of the international workshop on socio-economic constraints to development of semi-arid tropical agriculture, International Workshop on Socio-economic Constraints to Development of Semi-Arid Tropical Agriculture, Hyderabad (India), 19-23 Feb 1979, p. 221-233, 2 tables; 27 ref. **En** (En Fr)
☐*Examines the socio-economic factors most relevant to decisions concerning the role of animal-drawn implements in the semi-arid farming regions of Kenya, Tanzania and Uganda, with emphasis on structural and demographic features that should be taken into consideration in determining agricultural research priorities and development strategies.*
Mic.No: 82096

0675 Jones, A. 1990. **Socio-economic constraints to the use of animal traction for rainfed rice production in The Gambia.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 310-316, 1 table; 14 ref., ISBN 92-9081-046-7 **En** (En)
☐*Farm mechanization is widespread in The Gambia but use was restricted to upland crops until recent research showed that upland equipment could also be used in rice fields. Examines socio-economic factors associated with gender roles in crop production and resource control which must be confronted if animal traction is to spread to rice. Household case studies indicated that rice is cultivated by hand as the women's contribution to domestic food production and not as a cash crop; men, using animal traction, cultivate both food crops (millet and sorghum) and cash crops (groundnuts). Concludes that household heads must be convinced that use of animal traction in rice production will increase yields and therefore reduce need to purchase food staples.*
Mic.No: 82065

0676 Kalb, D. 1982. **Sociological aspects of the use of draught animals on African smallholdings. (Aspects sociologiques de l'utilisation de la traction animale dans l'agriculture paysanne africaine)**
Munzinger, P. (ed.). In: Animal traction in Africa, p. 341-372, ISBN 3-88085-133-6 **En, Fr**
☐*Describes essential sociological features of African smallholders in terms of their relevance to the use of draft animals, with particular reference to the division of labour, cultural identity, social stratification, land law, and taboos; presents criteria for the implementation of projects aimed at promoting the use of draft animals; and outlines the role of extension services and credit facilities in the spread of innovations.*
Mic.No: 80685

0677 N'Diaye, A.D. 1973. **Problèmes sociaux et économiques poses par l'introduction de la culture attelée en milieu rural dans le cadre de l'opération arachide du Mali. (Social and economic problems posed by the introduction of animal traction in rural areas within the framework of the groundnut operation in Mali)**
Bureau pour le Développement de la Production Agricole, Paris (France), 35p., 3 maps, 4 tables **Fr**
☐*Discusses conditions for the success of animal traction in Mali, particularly referring to those concerned with the management and selection of animals, choice of implements and soil conservation systems; includes recommendations.*
Mic.No: 05440

0678 Nelson-Fyle, M.R.; Sandhu, R. 1990. **The impact of animal traction on women.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 153-155, ISBN 92-9081-046-7 **En**
☐*Concludes that animal traction is advantageous and can improve living standards of both men and women, but advantages are positive only if it is introduced with both sexes in mind and effects of its use considered for all sectors of society; introduction of animal traction must be within the social, economic and cultural context of the community.*
Mic.No: 82063

0679 Roosenberg, R. 1986. **Looking back at the long-term effects of animal traction.**
Tillers Report (USA), Fall/Winter, p. 1–2, 10, 3 photographs **En**
☐*Describes changes observed on re-visiting Togo and Benin since the author's initial visit introducing ox-farming skills in North Benin in 1969–72. Comments on the new independence and initiative that ox-power has given to farmers.*
Mic.No: 80368

0680 Ryan, J.G. (ed.) 1980. **Socio-economic constraints to development of semi-arid tropical agriculture.**
ICRISAT, Patancheru, AP (India). International Workshop on Socio-economic Constraints to Development of Semi-Arid Tropical Agriculture, Hyderabad (India), 19–23 Feb 1979, 435p., fig., tables; ref. **En, Fr**
☐*Proceedings of a workshop whose objective was to consider ways and means of overcoming constraints identified during the participants' research in the semi-arid tropics. Presented papers focussed on the role of new technologies or policies aimed at alleviating these constraints.*
Mic.No: 80897

0681 Starkey, P.H. 1987. **Animal power in development: Some implications for communities.**
Community Development Journal (UK), v. 22(3), p. 219–227, 2 fig.; 11 ref. **En**
☐*Discusses some of the implications of promoting draft animal power use for rural communities, including consequences related to changes in the farming systems, effects on domestic economies, effects on the work loads at different times for different groups, changes in risk, and implications for community friction or cooperation.*
Mic.No: 86977

0682 Steinfeld, H. 1984. **The impact of storing water in excavated ponds on water constraints. A case study of reservoirs constructed using ox-drawn scoops, Debre Berhan, Ethiopia.**
90p., 13 fig., 14 tables; ref. **En** (En De)
☐*Presents the results of a survey of scoop technology tested by excavating a pond at ILCA's research site at Debre Berhan, Ethiopia, in 1983/84. Defines constraints on the traditional farm-household system and assesses the impact of storing water in excavated ponds on water constraints, with emphasis on technical and organizational issues involved in the application of the innovation.*
Mic.No: 38583

0683 Vail, D.J. 1973. **Induced farm innovation and derived scientific research strategy: The choice of techniques in developing smallholder agriculture in land abundant areas.**
East African Journal of Rural Development (Kenya), v. 6(1,2), p. 1–17, 17 ref. **En**
☐*Examines the major reasons for the failure of the derived research model in East Africa and proposes the adoption of an applied research strategy derived from the technological constraints limiting productivity, with particular reference to alternative technological choices combining the use of improved seeds, fertilizers, draft animals and drainage systems with minimum costs to achieve sustained development.*
Mic.No: 80736

0684 Zweier, K. 1986. **Women can handle draught oxen, too.**
GTZ, Eschborn (Germany, F.R.). GATE (Germany, F.R.), no. 86/6, p. 17–19, 2 photographs **En** (En Es Fr)
☐*Discusses the effect on the social and economic position of women of the integration of men into work in the fields by introducing animal traction and the success of a programme to promote women's interests and their acceptance as farmers by men.*
Mic.No: 80234

MANAGEMENT AND TRAINING OF DRAFT ANIMALS

0685 Akou, A. s.d. **Oxen are never written off.**
Uganda. Ministry of Agriculture and Animal Resources, 26p., 15 drawings, 14 photographs **En**
☐*Presents, in a simple form intended for extension workers, background information on and problems involved in introduction of draft oxen in Uganda, and describes and illustrates methods of training, yokes, reins, animal management and draft implements (plows and wheeled toolcarriers) and how they can be made (or obtained) and used.*
Mic.No: 80185

0686 Anon. 1933. **The ox.** War Office, London (UK). In: Animal management, p. 303–309, 2 tables **En**
☐*Discusses the general characteristics of oxen and their uses as draft animals in South Africa and India, mentioning the selection of oxen for work, the age up to which they are serviceable and the care that must be taken in their handling.*
Mic.No: 20614

0687 Anon. 1971. **Le boeuf de travail voltaïque. (Work oxen in Upper Volta)**
Cahiers d'Agriculture Pratique des Pays Chauds (France), no. 3, p. 167–170 **En**

☐*Discusses briefly the management of work oxen in Burkina Faso, referring to housing, feeding, health care, domestication, training and harnessing practices.*
Mic.No: 68686

0688 Anon. 1976. **Using work oxen in Malawi.**
Malawi. Ministry of Agriculture and Natural Resources, 11p., 18 drawings, 1 photograph **En**
☐*Booklet designed for farmers and extension staff in Malawi describing selection, training and management (housing, feeding, working and health) of work oxen, use and maintenance of carts, plows, ridgers and cultivators, how to make yokes and harnesses and from where to obtain further advice.*
Mic.No: 80446

0689 Anon. 1982. **A guide for extension officers to assist in the conduct of demonstrations to farmers of improved agricultural equipment.**
Kenya. Ministry of Agriculture. Small Farm Mechanisation Programme, 27p. **En**
☐*Details important points to be made when demonstrating small-scale agricultural equipment to farmers.*
Mic.No: 80809

0690 Anon. 1983. **Gros élevage et culture attelée. (Livestock production and animal traction)**
Agripromo (Côte d'Ivoire), no. 41, 24p., 3 fig., 4 tables, 9 photographs, 1 map **Fr**
☐*This special issue of Agripromo includes brief articles on animal traction in the Bambari region of the Central African Republic, Togo and Burkina Faso, feeding oxen for work and breeding, animal traction equipment in Cameroon, Côte d'Ivoire, Mali and Senegal (tables) and how to adjust plows.*
Mic.No: 80332

0691 Anon. 1984. **Mémento de culture attelée. (Notes on animal traction)**
Centre d'Action Régionale pour le Développement Rural, Borgou (Bénin), 108p., drawings, tables **Fr**
☐*This publication on animal traction is in four parts: animals (choice of animal, training, feeding, housing and manure, and health); equipment; farming operations suitable for animal traction; costs.*
Mic.No: 80223

0692 Anon. 1986. **Selection, care and training of draft cattle for agricultural extension workers and extension supervisors.**
Zimbabwe. Ministry of Lands, Agriculture and Rural Settlement. Dept. of Agricultural, Technical and Extension Services; Institute of Agricultural Engineering, Harare (Zimbabwe). Animal Power Training Centre, 188p. **En**
☐*Presents guidelines for extension workers and supervisors who will assist farmers in solving problems associated with draft cattle, covering procedures for selecting, feeding and health care of draft cattle, special harnesses that should be used and steps in training the cattle.*
Mic.No: 80035

0693 Anon. 1987. **Using donkeys for draught power. Part I. Principles of animal draught. Part II. Donkey management. Part III. Harnesses for donkeys. Part IV. Hitches for donkeys.**
Botswana. Ministry of Agriculture. Agricultural Information Services, v.p., fig., tables **En**
☐*Presents information on the use of donkeys for draft purposes, with particular reference to the principles involved when using animal power, as well as proper management, harnessing and hitching of donkeys.*
Mic.No: 38949

0694 Anon. 1987. **Force animale.**
Projet pour la Promotion de la Traction Animale, Atakpame (Togo). Force Animale (Togo), no. 2, 21p., tables, drawings **Fr**
☐*The second issue of this publication devoted to animal traction contains short articles on animal health, tours by the Minister of Rural Development and uses of farmyard manure and technical notes on animal shelters, mangers, troughs, manure pits, yokes and yoking.*
Mic.No: 80800

0695 Anon. s.d. **Animal power.** World Neighbors, Oklahoma City, Okla. (USA). World Neighbors in Action (USA), v. 11(1E), 8p., 22 photographs, 1 map **En**
☐*Describes an animal traction training programme in Yendi, Ghana.*
Mic.No: 80334

0696 Anon. s.d. **Guide on the care and management of work bulls.**
Ahmadu Bello Univ., Zaria (Nigeria). Agricultural Extension and Research Liaison Services. AERLS Extension Guide (Nigeria), no. 58, 5p. **En**
☐*Presents guidelines for the selection, housing, feeding, handling and health care of work bulls.*
Mic.No: 80623

0697 Anon. s.d. **Les bovins utilisés en Haute-Volta pour traction animale. (Cattle used for animal traction in Upper Volta)**

FAO, Rome (Italy), 42p., 150 photographs **En, Fr**
□*This booklet accompanying a filmstrip illustrates types of draft cattle available in Burkina Faso, how to choose suitable animals and training methods.*
Mic.No: 80895

0698 Anon. s.d. **Ox shoeing. Making and fitting ox shoes.**
s.n., s.l., 10p., 7 fig. **En**
□*Presents practical tips for the preparation and fitting of ox shoes.*
Mic.No: P00539

0699 Anon. s.d. **The donkey.**
s.n., s.l., 3p. **En**
□*Presents brief information on the breeding, feeding and housing of donkeys as well as on the rearing of foals.*
Mic.No: 38993

0700 Anon. s.d. **Training a farmer and the draught animal, Vol. 1.**
Action Aid-Kenya, Nairobi, 33p. **En**
□*Presents guidelines for workers engaged in the training of farmers on the use of animals for work and transport, covering the selection, training and feeding of working animals, tick and worm control, purchasing and castration of bulls, making of yoke, reins and muzzle, general principles of yoking and harnessing, maintenance of equipment and record keeping.*
Mic.No: 82244

0701 Bah, O.A. 1976. **Rapport de stage - C.N.E.A.T. (Report of a training course - C.N.E.A.T.)**
s.n., s.l., 21p., 7 tables **Fr**
□*Reports on a training course on animal traction that dealt with problems related to farm implements; includes proposals for the use of animals for work.*
Mic.No: 10485

0702 Barton, D.; Jeanrenaud, J.P.; Gibbon, D. 1982. **The training and management of draught oxen.**
East Anglia Univ., Norwich (UK). School of Development Studies. School of Development Studies Discussion Paper (UK), no. 126, 26p., 10 fig., 3 tables; 17 ref. **En**
□*Discusses various aspects of the training and management of draft oxen, particularly, criteria for selecting a well-matched pair, training equipment and methods, their nutrition and draft-power capabilities, particularly in relation to the type of yoke or harness and method of hitching these implements.*
Mic.No: 31656

0703 Bates, A. 1980. **How to trim ox feet.**
Evener (USA), v. 5(1), p. 46-50, 8 photographs, ISSN 0164-6613. **En**
□*Presents guides for the proper trimming and shoeing of ox feet.*
Mic.No: P00541

0704 Bowmaker, R.J. s.d. **Using work oxen in Malawi.**
s.n., s.l., 24p., 1 plate, 22 illus. **En**
□*Presents guidelines for the selection, training and management of working oxen and for the use and maintenance of various farm implements.*
Mic.No: 55213

0705 Chu, C.L.; Kehoe, M.M. 1982. **Restraint methods for working buffaloes.**
Planter (Malaysia), v. 58(680), p. 507-514, 2 fig.; 3 ref. **En** (En)
□*Discusses various methods of controlling buffaloes for work or other purposes, including the psychological approach, restraint by contrivances, and the use of sedatives and general anaesthesia.*
Mic.No: 86289

0706 Cockrill, W.R. 1974. **Dairying as an instrument of social and economic change. The neglected water buffalo - an important dairy animal.**
FAO, Rome (Italy). 19. International Dairy Congress, New Delhi (India), Dec 1974., 19p., 25 ref. **En**
□*Discusses the possibility of utilising the water buffalo for beef production, as a working animal and in dairying, and examines its breeding characteristics.*
Mic.No: 80702

0707 Cockrill, W.R. (ed.) 1974. **The husbandry and health of the domestic buffalo.**
FAO, Rome (Italy), 993p., 223 fig., tables; ref. **En**
□*Describes and appraises the water buffalo, with detailed discussions of its biology, characteristics, management and uses; includes information specific to the buffaloes of Oceania, the Far East, the Near East, Africa, Latin America and Europe.*
Mic.No: 00107

0708 Dineur, B.; Morieres, G.; Canard, P. 1976. **Guide pratique de la culture attelée au Bénin. (Handbook on animal traction in Benin)**
FAO, Rome (Italy), 84p., illus. **Fr**
□*Presents simple guidelines for the selection and care of draft oxen including recommendations on sheltering, feeding, hygiene and harnessing; and*

describes animal-drawn implements and techniques of their utilization in various agricultural operations.
Mic.No: 80714

0709 Duchenne, T. 1981. **Manuel de culture attelée à l'usage des formateurs du G.R.D.R. (Manual on animal traction for GRDR instructors)**
Groupe de Recherches et de Réalisations pour le Développement Rural dans le tiers monde, Paris (France), 88p., fig., tables, maps, drawings; ref. **Fr**
☐*Manual on animal traction including sections on draft animals (species and breeds, ox training, feeding, animal health and harnessing), equipment and agro-socio-economic aspects.*
Mic.No: 80373

0710 Elmer, L.A. 1944. **Care and management of working oxen.**
East African Agricultural Journal (Kenya), v. 9(4), p. 213–220 **En**
☐*Presents information on the proper selection, feeding, training, working and health care of oxen.*
Mic.No: 58182

0711 Elmer, L.A. 1944. **Ox trek gear.**
East African Agricultural Journal (Kenya), v. 10(1), p. 44–46, 7 fig. **En**
☐*Presents guidelines on the selection and maintenance of yokes, ties, chains, reins, skeys, strops and whips for ox-trek purposes.*
Mic.No: 58188

0712 Fischer, R. 1982. **WADA oxenfarmer's handbook.**
Wum Area Development Authority (Cameroon), 86p., 50 drawings **En**
☐*A practical, illustrated guide to the use of draft oxen, draft equipment and cultivation techniques as promoted by the WADA Oxen Programme and intended as a guide for the WADA ox farmers' basic training course and an aid for extension workers.*
Mic.No: 80237

0713 Fischer, R. 1986. **Oxenfarmer's handbook. Animal power for easy farming.**
GTZ, Eschborn (Germany, F.R.); Wum Area Development Authority (Cameroon), 94p., drawings **En**
☐*A practical, illustrated guide to the use of draft oxen, draft equipment and cultivation techniques as promoted by the WADA Oxen Programme and intended as a guide for the WADA ox farmers' basic training course and an aid for extension workers.*
Mic.No: 80802

0714 Gninofou, A.; Amegavie, K. 1987. **Recommandations faites sur la culture attelée. (Recommendations on animal traction)**
Projet pour la Promotion de la Traction Animale, Atakpame (Togo). Force Animale (Togo), no. 1, p. 11–12 **Fr**
☐*Briefly reports on a meeting on the subject of animal traction in Togo held at the Direction Générale du Développement Rurale on 18 Feb 1987. Includes provision of draft animals, animal health, operations for which draft animals can be used, equipment and credit.*
Mic.No: 80798

0715 Hoste, C.; Peyre de Fabreques, B.; Richard, D.; Guillet, I. 1984. **Le dromadaire et son élevage. (The camel and its husbandry)**
Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). Etudes et Synthèses de l'IEMVT (France), no. 12, 162p., fig., tables; ref., ISBN 2–85985–096–1 **Fr**
☐*Presents notes on the distribution, ecology, and breeds of camels, along with detailed description of rearing methods, productivity parameters, nutritional requirements and pathology. Discusses future prospects of camel rearing.*
Mic.No: 80621

0716 Kanu, B.H. s.d. **Training manual for extension workers.**
Njala University Coll. (Sierra Leone), 17p., 5 fig., 1 table **En**
☐*Covers selection of bulls for training, pre-training preparation, training methods, training oxen and handlers, health care, crops cultivated and possible operations for work oxen, equipment, and techniques for working with ox-drawn equipment.*
Mic.No: 80316

0717 Kehoe, M.M.; Chan, L.C. 1985. **Training draught buffaloes.**
Livestock International (UK), v. 37(6), p. 222–226, 4 drawings, 5 photographs; 13 ref., ISSN 0306–8560. **En** (En)
☐*Describes a method for the breaking and training of buffalo for draft purposes developed in Borneo.*
Mic.No: 80115

0718 Leese, A.S. 1972. **A treatise on the one-humped camel in health and in disease.**
Haynes & Sons, Stamford (UK), 383p., 20 fig. **En**
☐*Presents detailed information on the zoology, characteristics, history, distribution, types, breeds, management, diseases and medical treatment of the one-humped camel.*
Mic.No: 08335

0719 Lemmer, von B. 1982. **Der beschlag von als tragtiere eingesetzten maultieren. (The shoeing of mules used as pack animals)**
Tieraerztliche Umschau (Germany, F.R.), v. 37(11), p. 766–770, 3 plates; 9 ref., ISSN 0049-3864. **De** (De En)
☐*Discusses special shoeing techniques for mules used as pack animals indicating ways of correcting excessive curvature of the sole. Describes orthopaedic shoeing.*
Mic.No: 86292

0720 Leonard, A G. 1894. **The camel: its uses and management.**
Longmans, Green, and Co., London (UK), 335p. **En**
☐*Presents information on the treatment and management of camels, based on practical observations and experience in Afghanistan, India, Egypt and the Sudan, with particular reference to the camel's anatomy, characteristics, species and breeds, watering, feeding, breeding, loading, marching and carrying power and diseases. Includes a comparison of the camel with other working animals.*
Mic.No: 08111

0721 Lhoste, P. 1990. **La gestion de la carrière des bovins de trait. (Management of the working lives of draft oxen)**
Starkey, P.H. (ed.) ; Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 144–152, 1 graph, 3 tables; 17 ref., ISBN 92-9081-046-7 **Fr** (Fr)
☐*Based on research at Sine-Saloum (Senegal) in 1980–83 and more recent work in Burkina Faso, Côte d'Ivoire and Mali notes major disparities in management of the life and career of the draft ox throughout the region. In some cases animal traction has resulted in livestock production becoming an important part of the agriculture of the region with the eventual use of the animal for meat playing an important role.*
Mic.No: 82047

0722 Liang, J.B.; Nasir, A.M.; Ismail, A.; Abdullah, R.S. 1989. **Management of draught animals in Malaysian oil palm estates.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 242–245, 4 tables, 1 drawing; 10 ref., ISBN 1-86320-003-7 **En** (En)
☐*Reviews current information and research data on the use of buffaloes for transport on oil palm estates in Malaysia. Results indicate that use of buffaloes has increased productivity and income by 31. Suggests that buffaloes should be dual-purpose, providing draft and meat, to maximize profit.*
Mic.No: 80945

0723 Lungwitz, A.; Adams, J.W. 1966. **Shoeing mules, asses and oxen.**
Lungwitz, A.; Adams, J.W. In: Horseshoeing for horse shoers and veterinarians, Oregon State University Press, Corvallis, Oregon (USA), p. 207–212, 5 fig. **En**
☐*Presents practical tips on the materials and techniques for shoeing horses, mules and donkeys.*
Mic.No: P00501

0724 Mignolet, B.; Lecca, M. 1986. **Sélection et dressage des bovins de trait. (Selection and training of draft cattle)**
Niger. Ministère de l'Agriculture. Fiche Technique du Ministère de l'Agriculture (Niger), no. 1, 18p., 12 fig. **Fr**
☐*An illustrated guide to the selection and training of draft oxen.*
Mic.No: 80259

0725 Mignolet, B.; Lecca, M. 1987. **Logement, alimentation et soins des bovins de traits. (Housing, feeding and care of draft oxen)**
Niger. Ministère de l'Agriculture. Fiche Technique du Ministère de l'Agriculture (Niger), no. 2, 18p., 4 fig. **Fr**
☐*A brief illustrated guide to the shelter, feeding and health of draft oxen.*
Mic.No: 80260

0726 Mungroop, R.R. 1988. **Guide pratique du dressage de jeunes bovins pour la culture attelée. (Practical guide to the training of young draft cattle)**
Mali. Ministère de l'Agriculture, Volet Fonsebougou, 30p., tables, drawings **Fr**
☐*Practical illustrated programme for training a pair of young oxen (3- to 4-years old) for draft purposes in three weeks.*
Mic.No: 80253

0727 Neugbauer, J.; Chikwanda, B.; Magumise, J. 1989. **Training and handling of oxen for work in Zimbabwe.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 226–230, 2 tables; 5 ref., ISBN 1-86320-003-7 **En** (En)
☐*Describes the role of draft oxen in Zimbabwe and the programme for training and handling draft*

animals at the Institute of Agricultural Engineering, Harare, through courses for extension staff and other instructors in the field.
Mic.No: 80943

0728 Pathak, B.S. 1984. **Management and utilization of camels for work.**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 46–51, 3 ref., ISBN 92-5-001474-0 **En** (En Fr)
☐*Discusses the management and use of the camel for work, with brief descriptions of camel breeds, characteristics of the animal, housing and feeding requirements, castration, handling and training practices, health care, work physiology and environmental effects, power output and work capacity, as well as the economics of camel use.*
Mic.No: 80588

0729 Pearson, R.A. 1986. **Feeding and management of draught animals: A review.**
Indian Journal of Animal Production and Management, v. 2(2), p. 48-69, 4 tables; 56 ref. **En**
☐*Examines some of the factors that influence the performance of draft cattle and buffaloes and which should be considered when using draft animals in any farming system, with particular reference to nutritional requirements and common feeding practices. Reviews briefly work on the use of crossbred animals for work, improved yokes and harnesses, and the scope for increasing the efficiency of draft animal power.*
Mic.No: P00532

0730 Roux, L.L.; Merwe, H.J. van der. s.d. **Draught horses.**
South Africa. Department of Agriculture and Forestry. Department of Agriculture and Forestry Bulletin (South Africa), no. 258, 47p., fig., ref. **En**
☐*Presents general information pertaining to draft horses, especially their physiology, positions of the limbs and feet, breeds of draft horses, colours and descriptions, causes of unsoundness and blemishes, as well as guidelines to proper feeding and general management.*
Mic.No: 55619

0731 Sambou, P. 1981. **Dressage des boeufs pour la culture attelée. (Training oxen for cultivation)**
Environnement et Développement du tiers monde, Dakar (Sénégal). ENDA Environnement Africain (Sénégal), no. 37, 15p., 13 fig. **Fr**
☐*Gives a brief programme for training a pair of draft oxen.*
Mic.No: 80284

0732 Sasimowski, E. 1984. **Management and utilization of equine animals for work.**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 30–36, ISBN 92-5-001474-0 **En** (Fr)
☐*Outlines favourable characteristics of equines when used as working animals, comparing them with ruminants, and discusses the need for appropriate working equipment and proper management of animals.*
Mic.No: 80586

0733 Sastry, N.S.R.; Thomas, C.K.; Singh, R.A. 1985. **Management of work animals.**
Sastry, N.S.R.; Thomas, C.K.; Singh, R.A. In: Farm animal management and poultry production, Vikas Publishing House Pvt. Ltd. New Delhi (India), p. 417–433, 5 fig., ISBN 0-7069-1730-8 **En**
☐*Presents management guidelines for bullocks and camels under Indian conditions, with particular reference to selection, training, general care, working capacity, feeding, general welfare as well as yokes and harnesses.*
Mic.No: 82264

0734 Singh, V.; Nagaiah, B.B. 1982. **Problems in draught animal power system and proposed measures for their solution.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 5p., 3 ref. **En**
☐*Identifies causes for the low productivity of draft animals in India and proposes solutions, with particular reference to problems related to research and development, health control and management of animals, development of suitable implements, and underutilization of animals.*
Mic.No: 80698

0735 Smith, A.J. 1985. **Management and health requirements of draught animals.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine. 36. Annual Meeting of the European Association for Animal Production, Kallithea (Greece), 30 Sep–3 Oct 1985, 7p. **En**

☐*Discusses the importance of maintaining draft animals in a fit condition despite unfavourable conditions and deals with problems of feed shortage, heat stress, diseases (trypanosomiasis) and injuries. Briefly summarizes results of research carried out to provide detailed information on needs of draft animals at the Centre for Tropical Veterinary Medicine in Edinburgh (UK) and at the Escuela Centroamericana Ganaderia (Costa Rica).*
Mic.No: 80381

0736 Starkey, P.H. 1983. **The training of draught cattle.**
Appropriate Technology (UK), v. 10(1), p. 28–29, 3 photographs; 2 ref., ISSN 0305–0920. **En**
☐*Describes techniques for training draft oxen based on experience in Sierra Leone.*
Mic.No: 80792

0737 Starkey, P.H. 1984. **The selection of draught cattle.**
Appropriate Technology (UK), v. 10(4), p. 9–11, 5 fig.; 6 ref., ISSN 0305–0920.
En
☐*Presents guidelines for the selection of draft animals and their reining system, using the experience of the Sierra Leone Work Oxen Project.*
Mic.No: 80644

0738 Svendsen, E.D. (comp.) 1986. **The professional handbook of the donkey.**
Donkey Sanctuary, Sidmouth (UK), 248p., fig., photographs **En**
☐*Presents practical information on the management of donkeys, with detailed sections on nutrition, handling, showing, breeding, health and the use of donkeys for different types of work.*
Mic.No: 38165

0739 Upadhyay, R.C. 1985. **Selection and training of bullocks for work.**
Livestock Adviser (India), p. 39–44 **En**
☐*Discusses criteria that should be considered when selecting bullocks for work, particularly referring to an animal's temperament, body characteristics and breed. Briefly outlines requirements for the training of animals for work.*
Mic.No: P00543

0740 Walley, V.P. 1936. **Working cattle in the Anglo-Egyptian Sudan.**
Empire Cotton Growing Review (UK), p. 294–301, 6 fig., 5 plates **En**
☐*Presents recommendations for the management and use of cattle for work in the Sudan, with particular reference to optimum working hours, nutrition, means of control and yoking of single or pairs of cattle, and suitable implements.*
Mic.No: 22081

0741 Wiseman, R.F. 1968. **Special shoeing.**
Wiseman, R.F. In: The complete horseshoeing guide, University of Oklahoma Press, Norman, Oklahoma (USA), p. 197–213 **En**
☐*Presents practical guidelines for the proper trimming and shoeing of the feet of bulls, oxen and horses.*
Mic.No: 86976

THE HEALTH AND HUSBANDRY OF DRAFT ANIMALS

0742 Bah, M.S. 1983. **Observations on disease problems and traditional remedies relating to the use of work oxen in the Karina area.**
Sierra Leone Work Oxen Project, Freetown, 13p. **En**
☐*This pilot study for a research project on the health and management of N'Dama cattle in Sierra Leone with special reference to the use of work oxen under village conditions covers external parasites, intestinal problems, external injuries and accidents, exhaustion, blood diseases, psychological disorders, calves, feeding, mortality and miscellaneous subjects such as taboos, upkeep of sheds and veterinary services.*
Mic.No: 80310

0743 Bah, M.S. 1985. **The role and potential of traditional medicine and animal husbandry for work oxen in Sierra Leone.**
Sierra Leone Work Oxen Project, Freetown, 8p, 24 ref. **En**
☐*Reviews the role of and potential for traditional medicines in maintaining the health of draft oxen.*
Mic.No: 80317

0744 Bourn, D.; Scott, J.M. 1978. **The successful use of work oxen in agricultural development of tsetse infested land in Ethiopia.**
Tropical Animal Health and Production (UK), v. 10(4), p. 191–203, 3 fig., 12 tables; 42 ref., ISSN 0049–4747. **En** (En Es Fr)
☐*Discusses the possibility of using trypanocidal drugs to protect cattle and upgrade their performance in agricultural work in areas of high tsetse challenge, taking the achievements of the Angar Gutin settlement project in western Ethiopia as example and describing the epizootiology of trypanosomiasis in the oxen and in the vector, Glossina morsitans.*
Mic.No: 12666

0745 Boyt, W.P.; Mackenzie, P.K.I.; Pilson, R.D.; Leavis, H. 1972. **The importance of the donkey (Equus asinus) as a**

source of food and a reservoir of trypanosomes for Glossina morsitans Westw.
Rhodesia Science News, v. 6(1), p. 19–20, 1 table, 2 plates; 9 ref. **En**
□*Presents results of analysis carried out on blood meals collected from tsetse resting and refuge sites in order to test the hypothesis that donkeys may serve as favoured food hosts for Glossina morsitans Westw.*
Mic.No: 55796

0746 Carlson, G.P. 1985. **Medical problems associated with protracted heat and work stress in horses.**
Equine Sports Medicine (USA), v. 7(9), p. 542–550, 1 table; 5 ref. **En**
□*Discusses heat stroke and anhydrosis as related to underlying thermoregulatory responses in the horse, and describes clinical problems associated with excessive fluid and electrolyte losses.*
Mic.No: P00547

0747 Dorward, D.C.; Payne, I. 1975 **Deforestation, the decline of the horse and the spread of the tsetse fly and trypanosomiasis (Nagana) in nineteenth century Sierra Leone.**
Journal of Agricultural History (USA), v. 16(2), p. 239–256, 1 fig.; ref. **En** (En)
□*Concludes that the abrupt decline of horses in the Freetown peninsula of Sierra Leone in the 1850s was due to their susceptibility to trypanosomiasis which spreed rapidly following deforestation.*
Mic.No: 80304

0748 Hoffmann, D.; Dalgliesh, R.J. 1985. **A multidisciplinary approach to health and disease in draught ruminants.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 134–139, 1 fig.; 13 ref. **En**
□*Discusses the dynamics of the disease process in working ruminants using examples of specific diseases in Southeast Asia. Emphasizes the importance of sound husbandry and management practices in preventing and controlling disease; and oudines the interdependence of various disciplines in understanding the disease process in order to increase the productivity and output of draft animals.*
Mic.No: 80507

0749 Ikede, B.O.; Akpokodje, J.U.; Hill, D.H.; Ajidagba, P.O.A. 1977. **Clinical, haematological and pathological studies in donkeys experimentally infected with Trypanosoma brucei.**
Tropical Animal Health and Production (UK), v. 9(2), p. 93–98, 22 ref., ISSN 0049–4747. **En** (En Es Fr)
□*Presents results of investigation on the clinical, haematological and pathological features of experimental Trypanosoma brucei infection in donkeys, particularly dullness, weakness, fever, inappetence, conjunctivitis, tachycardia, and polydyspnoea.*
Mic.No: 19569

0750 Kapinga, C. 1979. **The problem with foot and mouth disease.**
Tanzania Society of Animal Production, Morogoro. In: Proceedings of the sixth scientific conference of the Tanzania Society of Animal Production, 6. Scientific Conference of the Tanzania Society of Animal Production, Iringa (Tanzania), 29–31 May 1979, p. 68–71 **En**
□*Indicates some of the economic losses during outbreaks of foot-and-mouth disease in Tanzania, with emphasis on reduction of milk from lactating cows, increase in fattening costs due to increase in the fattening period, mortality and negative effects on draft animals.*
Mic.No: 21198

0751 Karbe, E. (ed.); Freitas, E.K. (ed.) 1982. **Trypanotolerance. Research and application.**
GTZ, Eschborn (Germany, F.R.). Workshop on Trypanotolerance and Animal Production, Lome and Avetonou (Togo), 10–14 May 1982, 314p., ISBN 3–88085–158–1 **En**
□*Presents workshop papers on various issues related to trypanotolerance in Africa, especially trypanotolerance and productivity of various ovine and bovine breeds; work on the introduction of tolerant breeds; mechanisms of trypanotolerance and immunology; evaluation of trypanotolerance and heredity; possibilities and limitations of the use of trypanotolerant cattle for draft purposes; economics of trypanotolerant breeds; and breeding programmes.*
Mic.No: 33144

0752 Kenyon, S.; Fauzi, S.; Burton, R.; Darsana, R. 1989. **Health in draught animals: An example from West Java, Indonesia.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 212–215, 2 tables; 5 ref., ISBN I–86320–003–7 **En** (En)
□*Following the sending of animal health questionnaires to selected farmers in the Subang district of Java a programme of animal health visits was established to further define problems. Draft*

animals (buffaloes) appeared more susceptible to common diseases than those not used for draft and also suffered ailments resulting directly from draft use.
Mic.No: 80942

0753 Leroy, E.; Klutse, M. 1987. **Force animale et la campagne de prophylaxie des animaux de trait. (Animal power and the work animal prophylaxis campaign)**
Projet pour la Promotion de la Traction Animale, Atakpame (Togo). Force Animale (Togo), no. 1, p. 4–5, 1 fig. **Fr**
☐*This editorial stresses the importance of prophylaxis in maintaining the health of draft animals.*
Mic.No: 80341

0754 Leroy, E. 1988. **Suivi sanitaire des animaux de trait au Togo: situation et amelioration. (Health monitoring of work animals in Togo: Present situation and improvements)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 361–363, ISBN 3–528–02047–4 **Fr** (Fr)
☐*Describes the role of the Inspection Vétérinaire et Santé Animale in promoting health of draft animals in Togo.*
Mic.No: 82032

0755 Lloyd, D.H. 1973. **The economic effects of bovine streptothricosis.**
Ibadan Univ. (Nigeria). Dept. of Veterinary Science; Ahmadu Bello Univ., Zaria (Nigeria). Faculty of Veterinary Science. In: International symposium on Dermatophilus infection. Programme and texts of papers, International Symposium on Dermatophilus Infection, Ibadan (Nigeria), 25–28 Jun 1973, p. 108–123, 7 tables; 15 ref. **En**
☐*Assesses the economic importance of bovine streptothricosis on the basis of a survey conducted in Nigeria concerning its prevalence and effects on hide quality, weight gain, fattening potential, meat and milk production, and body condition of draft cattle.*
Mic.No: 18041

0756 McKinlay, W. 1990. **Overcoming some animal health constraints to work oxen in Sierra Leone through a revolving fund.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 328–331, 3 ref., ISBN 92–9081–046–7 **En** (En)
Describes the setting up of a self-sustaining Revolving Fund by the Sierra Leone Work Oxen Programme to provide an adequate supply of animal health requisites to ox farmers following losses of oxen due to the fly Stomoxys.
Mic.No: 82220

0757 Partoutomo, S.; Ronohardjo, P.; Wilson, A.J.; Stevenson, P. 1985. **Review of diseases in Indonesia affecting draught power in domestic animals.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 140–146, 2 tables; 34 ref. **En**
☐*Reviews the aetiology, distribution and epidemiology of acute and chronic diseases known to affect large ruminants and horses in Indonesia.*
Mic.No: 80681

0758 Payne, I. 1980. **Trees and disease.**
New Scientist (UK), p. 12–14, 1 map, 7 photographs, ISSN 0028–6664. **En**
☐*Discusses the decline of the horse population of Sierra Leone in 1856–1858 due to trypanosomiasis as a direct result of deforestation.*
Mic.No: 80306

0759 Rahman, A.; Ahmed, J.U.; Islam, A. 1985. **Quantification of losses among draught cattle due to foot-and-mouth disease: A study in Mymensingh District, Bangladesh.**
Indian Journal of Animal Sciences, v. 55(1), p. 25–26, 1 table; 2 ref., ISSN 0367–8318. **En**
☐*Presents findings of a study on economic losses due to an outbreak of foot-and-mouth disease involving 114 adult draft cattle in 3 villages of Mymensingh, Bangladesh, particularly in terms of loss of working days, body weight loss and loss in the market value of the animal.*
Mic.No: 80469

0760 Ravindran, S. 1988. **Preliminary observations on the effect of draft work on growth and trypanotolerance of N'Dama oxen.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 325–328, 1 table; 3 ref., ISBN 3–528–02047–4 **En** (En)
☐*In areas of medium tsetse challenge, N'Dama working oxen gained 18% more body weight in one year and appeared to be more trypanotolerant than*

non-working controls maintained under the same grazing system.
Mic.No: 82028

0761 Reh, I. 1982. **Animal husbandry and veterinary aspects. (Animaux de trait et hygiène des bétail)**
Munzinger, P. (ed.). In: Animal Traction in Africa, p. 67–132, 2 fig., 19 tables, ISBN 3-88085-133-6 **En, Fr**
☐*Discusses various issues related to the husbandry and health of draft animals, particularly selection, training and feeding of draft cattle, with emphasis on the requirements of animals and practical aspects such as fodder storage and conservation and ration preparation. Examines hygienic and veterinary aspects, period of time draft animals can be worked, marketing of draft cattle and the use of horses and donkeys, comparing their advantages and disadvantages with those of draft cattle.*
Mic.No: 80646

0762 Reh, I.; Horst, P. s.d. **Section 6: Draught animals and trypanotolerance. Possibilities and limits of the use of trypanotolerant cattle for draught purposes.**
GTZ, Eschborn (Germany, F.R.), 4p., 3 fig., 1 table; 2 ref. **En** (En)
☐*Discusses the use of trypanotolerant cattle for agricultural and transport work, mentioning the determination of factors affecting draft efficiency, results of work comparing production criteria between working and non-working N'Dama and Djakore cattle in Senegal, and conditions that should be considered for the efficient use of trypanotolerant cattle for draft purposes.*
Mic.No: 32619

0763 Sowe, J.; Gai, B.; Sumberg, J.; Gilbert, E. 1990. **Foaling and mortality of equines in the Gambia: A national survey.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 315–321, 2 fig., 7 tables; 7 ref., ISBN 92-9081-046-7 **En** (En)
☐*Results of a national survey of 642 dabadas in The Gambia in December 1987 showed that foaling rates of horses and donkeys were 24 and 29%, respectively, and overall mortality was 27% for both species. These figures combined with data on sales and purchase indicated that equine populations of The Gambia are not currently self-sustaining. Explores economic implications of low foaling and high mortality rates and presents three scenarios to make equine populations self-sustaining.*
Mic.No: 82114

BREEDING OF DRAFT ANIMALS

0764 Ali Yusran, M.; Ma'sum, K.; Priyo, Y. 1989. **Profiles of draught animal rearing in two villages in East Java.**
ACIAR, Townsville (Australia). ACIAR DAP Project Bulletin, no. 9, p. 1–17, 11 photographs, 10 tables, 6 diagrams; 4 ref., ISSN 0819-2596. **En** (En)
☐*Aims to explain the main characteristics of draft animal rearing in two villages in East Java chosen as farming systems research (FSR) sites by the ACIAR DAP project. Includes data on the human population, rearers of draft cattle, land tenure by rearers, large ruminant enterprises, use of animals for draft power, implements, rate of work in land preparation, reproduction in village herds, feeding practices, forage sources and ownership, non-rearers of livestock and main problems of rearing. Ideas for the possible improvement of the DAP system include introduction of high quality forages, improved weeders and harnesses and implements for single-animal use.*
Mic.No: 80961

0765 Anon. 1978. **Technique et système. Division des études agropastorales. Rapport d'activité 1977. (Report of activities 1977. Division of Agropastoral Studies)**
Institut Sénégalais de Recherches Agricoles, Bambey. Centre National de Recherche Agronomique, 33p., 21 tables; 4 ref. **Fr**
☐*Reports on the work of the Division des Etudes Agropastorales, CNRA, Senegal in 1977, examining results on the improvement of Djakore cattle for work by crossbreeding with Bambey cattle, on the effects of organic manure on the forage yield of Pennisetum pedicellatum, and on fattening trials.*
Mic.No: 40631

0766 Anon. 1984. **Thème 1: le point sur le N'Dama. Thème 2: les problèmes de l'alimentation du bétail. Thème 3: santé animale. (Theme 1: N'Dama cattle. Theme 2: Problems of cattle feeding. Theme 3: Animal health)**
Guinée. Ministère de l'Elevage et de la Pêche; Centre de Documentation Universitaire Scientifique et Technique, Conakry (Guinée). Séminaire National sur la Culture Attelée, Conakry (Guinea), 15–26 Oct 1984, 17p., 2 tables; 5 ref. **Fr**
☐*Describes the distribution of N'Dama oxen in Africa in general and in Guinea, their origin, performance, breeding programmes (especially crossing N'Dama oxen with other breeds), the importance of the N'Dama in animal traction and use of draft cows. Discusses the question of which race should be introduced into N'Dama breeding programmes to improve milk and meat production.*

Includes section on the dietary needs of work oxen. Discusses animal health in Guinea and particular problems of draft animals.
Mic.No: 80302

0767 Chantalakhana, C. 1981. **A scope on buffalo breeding for draft.**
ASPAC, Taipei City (Taiwan). Food and Fertilizer Technology Centre. ASPAC/FFTC Extension Bulletin (Taiwan), no. 166, 10p., 6 tables; 14 ref. **En**
☐*Examines the potential for breeding improvement of swamp buffaloes through genetic selection and crossbreeding, for work and for meat production under small farm conditions in Southeast Asian countries; includes data on traits related to work and size of swamp and river buffaloes.*
Mic.No: 18487

0768 Chantalakhana, C. 1985. **Breeding improvement of draught buffalo and cattle for small farms.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 101–108, 7 tables; 12 ref. **En**
☐*Presents some aspects of genetic improvement of buffalo and cattle for draft with special attention to certain farming and husbandry practices of farmers under rural small-farm conditions.*
Mic.No: 80530

0769 Gaudefroy-Demombynes, P. 1961. **Croissance des bovins N'Dama au CRA, Bambey. (Growth of N'Dama cattle at CRA, Bambey)**
Agronomie Tropicale (France), no. 18, p. 121–127, 2 graphs, 1 table; 4 ref., ISSN 0002–1946. **Fr** (En Es)
☐*Gives results of research into the growth and longeviy of N'Dama cattle. Growth is slow with oxen not maturing until they are 5-years old and cows when 3-years old and full maturity is not reached until they are 6 and 7, respectively. Growth is also irregular being rapid in Nov-Jan and slow in Apr-Aug. Suggests that animals should not be trained for draft purposes until they are 5-years old and that training should start in Nov.*
Mic.No: 80285

0770 Gunawan, B.; Vercoe, J.E. 1989. **Genetic improvement of draught animals.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 195–198, 11 ref., ISBN 1 86320 003 7 **En** (En)
☐*Considers the genetic improvement of draft animals in terms of the multipurpose role of animals in existing systems and changes in the relative importance of these roles which are likely to occur in the next 20–25 years. Suggests that genetic improvement should concentrate on increasing growth rate and fertility on modest fibrous rations and that in smallholder systems improvement is only feasible using crossbreeding.*
Mic.No: 80941

0771 Hamon, R. 1971. **Création, amélioration et performances d'une race de bovins de trait au C.N.R.A. de Bambey. (Development, improvement and performance of a draft cattle breed at Bambey Research Station)**
Organisation Commune Africaine et Malgache, Yaoundé (Cameroun); Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France). In: Colloque sur l'Elevage, Colloque sur l'Elevage, Ndjamena (Tchad), 8–13 Dec 1969, p. 503–514, 4 tables, 2 graphs **Fr**
☐*Presents results of selection and crossbreeding between Gobra zebu and N'Dama cattle at Bambey Research Station in Senegal to improve their performance as draft animals, particulary citing the birth weight, growth and weight gain of crossbreeds; includes evaluation of the crossbreeds in terms of their fitness for work and fattening.*
Mic.No: 80656

0772 Hamon, R. 1971. **Quelques résultats obtenus en matière d'intégration élevage-agriculture par le C.N.R.A., Bambey. (Some results obtained by CNRA, Bambey, on the integration of animal production and agriculture)**
Machinisme Agricole Tropical (France), no. 36, p. 34–41, 5 fig., 6 tables, 5 photographs **Fr**
☐*Animal traction research carried out by the CNRA, Bambey, Senegal includes comparisons of growth and performance of local cattle with zebu and N'Dama cattle, studies on energy expenditure of a pair of oxen when used for seeding, harrowing, groundnut harvesting and plowing, and effects of various workloads on fatigue and longevity of work oxen.*
Mic.No: 80275

0773 Momongan, V.G.; Parker, B.A.; Santos, E.B. de los; Ranjhan, S.K. 1989. **Breeding programs for improved draught animal power: Crossbreeding of buffaloes.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught

Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 190–194, 7 tables; 10 ref., ISBN 1-86320-003-7 **En** (En)
☐*Reviews breeding programmes in the Philippines to improve the productivity of the Philippine carabao, a swamp-type buffalo, to meet increasing needs for draft animal power, meat and milk through crossbreeding with Murrah and Mili-Ravi river-type buffaloes. F1 hybrids retained the resistance to work stress and docility of the carabao with greatly increased milk production.*
Mic.No: 80940

0774 Rollins, W. 1974. **Genetic improvement of work and pleasure animals.**
Cole, H.H. (ed.); Ronning, M. (ed.). In: Animal agriculture. The biology of domestic animals and their use by man, W.H. Freeman and Company San Fransisco (USA), p. 334–345, 8 fig.; 8 ref., ISBN 0-7167-0791-8 **En**
☐*Discusses earlier work on the genetic improvement of horses and dogs, with a brief description of modes of inheritance and response to selection of traits of interest in work and pleasure animals in general.*
Mic.No: 82099

0775 Sasimowski, E. 1984. **Breed improvement of draught animals.**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia. FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 52–59, ISBN 92-5-001474-0 **En** (FR)
☐*Discusses various factors involved in draft animal breed improvement, particularly the selection of animals for breeding through evaluation of body conformation and performance testing.*
Mic.No: 80528

0776 Starkey, P.H. 1985. **Genetic requirements for draught cattle: Experience in Africa.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 109–114, 23 ref. **En**
☐*Discusses genetic priorities for draft animal programmes in Africa, particularly proper selection, performance evaluation, genetic improvement of indigenous breeds, and crossbreeding.*
Mic.No: 80613

0777 Tumwasorn, S. 1981. **Crossbreeding of swamp buffalo for milk and draft.**
ASPAC, Taipei City (Taiwan). Food and Fertilizer Technology Centre. ASPAC/FFTC Book Series (Taiwan), no. 22, p. 141–152, 5 tables; 51 ref. **En**
☐*Reviews previous research results on crossbreeding of swamp and riverine buffaloes for milk and draft purposes with special reference to Asian countries.*
Mic.No: 86290

0778 Vercoe, J.E.; Frisch, J.E.; Young, B.A.; Bennett, J.L. 1985. **Genetic improvement of buffalo for draught purposes.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 115–120, 3 fig., 2 tables; 15 ref. **En**
☐*Reports results of a study carried on alternative strategies for the improvement of draft output of buffaloes using a model that allows the assessment of the relative effect on draft output of factors such as body size, draft load and speed, heat tolerance and climatic conditions.*
Mic.No: 80612

0779 Winugroho, M.; Situmorang, P. 1989. **Nutrient intake, workload and other factors affecting reproduction of draught animals.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 186–189, 22 ref., ISBN 1-86320-003-7 **En** (En)
☐*Briefly reviews the effect of nutrient intake and work on reproductive performance especially of female buffaloes and cattle. Concludes that normal ovarian activity and normal calving interval are negatively affected by poor nutrition and management, heat stress and reproductive diseases, whereas work per se is not a major factor provided energy reserves are adequate. Discusses body condition, levels of nutrition, liveweight and work with regard to reproduction.*
Mic.No: 80939

USE OF FEMALE DRAFT ANIMALS

0780 Bamualim, A; Ffoulkes, D.; Fletcher, I.C. 1987. **Preliminary observations on the effect of work on intake, digestibility, growth and ovarian activity of swamp buffalo cows.**
James Cook Univ., Townsville (Australia). Draught Animal Power Project. DAP Project Bulletin (Australia), no. 3, p. 6–10, 4 photographs, 2 tables; 2 ref. **En**

☐*Presents results of a study at Balai Penelitian Ternak, Indonesia in which 16 non-pregnant swamp buffalo were divided into two groups one of which did no work but the other was subjected to a work regime in which pairs pulled a sledge with a draft force of 80 kg for 2 h/day for 5 days/week for 12 weeks; all were offered chopped fresh rice straw and grass ad lib. The two groups did not differ in feed intake and digestibility but non-working animals grew at twice the rate of working animals. Ovarian activity tended to decrease in working cows.*
Mic.No: 80365

0781 Bhattacharya, P. 1965. **Rapporteur's report on economics of livestock enterprise (including dairy) with particular reference to the scale of the enterprise.**
Indian Journal of Agricultural Economics, v. 20(1), p. 135–140, ISSN 0019–5022. **En**
☐*Presents papers on the economics of livestock enterprises, with summary of group discussion on the use of cows for milk and as working animals, and on feed availability.*
Mic.No: 07855

0782 Gryseels, G.; Anderson, F.M. 1985. **Use of crossbred dairy cows as draft animals: Experiences from the Ethiopian highlands.**
Nordblom, T.L.; Hamid Ahmed, A.K.; Gordon, R.P. In: Research methodology for livestock on-farm trials, ICARDA/IDRC Regional Workshop on Research Methodology for Livestock on-Farm Trials, Allepo (Syria), 25–28 Mar 1985, p. 237–258, 5 ref., ISBN 0–88936–446–X **En** (Ar En Fr)
☐*Reports on ILCA's experiences in using crossbred dairy cows as working animals in the highlands of Ethiopia, describing the gradual approach used in testing the technology's use on research farms and in complementary on-station research.*
Mic.No: 82087

0783 Jabbar, M.A. 1983. **Effect of draught use of cows on fertility, milk production and consumption.**
Davis, C.H. (ed.); Preston, T.R. (ed.); Haque, M. (ed.); Saadullah, M. (ed.). In: Maximum livestock production from minimum land, 4. Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 2–4 May 1983, p. 71–85, 2 fig., 12 tables; 12 ref., ISBN 0–86443–120–1 **En**
☐*Discusses theoretical issues pertaining to the production possibilities of multipurpose cows, and analyses the relationship among draft, fertility and milk production and consumption, using data from farm survey conducted in Mymensingh, Bangladesh.*
Mic.No: 82097

0784 Jainudeen, M.R. 1985. **Reproduction in draught animals: Does work affect female fertility?**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 130–133, 1 table; 21 ref. **En**
☐*Highlights briefly the reproductive characteristics of female zebu cattle and water buffaloes and discusses stages of the female reproductive cycle during which the animals are vulnerable to thermal stress and inadequate nutrition. Indicates areas for future research which could lead to the development of potentially useful methods for alleviating reproductive disorders in the draft cow and buffalo.*
Mic.No: 80679

0785 Lall, H.K. 1949. **The use of cows for work.**
Indian Farming, v. 10, p. 286–287, 2 fig. **En**
☐*Discusses the advantages of using cows for work in India in view of the shortage of bullocks and of the economic feasibility of the practice. Includes notes on training of cows for work and their feed requirements.*
Mic.No: 17581

0786 Matthewman, R.W. 1987. **Role and potential of draught cows in tropical farming systems: A review.**
Tropical Animal Health and Production (UK), v. 19(4), p. 215–222, 1 table; 49 ref., ISSN 0049–4747. **En** (En Es Fr)
☐*Discusses the importance of female animals for work in tropical countries, reviewing studies on the effect of work on milk production, fertility and on reproduction; also discusses issues related to the efficiency of draft cows.*
Mic.No: 78686

0787 Momongan, V.G. 1985. **Reproduction in draught animals.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 123–129, 6 tables; 34 ref. **En**
☐*Presents information on how reproduction in animals is affected by their being used for draft, with particular emphasis on cattle and buffaloes under smallholder farm conditions.*
Mic.No: 80678

0788 Reh, I.; Horst, P. 1985. **Beef production from draught cows in small scale farming.**

Quarterly Journal of International Agriculture (Germany, F.R.), v. 24(1), p. 38–47, 1 fig., 5 tables; 10 ref., ISSN 0049–8599. **En** (En)
☐*Presents results of an investigation on weight development, mortality, calving rate, slaughter yields and slaughter prices of draft and herd cows in the Sine Saloum region of Senegal in order to evaluate the effect of work on beef production.*
Mic.No: 65955

0789 Rizwan-ul-Muqtadir; Gill, R.A.; Ahmad, M.; Ahmad, Z. 1976. **Draught power and its effects on milk yield and milk composition in lactating buffaloes during winter season.**
Pakistan Journal of Agricultural Sciences, v. 13(1), p. 53–58, 6 ref. **En**
☐*Describes an experiment conducted to examine the effect of three hours work per day on the milk yield and composition of lactating buffaloes.*
Mic.No: 80725

0790 Wignolle, P. 1985. **L'association agriculture-élevage par l'utilisation des femelles en culture attelée. (Crop-livestock integration through the use of cows for work)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 16–19, 1 graph **Fr**
☐*Discusses the use of cows as draft animals with particular reference to meat, calf and milk production.*
Mic.No: 80777

NUTRITION AND FEEDING OF DRAFT ANIMALS

0791 Abiye Astatke; Reed, J.D.; Butterworth, M.H. 1986. **Effect of diet restriction on work performance and weight loss of local Zebu and Friesian X Boran crossbred oxen. (Effet d'une restriction alimentaire sur les rendements et les pertes pondérales de boeufs de trait – races Zébu locale et Frisonne X Boran)**
ILCA Bulletin(Bulletin du CIPEA), no. 23, p. 11–14, 1 fig., 7 tables; 7 ref., ISSN 0255–0008 (E) and ISSN 0255–0016 (F). **En, Fr** (En)
☐*Reports results of an experiment conducted to determine the effect of diet restriction on work performance and body weight in crossbred and local oxen worked as singles in farmers' fields around Debre Zeit, Ethiopia, during the normal cultivation season.*
Mic.No: 67266

0792 Anderson C.E.; Potter, G.D.; Kreider, J.L.; Courtney, C.C. 1983. **Digestible energy requirements for exercising horses.**
Journal of Animal Science (USA), v. 56(1), p. 91–95, 1 fig., 5 tables; 14 ref., ISSN 0021–8812. **En** (En)
☐*Presents findings of a study conducted to determine the digestible energy requirement in the light horse using repeatable quantitative definitions of work, and to provide additional information for estimating digestible energy requirements for maintenance.*
Mic.No: P00537

0793 Anon. 1936. **Making silage for cattle food.**
Gold Coast Farmer (Ghana), v. 5(1), p. 16 **En**
☐*Examines methods of storing and preserving fodder for working cattle in Ghana, particularly referring to methods and materials for silage making.*
Mic.No: 40454

0794 Anon. 1983. **Networkshop on draft power and animal feeding.**
CIMMYT, Mexico City (Mexico). Eastern and Southern Africa Economics Programme. Networkshop on Draft Power and Livestock Feeding in Eastern and Southern Africa, Mbabane (Swaziland), 4–6 Oct 1983, v.p., 14 fig., 55 tables; 212 ref. **En**
☐*Includes papers presented at a workshop on draft power and animal feeding. Papers discuss the nature of draft power and animal feeding problems in specific local systems of eastern and southern Africa, and analyze how the results of experimental programmes on forage production, animal nutrition and tillage methods compare with the current strategies farmers are adopting to manage the draft power problem. Papers also discuss how on-farm research support programmes fit into local farming systems and deal effectively with the problems.*
Mic.No: 82249

0795 Anon. s.d. **Essai d'alimentation rationnelle des boeufs de labour en vue d'une amélioration du rendement à l'Office du Niger. (Trial on rational feeding of plow-oxen in view of yield improvement at the Office du Niger)**
Institut d'Economie Rurale, Bamako (Mali), 23p., 2 graphs, 10 tables **Fr**
☐*Discusses rational feeding of work-oxen to improve the output of animal traction, with data on weight gain, feed intake, distribution of feed rations, and economic aspects.*
Mic.No: 09587

0796 Anon. s.d. **Résultats des recherches 1979–1982. (Research results, 1979–1982)**

CIPEA, Bamako (Mali). Section Nutrition Animale, v.p., 18 fig., 5 tables; 8 ref. **Fr**
☐*Studies the nutritive value of Sahelian pastures and agro-industrial byproducts in Mali and the supplementary feeding of work oxen, considering the feeding behaviour of cattle, sheep and goats, daily changes in weight and average costs of feeding.*
Mic.No: 34914

0797 Attiogbe, A.Y. s.d. **Alimentation des animaux de trait. (Feeding of work animals)**
Institut Polytechnique Rural de Katibougou (Mali), 74p., tables; 60 ref. Thèse (Ingénieur des Sciences Appliquées d'Elevage). **Fr**
☐*Studies the nutrition of working animals in Togo, with particular reference to available feeds such as crop residues, agro-industrial byproducts and animal byproducts; also discusses the preparation of feed rations for working animals.*
Mic.No: 76082

0798 Bamualim, A.; Kartiarso. 1985. **Nutrition of draught animals with special reference to Indonesia.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 64–68, 1 fig., 3 tables; 16 ref. **En**
☐*Discusses nutrient requirements of draft animals for maintenance, production and work, considering the feed supply and demand situation in Indonesia. Suggests possible areas for research.*
Mic.No: 80673

0799 Bartlett, J.; Barrett, E.; Gibbon, D. 1982. **Nutrition and working efficiency of draught bovines on a Norfolk small holding.**
East Anglia Univ., Norwich (UK). School of Development Studies. School of Development Studies Discussion Paper (UK), no. 127, 12p., 4 tables; 8 ref. **En**
☐*Presents results of a study on energy requirements of a pair of working draft bullocks on the School of Development Studies farm at the University of East Anglia, Norwich, calculating their metabolizable energy need (for maintenance) and energy costs for walking, pulling/carrying in terms of their liveweight, total distance travelled, speed of work and draft needs (as measured by a dynamometer) while performing a variety of farm operations and evaluating their efficiency in relation to the metabolizable energy content of consumed fodder.*
Mic.No: 31660

0800 Barton, D. 1987. **Draught power supply, nutrition and the work output of draught animals in Bangladesh.**
s.n., s.l., 19p., 5 fig., 9 tables; 18 ref. **En**
☐*Discusses the status of animal power use in Bangladesh, using findings of a survey carried out at Kazri Shimla village to assess the status of draft power supply and feed availability; also assesses the nutrient requirements and work output of draft animals based on results of experiments.*
Mic.No: 86966

0801 Chacafi, M. 1984. **Supplémentation des boeufs de labours du sous-système agropastoral du mil: impact d'une supplémentation en tanes de niébé sur le maintien et le rendement au travail. (Supplementary feeding of work oxen in the millet agropastoral sub-system. Effects of supplementation with cowpea haulms on maintenance and work output)**
Institut Polytechnique Rural de Katibougou (Mali), 30p., 4 fig., 12 tables; 11 ref. Mémoire de Fin d'Etudes. **Fr**
☐*Examines the effects of supplementation with cowpea haulms at the end of the dry season, on the maintenance, work output and weight changes of working animals in Mali.*
Mic.No: 35652

0802 Cooke, F.C.; Chem, A.M.J. s.d. **Alimentation du bétail à l'aide des sous-produits issus de l'industrie de l'ananas. (Pineapple byproducts in livestock feeding)**
s.n., s.l., 5p. **Fr**
☐*Studies the nutrient composition of pineapple byproducts and assesses their nutritive value for working animals, dairy cows and pigs.*
Mic.No: 01732

0803 Coulibaly, D.B. 1983. **Supplémentation alimentaire des boeufs de labour du système agropastoral du mil. (Supplementary feeding of work oxen in the millet agropastoral system)**
Institut Polytechnique Rural de Katibougou (Mali); CIPEA, Bamako (Mali). Programme des Zones Aride et Semi-Aride, 54p., 5 fig., 9 tables; 15 ref. Ingénieur – Elevage. **Fr**
☐*Describes the Dalouguebougou village in Mali, evaluating conditions of animal husbandry, animal traction and the utilization of work oxen in the millet agropastoral system; and assesses constraints in the nutrition of work oxen. Studies the effects of supplementary feeding of work oxen during the dry season on maintenance and work output.*
Mic.No: 32554

0804 Dicko, M.S.; Sangare, M.I. 1984. **De l'emploi de la traction animale en**

zone sahélienne: role de la supplémentation alimentaire. (The use of animal traction in the Sahelian zone: The role of supplementary feeding)
CIPEA, Bamako (Mali). Programme des Zones Aride et Semi-Aride; ICRISAT, Niamey (Niger). CIPEA Mali Document de Programme, no. AZN 3, 24p., 3 fig., tables; 4 ref. **Fr**
☐*Discusses the importance of supplementary feeding for the improvement of work output, growth, reproduction, and health of working oxen in the Sahelian zone.*
Mic.No: S-90 No. AZN3

0805 Ffoulkes, D.; Bamualim, A. 1986. **A note on the effect of work on the utilization of low protein fibrous diets by buffaloes.**
Buffalo Bulletin (Thailand), v. 5(1), p. 3–5, 1 table; 6 ref. **En** (En)
☐*Describes results of a trial carried out to determine the effect of work on the utilization of low protein fibrous feeds in 2 groups of 4 non-pregnant female buffaloes given an ad libitum ration of freshly chopped rice straw and field grasses.*
Mic.No: P00555

0806 Ffoulkes, D.; Bamualim, A. 1989. **Improving the nutrition of draught animals using available feeds.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 134–145, 3 tables, 1 diagram; ref., ISBN 1-86320-003-7 **En** (En)
☐*Discusses the nutrition of working animals (including the metabolism of active muscle, effects of work on digestion and requirements for energy, protein and minerals), nutritional value and utilization of feeds and feed management strategies. Concludes that rumen undegraded concentrate supplements should be fed to animals during periods of hard work and to pregnant and lactating working animals.*
Mic.No: 80935

0807 Graham, N. McC. 1985. **Relevance of the British metabolizable energy system to the feeding of draught animals.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 96–98, 14 ref. **En**
☐*Describes the British system for calculating the feed needed to satisfy a non-working ruminant's energy requirements in temperate regions and discusses the system's applicability to draft animals in the tropics.*
Mic.No: 80677

0808 Hartley, K.T.; Ross, S.D. 1938. **Feeding of Nigerian stock.**
In: Papers presented at the Third West African Agricultural Conference, s.n., s.l. 3. West African Agricultural Conference, Ibadan (Nigeria), 2–25 Jun 1938, p. 85–101, 6 tables **En**
☐*Discusses the feeding of mixed farmers' stock at Shika and Samaru, Nigeria, suggesting the use of farm waste products in feed rations; and presents tables on the chemical composition of feedstuffs, digestible nutrient as a percentage of dry matter and whole food, and requirements of working animals and milch cows in terms of starch equivalents and digestible protein. Includes a rationing formula.*
Mic.No: 20767

0809 Harvey, A.L.; Thomas, B.H.; Culbertson, C.C.; Collins, E.V. 1939. **The effect of limited feeding of oats and Timothy hay during work on the nitrogen balance of draft geldings.**
Iowa Agricultural Experiment Station, Ames (USA). Iowa Agricultural Experiment Station Journal (USA), no. J-706, p. 94–103, 4 fig., 3 tables; 10 ref. **En** (En)
☐*Presents results of a metabolism trial designed to determine the nitrogen retention of a pair of Percheron draft geldings fed a basal daily ration of 1.36 kg of finely ground oats and 20 pounds of finely chopped Timothy hay while resting or at different intensities of work.*
Mic.No: P00556

0810 Harvey, A.L.; Thomas, B.H.; Culbertson, C.C.; Collins, E.V. 1943. **Effect of work on the calcium and phosphorus retention of Percheron geldings.**
Journal of Animal Science (USA), v. 2(2), p. 103–111, 2 fig., 3 tables; 16 ref., ISSN 0021-8812. **En**
☐*Details findings of a trial carried out to determine the calcium and phosphorus retentions of a pair of Percheron geldings weighing about 763.5 kg each as part of an experiment that also included a study of nitrogen balances. Also assesses the effect of work on calcium and phosphorus balances.*
Mic.No: P00528

0811 Hrabovszky, J. 1983. **Feeding of draught animals. (Besoins fourragers des animaux de trait)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 46, p. 47–48, 3 tables, ISSN 0049-8025. **En, Fr**

□*Estimates the feed requirements of a draft animal herd assuming the average weight of an animal to be 350 kg and assesses the likely composition of the various sources of feed energy.*
Mic.No: 29789

0812 Ibrahim, M.N.M. 1985. **Nutritional status of draught animals in Sri Lanka.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 84–89, 4 tables; 8 ref. **En**
□*Highlights specific nutrient requirements of working animals and the need for better feeding management during working periods, discussing different management practices adopted in Sri Lanka, the nutritional value of common feeds consumed by draft animals, and ways to improve the traditional type of feeding management.*
Mic.No: 80671

0813 Koch, B.; Masikara, S.; Hein ch, G.; Mattho, W. 1986. **Draught animal management for early ploughing.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine. Draught Animal News (UK), no. 5, p. 16–19, 1 table; 2 ref. **En**
□*Presents results of trials in the Tutume District of Botswana in which draft animals (donkeys and oxen) were given a supplemented diet to ascertain whether farmers could and would carry out early plowing (the first plowing in a double-plowing system recommended to but not readily taken up by farmers).*
Mic.No: 80463

0814 Kumarasuntharam, V.R.; Jayasuriya, M.C.N.; Joubert, M.; Perdok, H.B. 1984. **The effect of method of urea-ammonia treatment on the subsequent utilization of rice straw by draught cattle.**
Doyle, P.T. (ed.). In: The utilization of fibrous agricultural residues as animal feeds. Proceedings of the third annual workshop, 3. Annual Workshop of the Australian-Asian Fibrous Agricultural Residues Research Network, Peradeniya (Sri Lanka), 17–22 Apr 1983. p. 124–130, 3 tables; 8 ref., ISBN 0–86839–390–8 **En** (En)
□*Presents results of a feeding experiment conducted in Sri Lanka to study the effects of different methods of storing rice straw treated with a urea solution on subsequent utilization by draft bull calves; includes data on weight gain of the animals, required storage time under the various treatments and the economic aspects of the treatments.*
Mic.No: 82270

0815 Lambourne, J.L.; Zelleka Getahun. s.d. **Effects of lactation and work on feed intake of crossbred cattle.**
ILCA, Addis Ababa (Ethiopia), 5p., 1 table; 10 ref. **En** (En)
□*Reports findings of a study carried out in Ethiopia to assess the feed intake of four lactating crossbred cows, two of them used for plowing, and of two zebu work oxen for five and a half months including the main plowing season, using the chromium oxide/nitrogen method.*
Mic.No: 80021

0816 Lawrence, P.R. 1988. **A review of the nutrient requirements of draught oxen.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 59–63, 5 tables; 8 ref. **En**
□*Discusses nutrient requirements of working cattle above the requirements for maintenance.*
Mic.No: 80529

0817 Mathers, J.C. 1984. **Nutrition of draught animals.**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 60–66, 20 ref., ISBN 92–5–001474–0 **En** (Fr)
□*Examines the dietary energy and nutrient requirements of ruminants and equidae for maintenance, growth, lactation and for various draft activities; outlines ways of calculating energy needs; and briefly discusses constraints on work output due to limitations on feed intake, diseases and climatic effects.*
Mic.No: 80589

0818 Mathers, J.C.; Pearson, R.A.; Sneddon, J.C.; Matthewman, R.W.; Smith, A.J. 1985. **The use of draught cows in agricultural systems with particular reference to their nutritional needs.**
Smith, A.J. (ed.). In: Milk production in developing countries, Conference on Milk Production in Developing Countries, Edinburgh (UK), 2–6 Apr 1984, p. 476–496, 2 fig., 11 tables; 28 ref. **En**
□*Reviews the energy, protein and other nutrient requirements of draft cows and discusses the interaction between work, milk production and fertility.*
Mic.No: 35152

0819 Meda, M. 1972. **Problèmes de l'alimentation des boeufs de labour à l'Office du Niger. (Problems of plow-ox feeding at the Office du Niger)**
Institut Polytechnique Rural de Katibougou (Mali), 36p., 17 tables, 2 graphs; 13 ref. Ing. Sc. Appl. **Fr**
☐*Presents proposals for improved feeding of draft cattle in Mali and Burkina Faso, with data on weight gain, economic aspects of feeding, and various feeds available in Burkina Faso, particularly rice, groundnut cake and brewers' grains.*
Mic.No: 09589

0820 Mohamed-Saleem, M.A.; Kaufmann, R. von. 1988. **A rapid survey of feeding regimes of draught animals in Niger state of Nigeria. A research note.**
ILCA, Kaduna (Nigeria). Subhumid Zone Programme, 8p., 1 fig., 1 table; 7 ref. **En**
☐*Presents results of a study conducted to assess dry season feeds used by farmers for supplementary feeding of draft cattle in the Niger state of the subhumid zone of Nigeria.*
Mic.No: 85351

0821 Orton, R.K.; Hume, I.D.; Leng, R.A. 1985. **Effects of level of dietary protein and exercise on growth rates of horses.**
Equine Veterinary Journal (Australia), v. 17(5), p. 381–385, 2 fig., 3 tables; 25 ref. **En** (En)
☐*Reports results of two experiments conducted to determine the effects of dietary protein level and exercise on the growth of young horses, by feeding two-year-old and nine-month-old horses high (12 or 14 per cent) or low (6 or 8 per cent) crude protein diets with one or two levels of exercise and measuring feed intakes and rates of growth.*
Mic.No: P00527

0822 Oule, J.M. 1984. **Alimentation des boeufs de trait en saison sèche dans le Yatenga. (Dry season feeding of work oxen in Yatenga)**
Université de Ouagadougou (Burkina Faso). Inst. Supérieur Polytechnique, 82p., 6 fig., 21 tables; 88 ref. Thésis (Diplôme d'Ingénieur du Développement Rural). **Fr**
☐*Outlines justifications for and constraints on the use of animal traction in Yatenga, Burkina Faso and presents results of a trial undertaken in the region on dry season supplementary feeding of work oxen, with data on feed intake, weight changes and the economics of utilizing treated straw.*
Mic.No: 51621

0823 Pagau, J.D.; Hintz, F. 1986. **Equine energetics. 1. Relationship between body weight and energy requirements in horses.**
Journal of Animal Science (USA), v. 63, p. 815–821, 7 fig., 3 tables; 21 ref., ISSN 0021-8812. **En** (En)
☐*Presents findings of a study conducted to evaluate the relationship between maintenance energy requirements and body weight in horses, and to determine a minimum resting maintenance digestible energy and metabolizable energy requirement of horses with highly differing mature body sizes.*
Mic.No: P00538

0824 Patterson, P.H.; Coon, C.N.; Hughes, I.M. 1981. **Protein requirements of mature working horses.**
Journal of Animal Science (USA), v. 61(1), p. 187–196, 3 fig., 8 tables; 34 ref., ISSN 0021-8812. **En** (En)
☐*Presents findings of an investigation conducted to determine the dietary protein requirement of mature horses under intense exercise, medium exercise and maintenance with three levels of calculated dietary protein.*
Mic.No: 82098

0825 Perdok, H.B. 1984. **Urea-ensiled paddy straw and its potential as draught animal feed.**
Farrington, J. (ed.); Abeyratne, F. (ed.) ; Gill, G.J. (ed.). In: Farm power and employment in Asia: Performance and prospects. Proceedings of a regional seminar, Regional Seminar on Farm Power and Employment in Asia, Colombo (Sri Lanka), 25–29 Oct 1982, p. 339–350, 10 tables; 6 ref. **En**
☐*Presents results of trials conducted in Sri Lanka on the use of urea-treated paddy straw to feed young Sahiwals, lactating Gir cows and Surti buffaloes; includes data on the composition of the diets for the different groups of animals, and on the effects of the diets on milk yield and composition, live weight changes, and on feed conversion efficiency and dry-matter intake of the animals. Discusses the potential usefulness of treated straw for draft animals.*
Mic.No: 82098

0826 Rao, M.V.N.; Upadhyay, R.C. 1987. **Physiological efficiency of nutrient utilization in crossbred bullocks in different seasons.**
Srivastava, N.S.L. (ed.); Ojha, T.P. (ed.). In: Utilization and economics of draught animal power. Proceedings of the national seminar, National Seminar on Status of Animal Energy Utilization, Bhopal (India), 24–25 Jan 1987, p. 64–68, 1 table; 11 ref. **En** (En)

☐*Presents data on nutrient intake, balance, heat production and efficiency of nutrient utilization in crossbred bullocks during summer, hot-humid and winter seasons.*
Mic.No: 80063

0827 Raut, K.C. 1982. **Working bullocks, their nutritional status and utilization in some areas.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 12p., 6 tables **En**
☐*Investigates the level of feeding of bullocks maintained in some parts of Haryana, West Bengal and Aimachal Pradesh in India using data collected through sample surveys; examines the extent of utilization of draft power for agricultural purposes.*
Mic.No: 80693

0828 Senakas, U.; Neric, S.P. 1988. **Nutritional management for improved draught ability in Philippine native and crossbred buffaloes.**
Buffalo Bulletin (Thailand), v. 7(2), p. 29–34, 6 tables; 7 ref. **En** (En)
☐*Gives data on energy balance and protein intake and expenditure under two intensities of workload and compares working performance of Murrah crossbred and Philippine carabao buffalo.*
Mic.No: 80418

0829 Slade, L.M.; Lewis, L.D.; Quinn, C.R.; Chandler, M.L. s.d. **Nutritional adaptation of horses for endurance type performance.**
California State Polytechnic Univ., Pomona (USA). Continuing Education Centre. In: Fourth equine nutrition and physiology symposium, 4. Equine Nutrition and Physiology Symposium, Pomona, California (USA), 16–18 Jan 1975, p. 114–120, 10 ref. **En** (En)
☐*Details results of an experiment conducted to study the influence of nutrition on the performance of endurance type work by horses by feeding them three diets which were supplemented with starch, protein or fat and analyzing blood changes from samples taken after exercise the day before the endurance ride and immediately following it.*
Mic.No: P00526

0830 Smith, A.J. 1981. **Specific requirements of draught animals.**
Huhn, J.E. (ed.). In: Proceedings of the conference on impact of animal disease research and control on livestock production in Africa, 3. International Conference of the Association of the Institutes for Tropical Veterinary Medicine, Nairobi (Kenya), 1–5 Sep 1980, p. 62–70, 2 tables; 14 ref. **En**
☐*Discusses the use of draft animals in Africa with emphasis on their feed requirements and factors influencing their efficiency, particularly correct harnessing and equipment and the fitness and health of the animals.*
Mic.No: 82266

0831 Soller, H.; Reed, J.D.; Butterworth, M.H. 1986. **Intake and utilization of feed by work oxen. (Ingestion fourragère et utilisation des aliments par les boeufs de trait)**
ILCA Newsletter (CIPEA actualités), v. 5(2), p. 5–7, 2 fig., 1 photograph, 1 table; 3 ref., ISSN 0255–0024 (E) and ISSN 0255–0032 (F). **En, Fr**
☐*Presents findings of a study conducted to determine changes in feed intake and utilization by oxen during work, comparing estimated energy balance and liveweight change in local zebu and crossbreds. Also assesses breed effects on water intake, feed intake and utilization.*
Mic.No: 67828

0832 Stillions, M.C.; Nelson, W.E. 1972. **Digestible energy during maintenance of the light horse.**
Journal of Animal Science (USA), v. 34(6), p. 981–982, 2 tables; 3 ref., ISSN 0021–8812. **En** (En)
☐*Presents findings of a study conducted to obtain information on the digestible energy requirement of the light horse, using six mature geldings of the quarter-type horse.*
Mic.No: P00536

0833 Teleni, E.; Hogan, J.P. 1989. **Nutrition of draught animals.**
Hoffman, D. (ed.); Nari, J. (ed.); Pecheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 118–133, 4 diagrams, 9 tables; ref., ISBN 1–86320–003–7 **En** (En)
☐*Reviews work on the nutrition of draft animals and highlights some areas of knowledge and ignorance. Discusses the need to define more clearly types of work undertaken by draft animals and associated energy expenditures, nutrient utilization (particularly the partitioning of free fatty acids and glucose between the lactating mammary gland or the pregnant uterus and the muscles) and probable differences between cattle and buffaloes in capacity to utilize low-quality feeds. Stresses the importance of some of the basic knowledge of the role of body reserve nutrients in rationalizing feeding systems for draft cattle and buffaloes.*
Mic.No: 80934

0834 Tourte, R. 1962. **Le bétail de trait et son alimentation. Un tel élevage**

est rentable dans les conditions écologiques de Bambey. (Working animals and their feeding. Profitability of their rearing under the ecological conditions at Bambey)
Agronomie Tropicale (France), no. 17, p. 166–173, 4 tables, ISSN 0002-1946. **Fr** (En Es Fr)
☐*Presents results of experimental research and theoretical study at Bambey, Senegal, concerning management conditions of farm enterprises using working animals. Also indicates types of feed rations proposed for draft animals, particularly groundnut straw and common land plant resources.*
Mic.No: 05401

0835 Traore, A.; Soumare, S. 1984. **Supplémentation alimentaire des boeufs de labour du système agropastoral du mil à Dalonguebougou: r ésultats préliminaires. (Supplementary feeding of work oxen in the Dalonguebougou millet agropastoral system: Preliminary results)**
CIPEA, Bamako (Mali). Programme des Zones Aride et Semi-Aride. CIPEA Mali Document de Programme, no. AZ 111, 17p., 1 fig., 4 tables; 9 ref. **Fr** (En Fr)
☐*Presents findings of a study carried out at Dalonguebougou in Mali to examine the effects of supplementary feeding with cowpea haulms on the maintenance and work output of draft oxen.*
Mic.No: S-90 No. AZ111

0836 Traore, A.; Soumare, S. 1985. **Supplémentation alimentaire des boeufs de labour du système agropastoral du mil à Dalonguebougou: effet comparé de deux régimes de supplémentation en fanes de niébé. (Supplementary feeding of work oxen in the millet agropastoral system at Dalonguebougou. Comparison of two supplementary rations composed of cowpea haulms)**
CIPEA, Bamako (Mali). Programme des Zones Aride et Semi-Aride. CIPEA Mali Document de Programme, no. 125, 15p., 4 fig., 5 tables; 6 ref. **Fr** (Fr)
☐*Examines the effects of cowpea haulm supplementation on the maintenance and work output of draft animals in the millet agropastoral system of central Mali.*
Mic.No: S-90 No. 125

0837 Upadhyay, R.C.; Rao, M.V.N.; Gupta, B.N. 1983. **Effects of nutrients intake upon the efficiency of work in young cross-bred bullocks.**
Indian Journal of Animal Sciences, v. 53(12), p. 1335–1337, 2 tables; 4 ref. **En**
☐*Reports findings of an experiment carried out to determine the work efficiency of two- to three-year-old Brown Swiss × Sahiwal crossbred bullocks maintained under two different planes of nutrition, viz. a concentrate mixture and wheat straw ad lib, or 60 per cent berseem and 40 per cent wheat straw. Includes data on work efficiency, energetic efficiency and blood lactic acid increase during work.*
Mic.No: 80069

0838 Wanapat, M. 1985. **Nutritional status of draught buffaloes and cattle in northeast Thailand.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985, no. 10, p. 90–95, 3 fig., 6 tables; 12 ref. **En**
☐*Discusses traditional buffalo and cattle management practices in northeast Thailand, with particular reference to wet- and dry-season feeding, and effects of supplementary feeding as related to work.*
Mic.No: 80672

0839 Wanapat, M. 1989. **Supplementary feeds: Their effects on performance of draught animals and their acceptability to Southeast Asian farmers.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 146–154, 9 tables, 5 diagrams; 20 ref., ISBN 1-86320-003-7 **En** (En)
☐*Discusses feeding strategies for draft buffaloes based on crop residues and presents results of trials aimed at introducing crop residue-based feeds at village level in Thailand in 1988, where the technique was received with great interest.*
Mic.No: 80936

0840 Weston, R.H. 1985. **Some considerations of voluntary feed consumption and digestion in relation to work.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 78–83, 1 fig.; 38 ref. **En**
☐*Discusses determinants of voluntary feed consumption in working animals including level of work load, the animal's physiological state and physical preparation, availability of essential nutritients in the diet, heat dissipation and the capacity of the gastrointestinal tract; includes suggestions for research.*
Mic.No: 80688

0841 Winugroho, M. 1989. **Mineral supplementation to working buffalo and cattle grazed on field grasses in Subang, West Java.**

ACIAR, Townsville (Australia). ACIAR DAP Project Bulletin, no. 9, p. 19, 1 ref., ISSN 0819-2596. **En** (En)

☐*Summarizes results of a study at village sites in Subang (Java) where buffaloes and cattle were supplemented with a mineral mix, based on liveweight responses and low cost and ready availability of the material used in the mix. Concludes that mineral supplementation of draft animals in the region would be advantageous.*

Mic.No: 80963

PHYSIOLOGY OF WORK AND ENERGY EXPENDITURE

0842 Agarwal, S.P.; Singh, N.; Agarwal, V.K.; Dwaraknath, P.K. 1982. **Draught capacity in castrated vis-à-vis entire male buffaloes.**

Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16-17 Jul 1982, 18p., 41 ref. **En**

☐*Presents results of a study conducted in India to compare the ability of entire, castrated and vasectomized male buffaloes to withstand the stress of draft, by exercising the animals and observing their automatic, biochemical, enzymological and hormonal responses.*

Mic.No: 80695

0843 Agarwal, S.P.; Agarwal, V.K.; Dwaraknath, P.K. 1985. **Response of serum cortisol in crossbred bullocks to graded work load.**

Indian Journal of Animal Sciences, v. 55(1), p. 47-49, 2 tables; 11 ref., ISSN 0367-8318. **En** (En)

☐*Presents results of a trial carried out to monitor serum cortisol levels of crossbred bullocks before, during and after hauling a bullock cart with graded load over standard distances.*

Mic.No: 80470

0844 Agarwal, S.P.; Agarwal, V.K.; Dwaraknath, P.K. 1986. **Effect of work load on plasma renin activitiy and angiotensin-1 in male buffaloes and crossbred bullocks.**

Indian Journal of Animal Sciences, v. 56(5), p. 521-524, 3 tables; 6 ref. **En**

☐*Reports results of experiments carried out to monitor plasma renin activity and angiotensin-1 levels in cattle and buffaloes pulling a bullock cart with or without load; includes data on the effects of haulage on heart rate.*

Mic.No: P00531

0845 Andromeders, J.N.; Lewis, R.E. 1977. **Appropriate technology, energetics and draft animals.**

s.n., s.l. Annual Meeting of the American Anthropological Association, Houston, Texas (USA), 2 Dec 1977, 21p. **En**

☐*Emphasizes the importance of certain variables not usually taken into account in analyses of the efficiency of food production and distribution systems and in the planning of culture change intended to improve the systems, describing energetic efficiency, i.e. excess of energy output over energy input, as the most promising and complex measure of efficiency.*

Mic.No: 86972

0846 Bakric, B.; Murray, R.M.; Hogan, J.P.; Kennedy, P.M. 1987. **Body temperature regulation in working buffalo and cattle.**

James Cook Univ., Townsville (Australia). Draught Animal Power Project. DAP Project News (Australia), no. 1, p. 9-10, 1 fig.; 4 ref. **En**

☐*Presents preliminary results of studies with buffalo and zebu-cross steers pulling a cart. Steers worked readily for 2 h but buffalo became distressed and had to be rested after 1 h. Rectal temperature and respiration rates were higher in buffalo after 1 h than in steers after 2 h. Rates of recovery in shade were similar in both species but wallowing buffalo recovered more rapidly. Suggests that these findings may explain why cattle are preferred to buffalo in drier regions of Indonesia and buffalo are used mainly for plowing in flooded rice fields.*

Mic.No: 80385

0847 Boyne, A.W.; Brockway, J.M.; Ingram, J.F.; Williams, K. 1981. **Modification, by tractive loading, of the energy cost of walking in sheep, cattle and man.**

Journal of Physiology (UK), v. 315, p. 303-316, 5 fig.; 14 ref., ISSN 0022-3751 and ISSN 0022-3751. **En** (En)

☐*Reports on experiments conducted to study changes in energy expenditure by cattle and sheep walking on a treadmill in relation to voluntarily exerted tension in the tether between animal and treadmill; and to investigate in human subjects walking on a treadmill, the alteration to energy expenditure as a result of positive and negative tractive loads applied at waist level through a rope parallel to the plane of the treadmill.*

Mic.No: P00521

0848 Bunyavejchewin, P.; Veerasit, P.; Chaidirek, P.; Chantalakhana, C. 1985. **Changes in body temperature and working efficiency of Thai swamp buffalo.**

Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10-16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 46-50, 1 fig., 2 tables; 24 ref. **En**

☐*Reports results of a study carried out in Thailand on the use of buffaloes for the operation of a water-lifting device, particularly regarding buffalo behaviour while operating the device, changes in body temperature within one working hour and efficiency of buffaloes at different periods of time during the day.*
Mic.No: 80531

0849 Georgie, G.C.; Sastry, N.S.R.; Razdan, M.N. 1970. **Studies on the work performance of cross-bred cattle. II. Responses of some chemical constituents of blood of Brown Swiss-Sahiwal (F1) and Sahiwal bullocks to exercise during different seasons.**
Indian Journal of Animal Production, v. 1(3), p. 115–119, 1 fig., 3 tables; 26 ref. **En** (En)
☐*Reports the responses, during autumn and winter, of haemoglobin, glucose and lactic acid levels of blood, plasma bicarbonate, and serum sodium and potassium, to a submaximal exercise test in crossbred and Sahiwal bullocks.*
Mic.No: P00502

0850 Gray, R.; Berg, C.; Koch, B.; Windsor, R.; Mahabile, W.; Holmes, A. 1987. **Blood parameters of donkeys, Mathangwe Village, Tutume agricultural district, Botswana.**
Botswana. Ministry of Agriculture. Dept. of Agricultural Research. Agricultural Technology Improvement Project Working Paper (Botswana), no. ATIP WP-8, 7p., tables; 3 ref. **En**
☐*Describes findings of a study carried out over two years in Botswana to determine normal phosphorus, calcium, copper, total protein and urea levels in donkey blood, and to assess the effects of feeding a supplementary mineral-mix containing equal parts of salt and dicalcium phosphate on the blood parameters and on the performance of the animals.*
Mic.No: 38915

0351 Hall, W.C.; Brody, S. s.d. **Growth and development with special reference to domestic animals. XXXII. The energy cost of horizontal walking in cattle and horses of various ages and body weights.**
Missouri Univ., Columbia (USA). Agricultural Experiment Station. Missouri Agricultural Experiment Station Research Bulletin (USA), no. 208, 15p., 2 fig., 5 tables; 11 ref. **En** (En)
☐*Presents results of experiments conducted on seven cattle ranging in weight from 384 to 930 kg and seven horses ranging in weight from 91 to 688 kg in order to measure energy costs of horizontal walking at speeds of 1.5, 2.2 and 3.1 miles per hour. Includes cardio-respiratory data.*
Mic.No: 86970

0852 Hornicke, H.; Engelhardt, W.V.; Ehrlein, H.-J. 1977. **Effect of exercise on systemic blood pressure and heart rate in horses.**
Pflugers Archiv (Netherlands), v. 372, p. 95–99, 3 fig., 1 table; 23 ref., ISSN 0031-6768. **En** (En)
☐*Presents results of a study wherein systemic blood pressure was recorded at rest and during exercise by insertion of a plastic cannula into the cartoid artery of horses, in order to establish the relationship between blood pressure and work load.*
Mic.No: P00524

0853 Hornicke, H.; Meixner, R.; Pollmann, U. 1983. **Respiration in exercising horses.**
Snow, D.H. (ed.); Persson, S.G.B. (ed.); Rose, R.J. (ed.). In: Equine exercise physiology. Proceedings of the first international conference, Granta Editions. Cambridge (UK). 1. International Conference, Oxford (UK), 22–24 Sep 1980, p. 7–16, 6 fig., 1 table; 20 ref. **En** (En)
☐*Reports findings of 47 experiments carried out using a telemetric system for measuring respiratory air flow, oxygen consumption and heart rate of riding horses in the field. Presents data on pulmonary ventilation, oxygen consumption, and oxygen pulse in relation to riding velocity during walk, trot or gallop.*
Mic.No: P00514

0354 Kibler, H.H.; Brody, S. 1945. **Growth and development with special reference to domestic animals. LX. Field studies on cardio-respiratory functions and energy expenditure during work and recovery in mules.**
Missouri Univ., Columbia (USA). Agricultural Experiment Station. Missouri Agricultural Experiment Station Research Bulletin (USA), no. 394, 34p., 10 fig., 7 tables **En** (En)
☐*Describes apparatus and methods for the field measurement of energy expenditure and cardio-respiratory activities for use as criteria of work capacity in mules and horses, and presents data thus obtained on four mules during rest, at work with moderate and overload rates, and during recovery from work. Includes tables and charts on the relations between work rate on the one hand and energy expenditure and cardio-respiratory activities on the other hand as obtained under average field conditions.*
Mic.No: 86971

0855 Lamb, R.C.; Barker, B.O.; Anderson, M.J.; Walters, J.L. 1979. **Effects of forced exercise on two-year old Holstein heifers.**
Journal of Dairy Science (USA), v. 62(11), p. 1791–1797, 4 tables; 6 ref., ISSN 0022-0302. **En** (En)

□*Reports results of two trials on 88 two-year-old Holstein heifers to measure the effects of prepartum exercise on mammary edema, parturition, reproduction, consumption of feed, production and composition of milk and efficiency of feed utilization.*
Mic.No: P00559

0856 Leng, A. 1985. **Muscle metabolism and nutrition in working animals.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10-16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 69-77, 2 fig., 6 tables; 35 ref. **En**
□*Discusses issues related to nutrition and muscle metabolism in working ruminants, with particular reference to effects of work on energy expenditure, the most likely substrates for the heavily working muscle, sources of glucose for muscular work and its modes of utilization, and nutritional constraints to utilizing ruminants for work.*
Mic.No: 80670

0857 Maloiy, G.M.O. 1970. **Water economy of the Somali donkey.**
American Journal of Physiology, v. 219(5), p. 1522-1527, 1 graph, 3 tables; 9 ref. **En**
□*Presents findings of a trial carried out in Kenya to examine the effects of moderate and high ambient temperatures and water restriction on the water balance, feed intake, volume and concentration of urine, and changes in body weight of the Somali donkey.*
Mic.No: 58244

0858 Maloiy, G.M.O. 1971. **Temperature regulation in the Somali donkey (Equus asinus).**
Comparative Biochemistry and Physiology (UK), v. 39A, p. 403-412, 6 graphs; 14 ref. **En** (En)
□*Reports results of experiments carried out under field and controlled laboratory conditions to investigate temperature regulation of the adult Somali donkey when exposed to heat stress and when drinking water is restricted.*
Mic.No: 58246

0859 Maloiy, G.M.O.; Boarer, C.D.H. 1971. **Response of the Somali donkey to dehydration: Hematological changes.**
American Journal of Physiology, v. 221(1), p. 37-41, 2 tables, 2 fig.; 14 ref. **En** (En)
□*Describes results of a study carried out to compare the response of donkeys and zebu steers to dehydration and rehydration, particularly in terms of plasma osmolality, and levels of sodium, chloride, hemoglobin, packed cell volume, red blood cells and plasma volumes.*
Mic.No: 58250

0860 Martin, D.; Kartiarso; Teleni, E. 1989. **Muscle blood flows in draught animals.**
ACIAR, Townsville (Australia). ACIAR DAP Project Bulletin, no. 9, p. 17-19, 1 table; 2 ref., ISSN 0819-2596. **En** (En)
□*Summarizes results of measurement of blood flow and other metabolites in fat and thin steers and buffaloes. Suggests that any differences in quantitative metabolism between muscles of thin and fat cattle and buffaloes, or between cattle and buffaloes would be more a function of arterio-venous (A-V) concentration differences than blood flow; however, differences between working and resting muscles appear more a function of blood flow than A-V concentration differences. Concludes that in the working animal, the metabolic requirements of muscles would be met mainly by increased throughput of metabolites.*
Mic.No: 80962

0861 Maurya, N.L.; Devadattam, D.S.K. 1982. **Response of some physiological parameters of crossbred bullocks to different draft and ambient conditions.**
Indian Journal of Dairy Science, v. 35(1), p. 18-25, 3 fig., 3 tables; 7 ref., ISSN 0019-5146. **En** (En)
□*Details results of a trial carried out to test the physiological responses of Jersey X Red Sindhi bullocks to handling loaded carts on a gravelly track under different draft/ambient condition combinations; parameters studied include pulse rate, respiration rate and body temperature.*
Mic.No: P00561

0862 Mullen, P.A. 1979. **The biochemistry, haematology, nutrition and racing performance of two-year-old thoroughbreds throughout their training and racing season.**
Veterinary Record (UK), v. 104(5), p. 90-95, 8 fig., 3 tables; 33 ref., ISSN 0042-4900. **En**
□*Reports on observations made on 13 two-year-old thoroughbred horses regarding their feeding, work record and race course performance during training for 12 months; correlates the observed parameters.*
Mic.No: P00504

0863 Nangia, O.P.; Rana, R.D.; Singh, N.; Ahmed, A. 1978. **A note on draught capacity in castrated and entire male buffaloes as reflected in some blood constituents.**
Animal Production (UK), v. 27(pt. 2), p. 237-240, 1 table; 19 ref., ISSN 0003-3561. **En** (En)
□*Compares physiological response of castrated and entire male buffaloes to work, with particular reference to levels of blood constituents such as*

glucose, lactic acid, pyruvate, bicarbonate, chloride, total protein and icteric index.
Mic.No: 12684

0864 Pazan, J.D.; Hintz, F. 1986. **Equine energetics. II. Energy expenditure in horses during submaximal exercise.**
Journal of Animal Science (USA), v. 63, p. 822–830, 11 fig., 3 tables; 12 ref., ISSN 0021-8812. **En** (En)
☐*Discusses findings of studies conducted to measure energy expenditure during submaximal exercise (walking, trotting and cantering) in four geldings (433 to 520 kg) on a racetrack, using a mobile open circuit indirect respiration calorimeter.*
Mic.No: P00529

0865 Pearson, R.A. 1985. **Physiological changes associated with work: Some lessons from the horse.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 51–56, 1 fig.; 36 ref. **En**
☐*Examines factors influencing an animal's ability to do work and some of the physiological consequences of exercise, using information obtained from the study of equine exercise physiology. Also considers the application of physiological measurements to draft animals.*
Mic.No: 80674

0866 Pietersen, R.; Ffoulkes, D. 1988. **Thermoregulatory responses in working buffalo with and without covers of wet hessian sacking.**
James Cook Univ., Townsville (Australia). Draught Animal Power Project. DAP Project Bulletin (Australia), no. 5, p. 23–28, 2 fig.; 8 ref. **En**
☐*Presents results of a study using eight non-pregnant female buffalo during a programme of work based on a village draft system in West Java in which the evaporative effect of dampened hessian sacking placed over the backs and flanks was compared with the custom of splashing the uncovered animals with water as a means of reducing heat stress.*
Mic.No: 80367

0867 Rana, R.D.; Singh, N.; Galhotra, M.M.; Nangia, O.P. 1978. **Physiological response to exercise in buffalo-males.**
Indian Journal of Dairy Science, v. 31(4), p. 338–340, 1 table; 8 ref., ISSN 0019-5146. **En** (En)
☐*Describes results of experiment conducted in India in which castrated and uncastrated buffalo males were exercised by pulling a stone roller at a constant speed of about 3 km/h for 3 hours and the resulting changes in rectal temperature, pulse and respiratory rates were observed.*
Mic.No: P00511

0868 Ribeiro, J.M. de C.R.; Brockway, J.M.; Webster, A.J.F. 1977. **A note on the energy cost of walking in cattle.**
Animal Production (UK), v. 25(1), p. 107–110, 1 fig., 2 tables; 7 ref., ISSN 0003-3561. **En** (En)
☐*Presents results of measurements of the heat production of cattle while standing at rest or walking on a treadmill at different speeds, both on the level and at a gradient of six degrees.*
Mic.No: 26022

0869 Richards, J.I.; Lawrence, P.R. 1984. **The estimation of energy expenditure from heart rate measurements in working oxen and buffalo.**
Journal of Agricultural Science (UK), v. 102(pt. 3), p. 711–717, 1 plate, 6 fig.; 6 ref., ISSN 0021-8596. **En** (En)
☐*Details results of experiments carried out to correlate the heart rate and energy expenditure of adult Brahman cattle and water buffalo whilst standing, walking at speeds of up to 1 m/sec and pulling loads of up to 50 kg for periods of 1–2 h/day. Discusses the use of this assessment in predicting the energy expenditure of working animals under field conditions.*
Mic.No: P00503

0870 Sastry, N.S.R.; Georgie, G.C.; Razdan, M.N. 1970. **Studies on the work performance of cross-bred bullocks. III. Responses of some physical and morphological attributes of blood and its formed elements to exercise in Brown Swiss-Sahiwal (F1) and Sahiwal bullocks during two seasons.**
Indian Journal of Animal Production, v. 1(4), p. 176–179, 1 table; 9 ref. **En** (En)
☐*Reports results of experiments that compared Brown Swiss X Sahiwal (F1) and Sahiwal bullocks during a submaximal exercise of 2-hour duration and 2 hours of rest thereafter in autumn and in winter with respect to the responses of whole blood specific gravity and blood morphology.*
Mic.No: P00530

0871 Shibata, M.; Mukai, A.; Kume, S. 1981. **Estimation of energy expenditure in dairy heifers walking on the level and on gradients.**
Kyushu National Agricultural Experiment Station, Chikugo (Japan). Kyushu National Agri-cultural Experiment Station Bulletin (Japan), v. 21, p. 589–609, 2 fig., 11 tables; ref. **En** (En)

□*Presents results of experiment wherein the energy expenditure of 12 heifers was measured when they were resting and walking on the level and on gradients, in order to determine the energy cost of horizontal walking and of vertical ascent and to find a ready method to estimate the energy expenditure of heifers on free range.*
Mic.No: P00506

0872 Singh, N.; Gupta, V.K.; Nangia, O.P. 1979. **Blood constituents in relation to work load in buffalo calves.**
Indian Journal of Experimental Biology, v. 17(8), p. 844–846, 1 table; 33 ref., ISSN 0019–5189. **En** (En)
□*Examines blood constituents of 3-year-old male buffalo calves after work that involves the pulling of a stone-roller weighing 100 kg at a constant speed of about 3 km/h on even ground for 3 hours.*
Mic.No: 86289

0873 Singh, N.; Nangia, O.P.; Garg, S.K.; Dwaraknath, P.K. 1982. **Draught capacity in male buffaloes. 2. Autonomic and haematological responses in untrained entire, castrated and vasectomised animals.**
Indian Journal of Animal Sciences, v. 52(4), p. 216–221, 3 tables; 20 ref. **En** (En)
□*Compares the response of entire, castrated and vasectomized untrained male buffalo-calves of about 3 years of age made to work by pulling a stone-roller weighing 100 kg at a constant speed of about 3 km/h on even ground for 3 hours. Parameters examined include total enythrocyte count, packed cell volume, haemoglobin concentration, specific gravity, erythrocyte sedimentation rate, icteric index, respiration rate, pulse rate, body and skin temperature, and leucocyte count.*
Mic.No: 86286

0874 Sneddon, J.C. 1986. **The effect of treadmill slope on the relationship between heart rate and energy expenditure in cattle walking on treadmills.**
Journal of Agricultural Science (UK), v. 106(3), p. 433–436, 1 plate; 5 ref., ISSN 0021–8596. **En**
□*Reports experiments designed to test the effect of differences in animal, ambient temperature and rate of energy expenditure on the parameters of a linear model relating energy expenditure in cattle and swamp buffaloes working under experimental conditions on treadmills.*
Mic.No: P00509

0875 Thomas, C.K.; Pearson, R.A. 1986. **Effects of ambient temperature and head cooling on energy expenditure, food intake and heat tolerance of Brahman and Brahman X Friesian cattle working on treadmills.**
Animal Production (UK), v. 43(1), p. 83–90, 1 fig., 4 tables; 28 ref., ISSN 0003–3561. **En**(En)
□*Discusses results of experiment carried out to compare the energy expenditure, feed intake and some physiological reactions of Brahman and Brahman X British Friesian cattle working on an inclined treadmill at 33 degrees centigrade. Includes results of investigations on the effect of work at a lower ambient temperature (15 degrees centigrade) and local cooling of the head region while at 33 degrees centigrade.*
Mic.No: P00546

0876 Upadhyay, R.C.; Rao, M.V.N. 1984. **Thermoregulatory responses among bullocks during work under tropical climate.**
Indian Dairyman, v. 36(7), p. 353 **En**
□*Presents results of a study carried out on Haryana and crossbred bullocks to assess their thermo-regulatory responses during work under tropical climates for varying loads and over continued hours of work.*
Mic.No: 66974

0877 Upadhyay, R.C.; Rao, M.V.N. 1985. **Response of buffaloes to heavy working load under tropical conditions.**
Livestock Production Science (Netherlands), v. 13, p. 199–203, 1 fig., 1 table; 10 ref., ISSN 0301–6226. **En** (De En Fr)
□*Assesses the responses of buffaloes subjected to heavy loads during hot dry conditions for three hours continuously by analyzing rectal temperature, respiration rate, heart rate, blood composition, the ability to eliminate heat produced during work, and distress symptoms such as profuse salivation, lack of leg co-ordination, excitement and tongue protrusion.*
Mic.No: 80059

0878 Upadhyay, R.C.; Madan, M.L. 1985. **Studies on blood acid-base status and muscle metabolism in working bullocks.**
Animal Production (UK), v. 40, p. 11–16, 2 tables; 17 ref., ISSN 0003–3561. **En** (En)
□*Examines the effect of heavy work under hot dry conditions on the performance and functional activity of Haryana × Holstein crossbred bullocks in terms of changes in blood acid-base status and muscle metabolism; includes data on rectal temperature, respiration rate, heart rate, blood oxygenation, muscle lactic acid and creatine phosphate.*
Mic.No: 80067

0879 Upadhyay, R.C.; Madan, M.L. 1986. **Cardiac responses to work production under tropical conditions in bovines.**

Indian Journal of Dairy Science, v. 39(4), p. 388–393, 3 plates, 2 fig., 1 table; 12 ref., ISSN 0019–5146. **En**
□*Details results of a test carried out to examine the cardiac responses of four Haryana and four Holstein × Haryana crossbred bullocks subjected to 0.5 tonne and 1.0 tonne load in a modified single-animal pneumatic-tyred bullock cart during summer, hot-humid and winter seasons.*
Mic.No: 80068

0880 Upadhyay, R.C.; Madan, M.L. 1987. **Bovine work production under tropical condition. Thermoregulatory responses.**
Indian Journal of Dairy Science, v. 40(1), p. 23–27, 3 fig., 1 table; ref., ISSN 0019–5146. **En** (En)
□*Presents results of a study undertaken to assess physiological and behavioural responses of crossbred and Haryana bullocks working under different climatic conditions, with emphasis on rectal temperature, respiration and heart rate, frothing, excitement, leg incoordination, movement inhibition and tongue protrusion.*
Mic.No: 80527

0881 Upadhyay, R.C.; Madan, M.L.; Rao, M.V.N. 1987. **Draught animal power research in India. Review.**
World Review of Animal Production (Italy), v. 23(1), p. 65–70, 3 fig., 1 table; 29 ref., ISSN 0043–8979. **En**
□*Reviews the contribution of draft animal power to agricultural production in India, highlighting results of research carried out on the physiological response of animals to work.*
Mic.No: 80058

0882 Vercoe, J.E. 1973. **The energy cost of standing and lying in adult cattle.**
British Journal of Nutrition, v. 30, p. 207–210, 1 table; 8 ref., ISSN 0007–1145. **En** (En)
□*Reports results of experiment in which gas exchanges in 11 steers with a mean weight of 275 kg, fasted for 96 hrs were obtained over time intervals of 5.76 min in a confinement-type respiration chamber, when the animals were either standing or lying. Discusses results in relation to earlier estimates.*
Mic.No: P00507

0883 Wahid, A. 1971. **Draft monograph on Red Sindhi cattle.**
Karachi Univ. (Pakistan), 168p. **En**
□*Describes the development and characteristics of the Red Sindhi cattle breed and of the environment of its homeland, with data on its dairy and reproductive performance in different countries. Analyzes the effect of plowing on body temperature, pulse and respiration rates in bulls.*
Mic.No: 80735

0884 Yousef, M.-K.; Dill, D.B.; Freeland, D.V. 1972. **Energetic cost of grade walking in man and burro, Equus asinus: Desert and mountain.**
Journal of Applied Physiology (USA), v. 33(3), p. 337–340, 2 fig., 2 tables, ISSN 0021–9010. **En**
□*Presents results of experiment conducted to compare the energy expenditure in man and burro walking on grades of from 0 to 17% without a load or with a load equal to 25% of the subject's body weight in the desert or on the mountain.*
Mic.No: P00520

POWER OUTPUT AND DRAFT FORCES

0885 Acharya, S.; Mishra, M.; Nayak, J.B. 1979. **Working capacity and behaviour of crossbred versus nondescript indigenous bullocks under Orissa conditions.**
Indian Journal of Dairy Science, v. 32(1), p. 37–42, 3 tables; 12 ref., ISSN 0019–5146. **En** (En)
□*Presents results of a comparative study made at Orissa, India, on the working capacity (plowing and carting) between crossbred (Holstein X Hariana) F1 bullocks and nondescript indigenous bullocks in different seasons; parameters compared include body measurements, carting capacity, physiological responses, physical behaviour and haematological values.*
Mic.No: P00542

0886 Alikhani, Z. 1981. **Draft measurements in an Alfisol and a Vertisol under two management systems.**
Asian Inst. of Technology, Bangkok (Thailand), 71p., fig.; 100 ref. M.Sc. (Engineering). **En** (En)
□*Reports results of a study conducted to investigate the effect of the broadbed and furrow management systems on the draft requirements of a mouldboard plow and a planter on an Alfisol and a Vertisol. Also reports on the correlation between soil measurements and draft measurements using a shear vane and a penetrometer.*
Mic.No: 86959

0887 Anand, U.; Sundaresan, D. 1974. **Crossbred bullocks can contribute to agricultural operations.**
Indian Farming, v. 24(5), p. 27–29, 3 photographs, 2 tables, ISSN 0019–4786. **En**
□*Describes some indigenous Indian draft animal breeds and their crosses with exotic animals, particularly regarding body measurements and physiological characteristics such as respiration and pulse rates, and work capacity.*
Mic.No: P00512

0888 Berkovitch, I. 1989. **Researchers pull together.**
African Farming (UK), p. 29–30 **En**
☐*Reports on tests being carried out at the AFRC-Engineering (UK) on methods and instrumentation for measuring factors related to the efficiency and working conditions of draft animals, as a prelude to working on directly improving animal-implement systems.*
Mic.No: P00549

0889 Bhosrekar, M.A.; Mangurkar, B.R. 1988. **Draftability of crossbred in comparison to local breed bullocks at ploughing.**
Indian Journal of Animal Sciences, v. 58(8), p. 964–968, 5 tables; 4 ref. **En** (En)
☐*Presents results of a study carried out in India to assess the working capacity of crossbred bullocks (Holstein Friesian X Jersey) by putting them in routine farm operations like plowing and carting at locations having different agroclimatic conditions and soil texture, using same yokes used for local bullocks.*
Mic.No: P00550

0890 Dawson, W.M. 1983. **The pulling ability of horses as shown by dynamometer tests in Illinois.**
s.n., s.l. 26. Annual Meeting of the American Society of Animal Production, s.l., 1–2 Dec 1983, 5p., 1 chart; 3 ref.
En
☐*Reports on the outcome of analysis of data on the pulling ability, age, weight, height, depth of chest, ground to floor of chest, heart girth, breed, sex, soundness, shoeing, condition and quality of horses, in order to determine whether there was an association between any of these characters and pulling ability and if an association was found to determine its nature and extent.*
Mic.No: P00551

0891 Devadattam, D.S.K. 1977. **Development of a loading car for draft animals.**
Journal of Agricultural Engineering (India), v. 14(1), p. 49–50, 1 fig.; 2 ref. **En** (En)
☐*Presents results of trials carried out on a loading car used to test the working capacity of a pair of Haryana bullocks at different loads in field conditions.*
Mic.No: 86285

0892 Devadattam, D.S.K.; Maurya, N.L. 1978. **Draftability of Hariana bullocks.**
Indian Journal of Dairy Science, v. 31(2), p. 120–126, 5 fig., ISSN 0019–5146. **En** (En)
☐*Presents results of experiments conducted to test the work performance of an average pair of Haryana bullocks, by making them haul a loading car at a particular load for 8 cycles, each cycle being 375 meters and observing parameters such as body temperature and pulse rate of bullocks, atmospheric temperature and relative humidity.*
Mic.No: P00525

0893 Dibbits, H.J. 1981. **Factors which influence the power output of draught animals.**
Nairobi Univ. (Kenya). Dept. of Agricultural Engineering, 19p., 6 fig.; 27 ref. **En** (En)
☐*Examines the power output of draft animals and factors that influence it such as health, species, breed, weight, sex, nutrition, work environment and harnessing.*
Mic.No: 80078

0894 Dyrendhal, S.; Bengtsson, G. 1984. **Performance testing of draught horses: Initiatives and experience of the North Swedish Horse Association (NSHA).**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 37–45, ISBN 92–5–001474–0 **En** (Fr)
☐*Describes the history and development of performance testing of draft horses in Swedish institutions, particularly referring to power tests with fixed or mobile ergometers and the draft aptitude test.*
Mic.No: 80587

0895 Garillo, E.P.; Salas, G.G.; Neric, S.P.; Quines, O.D.; Ranjhan, S.K. 1987. **Draftability of swamp buffaloes and their crosses with Murrah (F1) under wetland and dryland tillage operations in the Philippines.**
Indian Journal of Animal Sciences, v. 57(6), p. 575–580, 3 tables; 6 ref., ISSN 0367–8318. **En** (En)
☐*Evaluates four Philippine swamp buffaloes and Phil-Murrah F1 crossbred steers (Murrah × swamp buffaloes) weighing 520 kg and 5–7 years old for their work performance for wet and dry plowings. Compares time required to plow the same size of land, draw-bar horsepower and resistance and adaptability to work as measured by increases in respiration, pulse, temperature and eosinophil counts.*
Mic.No: 80603

0896 Kemp, D.C. 1985. **Performance measurement for ox and implement combinations.**

Indian Society of Agricultutural Engineers Silver Jubilee Convention, s.l., 29–31 Oct 1985. Proceedings of the Indian Society of Agricultural Engineers, v. 1, p. 16–21, 2 photographs; 1 ref. **En** (En)
☐*Describes sensors and a self-contained logger developed at the NIAE, Silsoe (UK) to record data describing the work load and its effect on the animal.*
Mic.No: 80422

0897 Kemp, D.C. 1986. **Performance measurement for ox and implement combinations.**
Agriculture International (UK), v. 38(9), p. 271–273, ISSN 0269–2457. **En**
☐*Describes an instrument package being developed to facilitate an accurate, comprehensive study of the parameters surrounding the draft animal-and-implement cultivation unit with the aim of introducing improvements in performance.*
Mic.No: 80485

0898 Kemp, D.C. 1990. **Workload constraints: The measurement and interpretation of mechanical factors.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 242–246, 1 photograph, 1 graph, 1 fig., ISBN 92–9081–046–7
☐*Briefly describes a system developed by AFRC-Engineering for measuring work output and various physiological parameters of working animals. The system comprises several sensors which are connected to a portable computer. Some results are given for trials carried out in India using the equipment. It is noted that the brief rests from cultivation work that occur when animals turn at the end of rows, appear to significantly reduce animal stress, as indicated by heart rate measurement.*
Mic.No: 82231

0899 Konanta, C.; Limsakul, A.; Treephan, V.; Srisan, Y.; Onwan, N.; Konanta, S. 1986. **Working capacity of Murrah × swamp crossbreds and Thai swamp buffaloes.**
Buffalo Bulletin (Thailand), v. 5(4), p. 75–79, 3 tables; 2 ref., ISSN 0125–6726. **En** (En)
☐*Presents findings of a comparative study on the growth rate and working capacity of Murrah × swamp crossbred and the Thai swamp buffalo under four treatments, viz, feed supplement, non-feed supplement, and working and non-working regimes.*
Mic.No: 80035

0900 Lawrence, P.R.; Pearson, R.A. 1985. **Factors affecting the measurements of draught force, work output and power of oxen.**
Journal of Agricultural Science (UK), v. 105(3), p. 703–714, 3 fig., 11 tables; 5 ref., ISSN 0021–8596. **En** (En)
☐*Reports results of experiments carried out to measure the draft force, speed and power of three pairs of draft oxen performing a variety of tasks over long (30 sec) and short (5 sec) periods, by measuring true and apparent draft.*
Mic.No: 66940

0901 Lawrence, P.R. 1986. **Report on a visit to FAO project ETH/82/004 at Nazareth, Ethiopia from 22 September to 3 November 1986 to set up facilities for the testing of draught oxen.**
Agricultural Implements Research and Improvement Centre, Nazareth (Ethiopia), 36p., 16 photographs, 3 drawings **En**
☐*Describes the setting-up of facilities to test the work output and draft force of work oxen and discusses problems encountered. Makes recommendations for the use of loading devices, measurement of work output, body temperature and heart rate and ways of improving facilities for handling animals and the level of skill amongst the staff.*
Mic.No: 80558

0902 Lawrence, P.R.; Pearson, R.A. 1989. **Measurement of energy expenditure in working animals: Methods for different conditions.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 155–165, 5 diagrams, 1 table; 28 ref., ISBN 1–86320–003–7 **En** (En)
☐*Defines and briefly discusses the terms heat output, energy expenditure, direct measurement of heat output and indirect measurement of energy expenditure, in relation to draft animals; direct measurement of heat output appears not to be feasible for draft animals. Discusses methods of measuring gaseous exchange and the theory and applicability of two tracer methods. Suggests that two possible alternative methods (one direct and one indirect) from human physiology might be worth developing.*
Mic.No: 80937

0903 Mack, von R.P.; Weniger, J.H.; Teuscher, T. 1987. **Untersuchungen uber die Arbeitseignung von Zugochsen der lokalen rase und F-1-Kreuzumgstieren in Bangladesh. (Work performance of local and F1 steers in Bangladesh)**
Journal of Animal Breeding and Genetics (Germany, F.R.), v. 14(1,2), p. 96–112, 1 table,

18 fig.; 19 ref., ISSN 0401-0096. **De** (De En Es Fr Nl)
□*Presents results of a study carried out in Bangladesh to compare draft animals of the local breed and its F1 crosses with either Jersey or Friesian cattle, particularly in terms of long-term draft power, maximal draft power and working ability under typical local working conditions.*
Mic.No: 80752

0904 Macmillan, R.H. 1985. **Engineering problems in the measurement of draught animal performance.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10-16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 149-155, 6 fig., 1 table; 5 ref. **En**
□*Discusses engineering aspects of the animal draft process, reviewing briefly animal-implement characteristics, the energy-absorbing process which might be used in a dynamometer to absorb energy from a draft animal, and the form which the mechanism or measurement system might take.*
Mic.No: 80666

0905 Matthews, M.D.P.; Kemp, D.C. 1985. **Techniques proposées pour la mesure précise des performances des boeufs de trait au travail. (Proposed techniques for the precise measurement of the performance of draft oxen at work)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 12-15, 2 photographs **Fr**
□*Describes techniques for monitoring the effects of work on physiology of draft animals.*
Mic.No: 80369

0906 Matthews, M.D.P. 1987. **The Philippines – measuring draught animal power of carabaos crossbred with exotic buffaloes. (Philippines. Mesure de la puissance de trait des carabaos croisés avec des buffles exotiques)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 63, p. 15-19, 4 fig., 1 ref., ISSN 0049-8025. **En, Fr**
□*Describes planned evaluation of crossbreeding work carried out at the Philippine Carabao Research and Development Centre (PCRDC), where efforts were made to develop a triple-purpose breed by crossbreeding carabao with Murti buffalo from India and Nili-Ravi buffalo from Pakistan.*
Mic.No: 80482

0907 Maurya, N.L. 1982. **Draftability of cross-bred bullocks.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16-17 Jul 1982, 24p., 6 fig., 1 table; 13 ref. **En**
□*Presents results of a study undertaken in India to test crossbred (Jersey x Red Sindhi) bullocks for their draft performance, endurance and heat sensitiveness, by varying draft from 11 to 18% of the animals' body weight and observing changes in power output and speed of bullocks.*
Mic.No: 80607

0908 Mukherje, D.P.; Dutta, S.; Bhattacharya, P. 1961. **Studies on the draught capacity of Haryana bullocks.**
Indian Journal of Veterinary Science, v. 31(1), p. 39-50, 1 fig., 5 tables; 10 ref. **En**
□*Discusses findings of an experiment carried out in India to determine whether the draft capacity of Haryana bullocks could be correlated with physiological characteristics of animals which could easily be measured under field conditions, such as pulse rate, respiration rate, body temperature and body weight.*
Mic.No: P00554

0909 Nagpaul, P.K.; Rao, M.V.N.; Singh, C.B.; Bhatnagar, D.S. 1984.
Draught efficiency of crossbred vis-à-vis Zebu and buffalo bullocks in India.
World Review of Animal Production (Italy), v. 20(3), p. 51-55, 4 plates, 5 tables; 8 ref., ISSN 0043-8979. **En**
□*Reports results of investigations carried out in India to compare physiological and behavioural responses of zebu, crossbred and buffalo bullocks to work on various farm operations such as carting and plowing during hot summer and winter seasons.*
Mic.No: 66191

0910 O'Neill, D.H.; Howell, P.J.L.; Paice, M.E.R.; Kemp, D.C. 1987.
An instrumentation system to measure the performance of draught animals at work.
AFRC Engineering, Silsoe (UK). National Seminar on Animal Energy Utilization, Bhopal (India), 24-25 Jan 1987, 22p., 6 diagrams, 2 tables, 4 photographs; 10 ref. **En** (En)
□*Describes an instrumentation system for acquiring data on the performance of draft animals at work and gives a general specification for the sensors, the original conditioning circuits and the data logger. Outlines the potential of the system for increasing the understanding of factors affecting the application of draft animal power to cultivation and presents some results from field trials in Ethiopia and India demonstrating the use of the system.*
Mic.No: 80957

0911 O'Neill, D.H.; Kemp, D.C. 1988. **A comparison of work outputs of draught oxen.**
s.n., s.l. International Conference on Agricultural Engineering, Paris (France), 2–5 Mar 1988, 12p., 2 fig., 5 tables; 5 ref. **En**
☐*Reports findings of trials carried out in India to assess factors that influence the work output of working oxen, by measuring seven variables selected as indicative of performance of the animal-implement system, particularly draft force, draft angle, forward progression, heart rate, breathing rate, body temperature and stepping rate.*
Mic.No: 86967

0912 O'Neill, D.H.; Kemp, D.C. 1988. **Research to improve the efficiency of draught ox powered cultivation (Project R3906).**
AFRC Engineering, Silsoe (UK), 41p., tables; 2 ref. **En** (En)
☐*Reports on the progress of a collaborative project between AFRC-Engineering, CTVM (Edinburgh) and CIAE (Bhopal) and describes the instrumentation system developed specifically for the project. Discusses results of 4 seasons of work at CIAE, Bhopal, India covering 52 field trials with oxen in which relationships between heart rate and draft force and heart rate and power were identified, suggesting that draft force variability may interact with cardiovascular stress and thus be a possible constraint to work output.*
Mic.No: 80563

0913 O'Neill, D.H.; Hayton, S.; Sims, B.G. 1989. **Measurement of draught animal performance.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 264–271, 3 photographs, 1 table, 2 graphs; 20 ref., ISBN 1-86320-003-7 **En** (En)
☐*Describes the new AFRC-Engineering (UK) draft animal performance data logger which modifies and records mechanical (draft force, angle of application of draft force, speed) and physiological (heart rate, breathing rate, body temperature, stepping rate) performance data during work in field conditions. Preliminary results have shown a good correlation between power output and working heart rate; healthy oxen can perform sustained work with heart rates twice the resting value.*
Mic.No: 80947

0914 Pathak, B.S. 1985. **Engineering and draught animal power.**
Copland, J.W. (ed.). In: Draught animal power for production, International Workshop on Draught Animal Power for Production, Townsville (Australia), 10–16 Jul 1985. ACIAR Proceedings Series, no. 10, p. 156–160, 1 fig., 1 table; 7 ref. **En**
☐*Discusses engineering aspects related to the capacity and performance of draft animal power/implement system, taking oxen as the power unit.*
Mic.No: 80665

0915 Phillips, R.W.; Madsen, M.A.; Smith, H.H. 1940. **Dynamometer tests of draft horses.**
Utah State Agricultural Coll., Logan (USA). Agricultural Experiment Station. Utah Agricultural Experiment Station Circular (USA), no. 114, 14p., 5 fig., 5 tables; 14 ref. **En** (En)
☐*Discusses the usefulness of dynamometer tests for accurate measurement of tractive pull exerted by horses, using data recorded during pulling contests in Utah and southern Idaho during the years 1931–1939.*
Mic.No: 86973

0916 Rao, M.V.N.; Upadhyay, R.C. 1984. **Work performance of cross-bred bullocks.**
Indian Veterinary Journal, v. 61, p. 1050–1053, 2 tables; 10 ref. **En** (En)
☐*Reports findings of experiments carried out to assess the work performance of Sahiwal × Jersey crossbred bullocks by subjecting them to carting and plowing work and recording distress symptoms such as dribbling of saliva from the mouth, movement inhibition, and general fatigue or exhaustion as well as physiological reactions in terms of pulse and respiration rates.*
Mic.No: 80072

0917 Rao, M.V.N. s.d. **A comparative study of the draft capacity of cross-bred bullocks and indigenous bullocks.**
s.n., s.l., 6p., 3 tables **En**
☐*Reports results of experiments conducted in India wherein different age groups of crossbred and Haryana bullocks were put to plowing work during hot-humid, hot-dry, and winter seasons and physiological responses such as pulse rate, respiration rate and blood lactic acid rate as well as work efficiency in terms of distance covered and time taken were compared.*
Mic.No: 86979

0918 Rapte, S.L. 1982. **Draft requirement of various bullock drawn implements in deep black soil under different soil moisture levels.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 7p., 2 tables; 2 ref. **En**

□*Describes results of a trial undertaken in India to study soil moisture and draft relationships and to determine the optimum moisture level which creates soil conditions that offer least resistance to implements such as plows, blade harrows, seed drills and blade hoes.*
Mic.No: 80608

0919 Rautaray, S.K.; Srivastava, N.S.L. 1982. **Field performance of crossbred bullocks in black soils during tillage operations in summer.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 19p., 1 table, 9 fig.; 3 ref. **En**
□*Presents results of trials undertaken in India to evaluate the field performance of crossbred (Red Dane × Sahiwal) bullocks on black soils during tillage operations in summer, with particular reference to power and work output under continuous work and long duration trials, and physiological reactions such as changes in respiration rate, pulse rate and body temperature at different levels of power output.*
Mic.No: 80696

0920 Roy, S.R.; Neogi, A.K.; Guha, H. 1972. **Cross-bred bullocks vs. indigenous bullocks for draught purpose under West Bengal conditions.**
Indian Dairyman, v. 24, p. 66–70, 2 photographs, 3 tables, ISSN 0019–4603. **En**
□*Presents results of an experiment conducted in India to study the comparative merit of crossbred (Haryana X Jersey) bullocks and purebred Haryana bullocks for draft purpose.*
Mic.No: P00510

0921 Shetto, R.M. 1983. **Work assessment of draught animals.**
Cranfield Inst. of Technology, Bedford (UK). Faculty of Agricultural Engineering, Food Production and Rural Land Use, 70p., 6 plates, 8 fig., 2 tables; 28 ref. M.Sc. (Agricultural Engineering). **En** (En)
□*Reports results on an investigation carried out to study the use of heart rate as an indication of work output of draft animals, by analyzing data on heart rate, draft and speed recorded while carrying out field operations such as carting different weights, plowing, harrowing and cultivating with spring tines.*
Mic.No: 38274

0922 Sims, B.G.; Aragon, R.A. 1989. **Draft oxen energy expenditure: A Mexican case study.**
Agricultural Mechanization in Asia, Africa and Latin America (Japan), v. 20(2), p. 9–14, 5 tables, 1 photograph, 1 diagram; 16 ref. **En** En)
□*Presents measurements of power output and energy use of a pair of draft bulls performing traditional tasks on a small farm in Veracruz, Mexico. Data obtained using instruments made in Costa Rica was used to make preliminary observations on improvement of use of draft bulls. Suggests that with adequate feeding, a single draft animal can perform light tasks such as cultivating and planting and therefore single yokes should be evaluated, that irrigation would enable better use of draft animals during the dry season, and reducing excessive tillage would reduce energy use and allow greater areas to be sown.*
Mic.No: 80514

0923 Singhal, O.P.; Tomar, S.S. 1982. **Measurement of draftability of draught animal power.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 28p., 8 tables, 3 fig.; 17 ref. **En**
□*Reviews research conducted in India and elsewhere, on the performance measurement of draft animal power (DAP), with emphasis on works related to the physiological and engineering aspects of draft animals; identifies gaps in research work and outlines studies being undertaken at the Central Institute of Agricultural Engineering in Bhopal.*
Mic.No: 80668

0924 Slingerland, M.A. 1989. **Selection of animals for work in sub-Saharan Africa: Research at the ICRISAT Sahelian centre.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 203–210, 4 tables, 3 diagrams; 13 ref., ISBN 1–86320–003–7 **En** (En)
□*Reviews the development of draft animal power (DAP) in sub-Saharan Africa and the effects of DAP on agricultural production. Presents results of draft capacity trials with sledges and a braking device carried out in Niger, in which average and maximum power and work outputs for all species (bullocks, oxen, horses, camels) were determined in relation to imposed draft forces and liveweights. Suggests that horses and camels should also be tested in pairs and that cows should also be investigated.*
Mic.No: 82253

0925 Upadhyay, R.C.; Madan, M.L.; Rao, M.V.N. 1985. **Draught capacity of bullocks. A review.**
Agricultural Reviews (India), v. 6(1), p. 41–48, 30 ref., ISSN 0253–1496. **En** (En)
☐*Reviews major approaches employed and the salient findings of various investigations carried out to assess the draft capacity and efficiency of native Indian bullocks.*
Mic.No: 80062

0926 Upadhyay, R.C.; Madan, M.L. 1985. **Draught performance of Hariana and crossbred bullocks in different seasons.**
Indian Journal of Animal Sciences, v. 55(1), p. 50–54, 2 fig., 2 tables; 8 ref., ISSN 0367–8318. **En** (En)
☐*Evaluates the draft performance and work efficiency of Haryana and crossbred bullocks under hot-dry, hot-humid and dry-cold climatic conditions for varying loads and over continued hours of work, using single-animal pneumatic-tyred bullock carts.*
Mic.No: 80471

0927 Upadhyay, R.C. 1987. **Factors limiting work capacity and fatigue assessment in draught animals.**
Srivastava, N.S.L. (ed.); Ojha, T.P. (ed.). In: Utilization and economics of draught animal power. Proceedings of the national seminar, National Seminar on Status of Animal Energy Utilization, Bhopal (India), 24–25 Jan 1987, 16p., 3 fig., 3 tables; 31 ref. **En** (En)
☐*Reviews available information on factors limiting work performance of bovines and suggests a score card for fatigue assessment based on physiological reactions, distress symptoms and behavioural manifestations.*
Mic.No: 80079

0928 Upadhyay, R.C.; Madan, M.L. 1987. **Work capacity, speed and efficiency of sustained work of crossbred and Haryana bullocks.**
Indian Journal of Dairy Science, v. 40(1), p. 28–31, 2 fig., 1 table; 12 ref., ISSN 0019–5146. **En** (En)
☐*Presents findings of investigation carried out to evaluate pure and crossbred Haryana bullocks for their draft capabilities, efficiency and load fatigue relationships under summer, hot-humid and winter conditions.*
Mic.No: 80065

0929 Upadhyay, R.C. 1989. **Performance limiting factors in draught animals: Can they be manipulated to improve output.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 166–175, 4 diagrams; ref., ISBN 1–86320–003–7 **En** (En)
☐*Reviews the factors limiting the performance of draft animals and concludes that climate is the main constraint limiting work, stressing the physiological systems and inducing fatigue. Suggests ways in which climatic stress can be prevented and work output maximised, including improved harnessing techniques.*
Mic.No: 80938

0930 Willcocks, T.J. 1979. **Tillage energy requirements for semi-arid crop production in Botswana.**
Lal, R. (ed.). In: Soil tillage and crop production, Conference on the Role of Soil Physical Properties in Maintaining Productivity of Tropical Soils, Ibadan (Nigeria), 6–10 Dec 1977. IITA Proceedings Series, no. 2, p. 303–323, 4 fig., 5 plates, 9 tables; 15 ref. **En**
☐*Presents results of two agricultural engineering studies carried out in the semi-arid regions of Botswana to examine optimum tillage for reliable and efficient crop production, in terms of soil bulk density, moisture conservation, sheer strength, tillage depth and clod size; and to quantitatively assess amount of energy input required to reduce soil bulk density when using different types of tillage implements and to produce a ton of grain, one for dryland tillage when using various tractor-mounted equipment and the other for animal-drawn implements.*
Mic.No: 82269

HARNESSING SYSTEMS AND YOKES

0931 Anon. 1979. **The buffalo as a draft animal in Thailand.**
USAID, Bangkok (Thailand). Livestock Div., 30p., 8 tables, photographs **En**
☐*Briefly reviews the importance of the water buffalo in Thailand especially as a draft animal and points out that its current inefficiency is due to the type of harness used which restricts breathing. Discusses attempts to improve buffalo harnesses using a locally made collar and harness. Presents results of trials during which new harnesses proved superior for plowing and harrowing and in maximum load and endurance tests.*
Mic.No: 80548

0932 Anon. 1986. **Animal draught power, no. 2.**
Bellerive Rural Technology, Geneva (Switzerland), 4p., 2 drawings, 1 photograph **En**
☐*Reviews the role of correct harnessing on the efficiency of animal traction and discusses the*

creation in Kenya and other parts of Africa of centres to produce the modified Swiss collar.
Mic.No: 80853

0933 Anon. s.d. **Guide de l'attelage du bétail bovin. (Guide to the harnessing of oxen)**
Fédération Suisse d'Elevage de la Race Tachetée Rouge, Berne (Suisse), 9p., 7 drawings **Fr**
□*Contains recommendations on management of draft oxen, including lactating females, in Switzerland and covers harnessing, training, working day, feeding and animal health.*
Mic.No: 80141

0934 Ayre, M.; Swamy Rao, A.A. 1981. **Bullock Harness Research Project. Synopsis of a report on the preliminary investigations, design and development, testing and economic analysis of the new single and double bullock harnesses at the Development Center from May 1962 to April 1964 by A.A. Swamy Rao.**
Intermediate Technology Transport Ltd, Ardington (UK), 18p., 8 tables, 6 drawings; 9 ref. **En**
□*Synopsis of an original report on harnessing research at Allahabad (India). Discusses use of bullocks as draft animals, existing harnessing equipment (single harnesses and double yokes) and results of experiments which indicated the possibility of using one basic design to produce both single and double harnesses. Describes new harnesses developed and reports results of sledge and plow experiments comparing the single harness with a Japanese harness and the double harness with the Nagpuri yoke.*
Mic.No: 80149

0935 Ayre, M. 1982. **The Allahabad collar harness.**
Appropriate Technology (UK), v. 9(1), p. 26–28, 4 fig.: 1 ref., ISSN 0305–0920. **En**
□*Describes an improved bovine harness developed at the Allahabad Agricultural Institute in India, between 1962 and 1964, along with results of evaluation of the harness under continuous working conditions.*
Mic.No: 80148

0936 Barton, D. 1985. **Yokes or collars? Harnessing techniques for draught cattle.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine. Draught Animal News (UK), no. 4, p. 1–5, 1 fig., 4 tables **En**
□*Presents results of experiments to establish relative efficiencies of yoke and collar methods of harnessing draft oxen in Burundi using Ankole bullocks for plowing, harrowing, ridging and weeding operations and at the University of East Anglia (UK) using Hereford × Friesian bullocks for plowing and harrowing.*
Mic.No: 80849

0937 Barwell, I.; Ayre, M. 1982. **The harnessing of draught animals.**
Intermediate Technology Transport Ltd, Ardington (UK), 92p., 53 illus. **En**
□*Presents information on draft characteristics of bovines and equines, discussing requirements of efficient harnesses; and describes and analyses bovine yokes and harnesses along with information on improved technologies. Includes a list of contact organizations and useful publications.*
Mic.No: 34551

0938 Conroy, D. 1988. **The traditional ox team and its yoke.**
Tillers Report (USA), v. 8(1), p. 1–5, 12 photographs; 2 ref. **En**
□*Suggests that oxen can be controlled with voice, yoke and goad alone and that there is no reason to adapt horse harnesses to oxen. Discusses different yokes and the importance of a good fit.*
Mic.No: 80363

0939 Delamarre, M.J.-B. 1969. **Géographie et éthnologie de l'attelage au joug en France du XVIIe siècle à nos jours. (Geographical aspects and ethnology of harnessing to yokes used in France from the 17th century to the present day)**
Vydalo Slovacke Museum Uherske Hradiste (Czechoslovakia), 132p., drawings, photographs **Cz, Fr**
□*Describes and illustrates yokes used in France for draft animals from the 17th century to the present day.*
Mic.No: 80151

0940 Devnani, R.S. 1981. **Design considerations for harnesses and yokes for draught animals.**
Central Inst. of Agricultural Engineering, Bhopal (India). CIAE Technical Bulletin (India), no. CIAE/81/30, 67p., 4 tables, 1 map, 17 drawings, 12 photographs; 28 ref. **En**
□*Reviews research work on design of harnesses and yokes for draft animals in India and abroad and makes suggestions for future research.*
Mic.No: 80156

0941 Devnani, R.S. 1982. **Mechanics of animal traction.**
Journal of Agricultural Engineering (India), v. 19(3), p. 71–79, 4 fig.; 9 ref. **En**
□*Describes the analysis and mathematical relationships among the parameters which control the*

output or pull developed by working animals, particularly animal characteristics, terrain or soil conditions and method of harnessing or hitching. Discusses the advantages of different harnessing methods, viz the neck, trunk, shoulder and trunk, and the neck and forehead methods of harnessing.
Mic.No: P00505

0942 Devnani, R.S. 1983. **Design considerations for harness and yokes.**
RNAM Newsletter (Philippines), no. 18, 1p., 2 photographs, 8 drawings **En**
☐*Describes the basic design of harnesses and yokes used for bullocks in India.*
Mic.No: 80139

0943 Dibbits, H.J. 1981. **The use of draught animal power in Kenya.**
Nairobi Univ. (Kenya). Dept. of Agricultural Engineering. Workshop on Draught Animal Power of the Non-Governmental Organisations on New and Renewable Sources of Energy, s.l., 9-16 Aug 1981, 12p., 1 table; 5 ref. **En**
☐*Discusses the situation of draft animal power use in Kenya, describing factors which influence the power output of animals, constraints to the development of draft animal power such as lack of proper harnesses and suitable animal-drawn vehicles and small size of farms.*
Mic.No: 80045

0944 Dibbits, H.J. 1984. **Proper harnessing, key to better use of draught animals.**
Kenya Farmer, p. 6-8, 3 fig.; 4 ref., ISSN 0023-0421. **En** (En)
☐*Discusses the importance of a comfortable, efficient harness in the development of draft animal technology together with criteria for harness development. Describes an improved donkey harness and a three-pad collar harness suitable for one or several oxen.*
Mic.No: 80133

0945 Dibbits, H.J. 1985. **UNIDIB donkey harness.**
Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine. Draught Animal News (UK), no. 4, p. 16-17, 1 drawing **En**
☐*Discusses the importance of a well-harnessed donkey for pulling carts, plows, harrows and weeders especially in arid and semi-arid areas. Describes the UNIDIB donkey harness which it is hoped can be simplified in order to reduce costs thus encouraging construction at the village level.*
Mic.No: 80850

0946 Dibbits, H.J. 1985. **The donkeys' formidable role in agriculture.**
Kenya Farmer, p. 31, 33, 5 drawings, ISSN 0023-0421. **En**
☐*Suggests that with proper harnessing donkeys can be used for farming operations like plowing and weeding instead of simply as pack animals or to pull carts. Stresses the importance of a well-fitting collar. Describes the UNIDIB donkey harness which has proved very efficient in Kenya and whose design will be simplified so that it can be produced at low cost at village level.*
Mic.No: 80145

0947 Dibbits, H.J. 1985. **Animal Draft Power Development Project. Progress report no. 1.**
Nairobi Univ. (Kenya). Dept. of Agricultural Engineering, 36p., 5 drawings, 6 photographs; 4 ref. **En**
☐*Presents the background to the Kenyan Animal Draft Power Development Project and describes current harnessing systems for oxen and donkeys, rural transport, development of new harnessing systems for oxen (improved neck yoke and collar harness), development of a collar harness for donkeys and training and extension (harness makers' courses).*
Mic.No: 80158

0948 Dibbits, H.J. 1986. **Use of human and animal power on small farms in Africa.**
USAID, Washington, D.C. (USA); IRRI, Manila (Philippines). In: Small farm equipment for developing countries, International Conference on Small Farm Equipment for Developing Countries: Past Experiences and Future Priorities, Manila (Philippines), 2-6 Sep 1985, p. 577-582, 3 drawings; 4 ref. **En**
☐*Compares use of human power with that of animal power in Africa and discusses the importance of harnessing systems and implements in developing an efficient mechanized system based on animal draft.*
Mic.No: 80144

0949 Duchenne, T. 1984. **Le point sur les harnais pour la traction animale. (Harnesses for animal traction)**
Groupe de Recherche et d'Echanges Technologiques, Paris (France); Groupe de Recherches et de Réalisations pour le Développement Rural dans le tiers-monde, Paris (France). GRET Dossier (France), no. 5, 127p., 174 fig.; 63 ref., ISBN 2-86844-003-7 **Fr**
☐*Traces the historical development of harnessing techniques and the European, (particularly the French) concept of bovine and equine harnesses; studies constraints to the transfer of the French) techniques of harness production to developing countries. Provides illustrations of several proto-*

type yokes and harness systems developed in recent years and discusses some research studies on these.
Mic.No: 35411

0950 Fenton, A. 1969. **Draught oxen in Britain.**
Narodopisny Vestnik Ceskoslovensky, v. 3,4, p. 17–51, 12 fig., 2 photographs, 1 table; 70 ref. **En**
☐*Describes the history of the use of draft oxen in the UK, geographical distribution of ox and horse draft, changes in yoke types, teams and techniques and the change from yokes to collars. Discusses the relation between the declining use of oxen and the advance of agricultural improvements in Europe.*
Mic.No: 80134

0951 Fenton, A. 1973. **Early yoke types in Britain.**
Wellman, I. (ed.). In: Proceedings of the Hungarian Agricultural Museum. 1971–1972, p. 69–75, 3 fig.; 12 ref. **En**
☐*Describes 13 yokes of a variety of forms found in peat bogs in Scotland and Ireland none of which parallel the withers yokes which alone are known from the medieval period to the 19th century.*
Mic.No: 80848

0952 Froese, C. 1980. **Harness Project report.**
Mocnudi Farmers' Brigade (Botswana), 39p., 35 drawings **En**
☐*Describes and illustrates correct harnessing for donkeys, oxen and goats in Botswana.*
Mic.No: 80157

0953 Garner, J.K. 1957. **Increasing the work efficiency of water buffalo in drawing the plow and other drawn implements through the use of improved harness.**
US Operations Mission, Bangkok (Thailand), 11p., 4 tables **En**
☐*Discusses the importance of the water buffalo in various parts of the world, its uses as a draft animal and inefficiency of harnesses currently used. Describes experiments carried out to improve harnesses bearing in mind the importance of cost and local manufacture and value of increased efficiency. Reports on tests using the improved harnesses with water buffalo for plowing and harrowing to determine maximum load and endurance.*
Mic.No: 80150

0954 Gunthart, A. 1938. **Die erziehung des rindes zum zuge. (Training draft animals)**
Landwirtschaftliche Zeitschrift (Germany, F.R.), no. 6, p. 141–146, 1 drawing, 2 photographs **De**
☐*Briefly describes single harnesses for use with oxen in Switzerland*
Mic.No: 80852

0955 Gunthart, A. 1938. **Die Kraftentwicklung des Rindes. (The development of the strength of cows)**
Landwirtschaftliche Zeitschrift (Germany, F.R.), no. 25, p. 615–617, 1 drawing **De**
☐*Briefly describes reining and yoking systems for use with draft oxen in Switzerland.*
Mic.No: 80155

0956 Hussain. A.A.M.; Hussain, M.D.; Hossain, M.M. 1980. **Design and development of neck harness for cattle in Bangladesh.**
Agricultural Mechanization in Asia (Japan), Winter, p. 85–89, 1 fig., 3 tables, 5 graphs, 7 photographs; 5 ref. **En** (En)
☐*Presents results of performance tests with oxen using three harnesses developed in Bangladesh in which working speed, specific draft produced with plows, power and energy outputs and total area plowed were determined. Recommends one of these harnesses for commercial manufacture and use in Bangladesh.*
Mic.No: 80140

0957 Kerman, C. 1985. **Charrues et traction animale (1re partie). (Plow and animal traction, part 1)**
Inter-Tropiques (France), no. 9, p. 16–18, 2 photographs **Fr**
☐*Examines the characteristics and use of donkeys, oxen and horses for work, outlining harnessing techniques suitable for each species.*
Mic.No: 80597

0958 Kivikko, R.; Roosenberg, R. 1987. **Designing ox yokes for more effective power.**
Tillers Report (USA), Spring, p. 5–7, 5 fig., 1 table **En**
☐*Discusses the importance of good yoking for using draft oxen efficiently. Describes differences in yoke design and how traditional designs can be improved.*
Mic.No: 80147

0959 Kivikko, R. 1987. **Preliminary tests for single animal harness systems.**
Tillers Report (USA), Spring, p. 8–9, 1 drawing, 1 photograph, 2 graphs **En**
☐*Presents results of tests comparing the three-pad collar with a single yoke using a Shorthorn ox.*
Mic.No: 80146

0960 Kramer, D.; Roosenberg, R. 1989. **Production bending of ox bows.**
Tillers Report (USA), v. 9(2), p. 6–8, 6 photographs **En** (En)
☐*Describes modifications to a steaming technique for bending ox bows for use in developing countries.*
Mic.No: 80554

0961 Matthews, M.D.P. 1985. **Harnesses for animal power.**
National Inst. of Agricultural Engineering, Silsoe, Bedford (UK), 9p., 18 ref. **En** (En)
☐*Discusses advantages and limitations of traditional harnesses for oxen and alternatives to traditional designs. Makes suggestions for farther research preceded by farmer surveys and studies to determine the importance of the harness within the overall system.*
Mic.No: 80143

0962 Matthews, M.D.P. 1988. **Harnesses for animal power. (Harnais et énergie animale)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 60, p. 45–48, 2 plates: 11 ref., ISSN 0049–8025. **En, Fr**
☐*Discusses the need for proper harnessing of working animals, briefly describing types of traditional harnesses, alternatives to traditional designs and research and development work in different parts of the world.*
Mic.No: 80622

0963 Micuta, W. 1984. **The "Swiss collar" for developing countries.**
Bellerive Foundation, Geneva (Switzerland), 18p., 7 drawings, 9 photographs **En**
☐*Describes the characteristics of a good harness, the modified Swiss collar harness for use in developing countries and tests carried out with the new collar in Switzerland with cows and in Kenya with donkeys and oxen. Discusses the advantages of a collar harness over yokes.*
Mic.No: 80165

0964 Micuta, W. 1985. **The Swiss collar: A harness for developing countries.**
World Crops and Livestock (UK), v. 37(4), p. 130–135, 7 photographs, 6 drawings **En**
☐*Discusses the characteristics of a good harness. Describes a modified Swiss collar for use in developing countries and outlines tests carried out with the collar in Switzerland with cows and in Kenya with oxen and donkeys. Evaluates the advantages of a collar harness over a yoke.*
Mic.No: 80165

0965 Nielson, H. 1970. **Informal technical report on improvement of ox yokes.**
FAO, Rome (Italy), 12p., 9 plates **En** (En)
☐*Describes, with the help of diagrams, the types of ox yokes currently in use in Malawi; and presents designs of several experimental types which enable the animal to exert greater traction on implements and which are more convenient for the Malawi Zebu.*
Mic.No: 55232

0966 Orev, Y. 1977. **Improved farming system for Botswana.**
Appropriate Technology (UK), v. 4(2), p. 26–28, 2 drawings, 2 photographs, ISSN 0305–0920. **En**
☐*Discusses improving farming in Botswana (currently based on a single-furrow mouldboard plow) by introducing row planters, winter fallowing and use of fertilizers. Stresses the importance of harnessing for draft animals and recommends the three-pad harness for oxen and for donkeys a South African breastband and harness both of which could be locally produced.*
Mic.No: 80159

0967 Pragasam, A.R.A. 1987. **A three-point harness system for single-animal-drawn carts and implements. (Système d'attelage à trois points pour charrettes et instruments tirés par un seul animal)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 63, p. 20–22, 6 fig., ISSN 0049–8025. **En**
☐*Presents the three-point harness system, which can be easily attached to any type of cart or implement, is within the economic means of the average farmer, gives better draft power and is easily accepted by the animal.*
Mic.No: 80526

0968 Scherrer, J. 1966. **La traction animale en agriculture: possibilités pratiques des attelages 1966. (Animal traction in agriculture. Harnessing, 1966)**
Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Antananarivo (Madagascar). Région de Recherches de Madagascar; Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France), 10p., 3 tables **Fr**
☐*Describes results obtained on the use of harnesses in Madagascar, examining the strength of harnesses, the average level of power developed by different types of harnesses and the notion of maximum instantaneous pull.*
Mic.No: 77617

0969 Starkey, P.H. 1989. **Harnessing for cattle and buffaloes: Options and research.**

Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 280–292, 3 diagrams; ref., ISBN 1-86320-003-7 **En** (En)

☐*Reviews recent research and development initiatives related to harnessing with the emphasis on bovine harnessing systems and attempts to clarify some apparent areas of controversy. Includes sections on definitions, forehead, horn/head, withers/shoulder and single yokes, multiple hitching, full collars and three-pad harnesses, tyre collars and flexible harnesses, collar-type yokes, merits and demerits of yokes and animal comfort. Suggests that scope exists for thorough research on the mechanical and physiological attributes of harnesses and questions whether physiological stress indicates an efficient or an uncomfortable harness.*

Mic.No: 80948

0970 Varshney, B.P.; Mishra, T.N.; Kumar, A.; Singh, R.P. 1982. **Performance of harnesses used for draught animals.**

Agricultural Mechanization in Asia, Africa and Latin America (Japan), Summer, p. 15–19, 14 fig.; 5 ref. **En** (En)

☐*Five bullock harnesses from different regions of Uttar Pradesh (India) were evaluated in terms of their effect on speed, temperature, pulse rate and respiration rate of the animal carrying loads of 62, 105, 150 and 210 kg.*

Mic.No: 80404

0971 Vaugh, M. 1945. **Report on a detailed study of methods of yoking bullocks for agricultural work presented to the Imperial Council for Agricultural Research.**

Indian Journal of Veterinary Science and Animal Husbandry, v. 25(3), p. 186–198, 2 fig., 4 tables **En**

☐*Presents results of experiments in which 17 yokes (double and single hitches) were evaluated in terms of their effect on the pulling power of bullocks.*

Mic.No: 80132

0972 Vietmeyer, N. 1982. **The untapped science of animal power. (La science ignorée de l'énergie animale)**

Ceres. FAO Review(Ceres. Revue de la FAO), v. 15(4), p. 42–45, 8 plates, ISSN 0009-0379. **En, Fr**

☐*Discusses the need to develop and improve the yokes, harnesses, implements and vehicles used with oxen, water buffaloes and other draft animals. Also discusses the advantages of single harnesses, collars and swingle trees.*

Mic.No: 28635

0973 Wenger, H. 1938. **Kummet oder Yoch? (Collars of yokes?)**

Landwirtschaftliche Zeitschrift (Germany, F.R.), no. 6, p. 546–551, 3 photographs **De**

☐*Describes the use of the three-pad collar for draft oxen in Switzerland.*

Mic.No: 80154

TRANSPORT AND PACKING

0974 Anon. 1978. **Appropriate technology in rural development: Vehicles designed for on and off farm operations.**

IBRD, Washington, D.C. (USA). Transportation Dept., 171p., 169 fig. **En**

☐*Briefly describes vehicles that are, or can be, used for on- and off-farm transportation in rural areas, especially animal- or motor-drawn carts and cart assemblies, pedal vehicles, tractors and transport vehicles which are characterized by low prices, simple maintenance and repair requirements, adaptability to wide ranges of climatic and soil conditions, low fuel consumption and variety of uses.*

Mic.No: 50068

0975 Anon. 1986. **Donkeys as pack animals for small-scale farmers. (Utilisation des ânes comme animaux de trait)**

Department of Agriculture (Western Samoa). FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 57, p. 49–50, 4 photographs, ISSN 0049-8025. **En, Fr**

☐*Describes a project training farmers to use donkeys carrying baskets equipped with a hinged trap-door bottom for collecting coconuts.*

Mic.No: 80914

0976 Anon. 1986. **La charrette "Rolako" – dossier technique. (The "Rolako" ox-cart – technical information)**

Sierra Leone Work Oxen Project, Freetown, 12p., 4 fig., 9 tables **En, Fr**

☐*Gives details of the origin, specifications and costs of the Rolako ox cart.*

Mic.No: 80323

0977 Anon. 1987. **Computer-controlled production of farm carts.**

Agriculture International (UK), v. 39(9,10), p. 10–11, 10 photographs **En**

☐*Describes the production of low-priced farm carts suitable for animal power and supplied in kit form by Par Industries Ltd. of Britain.*

Mic.No: P00552

0978 Anon. s.d. **Carts.**

Intermediate Technology Publications

Ltd., London (UK), 8p., illus. **En**
□*Describes different types of ox-drawn carts and presents specifications and requirements for their construction.*
Mic.No: 06975

0979 Anon. s.d. **Carts for draught animals. (Les charrettes à traction animale)**
FAO, Rome (Italy), 28p., 85 photographs **En, Fr**
□*Illustrates types of carts available for use with draft animals in Burkina Faso and correct means of using and maintaining them.*
Mic.No: 80896

0980 Anon. s.d. **Dynamometer tests with wagons.**
Utah State Agricultural Coll., Logan (USA). Agricultural Experiment Station. Utah Agricultural Experiment Station Bulletin (USA), no. 4, p. 15–33 **En**
□*Describes results of tests carried out on wagons to determine the influence of wide and narrow wheels and the relation of grade and character of roads on draft required, by having a load with a gross weight of 3300 pounds drawn up an incline and measuring draft required by a self-recording dynamometer.*
Mic.No: P00533

0981 Bailey, J. 1975. **The village wheelwright and carpenter.**
Shire Publications Ltd. Princes Risborough (UK). Shire Album (UK), no. 11, 33p., 48 photographs, 3 drawings; 4 ref., ISBN 0-85263-314-9 **En**
□*Describes and illustrates the work of wheelwrights and village carpenters in the UK. Includes sections on wagons, wheel-making and tools and equipment.*
Mic.No: 80881

0982 Betker, J.; Kutzbach, H.D. 1989. **Influence of design on the draught force characteristics of animal drawn carts.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 258–263, 8 tables, 6 diagrams; 5 ref., ISBN 1-86320-003-7 **En** (En)
□*Describes factors influencing the draft animal transport system using a systematic approach and discusses cart design in general. Presents results of experimental work in Niger showing the influence of construction parameters (pneumatic tyres vs steel wheels, roller vs wooden bearings) on draft force requirements and the influence of forces under different conditions (laterite, sandy road, field and loose sand).*
Mic.No: 80946

0983 Bisen, H.J.; Pandey, K.P.; Ojha, T.P. 1982. **Comparative performance of an improved bullock-cart with wooden wheel having bush or ball bearing.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 14p., 5 fig.; 8 ref. **En**
□*Describes a study carried out in India to increase the load-carrying capacity of the conventional cart to about double its present capacity of 600–750 kg by the use of optimum dimensions of wooden cart wheels, and ball bearings in the hub of the cart wheel in place of plain bush bearings. Describes other features of the improved bullock-cart, such as friction type mechanical breaking device and improved yoke design.*
Mic.No: 80650

0984 Bulliet, R.W. 1975. **The camel and the wheel.**
Harvard University Press. Cambridge, Mass. (USA), 327p., illus.: ref., ISBN 0-674-09130-2 **En**
□*Analyzes the development of camel domestication and the technology of their utilization, the rise of camel-breeding nomads as a political force and the linking of their political ascendancy with the social and economic integration between desert and sown land, and the impact of "wheellessness" on the economic and social development of the area in the Middle Ages and in modern times.*
Mic.No. 09355

0985 Burgess, P. s.d. **Lincolnshire wagons.**
Lincolnshire Museums (UK). Lincolnshire Museums Local History Series (UK), no. 2, 8p., 5 fig., 8 photographs; 10 ref. **En**
□*Describes and illustrates horse-drawn wagons developed in Lincolnshire (UK) from early in the 19th century to the 1930s, examples of which are on display in local museums.*
Mic.No: 80379

0986 Carbuccia, J.L. 1853. **Armée d'Algérie: du dromadaire comme bête de somme et comme animal de guerre. Le régiment des dromadaires à l'armée d'Orient (1799–1801). (Algerian army: Camels as beasts of burden and war animals. The dromedary regiment in the Eastern army (1799–1801))**
s.n., s.l., 251p. **Fr**
□*Presents remarks on camels, with particular reference to their habitat, physiology, resistance to hunger and fatigue, mating period, castration, and diseases; includes data on the use of camels for meat and as working animals.*
Mic.No: 08506

0987 Chin, L.K. 1982. **Buffaloes in Pamol estates.**
Planter (Malaysia), v. 58(671), p. 48–55, 3 plates; 5 ref. **En** (En)
☐*Discusses the use of buffaloes in oil palm estates in Malaysia, mentioning factors that favour their use, benefits derived from the use of buffaloes in the estates, and issues in the selection, training, care and maintenance of buffaloes.*
Mic.No: 86293

0988 Danckwerts, B. 1980. **Fuel saving. The danky-ox-powered bogie.**
Farmer (Zimbabwe), v.p., 4 illus. **En**
☐*Describes the construction and uses of a two-wheeled, animal-drawn bogie which can be used to haul trailers, including two-wheeled trailers, normally drawn by tractors. Outlines the bogie's advantages as a fuel-saving method for using oxen interchangeably with tractors and as a system for improving the efficiency of ox-power for peasant farmers.*
Mic.No: 56345

0989 Deshpande, S.D. 1982. **Bullock carts of Bhopal – their special features and probable improvements.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 15p., 2 fig., 4 tables; 12 ref. **En**
☐*Reviews research on the improvement of bullock carts, presenting results of a survey carried out in three villages in Bhopal region, India, to study the status of existing carts, problems faced by owners and parts which need modifications; and describes results of performance evaluation of local bullock carts in the region and improved pneumatic-tyre carts.*
Mic.No: 80649

0990 Deshpande, S.D.; Ojha, T.P. 1983. **Annotated bibliography on improvisation of animal drawn vehicle transport in India and abroad.**
Central Inst. of Agricultural Engineering, Bhopal (India), 174p., 334 ref. **En**
☐*Presents 334 abstracts relating to bullock-cart technology.*
Mic.No: 80900

0991 Deshpande, S.D.; Ojha, T.P. 1984. **Monograph on traditional and improved bullock carts of India.**
Central Inst. of Agricultural Engineering, Bhopal (India), 168p., 27 fig., 26 photographs; 27 ref. **En**
☐*Describes, illustrates and critically reviews 35 local/traditional and improved bullock carts from 10 Indian states.*
Mic.No: 80915

0992 Dyck, E.H.; Hedrick, D.S. 1986. **Somalia donkey cart: income generation and appropriate technology. Project evaluation.**
Mennonite Economic Development Associates, Winnipeg (Canada), 51p., 1 fig., 2 tables **En** (En)
☐*Reports on a project resulting from visits to Somali refugee camps which indicated a need for a means of transport and income-generation activities. Describes the effects of the use of donkey carts on water supplies, truck transport, transport of goods, people, camp life and aid agencies and the success of the project in manufacturing, testing and improving the design of carts, holding regional workshops, materials procurement, and training and research.*
Mic.No: 80265

0993 Fielding, D. 1987. **Donkey power in African rural transport. (Afrique. L'âne, moyen de transport en zone rurale)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 63, p. 23–30, illus., 3 tables; 19 ref., ISSN 0049–8025. **En**
☐*Reviews the status and potential of the donkey as a rural power source in Africa, and discusses ways through which its use could be developed.*
Mic.No: 80479

0994 Fitzpatrick, J.; Morales, E.; Garcete, E. 1982. **New wheels for old. A wooden wheel with rubber tire.**
s.n., s.l., 7p., 3 fig. **En**
☐*Describes the assembly of a wooden wheel with a discarded automobile tyre, a sandwich-like construction of two wooden discs held together with four dowels cut from a broomstick, and two short pieces of galvanized water pipe.*
Mic.No: 40048

0995 Habshey, T.M. 1982. **Bullock cart productivity and what it means to India.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Banagalore (India), 16–17 Jul 1982, 4p. **En**
☐*Reports on a proposed project for increasing the productivity of the bullock cart in India by providing a low-cost conversion from inefficient wooden wheels to pneumatic tyres.*
Mic.No: 80648

0996 Hinz, H.-J. 1985. **A single traction bamboo-cart, specially designed for off-road transport.**
GATE (Germany, F.R.). no. 85/4, p. 31–32 **En** (En)
☐*Describes and illustrates a bamboo-cart with spring suspension developed by the author in cooperation with SECAP/LDP, Lushoto (Tanzania). It resembles a wheelbarrow, the load being placed between the wheels at the back and the drawbars in front, requires a three-fold harness (collar for traction, saddle for the load and a crupper, all padded) and can be adapted for all draft animals from donkeys upwards.*
Mic.No: 80424

0997 Hinz, H.-J. 1988. **String-spoked wooden wheels.**
GATE (Germany, F.R.), no. 88/2, p. 24–26, 5 fig., 4 tables **En** (En)
☐*Describes and illustrates a new technique of wooden wheel construction using string of a suitable fibre for the spokes. Technologically between the "cartwright" and "bicycle" design it is superior to wooden spoked wheels in all but two aspects (narrow track and wooden friction bearings) where it has only slight advantages.*
Mic.No: 80428

0998 Howe, J. 1984. **Rural transport: The efficient use of animals.**
Courier (Belgium), no. 83, p. 78–80, 4 photographs **En** (En)
☐*Suggests that development of efficient means of transport using animals has fallen behind that of animal-based agricultural systems and that two- and four-wheeled carts drawn by oxen, horses, donkeys, mules or camels and extensively used in various countries, notably India, have considerable potential for widespread use. Discusses cart design, harnessing and constraints to widespread introduction of modern designs for carts (including farmer conservatism and lack of credit facilities).*
Mic.No: 80426

0999 Immers, B.H.; Malipaard, E.J.; Oldenhof, M.J.H. 1989. **Rural transport in developing countries. A case study of Western Province, Zambia.**
GATE (Germany, F.R.), no. 89/1, p. 7–11, 2 diagrams, 1 photograph, ISSN 0723–2225. **En** (En Fr Es)
☐*Reviews the local economy and transport system of Western Province, Zambia. Transport conditions are generally poor with ownership of motor vehicles negligible and the ox-drawn sledge the most common means of transport, with a few ox carts. Discusses factors determining demand for transport focussing on the relationship between agricultural activities and transport. Suggests that draft animal power seems the most viable solution and more extensive use of sledges should be encouraged.*
Mic.No: 80559

1000 Iversen, E.H. 1987. **Animal-based transportation for drought relief.**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 61, p. 45–47, 4 plates; 1 ref., ISSN 0049–8025. **En**
☐*Discusses factors that favour the use of animals for transporting famine relief supplies, especially ease of operation and maintenance of animals, low cost of animal transport, and the possibility of integrating animal-based transportation with other modes of transport.*
Mic.No: 80509

1001 Kehoe, M.M.; Chan, L.C. 1987. **Buffalo draught power on oil palm estates.**
Incorporated Society of Planters, Kuala Lumpur (Malaysia), 121p., fig., plates, tables; ref., ISBN 967–9949–26–5 **En**
☐*Discusses the use of buffaloes as a cheap source of power for the in-field collection of fresh fruit bunches on oil palm estates in Malaysia; describes various ways of improving the efficiency of buffalo draft power and compares it with other manual and mechanized forms of harvesting, with particular emphasis on the selection, training, nutrition, management of buffaloes, and improvements in yokes, harnesses, and carts and sledges.*
Mic.No: 38841

1002 King, J.G.M. 1940. **Ox pack transport in Sukuma, Tanganyika Territory.**
East African Agricultural Journal (Kenya), p. 306–311, 2 fig., 8 photographs **En**
☐*Describes a pack saddle and pack basket made out of gunny sacks and bush materials for pack oxen in Tanzania and briefly discusses ox training and extension work.*
Mic.No: 80161

1003 Mairs, T.I. 1901. **The influence of height of wheels on the draft of farm wagons.**
Missouri Univ., Columbia (USA). Agricultural Experiment Station. Missouri Agricultural Experiment Station Bulletin (USA), no. 52, p. 143–165, 8 fig. **En**
☐*Presents results of tests carried out on the draft of wagons equipped with three sets of wheels of different heights, all with six-inch tyres, and used on macadam, gravel and dirt roads in all conditions, and on meadows, pastures, cultivated fields, stable land etc. with a net load of 2,000 pounds in every case.*
Mic.No: P00545

1004 Muller, H.E. 1986. **Oxpower in Zambian agriculture and rural transport.**
Edition Herodot/Rader Verlag. Aachen (Germany, F.R.). Socioeconomic Studies on Rural Development (Germany, F.R.), v. 65, 156p., 15 fig., 17 tables, 6 maps, 5 photographs; 145 ref. M.Sc., ISBN 3-922868-40-1 **En** (En)
□*Examines draft animal power in the context of Zambian agriculture with emphasis on rural transport. Gives data from a survey carried out among emergent farmers and ox-cart owners to determine their actual transport requirements. A cart specification was worked out and a design example is given. Proposals are made for the propagation of animal power and improvements in the manufacture of ox carts.*
Mic.No: 80912

1005 Naik, V.A.P. 1982. **Utilization of animal energy and development of improved carts.**
15. Sir M. Visvesvaraya Memorial Technical Seminar, Bangalore (India), 21 Nov 1981. Invention Intelligence (India), p. 193-199, 3 fig., 3 tables; 3 ref. **En**
□*Describes advantages of using animal energy over fossil fuels and describes and illustrates improved bullock carts developed at the Indian Institute of Management, Bangalore and now used by farmers.*
Mic.No: 80427

1006 Ramaiyan, G.; Parthasarathy, N.S. 1982. **Bullock cart and its improvement.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16-17 Jul 1982, 6p., 1 fig.; 2 ref. **En**
□*Discusses some of the improvements required to correct technical defects of Indian bullock carts, with particular reference to improvements such as the use of machined axle and bearings, and bamboo platform for weight reduction and braking arrangements. Presents results of performance trials on a prototype cart with some of the improvements.*
Mic.No: 80647

1007 Ramaswamy, N.S. s.d. **The management of animal energy resources and the modernization of the bullock-cart system.**
s.n., s.l., 110, fig., tables **En**
□*Presents a collection of papers on various aspects of animal energy management in India, particularly the history of the modern animal-drawn cart, technical and economic issues involved in modernizing the bullock cart, proposals for an Animal Energy Development Corporation, ways of increasing animal productivity and reducing cruelty to work animals, and notes on stunning and slaughtering practices.*
Mic.No: 39046

1008 Schneider, R.M. s.d. **The Samaru ox cart.**
Ahmadu Bello Univ., Zaria (Nigeria). Inst. of Agricultural Research. Samaru Miscellaneous Paper (Nigeria), no. 20, 6p., 2 plates, 2 fig. **En**
□*Describes pneumatic-type ox carts developed by the Institute of Agricultural Research in Nigeria, particularly mentioning types of axles used, frame design, cost of materials, various uses of the cart and options for marketing it.*
Mic.No: 32590

1009 Schwartz, H.J. 1980. **The role of the camel as a transport animal in the pastoral economy of the Rendille of Marsabit District, Kenya.**
In: Camels, Workshop on Camels, Khartoum (Sudan), Dec 1979. IFS Provisional Reports, no. 6, p. 459-469, 1 fig., 3 maps, 2 tables; 8 ref., ISBN 91-85798-05-3 **En** (En)
□*Assesses the role played by the number of loading camels available per household in determining movements of settlements and their distance from water holes, degree of mobility, frequency of shifts to fresh pastures and shifting distances involved and consequent range occupation density and pasture utilization among the pastoralist Rendille in the Marsabit District of Kenya.*
Mic.No: 82268

1010 Shetto, R.M.; Kwiligwa, E.M. 1988. **Survey of ox cart production and use in Mbeya region (Tanzania). (A project report financed by and carried out for the Mbeya Oxenisation Project.)**
Mbeya Oxenisation Project (Tanzania), 70p., 11 tables, 50 photographs, 2 maps; 9 ref. **En**
□*Presents results of a study into the types of ox carts used in the Mbeya region of Tanzania, technical problems and how farmers try to solve them, farmer preference and ox-cart production and marketing systems and recommends appropriate designs for promotion in the region covered by the Mbeya Oxenisation Project.*
Mic.No: 80515

1011 Sivaguru, N.; Mamtani, I.J. s.d. **The effects of bullock carts on road surfaces and road capacity.**
s.n., s.l., 8p., 2 tables; 2 ref. **En**
□*Discusses adverse effects of bullock carts on road surfaces and measures required to mitigate them, with particular reference to Indian conditions.*
Mic.No: 39042

1012 Starkey, P.H. 1989. **Animal-drawn transport in Africa.**
GATE (Germany, F.R.), no. 89/1, p. 13–18, 5 photographs, ISSN 0723–2225. **En** (En Fr Es)
☐*Reviews the present situation regarding animal-drawn transport in sub-Saharan Africa and highlights some problems and possible solutions. Discusses two- and four-wheeled carts and sledges as well as their component parts and materials from which they can be produced.*
Mic.No: 80954

1013 Toure, G. 1979. **Etude sur la contribution des animaux de transport à la dégradation de l'environnement autour de Niono. (The contribution of pack animals to environmental degradation around Niono)**
Mali. Ministère de l'Education Nationale. Direction de l'Enseignement Secondaire Supérieur et de la Recherche Scientifique, 32p., 5 graphs, 10 tables; 13 ref. **Fr**
☐*Describes the physical and human environment of the Niono Circle, Mali, and examines the role of transport animals in the environmental degradation process in the area, with data on the methodology of the study, census and general movement of transport animals such as donkeys, oxen, horses and camels; includes data on the size and frequency of loads, which include wood and bricks.*
Mic.No: 17238

1014 Wilson, R.T. 1981. **Distribution and importance of the domestic donkey in circumsaharan Africa.**
Singapore Journal of Tropical Geography, v. 2(2), p. 136–143, 1 fig., 6 tables; 8 ref., ISSN 0129–7619. **En**
☐*Presents data on donkeys and their potential as an economic force, indicating their importance in the world at large and in circumsaharan Africa in particular; discusses contributions of donkeys to the economies of undeveloped societies and their future potential, using case studies from Ethiopia, Sudan and Mali.*
Mic.No: 29087

1015 Wilson, R.T. 1985. **Animals for work: Non-draught uses in Ethiopia.**
ILCA, Addis Ababa (Ethiopia). Small Ruminant and Camel Group. Workshop on Review of the Status of Livestock, Pasture and Forage Research in Ethiopia, Addis Ababa (Ethiopia), 8–10 Jan 1985, 7p., 6 tables **En**
☐*Presents preliminary results of studies on the utilization of animals for transport in Ethiopia, outlining the need for further research and development.*
Mic.No: 34164

1016 Wilson, R.T. 1987. **The role of donkeys in the commodity supply of a central Malian town.**
Anthrozoos (UK), v. 1(1), p. 45–49, 3 fig., 2 tables; 2 ref. **En**
☐*Analyzes daily and seasonal activity patterns of donkeys and other transport animals at Niono, in Mali based on 13,556 observations made over a nine-month period.*
Mic.No: P00534

IMPLEMENTS AND EQUIPMENT

1017 Abiye Astatke. 1980. **1980 Progress report of the implements trial at Debre Zeit and Debre Berhan.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 19p. **En**
☐*Reports results obtained in the implement trial being carried out by ILCA at Debre Zeit and Debre Berhan, Ethiopia, to compare different cultivation systems using traditional implements with those using improved implements, the mouldboard plow and spring tine, especially in terms of cultivation and weeding time, yield under each cultivation system, power development of the various implements, and change of soil structure in the long term due to different cultivation systems.*
Mic.No: 38659

1018 Abiye Astatke. 1984. **The use of animal power in water conservation works.**
Cranfield Inst. of Technology, Bedford (UK), 46p., 4 fig., 4 tables, 4 plates; 21 ref. M.Sc. (Agricultural Engineering). **En**
☐*Discusses work related to the use of work oxen to power metal scoops in the excavation of ponds for dry season water conservation, based on work carried out at ILCA in Ethiopia; assesses the likely benefits of the innovation.*
Mic.No: 33840

1019 Adifon, L.; Aho, F.S.; Houndekpondji, G. 1983. **Conception et réalisation d'une billonneuse à socs. (Conception and production of a furrow opener)**
Collège Polytechnique Universitaire, Abomey-Calavi (Bénin), 131p., 3 tables, 70 illus. Mémoire de Fin d'Etudes (Mécanique Industrielle). **Fr**
☐*Reviews the availability of working animals in tropical Africa and Madagascar, the different types of soil and their characteristics, and agricultural implements; describes a furrow opener that can be used both as an ordinary plow and as a ridger.*
Mic.No: 60929

1020 Afantonou, L.A. 1988. **Unité de production de matefiel agricole (UPROMA). (UPROMA – the Agricultural Equipment Production Unit)**

Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19-25 Sep 1986, p. 169-172, ISBN 3-528-02047-4 **Fr**
☐*The role of UPROMA in developing and manufacturing animal traction equipment is discussed. Implements produced include toolbars, carts, harrows, rotary seeders, a fertilizer spreader and a groundnut harvester. Equipment is also available for exchange or rental.*
Mic.No: 82013

1021 Ahmed, I. (ed.); Kinsey, B.H. (ed.) 1984. **Farm equipment innovations in eastern and central southern Africa.**
Gower Publishing Company Ltd. Aldershot (UK), 357p., 11 fig., 5 maps, 26 tables; 200 ref. **En**
☐*This study prepared for the International Labour Office within the framework of the World Employment Programme contains an introduction by I. Ahmed and B.H. Kinsey, a background paper entitled Farm Equipment Innovations in Eastern Africa: Policy considerations by B.F. Johnston and six case studies by G. Muchiri (Kenya), B.H. Kinsey (Zambia, Tanzania, Uganda and Malawi) and de Coninck et al. (Sudan). Discusses issues raised (highlights the fact that a common finding was inappropriateness) and implications for future research.*
Mic.No: 80898

1022 Anon. 1963. **Demonstration 13th June 1963: N.I.A.E. single-wheel-drive tractor, N.I.A.E. animal-drawn toolbar, N.I.A.E. light weight rice thresher.**
Ahmadu Bello Univ., Zaria (Nigeria). Inst. for Agricultural Research and Special Services, 5p., 7 fig. **En**
☐*Describes the design and construction of one-wheel-drive tractors, animal-drawn toolbars and lightweight rice threshers for use in small holdings in the tropics, with illustrations showing the tools during trials.*
Mic.No: 20151

1023 Anon. 1965. **Indian standard specification for green manure trampler, animal drawn.**
Indian Standards Institution, New Delhi, 11p., 2 fig., 2 tables **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1965 specifying requirements for the animal-drawn green-manure trampler.*
Mic.No: 16543

1024 Anon. 1965. **Indian standard specification for levelling karaha (Keni), animal drawn.**
Indian Standards Institution, New Delhi, 10p., 2 fig., 1 table **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1965 specifying requirements for the levelling "Karaha", an implement used to level the land and to form large bunds and terraces.*
Mic.No: 16542

1025 Anon. 1965. **Indian standard specification for triphali (three tined cultivator), animal drawn.**
Indian Standards Institution. New Delhi, 9p., 1 fig.; 1 table **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1965 specifying requirements for the three-tined animal-drawn cultivator.*
Mic.No: 16541

1026 Anon. 1965. **Indian standard specification for single row cotton seed drill, animal drawn.**
Indian Standards Institution, New Delhi, 9p., 1 fig., 1 table **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1965, prescribing the requirements for the single row cottonseed drill used mainly in areas where cotton is grown, and drawn generally by a pair of animals.*
Mic.No: 16532

1027 Anon. 1967. **Techniques rurales en Afrique. Essai de materiel agricole à traction animale. (Rural techniques in Africa. Testing of implements for animal traction)**
Centre d'Etudes et d'Experimentation du Machinisme Agricole Tropical, Antony (France), 213p., fig. **Fr**
☐*Presents guidelines for the testing of agricultural implements frequently encountered on farms using animal traction in tropical Africa, in order to facilitate the rational choice of implements better adapted to local conditions.*
Mic.No: 00399

1028 Anon. 1969. **Indian standard guide for axle assembly for animal drawn vehicles.**
Indian Standards Institution, New Delhi, 8p., 1 fig., 4 tables **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1968 providing guidelines for the components of the axles assembly and recommendations for critical features and main dimensions of the axles for animal-drawn vehicles with track widths of 1,370 mm. (54 in.) and 1,525 mm. (60 in.).*
Mic.No: 16538

1029 Anon. 1969. **Progress report no. 1. Implement Research Section, June, 1969.**
Chilalo Agricultural Development Unit, Assela (Ethiopia). Implement Research Section. CADU Publications (Ethiopia), no. 32, 61p., illus., tables **En**
☐*Reports work carried out by the Implement Research Section of the Chilalo Agricultural Development Unit in Arsi, Ethiopia, concerning the design and performance testing of various implements used in soil preparation, crop handling and transportation.*
Mic.No: 35452

1030 Anon. 1972. **Indian standard specification for two-way animal drawn mouldboard plough shares.**
Indian Standards Institution, New Delhi, 9p., 1 fig., 2 tables **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1972 specifying requirements for two-way animal-drawn mouldboard plow shares.*
Mic.No: 16546

1031 Anon. 1972. **Specifying for disc harrow, animal drawn (First revision).**
Indian Standards Institution, New Delhi, 13p., 2 fig., 3 tables **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1972, prescribing the materials, dimensions and other requirements for single action and double action offset type disc harrows drawn by animals.*
Mic.No: 16535

1032 Anon. 1973. **Indian standard specification for bund former.**
Indian Standards Institution, New Delhi, 11p., 2 fig., 2 tables **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1966 prescribing the materials, dimensions and other requirements for the animal-drawn bund former.*
Mic.No: 16536

1033 Anon. 1973. **Indian standard specification for seed-cum-fertilizer drills.**
Indian Standards Institution, New Delhi, 11p. **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1973, specifying the material, dimensions and other requirements of seed-cum-fertilizer drills, both animal-driven and tractor operated.*
Mic.No: 16537

1034 Anon. 1974. **Indian standard specification for tines for animal-driven cultivators.**
Indian Standards Institution, New Delhi, 4p., 5 fig. **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1974 specifying materials, dimensions and other requirements for tines for animal-driven cultivators.*
Mic.No: 16547

1035 Anon. 1975. **The Mochudi toolbar: Makgonatsotlhe – the machine which can do everything.**
Botswana. Ministry of Agriculture. Agricultural Information Services, 16p., 1 fig., 12 photographs **En**
☐*Describes the Mochudi toolbar, an animal-drawn toolcarrier developed in Botswana, to which almost any type of cultivation tool could be attached, is used for carting and transporting water and allows inter-row cultivation in tailer crops.*
Mic.No: 80467

1036 Anon. 1976. **Résolutions de la 5e session du Comité Consultatif National du Machinisme Agricole. (Resolutions of the 5th session of the "Comité Consultatif National du Machinisme Agricole")**
Mali. Ministère du Développement Rural. Div. du Machinisme Agricole. 5. Session du Comité Consultatif National du Machinisme Agricole, Bamako (Mali), 29–31 Mar 1976, 6p. **Fr**
☐*Outlines briefly the resolutions of the 5th session of the "Comité consultatif national du machinisme agricole", touching upon administrative matters, training, external relations, research on animal traction, extension activities, workshop for the construction of agricultural implements and mechanization.*
Mic.No: 02403

1037 Anon. 1976. **Indian standard specification for animal-drawn mouldboard plough. Part I. Turnwrest type.**
Indian Standards Institution, New Delhi, 9p., 2 fig. **En**
☐*Presents a standard adopted by the Indian Standards Institution in 1976, prescribing materials, dimensions and other requirements of the turnwrest type animal-drawn mouldboard plow.*
Mic.No: 16533

1038 Anon. 1982. **Technical drawings.**
Kenya. Ministry of Agriculture. Agricultural Equipment Improvement Project, 27p., 27 drawings **En**
☐*Includes multipurpose toolbars and attachments.*
Mic.No: 80846

1039 Anon. 1982. **Second regional workshop on farm machinery testing**

procedures held at Chitedze Research Station and Bunda College of Agriculture.
Commonwealth Secretariat. London (UK). Food Production and Rural Development Div. 2. Regional Workshop on Farm Machinery Testing Procedures, Lilongwe (Malawi), 22–25 Jun 1982, 41p. **En**
☐*Presents the outcome of a workshop held to formulate testing procedures for hand tools, animal-drawn equipment, harvesting and post-harvest equipment and for tractors; also presents recommendations on the role of machinery testing in the overall process of identification and promotion of appropriate machinery for small farmers and on the preparation of the institutional support measures necessary to improve the effectiveness of machinery testing. Includes reports of tests made between 1970 and 1981 in Kenya, Malawi, Nigeria, Tanzania, Zambia and Zimbabwe.*
Mic.No: 32124

1040 Anon. 1983. **Herramientos agricolas. (Agricultural implements)**
Minka, Revista Peruviana de Ciencia y Tecnologia Campesina, no. 12, 31p., photographs, drawings **Es**
☐*Describes and illustrates hand and animal draft implements used in various regions of Peru.*
Mic.No: 80400

1041 Anon. 1983. **Regional Project on Farm Tool and Equipment Technology, Basic Needs and Employment. Appropriate farm equipment technology for the small-scale traditional sector. Synthesis report.**
ILO, Geneva (Switzerland), 295p., 20 ref., ISBN 92-2-103613-8 **En**
☐*Contains a socio-economic and technical evaluation of farm tools and equipment obtained using inter-disciplinary methodology, an analysis of problems of local supply and distribution and recommendations for policies and measures for use and local manufacture of selected farm equipment following extensive missions to project countries (Tanzania, Zambia, Botswana, Kenya and Sudan).*
Mic.No: 80902

1042 Anon. 1983. **Tools and equipment manual for labour intensive farming. A sub-regional manual: Botswana, Kenya, Sudan, Tanzania and Zambia.**
ILO, Geneva (Switzerland), 119p., fig., tables, photographs; ref., ISBN 92-2-103617-0 **En**
☐*Simple illustrated manual of a limited range of labour-intensive farm tools and equipment aimed at assisting extension workers and farmers in selection, correct use and maintenance of appropriate tools and implements and research and development institutions and manufacturers (particularly small, village-based firms) in designing, testing and defining quality standards for these implements.*
Mic.No: 80903

1043 Anon. 1983. **The animal drawn wheeled tool carrier.**
ICRISAT, Patancheru, AP (India). ICRISAT Information Bulletin, no. 8, v.p., 13 plates **En**
☐*Describes the animal-drawn wheeled toolcarrier and its possible uses in tillage, planting, fertilizer application, interrow cultivation, harvesting, transporting and land-shaping; and outlines the advantages and disadvantages of the implement.*
Mic.No: 80642

1044 Anon. 1984. **Royal Show-1984.**
Sahall Limited, Soil and Water Resources, Preston (UK), 4p., 16 plates **En**
☐*Introduces a range of animal-drawn farm implements developed by the Sahall Limited, Soil and Water Resources of the United Kingdom, including implements such as plows, disc harrows, cultivators, ridgers, seeders, weeding attachments and carts*
Mic.No: 86961

1045 Anon. 1984. **Draught animal equipment with emphasis on rice crop.**
Asian Livestock (Thailand), v. 9(5), p. 47–49, 54 **En**
☐*Discusses (based on a paper by B.S. Pathak, International Communication Newsletter, FAO, Dec 1983) improved types of animal-drawn equipment for various farm operations such as land-levelling, seedbed preparation, seeding, fertilizer application, irrigation, interculture, harvesting, threshing and transport, with particular emphasis on rice crops.*
Mic.No: 80030

1046 Anon. 1984. **Le rouleau piétineur à traction animale dans la préparation de rizières, à Madagascar. (The animal-drawn treading roller for the preparation of rice fields in Madagascar)**
Machinisme Agricole Tropical (France), no. 88, p. 3–10, 8 photographs; 2 ref. **Fr** (En Fr)
☐*Describes an animal-drawn roller designed to simulate the traditional method of stamping by oxen to prepare paddy fields in Madagascar.*
Mic.No: 80811

1047 Anon. 1985. **Le polyculteur à traction animale: un porte-outils polyvalent qui économise le temps. (The animal-drawn polycultor: A toolcarrier that saves time)**
Inter-Tropiques (France), no. 11, p. 28–29, 6 photographs **Fr**

☐*Briefly describes large-wheeled toolcarriers and how their use reduces time taken for various operations.*
Mic.No: 80130

1048 Anon. 1985. **Tools for agriculture. A buyer's guide to appropriate equipment.**
Intermediate Technology Publications. London (UK), 268p., 200 fig., 100 photographs, ISBN 0-946688-36-2 **En**
☐*A guide for farmers' representatives, advisers, development agency personnel, prospective manufacturers and development workers containing sections on equipment available for seedbed preparation, intercultivation, multipurpose toolbars, sowing, planting and fertilizer distribution, crop protection and operator safety, water-lifting, harvesting and threshing, postharvest crop processing, transport and materials handling, livestock husbandry and health, wool-harvesting and beekeeping. Within each section an introduction is followed by comprehensive tables listing manufacturers and pages laid out in a grid pattern in which the equipment is presented in logical order from hand-operated through anima-drawn to motorized.*
Mic.No: 80890

1049 Anon. 1986. **Field performance of 'maresha'.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 4, 5p., 2 fig.
En
☐*Presents results of tests carried out to study and evaluate the performance of the conventional Ethiopian plow, the* "maresha", *in light clay soils, particularly in terms of depth of operation, draft requirement, spacing between furrows, time taken to plow 1 ha of land, evenness of plowing and unit resistance.*
Mic.No: 82110 (Restricted)

1050 Anon. 1986. **Field performance of ARDU mouldboard.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 1, 10p., 7 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of the ARDU mouldboard plow in light soils, particularly in terms of working width and depth, draft requirements, evenness of plowing and weeding efficiency.*
Mic.No: 82247 (Restricted)

1051 Anon. 1986. **Field performance of maresha (secondary tillage).**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 5, 5p., 1 fig. **En**
☐*Presents results of tests carried out to study and evaluate the performance of the conventional Ethiopian plow, the* "maresha", *as secondary tillage implement in light soils, particularly in terms of width and speed of operation, draft requirement, evenness of plowing and weeding efficiency.*
Mic.No: 82109 (Restricted)

1052 Anon. 1986. **Field performance of Melkassa plough (winged chisel).**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement centre. IAR Test Report (Ethiopia), no. 8, 7p., 1 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of a modified version of the Melkasa plow in light soils, particularly in terms of depth of operation, draft requirements and unit resistance of the implement.*
Mic.No: 82255 (Restricted)

1053 Anon. 1986. **Field performance of modified ARDU mouldboard plough.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 2, 6p., 2 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of the modified ARDU plow in light clay soils, particularly in terms of working width, depth of operation, draft requirements, unit resistance and evenness of plowing.*
Mic.No: 82257 (Restricted)

1054 Anon. 1986. **Field performance of the IAR thresher.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 9, 6p., 1 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of the non-cleaning type thresher on wheat crop, particularly in terms of safety and grain loss from harvesting to threshing operations.*
Mic.No: 80967 (Restricted)

1055 Anon. 1986. **Outils et équipement: produits des artisans assistes par le CENAM. (Tools and equipment: Production by craftsmen with the assistance of CENAM)**
Centre National de l'Artisanat Malgache, Antananarivo, 33p., drawings **Fr**

☐*Illustrates tools and equipment produced by local craftsmen in Madagascar including animal traction equipment.*
Mic.No: 80552

1056 Anon. 1986. **Animal drawn implements. A study to assess feasibility of local manufacture in Sudan. Draft report to Ministry of Finance and Economic Planning, Democratic Republic of Sudan.**
Silsoe College (UK); Sudan. Ministry of Finance and Economic Planning, 123p., 16 fig., 3 maps, 6 tables **En** (En)
☐*Reports on a study centred at Zalingei in South Darfur Province, Sudan, and presents recommendations for the local manufacture of appropriate and affordable animal traction implements optimizing the use of available indigenous resources and involving the private sector in production and marketing.*
Mic.No: 80266

1057 Anon. 1987. **Field performance of Cossul disc harrow (Holetta).**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 17. 7p., 1 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of the Cossul disc harrow imported from India, particularly in terms of draft requirement, clod size after operation, stability, strength of scraper material and actual output.*
Mic.No: 82112 (Restricted)

1058 Anon. 1987. **Field performance of maresha.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 12, 8p., 2 fig. **En**
☐*Presents rsults of tests carried out to study and evaluate the performance of the conventional Ethiopian plow, the "maresha", in red clay soils, particularly in terms of speed and depth of operation, evenness of plowing, unit resistance and working efficiency.*
Mic.No: 82111 (Restricted)

1059 Anon. 1987. **Field performance of Melkassa plough (winged chisel).**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 11, 8p., 2 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of a modified version of the Melkassa plow in red clay soils, particularly in terms of depth of operation, draft requirements and unit resistance of the implement.*
Mic.No: 82256 (Restricted)

1060 Anon. 1987. **Field performance of Nazareth mouldboard plough (Melka-Werer).**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 15, 6p., 2 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of the Nazareth plow in black cotton soils, especially in terms of working width and draft requirement.*
Mic.No: 82258 (Restricted)

1061 Anon. 1987. **Field performance of the modified NARDI plough.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 10, 6p., 2 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of the modified NARDI plow in light soils, particularly in terms of unit resistance, draft requirement and evenness of plowing.*
Mic.No: 82259 (Restricted)

1062 Anon. 1987. **Field performance of the Nazareth mouldboard plough.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 14, 8p., 2 fig. **En**
☐*Presents results of tests carried out in Ethiopia to study and evaluate the performance of the Nazareth moldboard plow in light clay soils, particularly in terms of depth and evenness of plowing, draft requirements and weeding efficiency.*
Mic.No: 82274 (Restricted)

1063 Anon. 1987. **Field performance of 'maresha' – Secondary tillage (Holetta).**
Institute of Agricultural Research, Addis Ababa (Ethiopia). Agricultural Implements Research and Improvement Centre. IAR Test Report (Ethiopia), no. 18, 7p. **En**
☐*Presents results of tests carried out to study and evaluate the performance of the conventional Ethiopian plow, the "maresha", as a secondary tillage implement in clay soils, particularly in terms of working width, time required to cultivate 1 ha of land and weeding efficiency.*
Mic.No: 82254 (Restricted)

1064 Anon. 1987. **Herrandina.** Proyecto de Herramientas e Implementos

Agricolos Andinos, Cusco (Peru). , 28p., fig., maps, tables **Es**
☐*Describes the results of a project to improve the development and production of tools and implements in Cusco department of Peru. The programme included practical demonstrations.*
Mic.No: 80405

1065 Anon. 1987. **Improvement of the efficiency of draught animals by performance analysis and innovative development of implements: Interim report of progress December 1986–August 1987.**
AFRC Engineering, Silsoe (UK), 86p., tables, photographs, diagrams **En**
☐*Presents highlights of progress made in an AFRC-Engineering/CEEMAT project in developing instrumentation and techniques to measure the work output of draft oxen and to assess the effect of that work on the animals, designing and developing two novel cultivating implements for primary and secondary tillage (a tined cultivator and a rolling tiller) and the application in the field of the instrumentation system to evaluate the performance of the new implements and compare them with traditional methods.*
Mic.No: 80565

1066 Anon. 1987. **Comparative test report: Ox-drawn dam scoops.**
8p. **En**
☐*Reports results of tests carried out in Zimbabwe to compare different models of ox-drawn dam-scoops for dam construction, contour construction, removal of anthills and gathering kraal manure; testing criteria included ease of handling, draft requirement, scraping/penetrating ability, transportability, robustness and volume of soil in the bin.*
Mic.No: 86968

1067 Anon. 1987. **Agricultural equipment prototypes.**
Ahmadu Bello Univ., Zaria (Nigeria). Institute for Agricultural Research, 20p., 20 photographs **En** (En)
☐*Includes descriptions and illustrations of completed prototypes of a straddle row weeder which has a set of 4 rotary tine gangs mounted on a frame suitable for 76–90 cm ridges, and a rotary weeding attachment for the commercially available 'Emcot' ridger frame, both of which can be pulled by a pair of oxen. Also describes an animal-drawn leveller still under development.*
Mic.No: 80999

1068 Anon. 1989. **Animal-drawn tiller/planter/weeder tested. (Expérimentation d'une charrue/semoir/sarcleuse à traction bovine)**
ILCA Newsletter(CIPEA actualités), v. 8(3), p. 1–2, 3 photographs, ISSN 0255–0024 (E) and ISSN 0255–0032 (F). **En**
☐*Presents information on work carried out by ILCA in Ethiopia to develop an animal-drawn implement for reduced tillage, row planting and inter-row weeding. Comments briefly on the advantages and initial field test results on the implement.*
Mic.No: 78784

1069 Anon. s.d. **"Chitedze Ridgemaster" toolbar.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 5, 6p., diagrams **En**
☐*Describes the design, material requirements and operational features of the "Chitedze Ridgemaster" toolbar developed in Malawi.*
Mic.No: 80495

1070 Anon. s.d. **I.D.C." weeding attachment for "EMCOT" plough.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 12, 3p., diagrams **En**
☐*Describes the design, material requirements and operational features of a weeding attachment for use on "EMCOT" ridging plow which enables weeding in ridged row crops to be carried out by animal power instead of by hand.*
Mic.No: 80498

1071 Anon. s.d. **"Kabanyolo" toolbar.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 4, 5p., diagrams **En**
☐*Describes the design, material requirements and operational feature of the "Kabanyolo" toolbar which was developed based on the design of the "unibar".*
Mic.No: 80494

1072 Anon. s.d. **Adjustable-width "V-Drag" ditcher/bund former.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 13, 3p., 1 diagram **En**
☐*Describes the design, material requirements and operational features of the ditcher/bund-former used to make irrigation ditches, and to construct low-height contour bunds for border irrigation.*
Mic.No: 80499

1073 Anon. s.d. **Cultivators.** Intermediate Technology Publications Ltd.

London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 7, 9p. **En**
☐*Describes the design construction and operational features of the IT expandable and the five-tine sweep cultivators.*
Mic.No: 80496

1074 Anon. s.d. **Etude de factibilité d'une unité de fabrication de matériel de culture attelée au Togo. (Feasibility study on a plant for manufacturing animal-drawn cultivation implements in Togo)**
Togo. Ministère du Plan et de la Reforme Administrative, v.p., tables; ref. **Fr**
☐*Presents the history, responsible organization and constraints to animal traction work in Togo, along with a study of demand for various types of implements; describes specifications of implements to be produced and the material and technical means of production. Includes recommendations for the organization and management of the project as well as a cost/benefit analysis.*
Mic.No: 76130

1075 Anon. s.d. **Harrows: Triangular spike-tooth, high clearance peg tooth, flexible peg tooth, Japanese harrow.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), 5p., 6 diagrams **En**
☐*Describes the design, material requirements and operational features of different types of harrows, viz the triangular spike-tooth, high-clearance peg tooth, flexible peg tooth and the Japanese harrow.*
Mic.No: 80131

1076 Anon. s.d. **I.D.C. Bornu groundnut lifter; I.T. groundnut lifter.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 29, 8p., diagrams **En**
☐*Describes the design, material requirements and operational features of two groundnut lifters developed by the Industrial Development Centre, Nigeria and the Intermediate Technology Project also in Nigeria.*
Mic.No: 80503

1077 Anon. s.d. **I.T. granule applicator.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 30, 15p., 1 graph, diagrams **En**
☐*Describes the design, material requirements and operational features of an applicator for fertilizer granules.*
Mic.No: 80504

1078 Anon. s.d. **I.T. high-clearance rotary hoe (Daudawa, N.C.S. Nigeria).**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 33, 7p. **En**
☐*Describes the design, material requirements and operation features of a rotary hoe designed for weeding of crops grown on ridges at 75–90 cm spacing.*
Mic.No: 80508

1079 Anon. s.d. **Makgonatsotlhe. Mochudi tool bar.**
Mochudi Farmers' Brigade (Botswana), 50p., 45 drawings **En**
☐*Comprises a complete set of scale drawings (chassis, planter unit, fertilizer applicator and accessories) for the Mochudi toolbar developed by the Mochudi Farmers Brigade and given the local name Makgonatsotlhe ("the machine that can do everything").*
Mic.No: 80829

1080 Anon. s.d. **Mekins Nikart: Operator's manual.**
Mekins Agro Industrial Enterprises, Balangar (India), 18p., 2 tables, 1 fig., 28 photographs **En**
☐*Describes assembly, uses for various farming operations and maintenance of the Nikart multi-purpose animal-drawn wheeled toolcarrier.*
Mic.No: 80208

1081 Anon. s.d. **Multi-action paddy-field puddling tool (Japan).**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction, no. 17, 1p., 5 diagrams **En**
☐*Presents diagrams outlining the construction details of a multi-action paddy-field puddling tool.*
Mic.No: 80502

1082 Anon. s.d. **Oil soaked wood bearings.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), 10p., 3 fig.; 4 fig. **En**
☐*Presents background information to designers and constructors who wish to use wood bearings, discussing the type of wood to use, its treatment, lubrication and expected performance.*
Mic.No: 80493

1083 Anon. s.d. **Ox-drawn tie-ridger-weeder implement.**
Intermediate Technology Development Group, London (UK). Agricultural Equipment and Tools

for Farmers Designed for Local Construction (UK), no. 11, 3p., 2 fig. **En**
☐*Describes an ox-dawn tie-ridger/weeder designed for attachment to the "EMCOT" ox-drawn ridging plow, with illustrations and specifications for the various parts of the equipment.*
Mic.No: 06984

1084 Anon. s.d. **Prototype multi-purpose ox-drawn tool.**
Intermediate Technology Development Group, London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), 3p., 7 fig. **En**
☐*Describes a multipurpose ox-drawn farm equipment with an adjustable share to allow different operations to be carried out by small farmers who grow their crops on ridges: includes illustrations for the fabrication of the various parts.*
Mic.No: 08858

1085 Anon. s.d. **Prototype multi-purpose ox-drawn tool.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), 3p., drawings **En**
☐*Describes the design, material requirements and operational features of a multipurpose animal-drawn tool originally developed to assist small farmers who grow their crops on ridges.*
Mic.No: 80491

1086 Anon. s.d. **Single-row and three-row rice seeders (Zambia).**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 15, 4p., 13 diagrams **En**
☐*Presents diagrams outlining the construction details of single-row and three-row rice seeders.*
Mic.No: 80501

1087 Anon. s.d. **Sled-type corrugator/irrigation furrow former.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 14, 3p., 1 diagram **En**
☐*Describes the design, material requirements and operational features of an implement used to make small furrows or corrugations, for distributing water over a field.*
Mic.No: 80500

1088 Anon. s.d. **The "Rasulia" bladed roller thresher.**
Intermediate Technology Publications Ltd., London (UK), 4p., illus. **En**
Presents a brief description and construction details of the "Rasulia" animal-drawn roller thresher based on observations of the machine in Iran.
Mic.No: 06972

1089 Anon. s.d. **The ARIANA interchangeable implements system.**
Lesotho Steel Products Ltd., Maseru, v.p., fig. **En**
☐*Introduces the ARIANA animal-drawn tools system to be produced by the Maseru Company, Lesotho Steel Products Ltd., indicating the various components such as the basic tool frame, mouldboard plow, spiked tool harrow, cultivator, planter, reversible plow and the ox yoke.*
Mic.No: 80086

1090 Anon. s.d. **The I.I.S.R. weeder mulcher.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), 7p., 1 table, diagrams **En**
☐*Describes the design, material requirements and operational features of the weeder-mulcher developed by the Indian Institute of Sugarcane Research.*
Mic.No: 80490

1091 Anon. s.d. **The weeder mulcher.**
Intermediate Technology Development Group, London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), 8p., 6 illus. **En**
☐*Describes the operation of a self-cleaning animal-drawn weeder-mulcher designed to destroy weeds, leave a mulch on the soil and give a high work output, with a list of materials required and detailed illustrations for the construction of the various parts of the implement.*
Mic.No: 06976

1092 Anon. s.d. **Two designs for clod crushers.**
Intermediate Technology Publications Ltd., London (UK). Agricultural Equipment and Tools for Farmers Designed for Local Construction (UK), no. 10, 3p., diagrams **En**
☐*Describes the design, material requirements and operational features of two simple and cheaply constructed implements used for reducing the size of clods in cultivated land prior to ridging up the soil.*
Mic.No: 80497

1093 Apetofia, K.; Dogbe, L.A. 1990. **Usure des pièces travaillantes des équipements de culture attelée au Togo. (Animal traction equipment wear in Togo)**

Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 350–358, 4 tables, ISBN 92-9081-046-7
□*Discusses the need for some objective system for estimating the spare part requirements of different implements. The cause of implement wear are discussed and an estimating system is proposed, based on standard wear ratios. Presents information on the growth of animal traction in Togo, and some results of surveys of farmers and village blacksmiths. Gives details of some training schemes for blacksmiths.*
Mic.No: 82233

1094 Awadhwal, N.K.; Bansal, R.K.; Takenaga, T. 1985. **Improved agricultural implements for selected SAT regions – an ICRISAT approach.**
ICRISAT, Patancheru, AP (India). Small Farm Equipment for Developing Countries: Past Experience and Future Priorities, Los Banos (Philippines), 1–7 Sep 1985, 21p., 2 fig., 2 tables, 9 photographs; 10 ref. **En**
□*Describes ICRISAT's Improved Vertisol Management Technology (IVMT), development of improved implements for the semi-arid tropics including wheeled toolcarriers, an independent four-row planter and fertilizer applicator, sprayers and a crust breaker. Discusses technical support to manufacturers and future plans.*
Mic.No: 80352

1095 Awadhwal. N.K. 1986. **Development of inclined-roller crust breaker.**
ICRISAT, Patancheru, AP (India). 23. Annual Convention of the Indian Society of Agricultural Engineers, Allahabad (India), 23–25 Oct 1986, 11p., 1 fig., 1 table, 3 photographs; 6 ref. **En**
□*Describes an animal-drawn inclined-roller crust breaker which has been tested in the field, is of simple construction and can be fabricated locally.*
Mic.No: 80001

1096 Awadhwal, N.K.; Takenaga, T.; Bansal, R.K. 1987. **Development of improved agricultural implements at ICRISAT.**
Agricultural Mechanization in Asia, Africa and Latin America (Japan), v. 18(3), p. 21–25, 10 fig., 2 tables; 10 ref. **En**(En)
□*Summarizes progress made in farm machinery development at ICRISAT particularly regarding multipurpose animal-drawn wheeled toolcarriers, the four-row planter with a fertilizer applicator, low and ultra-low volume sprayers, and crust breakers designed to meet the needs of farmers in the semi-arid tropics.*
Mic.No: 80050

1097 Awadhwal, N.K.; Takenaga, T. 1988. **Groundnut digger (ICRISAT design) for hard soils.**
ICRISAT, Patancheru, AP (India). ICRISAT International Arachis Newsletter, no. 3, p. 17, 1 diagram **En**
□*Describes a groundnut digger designed for use in hard, dry soils which, when attached to a toolbar, can be pulled by a pair of oxen.*
Mic.No: 80956

1098 Awadhwal, N.K. 1988. **Low-cost implements to improve groudnut production.**
ICRISAT, Patancheru, AP (India). ICRISAT International Arachis Newsletter, no. 4, p. 13–14, 2 photographs **En**
□*Describes improved cultural practices for groundnuts developed at ICRISAT based on the broadbed-and-furrow system and using a suite of low-cost bullock-drawn implements (broadbed former, inter-row weeding attachment and groundnut planter) made in local workshops of locally available material, the central component common to all being a 'T-bar' of iron or wood.*
Mic.No: 80560

1099 Awadhwal, N.K. 1989. **A report on testing of crust breaker and development and testing of a donkey-drawn cultivator-cum-seeder in Mali.**
ICRISAT, Patancheru, AP (India), 12p., 4 photographs, 2 tables **En** (En)
□*Presents results of trials at the Cinzana Research Station in Mali in which a crust-breaker developed at ICRISAT-Centre in India effectively broke the crust over rows seeded with pearl millet damaging only 0.2% of emerged seedlings. Discusses a low-cost, donkey-drawn cultivator-cum-seeder designed, developed and tested in Mali which performs as well as the commercially available Hoe Asine and can be used for sowing pearl millet and sorghum in hills 50 cm apart and in rows 90 cm apart. Discusses the enormous potential for using donkeys for field applications in West Africa where soils are light and sandy.*
Mic.No: 80564

1100 Bansal, R.K.; Srivastava, K.L. 1981. **Improved animal drawn implements for farming in the semi-arid tropics.**
Agricultural Mechanization in Asia, Africa and Latin America (Japan), v. 12(2), p. 33–38, 6 fig., 2 tables; 16 ref. **En**
□*Describes the animal-drawn wheeled toolcarrier and its attachments developed for use in the semi-arid tropics, especially with regard to its field performance for various operations on broadbed and flat fields, and draft requirements for operations on different soil types.*
Mic.No: 80073

1101 Bansal, R.K.; Thierstein, G.E. 1982. **Animal drawn multi-purpose tool carriers.**
Agricultural Mechanization in Asia, Africa and Latin America (Japan), p. 27–36, 7 fig., 2 tables; 23 ref. **En** (En)
□*Discusses the development and impact of animal-drawn toolcarriers describing different designs developed in various countries; also discusses a specific soil and crop management situation where a multipurpose toolcarrier was useful in improving the quality and timeliness of operations. Presents some field performance results and economic aspects of the toolcarriers.*
Mic.No: 80051

1102 Bansal, R.K.; Thierstein, G.E. 1982. **Design and development of a planter-cum-fertilizer drill for dryland crops.**
Indian Society of Agricultural Engineers, New Delhi. 19. Annual Convention of the Indian Society of Agricultural Engineers, Udaipur, Rajasthan (India), 15–17 Feb 1982, 21p., 5 fig., 3 tables; 17 ref. **En** (En)
□*Describes the design and results of field evaluation trials of a 4-row animal-drawn planter-cum-fertilizer drill attachment to the animal-drawn wheeled toolcarrier developed at ICRISAT.*
Mic.No: 80006

1103 Bansal, R.K.; Awadhwal, N.K.; Mayande, V.M. 1984. **Implement development for SAT Alfisols.**
ICRISAT, Patancheru, AP (India). In: Proceedings of the consultants' workshop on the state of the art and management alternatives for optimizing the productivity of SAT Alfisols and related soils, Consultants' Workshop on the State of the Art and Management Alternatives for Optimizing the Productivity of SAT Alfisols and Related Soils, Patancheru, AP (India), 1–3 Dec 1984, p. 97–107, 5 fig., 7 tables; 9 ref. **En** (En)
□*Summarizes development work carried out at ICRISAT on animal-drawn multipurpose wheeled toolcarriers and rolling crust breakers suitable for Alfisols in the semi-arid tropics; also discusses results of selected tillage trials on Alfisols.*
Mic.No: 80002

1104 Bansal, R.K.; Thierstein, G.E. 1984. **Metering granular fertilizer with an oscillatory mechanism.**
Journal of Agricultural Engineering (India), v. 21(1,2), p. 1–8, 2 fig., 1 photograph, 1 table; 6 ref. **En** (En)
□*Describes an oscillatory metering mechanism for fertilizer application and evaluates a four-row fertilizer drill for attachment to an animal-drawn multipurpose wheeled toolcarrier.*
Mic.No: 80349

1105 Bansal, R.K. 1985. **The tropicultor operator's manual: Field operations.**
ICRISAT, Patancheru, AP (India), 62p., 12 fig., 2 tables, 89 photographs **En**
□*Describes and illustrates the assembly of the Tropicultor and how to use it for operations on flat land (plowing and cultivation) and on broadbeds (making broadbeds and furrows for the first time, tillage, planting and fertilizer application and inter-row cultivation).*
Mic.No: 80868

1106 Bansal, R.K. 1989. **The Agribar operator's manual: Field operations.**
ICRISAT, Patancheru, AP (India), 57p., ISBN 92-9066-126-7 **En**
□*Presents detailed guidelines for the use of the assembling and utilization of the Agribar for different farming operations on flat lands and on broadbeds.*
Mic.No: 80759

1107 Barbosa dos Anjos, J. 1985. **Equipements à traction animale développés par le CPATSA pour les cultures de la région du tropique semi-aride du Brésil. (Animal traction equipment developed by CPATSA for cultivation in the semi-arid tropical regions of Brazil)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 60–63, 1 fig., 3 photographs, 1 table **Fr**
□*Describes the history of the cooperation of EMBRAPA, EMBRATER and CEEMAT in introducing wheeled toolcarriers in Brazil, and development by CPTSA (Centro de Pesquisa Agropecuaria do Tropico Semi-Arido) of animal draft equipment for sowing and harvesting buffel grass (*Cenchrus ciliaris*), harvesting crops such as maize, sorghum and cowpeas, soil preparation and irrigation.*
Mic.No: 80214

1108 Barton, D.; Gibbon, D. 1983. **The strad. An ox drawn cultivator for small farm systems.**
East Anglia Univ., Norwich (UK). School of Development Studies, 25p., 8 plates, 13 fig. **En**
□*Presents a description and fabrication guide for a multipurpose culitvator originally designed for conditions in northern Nigeria.*
Mic.No: 34991

1109 Becker, H. 1987. **Development and testing of a weed roller. PN 77.2117.3. Tanga Integrated Rural Development Programme (TIRDEP), Tanzania. Final**

report prepared on behalf of Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) GmbH.
GTZ, Gissen (Germany, F.R.), 48p., 5 fig., 4 tables, 15 photographs, 1 map **En** (En)
☐*Describes field trials in the Tanga region of Tanzania to optimize the performance of an animal-drawn weed roller designed in Germany and to examine its possible uses from preparing land for main crops to cultivation of perennial crops.*
Mic.No: 80445

1110 Bertaux, S. 1985. **Le développement de prototypes d'équipements à traction animale au Brésil dans le cadre de la convention "EMBRAPA-EMBRATER-CEEMAT". (The development of prototypes of animal-drawn equipment in Brazil within the framework of the "EMBRAPA-EMBRATER-CEEMAT" agreement)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 63–65, 2 tables **Fr**
☐*A summary of a paper in which Bertaux describes the state of research into animal draft in France and Brazil in 1985 and promotion of multipurpose wheeled toolcarriers. Warns against automatically assuming that multipurpose equipment is desirable in Brazil and presents examples to show that although the Polycultor 1500 performed all operations required on an 8-h farm, similar operations could be performed using simpler and cheaper implements.*
Mic.No: 80218

1111 Beyene Megersa. 1980. **Low-powered and animal drawn agricultural implements (The Ethiopian experience).**
Arsi Rural Development Project, Assela (Ethiopia). Agricultural Engineering Section. AAASA/KNAAAS Symposium, Nairobi (Kenya), 28 Jan–1 Feb 1980, 15p., 6 tables **En**
☐*Discusses the experience of the Arsi Rural Development Project (ARDP) in Ethiopia regarding the production of various animal-drawn farm implements, carts and pumps; includes some results of field tests on the performance, draft requirements and yields obtained when using the implements.*
Mic.No: 86962

1112 Bordet, D. 1987. **Inventaire des matériels de culture attelée essayés, mis au point et diffusés au Sénégal depuis 40 ans. Réussites, échecs et lacunes des expériences de diffusion. (Inventory of animal traction equipment tested, introduced and distributed in Senegal in the last 40 years. Successes, failures and gaps in dissemination).**
Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France). CEEMAT Document de Travail (France), 54p., 2 fig., 7 tables **Fr**
☐*Identifies about 80 simple and 10 multipurpose items of animal draft equipment introduced into Senegal in the last 40 years and gives details of their technical adaptation and level of adoption by the rural population.*
Mic.No: 80290

1113 Brockbank, R.B. 1971. **Ox-drawn cultivation equipment.**
Bunda College of Agriculture Research Bulletin (Malawi), v.2, p. 57–59, 2 fig. **En**
☐*Compares three methods of constructing ox-drawn rollers for breaking clods prior to ridging with oxen, using principally gum (Eucalyptus sp.) poles.*
Mic.No: 55256

1114 Brown, S.R.H. 1975. **Design for a single purpose ox-drawn groundnut lifter.**
Chitedze Agricultural Research Station, Lilongwe (Malawi). Farm Machinery Investigation Section. Farm Machinery Investigation Section Report (Malawi), no. 75/2, 5p., 3 fig. **En**
☐*Presents results of tests carried out in Malawi on an inexpensive groundnut lifter which could be manufactured locally and which would be lighter, easier to transport and requires fewer stoppages to clear haulms and weeds from the blade. Compares results with those obtained on the "Chitedze Toolbar" lifter.*
Mic.No: 55110

1115 Brumby, P.J.; Singh, K. 1981. **India. Animal powered agriculture and improved technology – an interim report.**
s.n., s.l., 16p., 7 ref. **En**
☐*Presents a summary of the type and performance of animal-powered implements available in India, assessing the impact of improved versions on agricultural output and identifying possible means of improving their utilization and efficiency.*
Mic.No: 50064

1116 Bubi, B. 1986. **The demand and supply relationships and marketing of farm implements – the BCU viewpoint.**
ILO, Geneva (Switzerland) ; Botswana. Ministry of Agriculture. In: Initiatives for farm equipment programmes in Botswana: Improving co-ordination, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Gaborone (Botswana), 3–5 Dec 1985, p. 25–29, 1 fig., 1 table **En**

☐*Discusses marketing, distribution and demand/supply analysis of animal draft equipment in Botswana from the viewpoint of the Botswana Coop Union which began marketing animal-drawn implements in 1981.*
Mic.No: 80831

1117 Cham, P.A. s.d. **Appropriate tillage systems evaluation by the Department of Agricultural Engineering in the Gambia.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16–20 Jan 1979, p. 87–91, 8 fig. **En**
☐*Describes trials carried out in The Gambia in 1973–75 to compare the Sine-home Package (comprising a T-shaped frame with handles and a head wheel, 5 weeding/cultivating tines, 1 mouldboard 9-in plow, 1 groundnut lifter, 1 ridging attachment and a 3-m traction-chain) with traditional systems and to test the Super Eco Seeder. Modifications were made and both implements are now recommended and available for extended use.*
Mic.No: 82102

1118 Chimwaza, J. 1978. **Field performance of an ox-drawn planter modified for use on ridges.**
Bunda College of Agriculture, Lilongwe (Malawi), 11p., 6 tables; 10 ref. B.Sc. (Agriculture). **En** (En)
☐*Presents results of a field performance test conducted in Malawi on an ox-drawn planter fitted with a stabilizing mechanism so that it can be used on ridges. Assesses parameters such as rate of operation, spacing within rows, percentage gaps and germination rates.*
Mic.No: 55056

1119 Choudhary, M.A. 1986. **Inverted-T multicrop seeder for rice-based cropping systems.**
IRRI Newsletter, v. 11(5), p. 38, 1 fig. **En**
☐*Describes a multicrop seeder that utilizes a mechanical design developed on the basis of soil physical requirements for improved seed germination and seedling emergence and can be mounted on a two-wheeled tractor or can be operated by animals.*
Mic.No: 80753

1120 Constantinesco, I. 1964. **Development of ox-drawn toolframes.**
East African Agricultural and Forestry Journal (Kenya), p. 187–191, 2 photographs; 3 ref. **En**
☐*Discusses development of animal-drawn toolcarriers and describes a prototype ox-drawn toolframe designed and constructed at the Tanganyika Agricultural Machinery Testing Unit in 1962–3 to provide basic facilities for plowing, ridging, cultivating and transport.*
Mic.No: 80193

1121 Dam, K. van. 1990. **Local production of animal-drawn implements.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 224–225, 1 fig., ISBN 92-9081-046-7 **En** (Fr)
☐*Describes how Rumpstad, a developer and manufacturer of soil tillage implements for more than 50 years in The Netherlands, set up small-scale manufacturing of animal draft implements in Mali using local blacksmiths and now has similar operations in other African countries. Together with the Institute of Agricultural Engineering, Wageningen (The Netherlands) Rumpstad would like to conduct a survey into use of animal-drawn implements including those locally manufactured and into adaptation of Rumpstad implements to suit local requirements and are offering to supply free implements in return for cooperation in this project.*
Mic.No: 82062

1122 Demain, H.M.; Lugassy, J. 1984. **L'artisanat rural en Haute Volta et au Niger. (Rural handicraft in Upper Volta and Niger)**
Machinisme Agricole Tropical (France), no. 8, p. 11–23, 8 photographs, 2 fig. **Fr** (En Fr)
☐*Discusses the status of metal and leather working trades in rural areas of Burkina Faso and Niger, describing the country forge as it exists in the villages, production of agricultural hand tools, house-keeping instruments, arms, and harness parts (horse collars, saddles, traces, swingle bars), and the working methods employed.*
Mic.No: 80477

1123 Dumas, R. 1968. **Essais de faucheuse à traction animale. (Trials on an animal-drawn mower)**
Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Maisons-Alfort (France); Centre de Recherches Zootechniques de Wakwa (Cameroun), 5p. **Fr**
☐*Presents results of a trial carried out at the Centre Zootechnique de Wakwa in Cameroon, in order to study the adaptation of an animal-drawn grass mower, with data on productivity in terms of area covered, weight of hay and yield per hour.*
Mic.No: 31453

1124 Ellman, A. (comp.); Mackay, B. (comp.); Moody, T. (comp.) 1981. **Guide to technology transfer in East, Central and Southern Africa. A catalogue of agri-**

cultural equipment manufactured in the region, with a guide to its purchase and use.
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div., 134p., illus., ISBN 0-85092-198-8 **En**
□*Lists and describes small-scale agricultural implements manufactured in the commonwealth member countries of East, central and southern Africa, including addresses of manufacturers and individual drawings and descriptions of each implement.*
Mic.No: 86960

1125 Fall, A.; Ndiame, F. 1990. **Role des forgerons traditionnels dans la maintenance du matériel de traction animale en Basse-Casamance, Sénégal. (The roles of traditional blacksmiths in maintaining farm equipment in Lower Casmance, Senegal)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 256-266, 2 maps, 2 tables; 5 ref., ISBN 92-9081-046-7 **Fr**
□*Discusses current activities of blacksmiths in the Basse-Casamance region of Senegal in terms of maintaining farm equipment and potential improvement of services offered. Concludes that current facilities for maintenance of equipment are insufficient, blacksmiths tend to be relatively old and reluctant to relocate and there is a scarcity of good quality materials. Suggests modifications to equipment to reduce maintenance problems, setting-up new forges, providing more trained blacksmiths and improving provision of materials required by the blacksmiths.*
Mic.No: 82057

1126 Foster, J.D.G. s.d. **Dryland Farming Research Scheme (DLFRS), Botswana. Final scientific report of Phase II. Volume 4. Design of animal draught planters for semi-arid conditions.**
UK. Ministry of Overseas Development; Agricultural Research Station, Gaborone (Botswana), 42p., 29 fig., 11 tables **En**
□*Reports on studies undertaken on various aspects of animal-drawn planters and planter components in order to determine the best design for a simple planter for the semi-arid conditions of Botswana, with particular reference to factors in the design affecting plant emergence. Includes recommendations for official policy, farming practice, design of planters, and for further research.*
Mic.No: 57328

1127 Garg, B.K.; Devnani, R.S. 1983. **Animal drawn multipurpose tool carriers.**
Central Inst. of Agricultural Engineering, Bhopal (India). CIAE Technical Bulletin (India), no. CIAE/83/41, 81p., 20 fig., 6 photographs; 15 ref. **En**
□*Contains information on simple toolcarriers, wheeled toolcarriers and toolcarriers developed abroad (by NIAE, Silsoe (UK), ICRISAT and in France) aimed at research and extension workers, farmers and equipment manufacturers in India.*
Mic.No: 80856

1128 Gibb, J.A.C. 1983. **India: Developing agricultural mechanisation.**
Span (UK), v. 26(1), p. 17-18, 2 photographs, 1 fig. **En**
□*Discusses the benefits of the development of animal-drawn toolbars in the progression towards more efficient crop production in the less developed regions of India and in other countries with similar problems.*
Mic.No: 80918

1129 Gibbon, D.; Heslop, C.; Harvey, J. 1978. **The hashasha and atulba toolbar.**
East Anglia Univ., Norwich (UK). Overseas Development Group. Development Studies Discussion Paper (UK), no. 21, 39p., numerous illus. **En**
□*Describes farm equipment developed in the Sudan, particularly the Hashasha, a simple weeding device made from wood and metal and pulled by two oxen to pre-clean land in preparation for groundnuts and for within-crop weeding of millet; and the Atulba, which is a complex metal toolbar designed to carry out overall weeding or land preparaton, planting two rows at once and inter-row weeding. Includes illustrations and component lists indicating ways of constructing the equipment and operating it in the field.*
Mic.No: 30954

1130 Gibbon, D. 1985. **Multi-purpose toolbars.**
Carruthers, I. In: Tools for agriculture: A buyer's guide to appropriate equipment, IT Publications. Eschborn (Germany, F.R.), p. 45-55, 1 photograph, 31 drawings, 7 tables **En**
□*Discusses the concept, design and advantages of multipurpose toolbars, locally-produced low-cost alternatives, choice of equipment, social impact and special considerations (maintenance and availability of appropriate animals, training and harnessing techniques and farming systems). Illustrates multipurpose toobars available in the early 1980s.*
Mic.No: 80857

1131 Gibbon, D. 1987. **Multi-purpose toolbars: Some tools for agriculture.**
Intermediate Technology Publications, London (UK), 18p., 7 tables, 4 photographs, 31 drawings, ISBN 0-946688-73-7 **En**

□*Discusses problems of farmers in developing countries and impact of technology, concept, design and advantages of multi purpose toolbars, locally produced low-cost alternatives, choice of equipment, social impact and special considerations (maintenance and availability of appropriate animals, training and harnessing techniques and farming systems). Illustrates toolbars manufactured in the early 1980s.*
Mic.No: 80858

1132 Gifford, R.C. 1988. **The selection and use of animal draft technology.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn, Braunschweig, Wiesbaden (Germany F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19-25 Sep 1986, p. 116-118, ISBN 3-528-02047-4 **En**
□*The concept of a total agricultural mechanization technology as opposed to Draft Animal Power is discussed. Among the conclusions are that the technological shelf to support animal draft technology is enormous and this should be fully exploited before scarce resources are used to mount further extensive research and development schemes.*
Mic.No: 82006

1133 Gladden, R. 1974. **Mechanical aspects of dryland farming.**
Agricultural Research Station, Gaborone (Botswana). Dryland Farming Research Scheme Technical Bulletin (Botswana), no. 3, 3p. **En**
□*Examines tillage equipment readily available to farmers in Botswana, particularly plowing, planting and weeding equipment for animal draft; and briefly discusses the situation regarding new types of equipment and tractor implements.*
Mic.No: 57657

1134 Gueguen, R. 1988. **Fabrication locale et maintenance de matériel agricole en zone Mali-sud. (Local manufacturing and maintenance of farm equipment in the Mali-Sud area)**
Raymond, G. (ed.); Bigot, Y. (ed.); Bordet, D (ed.). In: Economie de la mécanisation en région chaude, Séminaire d'Economie Rurale, Montpellier (France), 12-16 Sep 1988, p. 89-100, 4 tables, ISBN 2-87614-026-8 **Fr** (Fr)
□*Describes the role of SMECMA (Société Malienne d'Etudes et de Construction de Matériel Agricole) in satisfying national needs for farm equipment and the use since 1985 by the CMDT (Compagnie Malienne pour le Développement des Fibres Textiles) of a nucleus of 150 smiths to form the basis of small-scale manufacturing units.*
Mic.No: 82069

1135 Gullman, D. 1989. **Testing the lister/planter: A search for energy-efficient minimum tillage.**
Tillers Report (USA), v. 9(2), p. 3-5, 7 photographs, 1 diagram **En** (En)
□*Describes an animal-drawn lister/planter system developed in the USA in which a lister (including a v-shaped double mouldboard plow and a planter) creates ridges and plants into the furrow in a single operation and once plants are tall enough to withstand some falling soil, a specialised weeding sled or ridge breaker known as the go-devil is pulled down the furrow. Discusses results obtained and problems encountered when the system was tested in Chad.*
Mic.No: 80555

1136 Gwani, E.S. 1990. **Animal power for agricultural production in Nigeria.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7-12 Jul 1988, p. 376-380, 3 photographs, 1 table, ISBN 92-9081-046-7
□*Provides information on the growth and present status of animal traction in Nigeria. Discusses the testing and development of animal-drawn implements, including ridgers, multipurpose toolbars and weeding devices. Gives brief details of a straddle-row weeder and a weeding attachment for the local ridger.*
Mic.No: 82234

1137 Haudricourt, A G.; Delamarre, M.J.-B. 1986. **L'homme et la charrue à travers le monde. (Man and plow around the world)**
La Manufacture. Lyon (France), 410p., 178 fig., 6 maps: ref. **En**
□*Examines the geographical distribution and history of the plow and the swing-plow throughout the world, discussing technical, demographic, economic and social problems related to the implements.*
Mic.No: 38185

1138 Havard, M. 1985. **La récolte mécanique de l'arachide au Sénégal. (Mechanized harvesting of groundnuts in Senegal)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Senegal), no. 1985/8, 27p., 15 fig., 5 tables, 1 graph; 16 ref. **Fr**
□*Describes, illustrates and compares the performance of motorized and animal draft equipment used for groundnut harvesting in Senegal. Discusses the role of local craftsmen. Concludes that use of motorized equipment is not viable economically, but that there is also a lack of draft animal*

equipment and that which is available is badly maintained.
Mic.No: 80774

1139 Havard, M. 1985. **Le semis du riz au Sénégal. (Sowing rice in Senegal)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Senegal), no. 1985/12, 41p., 28 fig., 7 tables; 24 ref. **Fr**
☐*Describes and illustrates the principal methods of sowing rice used in Senegal and the characteristics of the different row seeders used. Gives results of trials in which rice was sown mechanically and makes recommendations based on these results.*
Mic.No: 80773

1140 Havard, M. 1985. **Principales caractéristiques et contraintes de gestion du parc de matériels de culture attelée au Sénégal. (Major characteristics and constraints to the management of animal traction equipment in Senegal)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Senegal), no. 1985/2, 95p., 40 fig., 19 tables, 3 graphs; 32 ref. **Fr**
☐*Discusses the availability of animal draft equipment (illustrated) in Senegal and constraints to and future action to promote the spread of animal traction.*
Mic.No: 80772

1141 Havard, M. 1986. **Le semis du mil au Super-Eco en culture. (Sowing millet with an animal-drawn seeder – the "Super-Eco")**
Machinisme Agricole Tropical (France), no. 93, p. 15–20, 3 fig.; 15 ref. **Fr** (En, Es, Fr)
☐*Details results of tests carried out to adapt millet feed mechanisms on the animal-drawn "Super-Eco" seeder, which was used successfully for groundnut sowing. Includes observations on and proposed solutions for some problems associated with millet sowing with the "Super-Eco" such as unevenness of distribution and insignificant time-saving.*
Mic.No: 80484

1142 Havard, M. 1987. **Le parc de matériels de culture attelée et les possibilités de sa maintenance dans le Département de Nioro. (Animal traction equipment and possibilities for its maintenance in the Nioro District)**
Institut Sénégalais de Recherches Agricoles, Dakar. ISRA Document de Travail (Sénégal), no. 87–3, 50p., 1 fig., 22 tables, 1 map **Fr** (Fr)
☐*Results of a random survey of animal draft equipment in Nioro Departement and of a detailed survey of the craftsmen involved showed satisfactory levels of hoes and harvesters, heavy use of draft horses, well-developed levels of maintenance but a lack of high-quality materials for repairs.*
Mic.No: 80779

1143 Hopfen, H.J.; Biesalski, E. 1953. **Small farm implements.**
FAO, Rome (Italy). FAO Agricultural Development Paper, no. 32, 79p., 120 fig., ISBN 92–5–100452–8 **En**
☐*Examines some of the basic principles underlying the design and use of small farm implements and assesses possibilities of their further improvement in order to increase yields from limited arable land and assure a higher level of food production. Describes the various stages in the development of hand tools and simple animal-drawn implements used for soil preparation, sowing, planting, fertilizing, processing and transportation; and identifies tools necessary for the repair, maintenance and setting of small implements and machines within the scope of small-scale farming in different regions of the world.*
Mic.No: 18978

1144 Hopfen, H.J. 1969. **Farm implements for arid and tropical regions.**
FAO, Rome (Italy). FAO Agricultural Development Paper, no. 91, 159p., 120 fig., 5 tables; 76 ref., ISBN 92–5–101527–9 **En**
☐*Describes the most important hand- and animal-powered farm implements used for tillage, seedbed preparation, earth-moving, fertilizer spreading, sowing, planting, intercultivation, plant protection, harvesting, threshing and winnowing in arid and tropical regions.*
Mic.No: 18979

1145 Hornsby, R. 1984. **Ploughs up to date. The most reliable ploughs in the world.**
Lincolnshire County Council, Lincoln (UK), 66p., drawings **En**
☐*A facsimile reprint of a catalogue published by R. Hornsby & Sons of Grantham (UK) in 1891 illustrating 94 plow types for use at home and abroad.*
Mic.No: 80880

1146 Horspool, G.D. 1969. **A comparison of groundnut lifter blades and shares. Summary of report.**
Chitedze Agricultural Research Station, Lilongwe (Malawi). Farm Machinery Investigation Section. Farm Machinery Investigation Section Report (Malawi), no. 69/1, 3p. **En**
☐*Discussess the types, design, operation and efficiency of groundnut lifter blades and shares for use with an ox-drawn implement or a multipurpose tool under Malawian conditions.*
Mic.No: 55116

1147 Horspool, G.D. 1970. **Development of a multipurpose ox-drawn toolbar.**
Chitedze Agricultural Research Station, Lilongwe (Malawi). Farm Machinery Investigation Section. Farm Machinery Investigation Section Report (Malawi), no. 69/8, 21p., 3 plates, 16 illus. **En**
☐*Discusses the materials, design, cost, performance and future prospects of a multipurpose ox-drawn toolbar intended to give the Malawi farmer access to a wider range of ox-drawn tillage implements for roughly the same cost as the three single-purpose implements, the plow, the mouldboard ridger and the cultivator most commonly used in the country.*
Mic.No: 55112

1148 Horspool. G.D. 1971. **Performance test – unibar animal-drawn tool-frame.**
Chitedze Agricultural Research Station, Lilongwe (Malawi). Farm Machinery Investigation Section. Farm Machinery Investigation Section Report (Malawi), no. 70/4, 9p., 6 plates **En**
☐*Discusses the full range of operations covered and the parts of the Unibar, a multipurpose animal-drawn toolbar of the single row type.*
Mic.No: 55114

1149 Horspool, G.D. 1972. **A comparison of the performance of four types of ox drawn planters.**
Chitedze Agricultural Research Station, Lilongwe (Malawi). Farm Machinery Investigation Section. Farm Machinery Investigation Section Report (Malawi), no. 70/6, 12p., 6 tables. 4 plates; 4 illus. **En**
☐*Presents findings of a comparison made on four planters, viz the "SAFIM" single row planter, the NIAE "SISIS" soft roller seeder, the NIAE knotched wheel seeder and the "Unibar" combined planter, in terms of ease of operation and maintenance, and capability of sowing maize, groundnuts and soya beans on ridges and at rates acceptable to current recommendations.*
Mic.No: 55111

1150 Horspool, G.D. s.d. **Performance of a locally made version of the N.I.A.E. Aplos animal drawn toolbar.**
Chitedze Agricultural Research Station, Lilongwe (Malawi). Farm Machinery Investigation Section. Farm Machinery Investigation Section Report (Malawi), no. 69/7, 3p. **En**
☐*Presents results of field performance tests carried out on an animal-drawn toolbar copied from the original British made "Aplos", and produced in Malawi, in order to test the feasibility for a local firm to produce the toolbar using limited facilities.*
Mic.No: 55115

1151 Howell, J.M. 1989. **Weeding wings: A between-the-rows weeding solution.**
Tillers Report (USA), v. 9(2), p. 10–11, 2 photographs, 1 diagram **En** (En)
☐*Discusses result of tests in Togo where various types of weeding wings were used for cultivating between ridges of varying widths; they replaced the normal wings of a ridging plow. These adapted ridgers require a long yoke so the oxen can walk outside the two ridges being worked; where a single animal is used, yoke length is not a problem and weeding is easier with a single animal as the space required for turning is reduced.*
Mic.No: 80553

1152 Howell, P.J.L.; Paice, M.E.R. 1989. **An adaptive data logging system for animal power studies.**
Journal of Agricultural Engineering Research (UK), v. 42(2), p.111–121, 9 drawings, 1 table; 5 ref., ISSN 0021–8634. **En**
☐*Describes the development of a micro-processor based modular data-logging system capable of logging 160 channels/sec with simple processing, and gives details of the hardware, software and sensors. Discusses reasons for inclusion of certain features in the context of draft animal power investigations.*
Mic.No: 80557

1153 Hubbard, K.; Harvey, J.; Gibbon, D. 1974. **The Versatool: An animal drawn tool carrier for crop production systems in semi-arid regions.**
Agricultural Research Station, Gaborone (Botswana). Dryland Farming Research Scheme Technical Bulletin (Botswana), no. 6, 28p., 5 fig., 6 photographs **En**
☐*Describes a two-wheeled, animal-drawn implement carrier, developed by the Dryland Farming Research Team in Botswana, capable of accomodating plowing, weeding, planting, inter-row holing and fertilizer application implements.*
Mic.No: 10908

1154 Inns, F. 1980. **Agricultural machinery manufacture in developing countries: The potential contribution to agricultural and industrial development.**
Agricultural Engineer (UK), Winter, p. 100–103, 2 fig.; 1 ref., ISSN 0308–5732. **En** (En)
☐*Considers equipment required for broad-based productivity increases in developing countries based on draft implements, small tractors and related machinery. Stresses the importance of well-researched designs to meet agricultural needs and use of materials, processes and techniques which encourage industrial development.*
Mic.No: 80403

1155 Jeanrenaud, J.P.; Barton, D.; Gibbon, D. 1982. **An animal-drawn toolcarrier for small farm systems.**
East Anglia Univ., Norwich (UK). School of Development Studies. School of Development Studies Discussion Paper (UK), no. 110, 24p., 6 drawings, 20 photographs, 1 table; 6 ref. **En**
□*Describes and illustrates a low-cost animal-drawn toolcarrier developed at the University of East Anglia (UK) and details workshop equipment and labour input, construction materials and costs.*
Mic.No: 80851

1156 Jennings, B.A. 1937. **Plow adjustment.**
Cornell Univ., Ithaca, NY (USA). Coll. of Agriculture. Cornell Extension Bulletin (USA), no. 381, 36p., 36 fig. **En**
□*Discusses some of the more important adjustments of both horse-drawn and tractor-drawn plows so that good plowing can be accomplished more easily; emphasizes the importance of the condition of plowshares in plow adjustment.*
Mic.No: 86969

1157 Jutzi, S.; Anderson, F.M.; Abiye Astatke. 1988. **Low-cost modifications of the traditional Ethiopian tine-plow for land-shaping and surface drainage of heavy clay soils: preliminary results from on-farm verification. (Modifications à bas prix de la charrue éthiopienne de travail du sol et de drainage de surface sur les sols argileux et lourds: résultats préliminaires d'essais menés en milieu paysan)**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 127–132, 2 fig.; 10 ref., ISBN 3-528-02047-4 **En, Fr**
□*Modifications to the traditional ox-drawn Ethiopian ard plow (maresha) for use in the construction of terraces for soil conservation and of raised beds and furrows to facilitate surface drainage on heavy clay soils are described and the results of on-station and on-farm tests reported. Both modifications can be made by village craftsmen.*
Mic.No: 82008

1158 Kalkat, H.S.; Kaul, R.N. 1985. **Interim report on the assessment of animal-drawn toolbars in local farming systems.**
Ahmadu Bello Univ, Zaria (Nigeria). Inst. of Agricultural Research, 21p., 8 tables, 14 photographs; 27 ref. **En** (En)
□*Reports on performance under local farming conditions in Nigeria of seven animal-drawn toolbars (described), the imported Ariana, Arara, Unibar and Occidentale and the locally manufactured Emcot, Strad and Kazaure, none of which provided a complete set of attachments for all farming operations.*
Mic.No: 80195

1159 Kanu, B.H. 1988. **Village level engineering: The importance of the blacksmith in supporting animal traction and agricultural production.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 334–336, 4 ref., ISBN 92-9081-046-7 **En**
□*Presents results of a survey of 30 blacksmiths in the Mabole Valley of Sierra Leone in March 1987 which showed that most were peasant farmers and only 13 had worked on draft animal equipment. Discusses problems and constraints of the village blacksmith (major problem being availability of materials) and blacksmiths' equipment. Concludes that the importance of the blacksmith at village level cannot be overemphasized as his high position in the community and important function in production of agricultural equipment make him a focal point for rural development.*
Mic.No: 82119

1160 Kayumbo, A.K. 1987. **The local manufacture of farm tools and implements.**
ILO, Geneva (Switzerland); Tanzania. Ministry of Agriculture and Livestock Development. In: In quest of agricultural mechanisation policy and strategies in the United Republic of Tanzania, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Dar-es-Salaam (Tanzania), 8–10 Oct 1985, p. 41–44, ISBN 92-2-105482-9 **En**
□*Covers supply and testing of ox-drawn implements in Tanzania.*
Mic.No: 80818

1161 Kemp, D.C. 1983. **The Nikart: A new animal-drawn implement for cultivation and transport.**
Appropriate Technology (UK), v. 10(1), p. 11–13, 6 photographs; 3 ref., ISSN 0305-0920. **En**
□*Describes the Nikart wheeled toolcarrier developed jointly by NIAE (UK) and ICRISAT (India), its simple conversion from transport to cultivation role and attempts to initiate local manufacture. Preliminary results of evaluation trials mainly in India but also in Botswana, Mali, Zimbabawe and Mexico indicated that farmers tended to use either cultivation or transport modes for protracted periods rather than to fully exploit its dual-purpose capacity by frequent changes.*
Mic.No: 80192

1162 Kemp, D.C. 1987. **Draught animal power – Some recent and current work. (La culture attelée. Travaux récents et activités en cours)**
FAO World Animal Review(FAO Revue Mondiale de Zootechnie), no. 63, p. 7–14, 7 fig.; 15 ref., ISSN 0049–8025. **En, Fr**
□*Describes the introduction of draft animal power (DAP) in The Gambia using local N'Dama cattle for groundnut and cotton production, as well as the development of a multipurpose wheeled toolbar, the Nikart, presently being produced commercially in India and Mexico. Presents results of studies being undertaken at the Institute of Engineering, UK, and in several developing countries using a fully portable data acquisition system to evaluate precisely the performance of animal-implement combinations.*
Mic.No: 80481

1163 Kerman, C. 1985. **Charrues et traction animale (2e partie). (Plow and animal traction, Part II)**
Inter-Tropiques (France), no. 10, p. 16–17, 6 fig., ISSN 0755–6152. **Fr**
□*Describes various traditional types of tillage implements such as the Chinese and Japanese types and plows with or without stabilizers, examining briefly possibilities and constraints to their utilization.*
Mic.No: 66859

1164 Khelil, M.K.B. 1977. **Adaptation et fabrication des matériels destinés aux exploitations individuelles. (Adaptation and fabrication of implements for individual farms)**
Afrique Agriculture (France), v. 20, p. 42–45, 3 tables, 3 photographs, ISSN 0337–9515. **Fr**
□*Gives information on numbers of tractors and draft animals in Tunisia and describes a multipurpose toolbar developed by the CRGR (Centre de Recherche du Génie Rural) for smallholders growing vegetables with irrigation.*
Mic.No: 80272

1165 Kshirsagar, K.G.; Fieldson, R.S.; Mayande, V.M.; Walker, T.S. 1984. **Use and prospective demand for wheeled tool carriers in India.**
ICRISAT, Patancheru, AP (India). Resource Management Programme. ICRISAT Economics, Resource Management Programme Progress Report, no. 64, 34p., 4 tables, 1 map; 7 ref. **En** (En)
□*Results of interviews with manufacturers and surveys of farmers in India showed that few wheeled toolcarriers were sold to farmers without large subsidies, use by farmers was low, few were available for hire and farmers did not see their advantage over traditional methods for farm operations and/or transport. Suggests that potential for diffusion of wheeled toolcarriers in dryland regions is poor but may be greater in irrigated areas.*
Mic.No: 80356

1166 Lal, H. 1986. **India. Low-cost animal-drawn wheeled tool carrier. (Inde. Traction animale: un porte-outil à faible coût)**
FAO World Animal Review (FAO Revue Mondiale de Zootechnie), no. 59, p. 24–28, 2 fig., 2 tables; 5 ref. **En, Fr**
□*Describes results of work undertaken at the ICRISAT Research Station at Patancheru, AP in India on the conversion of a traditional bullock cart into a low-cost toolcarrier; includes data from tests and field performance trials on the implement.*
Mic.No: 80207

1167 Luque, V.R.; Alarcon, R.H.; Yamashita, L.M.; Meier, H.; Aquise, R. de la T.; Vargas, J.M.; Vera, E.; Zambrano, L.; Guevara, O.L. de. 1987. **Mecanizacion agricola en el Ande. (Agricultural mechanization in the Andes)**
Fundacion Friedrich Ebert (Peru); Proyecto Herrandina, Cusco (Peru); Centro Peruano de Investigacion Aplicada, 80p., 4 photographs, 12 tables **Es** (Es)
□*Describes the state of agricultural technology throughout the Andes and the promotion of appropriate technology in Latin America. Discusses the success of and problems associated with projects to provide the small farmer with appropriate equipment in Peru, Bolivia and Honduras.*
Mic.No: 80561

1168 Lyons, T.; Bahttarai, A.N. 1981. **The Nepal ridger.**
CIMMYT, Mexico City (Mexico), 7p., 4 fig., photographs **En**
□*Describes methods of constructing the Nepal ridger and its uses in land preparation, fertilizing, seeding, ridging, irrigation and weeding operations.*
Mic.No: 80009

1169 Macpherson, G.A. 1975. **Chapter 5. Agricultural equipment.**
Macpherson, G.A. In: First steps in village mechanisation, Tanzania Publishing House. Dar-es-Salaam (Tanzania), p. 116–123, 12 drawings **En**
□*Gives illustrated examples of animal draft equipment which can be made by villagers including simple wooden and iron-toothed harrows.*
Mic.No: 80127

1170 Madjid, R. 1986. **Animal-drawn soybean planter in Indonesia.**

RNAM Newsletter (Philippines), no. 25, p. 14, 1 drawing, 1 photograph **En**
☐*Describes a 2-row animal-drawn soya bean planter developed at the National Institute in Indonesia to replace the manually operated "tugal" or dibbler for planting soya beans, but which can be modified for use with maize, mung beans and groundnuts.*
Mic.No: 80126

1171 Malle, B.N. 1985. **La culture avec traction animale: quelques expériences pays par pays. Mali. (Cultivation with animal traction: Country experiences. Mali)**
Journée d'Etude sur la Culture avec Traction Animale, Antony (France), 7 Mar 1985. Afrique Agriculture (France), no. 122, p. 25–26, 1 photograph, ISSN 0337–9515. **Fr**
☐*Describes the role of SMECMA (Société Malienne d'Etude et de Construction de Matériel Agricole) in producing low-cost farm tools and equipment.*
Mic.No: 80659

1172 Malle, B.N. 1985. **Mali. "Le potentiel de production de la SMECMA va augmenter". (Mali. "Production potential of SMECMA to increase")**
Afrique Agriculture (France), no. 122, p. 26–27, ISSN 0337–9515. **Fr**
☐*Discusses the production of various animal-drawn implements in Mali by the Société Malienne d'Etude et de Construction de Matériel Agricole (SMECMA), examining technical, financial and commercial difficulties encountered as well as future prospects.*
Mic.No: 80123

1173 Matthews, M.D.P.; Pullen, D.W.M. 1974. **Groundnut cultivation trials with ox-drawn equipment: The Gambia 1973/74.**
National Inst. of Agricultural Engineering, Silsoe, Bedford (UK). Overseas Div. Tropical Agricultural Engineering Information Report Series (UK), 62p., illus., tables **En**
☐*Describes groundnut cultivation experiments undertaken in The Gambia using ox-drawn farm implements.*
Mic.No: 80715

1174 Matthews, M.D.P.; Pullen, D.W.M. 1976. **Cultivation trials with ox-drawn implements using N'dama cattle in the Gambia.**
National Inst. of Agricultural Engineering, Silsoe, Bedford (UK). Overseas Dept. Tropical Agricultural Engineering Information Report Series (UK), 48p. **En**
☐*Reports on trials conducted in 1975 in The Gambia on the cultivation of groundnuts, cereals and cotton with ox-drawn implements using N'Dama cattle; includes analysis of total yield and labour inputs for planting, weeding, cotton thinning and earthing-up, groundnut harvesting and total seasonal input. Also includes analysis of available planters.*
Mic.No: 11993

1175 Mayande, V.M.; Thierstein, G.E.; Sarin, R.; Sanghi, N.K.; Kidd, D.W. 1982. **A technical evaluation of improved animal drawn implements under on-farm conditions.**
ICRISAT, Patancheru, AP (India). 2. Annual Convention of Andhra Pradesh Chapter of the Indian Society of Agricultural Engineers, Hyderabad (India), 7 Jan 1982, 18p., 7 tables; 12 ref. **En** (En)
☐*Compares the technical performance of traditional and improved machinery systems in terms of field capacity and draft, using on-farm data from Indian villages.*
Mic.No: 30508

1176 Mayande, V.M.; Sarin, R.; Thierstein, G.E. 1985. **Animal-drawn wheeled tool carrier in India under on-farm conditions.**
Agricultural Mechanization in Asia, Africa and Latin America (Japan), v. 16(4), p. 17–24, 9 fig., 6 tables; 13 ref. **En** (En)
☐*Presents results of on-farm trials carried out in India to assess the technical and economical performance of the multipurpose animal-drawn wheeled toolcarrier developed at ICRISAT, on three soil types (shallow-to-medium Alfisols, shallow-to-medium Vertisols and deep Vertisols) and under different machinery management and cropping systems.*
Mic.No: 80052

1177 Mayande, V.M.; Bansal, R.K.; Sangle, R.D. 1985. **Performance of various animal drawn wheeled tool carrier systems.**
Journal of Agricultural Engineering (India), v. 22(2), p. 27–34, 4 tables; 7 ref. **En** (En)
☐*Evaluates and compares results of performance trials with four animal-drawn wheeled toolcarriers (Akola cart, Agri-bar, Tropicultor and Nikart) and their implement systems on a broadbed-and-furrow cultivation system at ICRISAT (India).*
Mic.No: 80187

1178 Meijer, R.A.; Chelemu, K. 1990. **The need for standardized procedures to test ox-drawn implements: Experience from Zambia.**

Starkey, P.H. (ed.); Fall, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 226–229

□*Discusses the advantages of standardized testing procedures for animal-drawn implements. Advocates a system for Zambia where all designs of animal-drawn implements and carts would have to undergo a three-stage series of on-station and on-farm testing. Recommends that only those implements passing all stages should be allowed to be sold in the country.*
Mic.No: 80966

1179 Menon, R.G.; Srivastava, N.S.L. 1968. **The I.I.S.R. bullock-drawn chemical applicator.**
Indian Farming, v. 18(1), p. 27–29, 1 fig., ISSN 0019–4786. **En**
□*Presents the construction details and operation requirements of a bullock-drawn fertilizer distributor capable of opening a slit of the required depth, applying the desired quantity of fertilizer in the slit and covering it up, all in one operation.*
Mic.No: P00518

1180 Mignolet, B.; Lecca, M.; Ashburner, J. (ed.); Romero, G. (ed.) 1987. **Utilisation du matériel de culture attelée. (Use of animal draft equipment)**
Niger. Ministère de l'Agriculture et de l'Environnement. Direction des Etudes, Programmation et Statistiques. Fiche Technique du Ministère de l'Agriculture (Niger), no. 3, 23p., 18 fig. **Fr**
□*A brief illustrated guide to animal draft equipment.*
Mic.No: 80261

1181 Moigne, M. le. s.d. **Possibilités de travail "en sec" en culture attelée bovine. Essais complémentaires menés en 1966. (Possibilities of dry tillage with ox-powered cultivation. Complementary trials undertaken in 1966)**
Centre National de Recherches Agronomiques, Bambey (Sénégal), 7p., 3 tables **Fr**
□*Compares the performance of six forms of animal draft equipment in preparing three types of soil in central Senegal.*
Mic.No: 80276

1182 Monnier, J. 1967. **A propos d'un matériel à traction bovine. Premier essai pour une meilleure utilisation de la force des boeufs. (An ox-drawn implement. Preliminary trial on the better use of ox-power)**
Centre National de Recherches Agronomiques, Bambey (Sénégal), 11p., 2 fig., 2 tables **Fr**
□*Compares the performance of intermediate-type tooljrames, e.g. the Ariana with the wheeled Polyculteur toolcarrier.*
Mic.No: 80286

1183 Monnier, J. 1971. **Le matériel à traction bovine dit "à grand rendement": premieres reflexions sur son utilisation. (So-called high-performance cattle drawn equipment: Preliminary observations on its use)**
Centre National de Recherches Agronomiques, Bambey (Sénégal), 18p., 7 drawings; 6 ref. **Fr**
□*Describes a high-output wheeled toolcarrier with a three-row seeder developed in Senegal and designed for use with two oxen.*
Mic.No: 80202

1184 Monnier, J.; Plessard, F. 1973. **Matériel à "Grand Rendement" pour traction bovine. (High-performance cattle-drawn equipment)**
Machinisme Agricole Tropical (France), no. 42, p. 46–51, 7 drawings, 2 photographs **Fr**
□*Describes a high-output wheeled toolcarrier with a three-row seeder designed for use with two oxen and recommended for the relatively few farms in Senegal of over 15 ha which have destumped areas.*
Mic.No: 80859

1185 Mothander, B.; Kjaerby, F.; Havnevik, K. s.d. **Farm implements for small scale farmers in Tanzania. Proposals for support to manufacture and development. Volume 1. Introduction, summary and recommendations. A study made for the Swedish International Development Authority.**
Swedish International Development Authority, Stockholm, 37p., 46 ref. **En**
□*Includes a proposed strategy for Swedish support for the supply and development of farm implements, especially those required for animal traction, in Tanzania.*
Mic.No: 80439

1186 Mothander, B.; Kjaerby, F.; Havnevik, K. s.d. **Farm implements for small scale farmers in Tanzania. Proposals for support to manufacture and development. Volume 2. Descriptive chapters. A study made for the Swedish International Development Authority.**
Swedish International Development Authority, Stockholm, 224p, fig., tables **En**
□*Includes data on types of farm implements used in Tanzania including factory-made ox-drawn implements, results of village visits to assess usage of tools, ox mechanization, introduction, research, testing and extension of new farm implements, demand estimates, distribution of farm implements*

in Tanzania, local production and repair facilities, and industrial production.
Mic.No: 80439

1187 Muchiri, G. 1983. **Production and use of agricultural machinery in Kenya.**
Industry and Development, no. 9, p. 13–38, 9 tables; 5 ref. **En**
☐*Examines production and use of agricultural machinery in Kenya against the background of the country's basic problems. Concludes that past efforts to mechanize have been misdirected and real need for farm tools and agricultural power has not been met. Discusses reasons for this failure and makes recommendations for means of promoting production of appropriate equipment.*
Mic.No: 82004

1188 Muchiri, G.; Oluoch-Kosura, W.; Michieka, R.W.; Dibbits, H.J. 1986. **Ox-drawn equipment development in Kenya.**
ILO, Geneva (Switzerland); Kenya. Ministry of Agriculture and Livestock Development. In: Excess manufacturing capacity and farm equipment needs in Kenya, National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Nairobi (Kenya), 15–18 Oct 1985, p. 37–51, 3 tables, 8 photographs; 7 ref., ISBN 92-2-105484-5 **En** (En)
☐*Describes current research and development activities in Kenya in the field of animal traction equipment, local manufacture of equipment and training, extension and marketing.*
Mic.No: 80909

1189 Mungroop, R.R. 1989. **L'introduction du multiculteur asin dans la région CMDT de San. (Introduction of a donkey drawn multipurpose toolbar in the CMDT region of San)**
Mali. Ministère de l'Agriculture. Div. de Recherches sur les Systèmes de Production Rurale, 10p. **Fr**
☐*Evaluates the performance of a multipurpose toolbar when tested by farmers with donkeys in the San region of Mali for operations including harrowing, plowing, hoeing and earthing-up. Equipment proved effective and easy to use and it was concluded it should be tested more widely.*
Mic.No: 80521

1190 Musa, H.L. s.d. **Traditional tillage operations and development and use of animal-drawn equipment.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16–20 Jan 1979, p. 29–36, 2 fig., 1 table **En**
☐*Describes traditional tillage tools and practices used in subsistence agriculture, with particular reference to tillage, seedbed preparation and cropping practices, as well as traditional ridge-making methods and factors affecting them; discusses the development and usage of animal traction equipment, mentioning the testing of imported animal-drawn equipment and straddle row rotary weeders.*
Mic.No: 31995

1191 Nirmal, T.H.; Luthra, P.L. 1970. **Pusa wooden plough toolbar increases scope three-fold.**
Indian Farming, p. 47–49, 3 photographs, ISSN 0019-4786. **En**
☐*Presents the construction details and results of field performance tests carried out on the Pusa toolbar which was designed to improve the scope of the indigenous Indian wooden plow.*
Mic.No: P00517

1192 Nolle, J. 1975. **Le tracteur animal. (Animal-drawn toolcarriers)**
Machinisme Agricole Tropical (France), no. 51, p. 46–56, 21 photographs **Fr** (En Fr)
☐*Describes the author's research on the development of animal-drawn toolcarriers, particularly the Ariana and Tropiculteur and the K-Nol.*
Mic.No: 80197

1193 Nolle, J. 1985. **La culture avec traction animale: le point de vue d'un inventeur. (Cultivation with animal traction: An inventor's point of view)**
Journée d'Etude sur la Culture avec Traction Animale, Antony (France), 7 Mar 1985. Afrique Agriculture (France), no. 122, p. 21–22, 1 photograph, ISSN 0337-9515. **Fr**
☐*Summarizes a meeting paper on animal draft equipment invented by the author over 30 years stressing the importance of multipurpose implements.*
Mic.No: 80120

1194 Nolle, J. 1985. **Le "MAMATA": qu'est-ce que c'est? (What is the "MAMATA"?)**
Conseiller Technique en Machinisme Agricole, Paris (France). Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985, 10p. **Fr**
☐*Jean Nolle defines his MAMATA (Machinisme Agricole Moderne à Traction Animale) philosophy, describes equipment involved (particularly multipurpose wheeled toolcarriers) and constraints to its further development.*
Mic.No: 80219

1195 Nolle, J. 1985. **Le point de vue d'un inventeur: "La solution se trouve**

uniquement entre les mains et le bon vouloir des petits paysans". (An inventor's opinion. "The solution lies in the hands of the smallholder")
Afrique Agriculture (France), no. 122, p. 21, ISSN 0337-9515. **Fr**
☐*Presents an inventor's opinion regarding animal-drawn implements in tropical countries.*
Mic.No: 80506

1196 Nolle, J. 1986. **Machines modernes à traction animale. Itinéraire d'un inventeur au service des petits paysans. (Modern equipment for animal traction. Itinerary of an inventor at the service of villagers)**
Harmatton. Paris (France), 478p., fig., drawings, tables, photographs **Fr**
☐*Semi-autobiographical account of Jean Nolle's life designing animal traction implements, notably multipurpose toolbars and wheeled toolcarriers. In addition to providing numerous design illustrations Nolle expounds his MAMATA (Machinisme Agricole Moderne a Traction Animale) philosophy in which he attempts to develop his three principles of simplicity of design, multipurpose use and standardization of components.*
Mic.No: 80860

1197 Nolle, J. 1987. **Animal drawn equipment for the small farmers of Lesotho.**
Matelile Rural Development Project, Maseru (Lesotho). 22p., 9 drawings **En**
☐*Reports on traditional marketing of animal draft equipment, possibility of Lesotho becoming self-sufficient in farm equipment and problems with equipment which has been developed. Stresses the value of basing future development on a basic toolframe (Ariana, Tropicultor or Kanol).*
Mic.No: 80112

1198 Nolle, J. s.d. **The tropiculteur. Instruction manual.**
s.n., s.l., 34p., 49 fig. **En**
☐*Describes simple and multiple harnessing arrangements for the Tropiculteur ox-drawn wheeled toolcarrier, track width, toolbars and modifications to be made for its use for transport, plowing, soil preparation, planting, maintenance (hoeing, ridging) and groundnut lifting.*
Mic.No: 80198

1199 Nunez, D.; Guevara, O.L. de; Hermoza, R. 1986. **Estudio comparativo de arados mejorados con arados tradicionales. (Comparative study of improved and traditional ard plows)**
Proyecto Herrandina, Cusco (Peru). In: Trabajos de investigacion en herramientas e implementos agricolas, p. 25-43, 10 line drawings, 1 photograph, 6 tables **Es**
☐*Compares the performance of two traditional heavy wooden plows (Paruro and Paucartambo types) used in Peru with the Andino-type produced by HERRANDINA based on models imported from Honduras and Bolivia, a 'mountain' plow from Bolivia, the INTINTEC/CESA model and a reversible plow. Trials were carried out on fallow and cultivated ground.*
Mic.No: 80921

1200 Nyirongo, K.G. 1987. **Marketing and distribution of basic farm equipment in Zambia.**
ILO, Geneva (Switzerland). National Workshop on Farm Tools and Equipment Technology, Basic Needs and Employment, Lusaka (Zambia), 26-28 Nov 1985, p. 55-68, 8 tables; 12 ref. **En**
☐*Presents a brief history of the development of small-scale farming in Zambia, surveys supply of and demand for basic farm tools and equipment (hoes, plows, harrows, ridgers, cultivators, ox carts and planters) and discusses marketing and distribution of farm tools with a view to improvement.*
Mic.No: 80824

1201 Ogborn, J.E.A. s.d. **Straddle ridge cultivation and equipment for the heavy lands of the African savanna.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16-20 Jan 1979, p. 49-57, 4 tables; 3 ref. **En**
☐*Presents results of experiments carried out in Nigeria on the performance, costs and profitability of various animal-powered cultivation equipment, viz the ridger plow, the SAMCOT which is a modified version of the standard EMCOT ridger plow, and the STRAD multipurpose toolbar.*
Mic.No: 82103

1202 Ogungbile, A.O.; Kaul, R.N.; Phillip, D.O.A. 1989. **Research studies on animal traction in Northern Nigeria.**
Animal Traction Research Network Protocol Planning Meeting (ILCA), Addis Ababa (Ethiopia), 8-15 May 1989, 15p., 9 tables; 10 ref. **En** (En)
☐*Presents results of experiments at the Institute for Agricultural Research, Zaria, to evaluate selected animal-drawn equipment (toolbars, groundnut lifters, weeders, sugar-cane crushers) and to develop animal-drawn equipment including a high clearance straddle row weeder, a straddle-row attachment for the commercial Emcot ridger, a land-leveller, a donkey-drawn cart and a single-row cultivator.*
Mic.No: 80556

1203 Olmstead, A.L.; Johnston, B.F.; Sims, B.G. 1986. **Forward to the past: The diffusion of animal-powered tillage equipment on small farms in Mexico.**
Agricultural History (USA), v. 60(1), p. 62–72, 2 photographs; ref. **En**
☐*Includes information on the role of the INIA (Instituto Nacional de Investigaciones Agricolas) in designing and perfecting wheeled toolcarriers (Yunticultor and Multibarra) for local needs in Mexico.*
Mic.No: 80191

1204 Pathak, B.S. 1984. **Selection and application of draught animal equipment.**
FAO, Rome (Italy). In: Animal energy in agriculture in Africa and Asia, FAO Expert Consultation on Appropriate Use of Animal Energy in Agriculture in Africa and Asia, Rome (Italy), 15–19 Nov 1982. FAO Animal Production and Health Paper, no. 42, p. 67–81, 10 fig., 1 table; 6 ref., ISBN 92-5-001474-0 **En** (Fr)
☐*Describes available draft animal implements for various operations, viz tillage, seeding, chemical applications, irrigation, harvesting and transport; discusses yokes and harnesses for draft cattle, buffaloes, camels and mules; and examines factors that determine the selection and application of implements.*
Mic.No: 80590

1205 Pathak, B.S. 1987. **A survey of agricultural implements and crop production techniques.**
Agricultural Implements Research and Improvement Centre, Nazareth (Ethiopia), 50p., 8 tables, 1 map, 16 drawings **En**
☐*Presents results of a survey of agricultural implements and crop production techniques in six regions of Ethiopia from June 1985–June 1986. The* maresha *(ard plow) was the most common animal traction implement. Includes information on repair and maintenance of implements and available animal power (mainly oxen). Makes recommendations for short-, medium- and long-term design and development programmes including the need for secondary tillage implements which can be pulled by a single ox and improved methods of sowing, weeding and harnessing and donkey carts.*
Mic.No: 80562

1206 Reis, O.G.; Baron, V. 1985. **Machinisme agricole avec traction animale au Bresil. (Agricultural mechanization through animal traction in Brazil)**
Journée d'Etude sur la Culture avec Traction Animale, Paris (France), 7 Mar 1985. Machinisme Agricole Tropical (France), no. 91, p. 24–30, 5 tables, 6 photographs; 9 ref. **Fr**
☐*Discusses history of animal traction in Brazil, use of human, animal and mechanical energy in agriculture (1965 and 1970), numbers and types of draft animals and animal draft equipment in Brazil, promotion of mechanization through animal traction including use of toolcarriers, a draft horse improvement project and future of animal draft in Brazil.*
Mic.No: 80216

1207 Richardson, G.L.; Namane, T. s.d. **The box level, a new implement for seedbed preparation with oxen.**
Lesotho. Ministry of Agriculture. Farming Systems Research Project, 12p., 4 fig., 4 tables **En** (En)
☐*Reports results of trials in Botswana in which an ox-drawn box level tested for seedbed preparation for maize, sorghum, beans and winter peas proved superior to the peg-tooth harrow.*
Mic.No: 80109

1208 Rickards, C.E. s.d. **Ox drawn equipment.**
Zambia. Department of Agriculture, 18p., 15 fig. **En**
☐*Gives information on maintaining and adjusting ox-drawn single-furrow and ridging plows, spike-toothed harrows, single row planters and cultivators. Spare parts are illustrated and listed.*
Mic.No: 80421

1209 Rojanasaroj, C.; Fischer, R.C.; Chakkaphak, C. 1981. **Buffalo drawn implements.**
15p. **En**
☐*Discusses the status of animal draft technology in Thailand, outlining the use of buffaloes for various farming operations, and new developments in animal-powered farm equipment.*
Mic.No: 86978

1210 Roosenberg, R. 1988. **Designing a water buffalo plow for Senegal.**
Tillers Report (USA), v. 8(1), p. 8–9,14, 3 fig., 1 photograph **En**
☐*Describes and illustrates the Makhana water buffalo plow which has the performance characteristics of a Japanese rice plow apart from its turn-wrest (reversible) capability and the convenient width-of-cut control and which incorporates the stable and self-clearing hitch point of the traditional Thai paddy plow but is more robust and only marginally heavier.*
Mic.No: 80876

1211 Sanborn, J.W. 1891. **Draft of mowing machines.**
Utah Agricultural Experiment Station Bulletin (USA), no. 7, 19p., 11 tables **En** (En)

□*Reports on evaluation of different types of mowing machines under six different kinds and conditions of grass and clover.*
Mic.No: P00557

1212 Sarker, M.M.; Farouk, S.M. s.d. **Animal-drawn mouldboard ploughs: An improvement over the existing ones.**
Preston, T.R. (ed.); Davis, C.H. (ed.); Dolberg, F. (ed.); Haque, M. (ed.); Saadullah, M. (ed.). In: Maximum livestock production from minimum land. Proceedings of the third seminar, 3. Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 13–18 Feb 1982, p. 206–216, 8 fig., 3 tables **En** (En)
□*Describes results of field performence trials obtained on an improvement over the traditional plow in Bangladesh which was achieved by incorporating a relatively larger share with a slight twist in order to invert and break the soil better, maintaining a wider cut and a uniform depth.*
Mic.No: 82081

1213 Sarker, M.N.; Farouk, S.M. 1983. **On better utilisation of animal energy.**
Bangladesh Agricultural Univ., Mymensingh. In: Maximum livestock production from minimum land, 4. Seminar on Maximum Livestock Production from Minimum Land, Mymensingh (Bangladesh), 2–4 May 1983, p. 86–90, 2 fig.; 3 ref., ISBN 0–86443–120–1 **En** (En)
□*Discusses recent developments and proposed modifications of animal-drawn farm implement designs in Bangladesh, with particular reference to an improved mouldboard type plow developed at the Farm Power and Machinery Department of Bangladesh University and an improved neck-harness made of wood.*
Mic.No: 80863

1214 Sayer, W. 1934. **Tests on Dunlop pneumatic equipment for farm carts, season 1933–34.**
Agriculture and Livestock in India, v. 4, 26p., plates **En**
□*Reports on tests undertaken in India on four sets of wheels, tyres, wheels and axles for animal-drawn farm carts, regarding design of carts, draft capacity, life and upkeep of tyres and equipment, effect of tyre wear on roads and fields, adaptability to all agricultural conditions, road damage, and capital cost and earning capacity.*
Mic.No: P00535

1215 Seubert, C. 1984. **Adjusting the ox plough.**
Swaziland. Ministry of Agriculture and Cooperatives. Ministry of Agriculture and Cooperatives Field Support Guide (Swaziland), no. FSG 64, 8p., 5 fig. **En** (En)
□*Briefly describes and illustrates adjustments to the ox-drawn mouldboard plow to ensure efficient and improved working.*
Mic.No: 80420

1216 Sims, B.G.; Jimenez, R.R.; Aragon, R.A. 1983. **Mise au point et essais d'épandeurs d'engrais destinés aux petits agriculteurs mexicains des régions tropicales humides. (Trials on fertilizer distributors destined for Mexican small holders in humid tropical regions)**
Machinisme Agricole Tropical (France), no. 99, p. 22–40, 20 diagrams, 3 photographs, 6 tables; 10 ref. **Fr** (Fr En Es)
□*Discusses six machines for fertilizer application designed by UIMA-INIFAP, most of which can be attached to toolcarriers. Tabulates results of laboratory and field trials. Likely problems are that frequent adjustments to the equipment are necessary to take into account the soil and fertilizer conditions and relative humidity, and oxidation or corrosion of metal parts necessitating frequent cleaning.*
Mic.No: 80958

1217 Sims, B.G.; Moreno Rico, D.; Albarran Simon, J. 1984. **Conceptos y practicos de cero labranza en maiz para el pequeno agricultor. (Theory and practice of zero-tillage for maize production by the small farmer)**
Centro des Investigaciones Agricolas del Golfo Centro, Cotaxtla (Mexico). SARH Folleto Tecnico (Mexico), no. 1, 39p., 4 drawings, 13 photographs, 6 tables, 1 graph; 24 ref. **Es** (Es)
□*Describes the use of the Mexican wheeled toolcarrier, the Yunticultor for maize grown in a zero tillage system.*
Mic.No: 80189

1218 Sims, B.G. 1984. **El programa de ingenieria y mecanizacion agricola del tropico humedo de Mexico. (The agricultural engineering and mechanization programme for the humid tropical zone of Mexico)**
Campo Agricola Experimental Cotaxtla, Veracruz (Mexico). SARH Folleto Informativo (Mexico), 22p., 13 fig., 2 photographs **Es**
□*Describes and illustrates the Multibarra and Yunticultor wheeled toolcarriers developed in Mexico and promotion of their use in humid regions.*
Mic.No: 80203

1219 Sims, B.G.; Moreno Rico, D.; Albarran Simon, J. 1985. **El yunticultor: equipo y uso. (The "Yunticultor", equipment and use)**
Campo Agricola Experimental Cotaxtla, Veracruz (Mexico). SARH Folleto Miscelaneo (Mexico), no. 1, 23p., 6 fig., 1 table, 3 photographs; 9 ref. **Es**
☐*Describes the Yunticultor animal-drawn wheeled toolcarrier developed in Mexico and presents comparative results of time taken for various farming operations using the Yunticultor or traditional equipment.*
Mic.No: 80209

1220 Sims, B.G.; Rico, D.M.; Simon, J.A. 1987. **Control del maleza con cultivadoras de traccion animal para el peqeno productor. (Weed control with animal-drawn cultivators for small producers)**
Agricultura Tecnica en Mexico, v. 13(1), p. 41–60, 6 diagrams, 2 tables; 13 ref. **Es** (Es)
☐*Presents results of trials at Cotaxtla, Veracruz, in which four animal-drawn cultivators (the Multibarra with three straight or three curved tines and the prototype and Victoria model) were compared in terms of weed control, manoeuvrability and stability in crops of maize and beans.*
Mic.No: 80537

1221 Sims, B.G.; Johnston, B.F.; Olmstead, A.L.; Maldonado, S.J. 1988. **Animal-drawn implements for small farms in Mexico.**
Food Research Institute Studies, v. 21(1), p. 69–95, 9 tables, 5 diagrams; 24 ref. **En**
☐*Reviews the INIA programme of research into agricultural engineering technologies designed to meet the needs of small farmers and located at Cotaxtla, Veracruz State, and analyzes related activities to encourage local manufacture of promising implements. Gives details of two animal-drawn implements which are now manufactured commercially, the Yunticultor multipurpose wheeled toolcarrier and the simpler Multibarra toolcarrier.*
Mic.No: 80955

1222 Singh, B.; Varshney, B.P. 1982. **Role of improved bullock drawn implements in crop production.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 15p., 7 tables **En**
☐*Describes improved bullock-drawn implements suitable for paddy-wheat rotation, with particular reference to implements for seedbed preparation, sowing and harvesting; includes data on the economics as well as test and demonstration results of using the improved implements.*
Mic.No: 80684

1223 Smith, D.J. 1979. **Discovering horse-drawn farm machinery.**
Shire Publications Ltd. Princes Risborough (UK). Discovering Series (UK), no. 245, 96p., 31 photographs, 51 drawings; 14 ref., ISBN 0-85263-664-4 **En**
☐*Describes and illustrates the vast range of horse-drawn farm equipment (including plows, grubbers, cultivators, harrows, rollers, drills, reapers, binders, root lifters, manure spreaders and rakes) manufactured in the UK from the Victorian era until the horse was replaced by the tractor in the 1930s. Includes chapters on horses and harnessing, inventors and manufacturers and places where these machines can be seen.*
Mic.No: 80884

1224 Srivastava, N.S.L.; Menon, R.G. 1970. **The I.I.S.R. bullock-powered sprayer.**
Indian Farming, v. 11(11), p. 23–24, 1 fig., ISSN 0019-4786. **En**
☐*Presents construction details, operational requirements and results of field performance tests carried out on a bullock-powered insecticide sprayer developed at the Indian Institute of Sugarcane Research for use on large holdings.*
Mic.No: P00513

1225 Starkey, P.H.; Verhaeghe, H. 1981. **A modified triangular spike tooth harrow and swamp leveller.**
Appropriate Technology (UK), v. 8(2), p. 8–9, 2 fig., 3 photographs; 2 ref., ISSN 0305-0920. **En**
☐*Presents the specifications and construction details of a triangular spike tooth harrow designed to be inverted for swamp-levelling purposes. Includes results of performance tests carried out under Sierra Leone conditions.*
Mic.No: 80765

1226 Starkey, P.H. 1984. **Evaluating equipment for draught animal programmes.**
Livestock International (UK), v. 12(1,2), p. 36–42, 8 plates; 3 ref., ISSN 0306-8560 and ISSN 0306-8560. **En**
☐*Discusses the need for testing equipment for animal traction use based on experiences from Sierra Leone, outlining methodology for equipment evaluation and specifications for the plow, harrow, seeders, weeders and carts. Also discusses the need for efficient information exchange and a reliable supply of appropriate equipment.*
Mic.No: 80606

1227 Starkey, P.H. 1987. **Constraints to the supply and manufacture of animal traction equipment: An overview of the situation in Africa.**

Deutsche Landwirtschafts-gesellschaft e. V., Frankfurt (Germany, F.R.). 7. DLG Symposium on Mechanization, Frankfurt (Germany, F.R.), 19–23 Nov 1987, 10p., 5 ref. **En**
□*Reviews existing facilities for supply and manufacture of animal draft equipment in Africa and donor influences, problems of local workshops, economic distortions, production runs, workshop location, bureaucracy, donor-financed imports and their effects on local manufacturing, policy implications, need for appropriate designs and standardization. Concludes that the most important area for cooperation is between equipment suppliers and users to ensure the appropriateness of equipment designs.*
Mic.No: 80374

1228 Starkey, P.H. 1987. **Farm power and equipment research at ICRISAT. A review and discussion of future directions.**
ICRISAT, Patancheru, AP (India), 58p., 94 ref. **En**
□*Reports on a consultancy visit to ICRISAT carried out to review past research of the Farm Power and Equipment Sub-group of the Resource Management Programme, especially on the Tropicultor and different types of wheeled toolcarriers in Africa and India and recommends new research thrusts that would make good use of ICRISAT's comparative advantage as an international research centre.*
Mic.No: 80028

1229 Starkey, P.H. 1987. **Animal-drawn wheeled tool carriers: A case for caution.**
Appropriate Technology (UK), v. 14(1), p. 10–12, 3 plates, 1 table; 7 ref., ISSN 0305–0920. **En**
□*Reviews the discrepancy between research findings concerning wheeled toolcarriers and their acceptance by farmers, using experiences from Africa, Asia and Latin America; outlines reasons for the toolcarrier's rejection by farmers.*
Mic.No: 80186

1230 Starkey, P.H. 1988. **Animal-drawn wheeled toolcarriers: Perfected yet rejected.**
Vieweg & Sohn. Braunschweig, Weisbaden (Germany, F.R.), 61p., 20 fig., 80 photographs, 5 tables; 200 ref., ISBN 3–528–02034–2 **En**
□*Describes the development of wheeled toolcarriers and experiences in Africa, India and Latin America. Discusses reasons for the rejection of wheeled toolcarriers by farmers as early as the 1960s and the anomaly that, as they had proved competent and often highly effective under optimum laboratory conditions, as late as 1986 most researchers, agriculturalists and decision makers in national aid programmes, aid agencies and international centres were under the impression that they were a highly successful technology. Stresses the need for more realism in reporting, appropriate programmes and more farmer involvement.*
Mic.No: 80889

1231 Starkey, P.H.; Sims, B.G. 1989. **Animal drawn implements: An overview of recent research and development.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 248–257, ref., ISBN 1–86320–003–7 **En** (En)
□*Briefly reviews recent work on ard plows, ridge-tiers, animal-drawn seeders, weeders and multipurpose toolbars and discusses lessons to be learnt from experiences with animal-drawn wheeled toolcarriers. Stresses the importance of identifying the causes of low uptake of apparently 'improved' implements by farmers and achieving a better understanding of complex interactions within farming systems. Suggests that research/development programmes could usefully work with farmers and blacksmiths to combine researcher knowledge of technological options and global experiences with farming systems analysis and the skills and understanding of local artisans.*
Mic.No: 80539

1232 Stokes, A.R. 1963. **Mechanisation and the peasant farmer.**
World Crops (UK), p. 444–450, 1 fig., 4 tables, 8 photographs; 3 ref., ISSN 0043–8391. **En** (En)
□*Reports on the impact of tractors on upland farming in northern Nigeria and concludes that improved ox-drawn machinery, which can be used to take advantage of the greater yield potential of tied-ridge farming, offers the greatest hope for increasing the productivity of the small-scale farmer.*
Mic.No: 80224

1233 Teclemariam Berhane. 1979. **Study on the use of ox-drawn equipments for the production of cowpea, maize, cotton and groundnut under irrigation in the Middle Awash Valley – Melka Werer.**
Institute of Agricultural Research, Addis Ababa (Ethiopia). IAR Agricultural Engineering Bulletin (Ethiopia), no. 1, 13p., 7 figures, 5 tables **En**
□*Presents results of utilizing ox-drawn plows, harrows, a Stokes Unibar with cultivators and planters for the production of cotton, maize, groundnuts and cowpeas in irrigated farms at Melka Werer, Middle Awash Valley, Ethiopia, with the aim of determining time taken for farm operations, assessing the quality of operations and comparing manual and machine operations.*
Mic.No: 31075

1234 Thiec, G. le; Bordet, D. 1988. **Etude de deux outils de traction animale visant à réduire les contraintes de travail du sol en zones sèches. (Study on two animal drawn implements designed to reduce constraints to soil tillage in dry areas)**
Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony (France), 25p., 3 tables, 2 graphs, 4 drawings; 7 ref. **Fr** (En Fr)
☐*Describes two new animal-drawn implements, the CEEMAT tine (designed for deep cultivation in dry, compacted soil while requiring minimum tractive forces to encourage infiltration of early rains) and the CEEMAT rolling cultivator or Roliculteur (for surface cultivation of an area three times wider than that of a plow on damp soil to conserve soil water by creating a mulch effect and limiting vegetation growth). Gives results of comparative performance trials.*
Mic.No: 80128

1235 Thiec, G. le; Bordet, D. 1990. **Etude de deux outils attelés: réduction des contraintes de travail du sol en zones sèches. (Study on two animal-drawn implements: reduction of constraints in soil cultivation in dry zones)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 210–217, 2 photographs, 2 fig., 3 tables; 7 ref., ISBN 92-9081-046-7 **Fr** (En Fr)
☐*Describes two new animal-drawn implements, the CEEMAT tine designed for deep cultivation in dry, compacted soil while requiring minimum tractive forces to encourage infiltration of the first rains, and the CEEMAT rolling cultivator (Roliculteur) designed for surface cultivation on damp soil over an area three times wider than that worked by a plow, to conserve soil moisture by creating a mulch effect and limiting vegetation growth. Trials in the laboratory and in the field in Botswana and Burkina Faso indicated the superiority of the rolling implement over tined implements.*
Mic.No: 82050

1236 Thiec, G. le; Bordet, D. s.d. **The performance of improved tillage implements for animal draught.**
s.n., s.l. International Conference on Agricultural Engineering, Paris (France), 2–5 Mar 1988, 18p., 4 photographs; 9 ref. **En**
☐*Describes the first prototype of the tine tiller developed by the Centre d'Experimentation du Machinisme Agricole Tropical (CEEMAT) for deep cultivation in dry, compacted soil, and outlines trials carried out on it in Botswana and Burkina Faso, as well as new prototypes of the implement. Also describes the rolling cultivator (Roliculteur) and tests carried out on it.*
Mic.No: 80025

1237 Thierstein, G.E. 1982. **Implements for dryland agriculture.**
ICRISAT, Patancheru, AP (India). Seminar on Increasing Agricultural Productivity through Efficient Use of Inputs, Transfer of Technology and Better Infrastructure, Bombay (India), 3–4 Nov 1982, 25p., 8 tables; 31 ref. **En** (En)
☐*Reviews ICRISAT research including the development of wheeled toolcarriers (presents economic results of on-farm verification trials with toolcarriers), use of crust breakers on red soils, a double cropping system on Vertisols, a new farming systems technology for Vertisols depending on broadbeds and furrows and wheeled toolcarriers and a new planter-cum-fertilizer drill for attachment to wheeled toolcarriers.*
Mic.No: 80354

1238 Uzureau, C. 1982. **La fabrication de matériel agricole à traction animale. (The production of animal-drawn farm implements)**
Machinisme Agricole Tropical (France), no. 80, p. 40–48, 6 illus.; 3 ref. **Fr** (En Es Fr)
☐*Describes the production of agricultural implements for animal traction in West Africa, identifying constraints to the development of animal traction; and reviews the existing situation in Mali, Burkina Faso, Senegal, Niger, Benin, Togo and Morocco; includes recommendations.*
Mic.No: 29668

1239 Vaitilingom, G. 1987. **Les procédures d'essai de matériels agricoles au Soudan – Propositions. (Procedures for the evaluation of agricultural implements in the Sudan – proposals)**
Machinisme Agricole Tropical (France), no. 97, p. 29–31 **Fr**
☐*Describes necessary steps in farm implement evaluation, particularly under conditions in the Sudan.*
Mic.No: 80758

1240 Varma, S.R. 1970. **Bullock-drawn reaper for wheat harvesting.**
Indian Farming, v. 11(11), p. 25–27,49, 4 fig., ISSN 0019-4786. **En**
☐*Presents the construction details and results of field performance trials of a bullock-drawn wheat reaper developed at the College of Agricultural Engineering, Punjab Agricultural University in India.*
Mic.No: P00544

1241 Varshney, A.C.; Patel, K.V. 1986. **Design, development and field operation of bullock-drawn castor planter.**

Indian Journal of Agricultural Sciences, v. 56(11), p. 788–791, 1 fig., 1 table, ISSN 0019–5022. **En** (En)
☐*Presents the construction details, functional requirements and results of field performance tests on a bullock-drawn castor planter developed in India to automatically place the seed at desired spacing and to drill the fertilizer near the seed for efficient use.*
Mic.No: P00515

1242 Viebig, U. 1982. **Harnessing and use of implements. (Technique des attelages et matériels à traction animale)**
Munzinger, P. (ed.). In: Animal traction in Africa, p. 135–221, 38 fig., 6 tables, ISBN 3–88085–133–6 **En, Fr**
☐*Discusses various types of harnesses and implements for animal traction in Africa, with particular reference to the traction capacity of various teams of animals; harnesses for cattle, donkeys and horses; selection of implements; working methods and appropriate implements to be used with draft animals under tropical and subtropical conditions; data necessary for estimating working time requirements; and some aspects of the maintenance and supply of animal-drawn implements.*
Mic.No: 80614

1243 Wahg, L.N. 1982. **Role of improved agricultural implements and use of draught animal power system.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 7p. **En**
☐*Discusses the role of improved agricultural implements and the use of draft animal power system in Indian agriculture, mentioning the advantages of improved and newly designed implements, and the need for proper extension work and ensuring the marketability of improved products; reviews work undertaken by MADIC in popularising improved agricultural implements.*
Mic.No: 80683

1244 Westley, S.B. (ed.); Johnston, B.F. (ed.) 1975. **Proceedings of a workshop on farm equipment innovations for agricultural development and rural industrialisation.**
Nairobi Univ. (Kenya). Inst. for Development Studies. Workshop on Farm Equipment Innovations for Agricultural Development and Rural Industrialisation. Kabete (Kenya), 19–21 Aug 1975. IDS Occasional Paper (Kenya), no. 16, 230p., fig., tables; ref. **En**
☐*Presents papers from a workshop that discussed ways of developing practical projects for promoting the use of appropriate technology, increasing agricultural development through the introduction of low-cost farm equipment well suited to Kenya's small-scale farmers, and promoting rural industrialisation through local manufacture of appropriate items of farm equipment.*
Mic.No: 04728

1245 Wilde, J.C. de. 1967. **Implements and machinery.**
In: Experiences with agricultural development in tropical Africa. Vol. 1 – The synthesis, Johns Hopkins Press, Maryland (USA), p. 95–131 **En**
☐*Discusses the introduction of appropriate animal- or tractor-drawn implements in African agriculture, identifying technical and other constraints related to labour, economics and provision of services; outlines some of the advantages and disadvantages of animal traction.*
Mic.No: 01264

1246 Willcocks, T.J. 1969. **Animal drawn toolbar.**
National Inst. of Agricultural Engineering, Silsoe, Bedford (UK). Overseas Dept. OLU Technical Bulletin (UK), no. 2, 16p., 45 fig. **En**
☐*Describes the historical development of the animal-drawn toolbar (ADT), ways of attaching stalks and ridgers, and requirements for primary tillage, seedbed preparation, weeding, spraying and crop harvesting. Also describes other ancillary tools and the assembly of the ADT.*
Mic.No: 80210

FIELD OPERATIONS

1247 Abiye Astatke; Matthews, M.D.P. 1982. **1981 Progress report of the cultivation trials and related cultivation work at Debre Zeit and Debre Berhan.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 29p., 4 fig., 5 tables **En** (En)
☐*Summarizes results of cultivation trials conducted on clay and clay loam soils at the ILCA Research Stations at Debre Zeit and Debre Berhan, both in Ethiopia, to test three cultivation systems with primary passes of the traditional plow (the* maresha*), the mouldboard plow, and the spring tine, and to evaluate the three systems in relation to the three major crops cultivated in each area, cultivation and weeding time, power requirements for cultivation and final crop yields.*
Mic.No: 30611

1248 Abiye Astatke; Matthews, M.D.P. 1983. **1982 Progress report of the cultivation trials and related cultivation work at Debre Zeit and Debre Berhan.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 39p., 1 fig., 32 tables **En** (En)

□*Summarizes results of ILCA's trials on clay and clay loamy soils at Debre Zeit and clay loamy soil at Debre Berhan, both in Ethiopia, to evaluate performances of modern animal-drawn cultivation implements, i.e. the 23 cm mould board plow and spring tines, with the traditional "maresha" in terms of cultivation and weeding time needed, draft power requirements and final crop yields of three principal crops. Also includes trial results on post-harvest cultivation as well as quality and quantity of herbage from seasonally waterlogged pastures when ripped with tines.*
Mic.No: 32528

1249 Abiye Astatke; Matthews, M.D.F. 1984. **Cultivation research in the highlands programme of the International Livestock Centre for Africa.**
ILCA, Addis Ababa (Ethiopia), 16p., 3 fig., 6 tables; 3 ref. **En**
□*Reviews research carried out by ILCA in the highlands of Ethiopia on the use of modern animal-drawn implements for crop production, mentioning the advantages of using modern implements, crop performance and the effects of seasonal climatic variability and moisture status of the soil on the use of modern implements to increase crop yield.*
Mic.No: 34915

1250 Abiye Astatke; Bunning, S.; Anderson, F.M. 1986. **Building ponds with animal power in the Ethiopian highlands. A manual.**
ILCA, Addis Ababa (Ethiopia). Highlands Programme, 38p., 13 fig., 4 tables; 11 ref., ISBN 92-9053-070-7 **En**
□*Examines work on pond construction with animal power in the Ethiopian highlands, describing preliminary surveys which included aerial photography, field visits and a hydrological study; also describes detailed surveys of soil and water loss. Discusses the design of the ponds and issues in the implementation of construction work, with particular reference to the use of implements, training of farmers and oxen, working period and feed requirements. Includes notes on the management of completed ponds.*
Mic.No: 36991

1251 Anon. 1986. **Ploughing with draught animals. Course for extension supervisors and extension workers.**
Zimbabwe. Ministry of Lands, Agriculture and Rural Settlement. Dept. of Agricultural, Technical and Extension Services; Institute of Agricultural Engineering, Harare (Zimbabwe). Agricultural Engineering Training Centre, 154p. **En**
□*Presents guidelines for extension workers and supervisors who will assist farmers to achieve better soil and water conservation and to increase crop yields by following recommended steps in the preparation, planning and plowing of fields with draft animals.*
Mic.No: 80034

1252 Anon. 1987. **Crop establishment using draft animals. Course for extension staff.**
Institute of Agricultural Engineering, Harare (Zimbabwe). Agricultural Engineering Training Centre, 152p. **En**
□*Presents guidelines for extension workers who will advise and demonstrate to farmers the correct sequence of crop establishment operations using animal traction, as well as methods and implements which will complete the sequence quickly and accurately with minimum amount of cultivation.*
Mic.No: 80036

1253 Anon. 1988. **Fiche technique provisoire: le grattage, le labour, le semis, le sarclage, le buttage. (Provisional technical document: Harrowing, tillage, seeding, weeding, ridging)**
Mali. Ministère de l'Agriculture, Volet Fonsebougou. Div. de Recherches sur les Systèmes de Production Rurale, v.p. **Fr**
□*Brief technical notes on the need for and animal draft equipment required for harrowing, plowing, seeding, weeding and earthing-up.*
Mic.No: 80247

1254 Anon. s.d. **Le labour. La charrue à soc à traction animale. Description et reglage. (The ox-drawn mouldboard plow. Description and levelling control)**
Centre d'Etudes et d'Experimentation du Machinisme Agricole Tropical, Antony (France), 14p., 15 fig. **Fr**
□*Reviews the objectives and characteristics of tillage in general and describes the major features and techniques for levelling control of an ox-drawn mouldboard plow known as the "Liancourtoise".*
Mic.No: 02442

1255 Aremu, J.A. s.d. **Effect of different cultivation techniques on infiltration in Samaru.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16–20 Jan 1979, p. 61–63, 4 tables; 3 ref. **En**
□*Presents results of experiments carried out in Samaru, Nigeria, to assess relative infiltration rates and bulk density of maize plots as indicators of changes in soil physical properties. Treatments included zero tillage, manual (hoe tillage), bullock-powered tillage and tractor-powered tillage.*
Mic.No: 82104

1256 Ashburner, J.E.; Mamane, Y. 1990. **The development of animal traction equipment adapted to the rainfed areas in the Republic of Niger.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 413–421, 4 fig., 5 tables, ISBN 92–9081–046–7
☐*Provides background to animal traction use in the rainfed areas of Niger. Presents data from on-farm tillage trials using different types of animal-drawn implements, including plows, scarifying spring tines, rigid tines and ridgers. Trial treatments included system of tillage, fertilizer levels and presence of crop residues from previous year. Concludes that mouldboard plows may increase yield, but work is slow, and there is a danger of erosion on sandy soils; scarifying is quicker than plowing and an improved implement should be developed; use of twin tines in strip tillage is difficult, and the technology needs further development; ridging is slower than tine tillage, but is beneficial in sandy soils.*
Mic.No: 82236

1257 Blondin, M. 1968. **Expérimentation culture attelée. (Animal traction trials)**
Union Nigérienne de Crédit et de Coopération, Niamey, v.p., tables **Fr**
☐*Presents a comparative study on soil preparation, management and tillage in Niger, with notes on traction power and utilization of implements for different farm operations.*
Mic.No: 75427

1258 Blondin, M. 1969. **Etude sur la mise en valeur des terres. (Study on land reclamation)**
Union Nigérienne de Crédit et de Coopération, Niamey, 78p. **Fr**
☐*Lists implements required by farmers for land reclamation work, with notes on the technical and financial aspects.*
Mic.No: 75442

1259 Brigden, R. 1984. **Ploughs and ploughing.**
Shire Publications Ltd. Princes Risborough (UK). Shire Album (UK), no. 125. 32p., 36 photographs, 10 drawings; 14 ref., ISBN 0–85263–695–4 **En**
☐*Describes and illustrates plows and plowing methods used in the UK from the earliest times to the present day.*
Mic.No: 80879

1260 Bunning, S. 1984. **Pond construction using draught oxen in the Ethiopian highlands. Progress report 1983–1984.**
ILCA, Addis Ababa (Ethiopia), 26p., 3 fig.; 5 tables **En**
☐*Describes the achievements and problems encountered during the excavation of the ILCA pond at Debre Berhan, Ethiopia, and discusses the progress of a pilot programme initiated in the dry season of 1983–84 to excavate ponds using ox-drawn scoops, outlining activities related to pond design and site selection, limitations to productivity experienced in the pilot scheme and acceptability of the technology in Ethiopia. Includes recommendations.*
Mic.No: 34271

1261 Dihenga, H. s.d. **Tanzania's experience in appropriate technology for tillage operations.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16–20 Jan 1979, p. 117–125, 6 tables, 6 photographs, 1 map; 8 ref. **En**
☐*Reviews past and current research into appropriate tillage techniques in Tanzania including studies at Mbeya where an ox-drawn multipurpose toolcarrier was used in minimum tillage operations.*
Mic.No: 80212

1262 Dugue, P. 1985. **Préparation du sol en zone Sahélo-Soudanienne (Yatenga: Burkina Faso). Atouts et contraintes. (Soil preparation in the Sudano-Sahelian zone (Yatenga, Burkina Faso). Successes and constraints).**
Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Ouagadougou (Burkina Faso). FSU/SAFGRAD Workshop: Technologies Appropriées pour les Paysans des Zones Semi-arides d'Afrique Occidentale, Ouagadougou (Burkina Faso), 2–5 Apr 1985, 29p., 12 fig., 13 tables, 1 map; 10 ref. **Fr**
☐*Presents results of field trials over three years in which draft animals were used for soil preparation and discusses constraints to the success of animal traction.*
Mic.No: 80238

1263 Duret, T.; Baron, V.; Barbosa dos Anjos, J. 1986. **"Systèmes de culture" expérimentés dans le nord-est du Brésil. (Farming systems tested in north east Brazil)**
Machinisme Agricole Tropical (France), no. 94, p. 62–74, 4 fig., 8 tables, 8 photographs; 11 ref. **Fr** (En Es Fr)
☐*Presents results of trials in North East Brazil to compare effects of six farming systems using equipment ranging from traditional implements to animal-drawn wheeled toolcarriers on optimization*

of implements used, operation times, soil water-holding capacity and crop yields.
Mic.No: 80211

1264 Fleur, D.-G. 1987. **Measurements of tillage effects of ox-drawn implements, and physical conditions in the seedbed: Comparison with tractor-mounted implements. A study from the Arsi region of Ethiopia.**
Swedish Univ. of Agricultural Sciences, Uppsala. International Rural Development Centre. IRDC Working Paper (Sweden), no. 41, 55p., 11 fig., 43 tables; 10 ref., ISSN 0280-4301. **En** (En)
☐*Reports results of a field study undertaken to study the tillage effects of animal-drawn tools, with particular emphasis on seedbed conditions both before and immediately after planting; compares results with those obtained for tractor implements; and provides suggestions for modifications of existing implements and proposals for further investigations.*
Mic.No: 78793

1265 Gibbon, D.; Harvey, J.; Hubbard, K. 1974. **A minimum tillage system for Botswana.**
World Crops (UK), v. 26(5), p. 229-234, 17 photographs; 11 ref., ISSN 0043-8391. **En** (En)
☐*Reports on a study to evaluate factors limiting arable crop production in a semi-arid environment and investigate means of improving the reliability of food crop production by small farmers in Botswana relying on animal power. Includes work carried out on use of the Versatool animal-drawn toolcarrier.*
Mic.No: 80188

1266 Havard, M. 1986. **Les principaux types de travaux du sol effectués par la traction animale au Sénégal. Observations et mesures utiles pour leur caractérisation dans les essais agronomiques. (Types of animal-powered tillage work in Senegal)**
Machinisme Agricole Tropical (France), no. 93, p. 6-14, 1 fig., 4 photographs, 3 tables; 10 ref. **En** (En Es Fr)
☐*Describes the major animal-powered tillage operations undertaken in Senegalese rainfed agriculture in relation to the physico-chemical properties of the soil, implements used, available traction power and existing cultural practices.*
Mic.No: 80977

1267 Herblot, G. 1982. **Une expérimentation "travail du sol en sec" en Haute-Volta. (Experiment on dry tillage in Upper Volta)**
Machinisme Agricole Tropical (France), no. 85, p. 3-41, 12 fig., 44 photographs, 2 graphs, 13 tables **Fr** (En Es Fr)
☐*Presents results of trials on tillage practices using animal and tractor-drawn equipment for sorghum, groundnuts and maize under dry conditions at the Gampela Experimental Farm, Burkina Faso aimed at developing methods for control of erosion and runoff.*
Mic.No: 80239

1268 Inns, F. 1985. **Intercultivation.**
In: Tools for agriculture. A buyer's guide to appropriate equipment, Intermediate Technology Publications. London (UK), p. 31-36, 5 fig., 2 tables, 1 photo, drawings; 8 ref., ISBN 0-946688-36-2 **En**
☐*Discusses reasons for performing intercultivation and describes equipment used including animal-drawn equipment, yokes and harnesses. Illustrates and describes animal-drawn hoes, cultivators and weeders and gives details of manufacturers.*
Mic.No: 80892

1269 Islam, S.O.; Mwaita, S.K.; Polhill, R.T. s.d. **Livestock and the improved management of dark clay soils (Vertisols) in semi-arid areas.**
Magarini Settlement Project, Malindi (Kenya), 9p., 2 tables; 5 ref. **En**
☐*Presents results of trials in which the Victory plow (Indian), the Machakos Integrated Development Project unit (a T-shaped toolbar) and the FAO Siakago unit were compared for plowing (54 farms) and weeding (24 farms) using oxen.*
Mic.No: 80268

1270 Kaul, R.N. s.d. **Some considerations for tillage research.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16-20 Jan 1979, p. 23-27, 2 tables **En**
☐*Discusses the scope and objectives of tillage in general, hoe-farming and animal power, the current status of animal traction in Nigeria, problems with lack of equipment and inadequate user training and the need to improve nutritional and draft characteristics of draft oxen. Reports on encouraging experiences using donkeys for tillage and weeding. Stresses the need for concurrent international testing of toolbars.*
Mic.No: 80226

1271 Keegan, T. 1984. **Horse ploughing.**
PMS Publications. Warminghurst (UK), 32p., 20 photographs, 18 drawings **En**
☐*Written in response to the renewed interest in plowing with heavy horses in the UK, contains a brief history of the plow and sections on breeds of plow horses, the art of plowing, plowing matches,*

horse-plowing societies, types of horse plows, harnessing and decorating the plow horse. Lists events and locations where horse plowing can be seen in the UK.
Mic.No: 80882

1272 Klaij, M.C.; Serafini, P.G. 1990. **The potential impact of the use of animal traction on millet-based cropping systems in the Sahel.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 422–429, 1 fig., 3 tables, ISBN 92-9081-046-7
☐*Presents results of long-term field experiments carried out at the ICRISAT Sahelian Centre in Niger on the effects of tillage, fertilization, crop management and crop residues on the production of pearl millet (Pennisetum glaucum). Concludes that animal-powered inter-cultivation is effective if accompanied by hand-weeding within rows and animal traction reduces the problems caused by the labour bottleneck at weeding time. The timing of tillage with draft animals had no effect on yields, suggesting that end-of-season cultivation may be a viable option. Comparative data is presented on labour requirements and crop yields using hand cultivation and animal traction.*
Mic.No: 82237

1273 Lal, H. 1986. **Development of appropriate mechanization for the "W"-form soil management system.**
Soil and Tillage Research (Netherlands), v. 8, p. 145–159, 1 fig., 4 tables, 8 photographs; 7 ref. **En** (En)
☐*Describes the "W"-form soil management system designed to improve rainwater harvesting and to control run-off and erosion. Details operational requirements for implementing and reshaping the system using animal traction (traditional implements or wheeled toolcarriers) or tractors.*
Mic.No: 80213

1274 Lekezime, P. 1988. **Mechanical weeding with animal traction: Some prerequisites.**
Starkey, P.H. (ed.); Ndiame, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Wiesbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 350–352, ISBN 3-528-02047-4 **En** (En)
☐*Problems with existing crop management systems which render mechanical weeding inefficient are described and a system is suggested that allows effective use of weeders.*
Mic.No: 82030

1275 Loewen-Rudgers, L.; Rempel, E.; Harder, J.; Harder, K.K. 1990. **Constraints to the adoption of animal traction weeding technology in the Mbeya region of Tanzania.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 460–471, 36 ref., ISBN 92-9081-046-7 **En** (En)
☐*Discusses the role of the Mbeya Oxenization Project in promoting use of animal traction for weeding in maize by farmers already plowing using cattle. Constraints include lack of locally available cultivators, poor quality of those available, lack of village level repair services and craftsmen, emphasis on inter-row as opposed to over-the-row cultivators, poor extension and liaison with farmers to seek their views, lower yields and poor functioning of cultivators due to late weeding, difficulties in training animals to follow crop rows and fears that cattle or cultivators would damage crops. Discusses means of reducing these constraints including training of "contact farmers" to continue the extension effort.*
Mic.No: 82042

1276 Lumphezi, E.Y.K. 1977. **The effect of alternative methods of land preparations by oxen on physical properties of soil and maize yield.**
Bunda College of Agriculture, Lilongwe (Malawi), 12p., 7 tables, 2 fig.; 8 ref. B.Sc. (Agriculture). **En** (En)
☐*Presents results of a study on the effects of hand cultivation, ox plowing/ridging and ox plowing/harrowing/ridging on the soil's physical properties and on maize yield at the Bunda College Research Farm in Malawi.*
Mic.No: 55049

1277 Matthews, M.D.P. 1985. **Seed-bed preparation.**
In: Tools for agriculture. A buyer's guide to appropriate equipment, Intermediate Technology Publications. London (UK), p. 5–11, 4 fig., 3 photographs, drawings, ISBN 0-946688-36-2 **En**
☐*Describes reasons for and means of performing seedbed preparation with a section on animal-powered cultivation. Illustrates and describes animal-drawn plows, harrows, ridgers, bund-formers, levellers and rollers and gives details of manufacturers.*
Mic.No: 80891

1278 Monnier, J. 1965. **Contribution à l'étude de la traction bovine au Sénégal. 1re partie. (Study of cattle traction in Senegal. Part 1)**

Machinisme Agricole Tropical (France), no. 10, p. 3–21, photographs, tables **Fr**
☐*Describes animal traction research carried out by the Centre de Recherches Agronomiques, Bambey (Senegal) and presents results of harrowing and soil preparation trials on various soil types.*
Mic.No: 80278

1279 Munzinger, P. 1985. **Sowing, planting and fertilizer distribution.**
In: Tools for agriculture. A buyer's guide to appropriate equipment, Intermediate Technology Publications. London (UK), p. 57–60, 8 fig., 1 photograph, drawings, ISBN 0-946688-36-2 **En**
☐*Discusses the importance of controlled sowing, planting and fertilizer distribution and describes and illustrates available equipment, including animal-drawn seeders, and gives details of manufacturers.*
Mic.No: 80893

1280 Orev, Y. 1976. **Improving single furrow animal ploughing in Botswana.**
World Crops (UK), v. 28(6), p. 252–253, 6 fig., ISSN 0043-8391. **En**
☐*Proposes a minimum tillage system for Botswana using single-furrow plows owned by most farmers, the only new investment required being in carts and 3-pad harnesses.*
Mic.No: 80465

1281 Schmitz, H. 1990. **Le semis direct sous mulch dans les petites exploitations du Sud-brésilien. (Direct sowing under mulches in smallholdings in southern Brazil)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 237–241, 4 photographs; 13 ref., ISBN 92-9081-046-7 **Fr**
☐*Describes trials in southern Brazil in which the idea of mulching was introduced to the farmer and direct sowing techniques using animal-drawn implements were investigated and compared with traditional manual methods. Discusses prospects for the future success of the system in the region.*
Mic.No: 82052

1282 Sene, M.; Garin, P. 1990. **Le travail à la dent sur sol gravillonnaire au Sénégal. (Tine tillage on hard soils in Senegal)**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 218–223, 1 graph, 4 tables, ISBN 92-9081-046-7 **Fr**
☐*Describes trials in the southeast of Sine Saloum (Senegal) in which soil was worked using an ox-drawn G-tine (chisel-type) at the end of the dry or rainy seasons to improve the infiltration of early rains and to reduce soil erosion.*
Mic.No: 82056

1283 Starkey, P.H.; Verhaeghe, H. 1982. **Weed control in maize using draught animals.**
Livestock International (UK), v. 10(3), p. 64–69, 3 fig., 8 tables; 3 ref., ISSN 0306-8566. **En**
☐*Presents results of experiments conducted to investigate the use of multipurpose animal-powered toolbars and compare their effectiveness with the use of hand labour and tractors in Sierra Leone in terms of time spent cultivating maize, efficiency in weed control and overall costs.*
Mic.No: 28775

1284 Virmani, S.M.; Willey, R.W.; Reddy, M.S. 1981. **Problems, prospects, and technology for increasing cereal and pulse production from deep black soils.**
ICRISAT, Patancheru, AP (India). In: Improving the management of India's deep black soils, Seminar on Management of Deep Black Soils for Increased Production of Cereals, Pulses, and Oilseeds, New Delhi (India), 21 May 1981, p. 21–36, 3 fig., 4 tables, 4 maps; 5 ref. **En**
☐*Describes the ICRISAT approach in developing suitable farming systems for Vertisols based on a broadbed-and-furrow system and use of wheeled toolcarriers.*
Mic.No: 80865

1285 Willcocks, T.J. s.d. **Semi-arid tillage research in Botswana.**
Commonwealth Secretariat, London (UK). Food Production and Rural Development Div. In: Proceedings of the appropriate tillage workshop, Appropriate Tillage Workshop, Zaria (Nigeria), 16–20 Jan 1979, p. 127–146, 11 fig., 11 tables; 22 ref. **En**
☐*Highlights findings of experiments conducted in Botswana to describe optimum tilth for reliable and efficient crop production in terms of tillage depth, soil porosity (bulk density), moisture conservation and sheer strength, and clod size; to assess quantitatively the amount of input energy necessary to reduce soil bulk density when using different types of tillage implements (both animal-drawn and tractor-operated) and to determine the energy input necessary to produce one tonne of grain; and to specify a tillage system that can be adopted by the farmer in relation to time of year and available draft power.*
Mic.No: 82101

1286 Zerbo, D.; Toure, A.; Toure, M. 1986. **Temps de travaux des prin-**

cipales cultures au Mali. (Working time required for major cultural operations in Mali)
Mali. Ministère de l'Agriculture, 23p., 15 tables; 10 ref. **Fr**
☐*Compares times taken for the various cultural operations required for cotton, groundnuts, maize, sorghum and rice by traditional hand labour, animal traction and motorized equipment.*
Mic.No: 80248

WATER-RAISING SYSTEMS AND ANIMAL-POWERED GEARS

1287 Ali, N.; Pandey, M.M. 1982. **Use of animal power in harvest and post harvest operations.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16-17 Jul 1982, 14p., 4 fig., 3 tables; 6 ref. **En**
☐*Evaluates the use of animal power for harvest and postharvest operations in India, with particular reference to operations such as harvesting, threshing, oilseed milling, chaff cutting, sugar-cane crushing and transportation; compares manual, animal and mechanical systems.*
Mic.No: 80689

1288 Anon. 1975. **Animal-driven power gear.**
UN, Geneva (Switzerland). Div. of Narcotic Drugs, 30p., 10 photographs **En**
☐*Contains technical descriptions of animal-driven power gear (small and large power units, threshing machine, chaff-cutting or chopping machine, grinding mill, winnower and root cutter) to aid the authorities in facilitating the village-level introduction of such equipment for processing new crops intended to replace the cultivation of narcotic crops.*
Mic.No: 80854

1289 Anon. 1985. **Sortir l'eau du puits – des attelages pour utiliser la traction animale. (Lifting water from wells – harnesses for using animal traction)**
Inter-Tropiques (France), no. 11, p. 30–31, 10 drawings **Fr**
☐*Describes and illustrates animal-powered water-lifting systems.*
Mic.No: 80172

1290 Anon. 1986. **Animal power technology. A program from GTZ/GATE in West Africa.**
German Appropriate Technology Exchange, Eschborn (Germany, F.R.), 31p., 1 table, 5 photographs, 6 drawings **En**
☐*Briefly describes the GTZ/GATE project aimed at improvement and propagation of animal-powered technotogy as a possible alternative for small farm mechanization in developing countries together with implementation of animal-powered systems in Senegal, Burkina Faso, Central African Republic and Sierra Leone. Gives full case studies of an animal-powered mill in Senegal, animal powered water-lifting (including the ox-driven Gueroult system) and universal animal power. Discusses organization of animal-power use at village level, and organization and dissemination of programmes.*
Mic.No: 80170

1291 Anon. 1986. **Animal power technology. A program from GTZ/GATE in West Africa and implemented by Projekt-Consult.**
German Appropriate Technology Exchange, Eschborn (Germany, F.R.), 4p. **En**
☐*Describes a GTZ/GATE multi-regional project which started in 1984 with the aim of improving and promoting animal-powered technology as a possible alternative for small farm mechanization in developing countries and has implemented 20 animal-powered systems in Senegal, Burkina Faso, Central African Republic and Sierra Leone.*
Mic.No: 80169

1292 Baqui, M.-A. 1986. **Animal-driven pump in Bangladesh.**
RNAM Newsletter (Philippines), no. 25, p. 12, 1 table, 1 photograph **En**
☐*Describes an animal-driven pump designed, made and tested in Bangladesh, for drawing groundwater and presents brief test results using bullocks and buffaloes.*
Mic.No: 80174

1293 Baqui, M.-A. 1986. **Developing an animal-driven pump to draw groundwater.**
IRRI Newsletter, v. 11(5), p. 37–38, 2 tables **En**
☐*Describes briefly an animal-driven groundwater pump with a positive displacement pumping unit that draws and delivers water through reciprocating pistons; includes results of tests on the pump's performance and outlines costs involved.*
Mic.No: 80601

1294 Bielenberg, C. 1988. **The development of an animal traction grinding mill for village groups in Senegal.**
Tillers Report (USA), v. 8(1), p. 10–12, 5 drawings, 1 photograph **En**
☐*Describes the Lowe/Gueye animal traction mill which eliminates the heavy gearing normally used in rotary animal-powered systems by transmitting the animal power to the equipment via a car tyre*

which rolls along a circular track just inside the animal's path. Following observations on performance of 10 prototype animal traction mills installed in villages around Koalack, Senegal, proposes a simpler version of the mill which could be produced by artisan blacksmiths throughout West Africa or could be manufactured by better-equipped workshops, sold as a kit and assembled by villagers themselves. Discusses constraints to the widespread use of animal traction for cereal milling in Sahelian Africa.
Mic.No: 80419

1295 Boie, W. 1989. **Introduction of animal powered cereal mills. (Introduction de moulins à manège pour céréales)**
Vieweg & Sohn, Braunschweig, Wiesbaden. Eschborn (Germany, F.R.), 70p., photographs, tables, drawings; 20 ref., ISBN 3-528-02045-8 **En, Fr**
☐*A guide for the implementation of animal-powered mills in developing countries discussing technical and socio-economic factors and the construction of the mills. Includes an annex with information on technical foundations for the evaluation of animal powered mills, a curriculum for project implementation, comparison of the economic efficiency of animal-powered mills and motor mills, lists of relevant publications and contact addresses.*
Mic.No: 80513

1296 Brandon, P.G. 1983. **L'expérience d'un constructeur de pompes à manège au Maroc. (Experiences with the construction of animal-powered pumps in Morocco)**
Machinisme Agricole Tropical (France), no. 84, p. 38-43, 2 plates, 1 table **Fr** (En Es Fr)
☐*Relates experience which took place in Morocco from 1960 to 1965 with the development and installation of 83 camel-driven pumps equipping wells which varied from 10 to 77 meters in depth.*
Mic.No: 80767

1297 Burton, J.D. 1986. **Water provision and water lifting technologies using livestock in semi-arid areas.**
Intermediate Technology Development Group, Rugby (UK). International Technology Development Group, Agriculture and Water Development Forum, Rugby (UK), 27-28 Jun 1986, 6p., 1 table, 1 graph; 8 ref. **En**
☐*Describes traditional and modern animal water-lifting devices and suggests that uptake of such systems in Africa will depend on the wider issues of introduction of animal draft power.*
Mic.No: 80167

1298 Busquets, E. 1986. **The power gear makes it worthwhile to keep draught animals.**
GATE (Germany, F.R.), no. 86/4, p. 13-16 1 photograph **En** (En Es Fr)
☐*Discusses animal power gears and their role in making further use of draft animals. Describes the GTZ/GATE Power Gear Project and details power gear systems installed in Burkina Faso (8), Senegal (7), Sierra Leone (3) and Central African Republic (2) and the introduction of power gears giving the example of the village of N'Gan in Senegal.*
Mic.No: 80168

1299 Finn, S. 1986. **An ox-powered sweep for stationary power.**
Tillers Report (USA), Fall/Winter, p. 4,10, 2 photographs, 2 drawings **En**
☐*Describes a prototype ox-powered circular sweep adapted from historical models for generating stationary power for equipment such as grain grinders, silage choppers, corn shellers, threshers and water pumps and designed with availability of materials and ease of fabrication in mind.*
Mic.No: 80917

1300 Gauthier-Pilters, H. 1972. **Le puits pastoral dans le désert. (Pastoral wells in the desert)**
Miferma - Informations, no. 23, p. 50-56, 12 illus. **Fr**
☐*Describes different types of pastoral wells operated by human or animal power for watering camels in the desert of Mauritania, with notes on their management.*
Mic.No: 08253

1301 Goubert, D. 1982. **Exhaure à traction animale au Sénégal. (Animal powered water lifting in Senegal)**
Environnement et Développement du Tiers-Monde, Dakar (Sénégal). ENDA Environnement Africain (Senegal), no. 48, 18p., 6 fig. **Fr**
☐*Describes a new animal-powered system for raising water installed in the Gossas and Koumpentoum regions of Senegal. Economic and social aspects are discussed.*
Mic.No: 80280

1302 Hofkes, E. 1985. **Water lifting.**
In: Tools for agriculture. A buyer's guide to appropriate equipment, Intermediate Technology Publications. London (UK), p. 93-99, 4 fig., 5 tables, 1 photograph, drawings; 2 ref., ISBN 0-946688-36-2 **En**
☐*Discusses means of lifting water and compares humans, animals and motors as power sources. Describes and illustrates equipment available, including animal-powered pumps, and gives details of manufacturers.*
Mic.No: 80894

1303 Jacobi, C.; Lowe, P. 1984. **Diffusion des manèges: l'approche d'ENDA. (ENDA's approach to the extension of animal power technology)**
Environnement et Développement du tiers monde, Dakar (Sénégal). ENDA Environnement Africain (Senegal), no. ET 119 F, 4p. **Fr**
□*Briefly describes the role of ENDA (Environment and Development in the Third World) in testing and developing animal-power technology, collecting and disseminating information on appropriate technology and assisting in the implementation of animal-power technology projects.*
Mic.No: 80176

1304 Jacobi, C.; Lowe, P. 1984. **Diffusion des pompes "Gueroult": impacts techniques et sociaux. (Introduction of "Gueroult" pumps: Technical and social impact)**
Environnement et Développement du Tiers-Monde, Dakar (Sénégal). ENDA Environnement Africain (Sénégal), no. ET 121 F, 8p., 3 fig. **Fr**
□*Describes technical and social results of the introduction of Gueroult pumps for water-lifting in Senegal.*
Mic.No: 80177

1305 Jacobi, C.; Lowe, P. 1984. **Pomper l'eau avec le Gueroult au village. (Pumping water with "Gueroult" pumps in villages)**
Environnement et Développement du Tiers-Monde, Dakar (Sénégal). ENDA Environnement Africain (Senegal), no. ET 122 F, 13p. **Fr**
□*Describes technical and social problems resulting from introduction of Gueroult pumps for water-lifting in villages in Senegal.*
Mic.No: 80178

1306 Jacobi, C.; Lowe, P. 1984. **Quelques techniques d'exhaure de l'eau au Sahel. (Some water lifting techniques in the Sahel)**
Environnement et Développement du tiers monde, Dakar (Senegal). ENDA Environnement Africain (Sénégal), no. ET 120 F, 8p., 10 drawings **Fr**
□*Briefly describes traditional water-lifting methods of the Sahel region of Africa together with modern alternatives.*
Mic.No: 80179

1307 Jacobi, C. 1985. **Raising water with the Gueroult creates conflicts.**
GATE (Germany, F.R.), no. 85/2, p. 40–42, 1 drawing **En** (En Es Fr)
□*Describes socio-economic problems associated with the introduction of the Gueroult water-lifting technique in villages in Senegal, mainly its acceptance by arable farmers and rejection by nomadic cattle farmers and anxiety of women regarding working with draft animals.*
Mic.No: 80182

1308 Khepar, S.D.; Kaushal, M.L.; Verma, S.R. 1982. **Present status of animal drawn water lifting devices in India.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 24p., 9 fig.; 7 ref. **En**
□*Discusses methods of lifting water by animal power in India, describing low, medium and high head-water lifts; and reviews research and development efforts towards the development of animal-drawn lift irrigation pump, describing the design of its various components, installation procedures and operation techniques.*
Mic.No: 80675

1309 Koroma, J.; Boie, W. 1988. **Demonstration of animal power gear systems at Rolako Ox Plow Centre.**
Starkey, P.H. (ed.); Ndiam, F. (ed.). In: Animal power in farming systems, Vieweg & Sohn. Braunschweig, Weisbaden (Germany, F.R.). 2. West Africa Animal Traction Networkshop, Freetown (Sierra Leone), 19–25 Sep 1986, p. 43–45, 3 photographs, ISBN 3-528-02047-4 **En**
□*Describes a single-purpose gear system used to drive a maize mill with a single ox, and a prototype multipurpose animal-powered gear system intended to drive various crop-processing machines.*
Mic.No: 82002

1310 Lowe, P. 1983. **At the heart of Egyptian agriculture – the sakia.**
GATE (Germany, F.R.), no. 83/4, p. 28–31, 2 photographs, 1 drawing **En** (En)
□*Describes the importance of the sakia as an animal-powered water-lifting device in Egypt both historically and at the present time in a modified form. Discusses the GATE survey of sakia technology to serve as a starting point for promotion of the sakia in other parts of the world.*
Mic.No: 80180

1311 Lowe, P. 1986. **Animal powered systems. An alternative approach to agricultural mechanization. (Le manège. Une autre source d'énergie pour l'agriculture)**
Friedr Vieweg & Sohn, Braunschweig (Germany, F.R.), 60p., 62 fig.; ref., ISBN 3-528-02023-7 **De, En, Fr**
□*Discusses fields of application for animal-powered systems, including areas in which such*

systems have not been used and areas of traditional application, where advanced, modernized versions would be of advantage. Includes profiles of water-raising mechanisms, animal-powered mills, sugar-cane crushers, universal power gears, and the sweep-power/runner-wheel combination.
Mic.No: 38943

1312 Lowe, P. 1986. **Without village artisans the power gear stands idle.**
GATE (Germany, F.R.), no. 86/2, p. 30–32, 1 photograph **En** (En Es Fr)
☐*Describes the importance of close cooperation with rural artisans when the GATE Power Gear Project was implemented in West Africa in 1984 with its aims of development and promotion of new power gear equipment based on traditional designs. Discusses the artisanal way of life, thinking, learning and working methods and importance of prototypes.*
Mic.No: 80181

1313 Major, J.K. 1985. **Animal-powered machines.**
Shire Publications Ltd. Princes Risborough (UK). Shire Album (UK), no. 128, 32p., 27 photographs, 12 drawings; 43 ref., ISBN 0-85263-710-1 **En**
☐*Describes the use of animal-powered machines in the UK from ancient times including sections on vertical hoist machines, horse engines in mines, industrial uses of animal-powered machines and the agricultural horse engine.*
Mic.No: 80855

1314 Maseng, L.; Jacobs, G. 1985. **Two days test of animal driven pump at Gamarotswana.**
Botswana Technology Centre, Gaborone, 29p., 5 tables; 5 ref. **En** (En)
☐*Presents results of experiments at Gamarotswana (Botswana) in which performance of an animal-driven pump was tested for one day using a tractor and for another day using eight donkeys.*
Mic.No: 80171

1315 Pargasam, A.R.A. s.d. **Animal power for lift irrigation.**
s.n., s.l., 25p., 2 tables; 9 fig. **En**
☐*Presents a proposal for an integrated programme of investigation, research, development and extension on Animal Power Irrigation Systems (APIS) in India, indicating the socio-economic implications and describing existing animal-powered lifting devices and the nature of work on them that will be undertaken as part of the proposed programme. Outlines new and improved methods that will be developed and integrated to enhance the efficiency of APIS.*
Mic.No: 86965

1316 Plessard, F. 1974. **Etude d'un système d'exhaure à traction bovine. (Observations on an ox-powered pumping system)**
Machinisme Agricole Tropical (France), no. 47, p. 44–52 **En**
☐*Presents observations made on an animal-driven water-pumping system installed at an experimental farm in Bambey, Senegal, with particular reference to its operation principles, component parts, performance and costs involved.*
Mic.No: P00560

1317 Snyman, N. 1980. **Back to animal power.**
Farmer's Weekly (Zimbabwe), p. 45,47, 1 table, 3 fig. **En**
☐*Discusses ways of designing and constructing animal-powered water-pumping and other equipment for small farmers; includes a brief description of ways of calculating power requirements.*
Mic.No: 56128

1318 Starkey, P.H.; Abiye Astatke; Goe, M.R. 1989. **Alternative applications of animal power.**
Hoffman, D. (ed.); Nari, J. (ed.); Petheram, R.J. (ed.). In: Draught animals in rural development, International Research Symposium on Draught Animals in Rural Development, Cipanas (Indonesia), 3–7 Jul 1989. ACIAR Proceedings Series, no. 27, p. 231–241, 5 drawings; 80 ref., ISBN 1-86320-03 **En** (En)
☐*Reviews possible alternative uses for animals other than for tillage and transport concentrating on African examples. Includes use of animal-drawn scoops for levelling of fields and making roads and ponds, modified* maresha *ards for constructing terraces and broadbeds, animal-powered water raising equipment and gears and pumps, animal-drawn groundnut and potato lifters and use of horses, mules and oxen for logging. Concludes that the technologies discussed offer potential for diversified employment of animals but advocates caution and pragmatism.*
Mic.No: 80944

1319 Tainsh, J.A.R.; Bursley, E.C.; Bunger, B. 1983. **Animal power for irrigation and rice milling.**
Livestock International (UK), v. 11(3), p. 58–59, 2 plates, ISSN 0306-8560. **En**
☐*Reviews developments in the use of bullocks to power village-size rice mills and small-scale irrigation of family farms.*
Mic.No: 80510

1320 Tainsh, J.A.R.; Bursey, E.C. 1985. **The use of bullocks to raise irrigation water and increase production.**

Edinburgh Univ. (UK). Centre for Tropical Veterinary Medicine. Draught Animal News (UK), no. 4, p. 10–13, 1 photograph **En**
☐*Describes the role of the Sarvodaya movement in encouraging use of bullocks or buffaloes for raising irrigation water in Sri Lanka, on-farm trials with Bunger pumps in the northern region and the effect irrigation will have on increased crop production. Discusses improved harnessing systems for bullocks and current developments in use of bullock power with small rice mills.*
Mic.No: 80173

1321 Thomas, T. 1990. **Animal power production mechanisms for linking animals to machines.**
Starkey, P.H. (ed.); Faye, A. (ed.). In: Animal traction for agricultural development, 3. Regional Workshop of the West Africa Animal Traction Network, Saly (Senegal), 7–12 Jul 1988, p. 230–236, 3 fig., 9 ref., ISBN 92-9081-046-7 **En**
☐*Discusses the economics of different sources of work energy for rural development and the animal-powered process driving low- and high-speed machines. Presents a tentative specification for an animal power take-off to be used in villages without mains electricity and with an erratic oil supply. Describes and illustrates a rope-driven mechanism for power take-off and discusses advantages of and design issues in rope-engines.*
Mic.No: 82034

ANIMAL POWER IN FORESTRY

1322 Allen, T.G. 1972. **Trial use of bullocks for cultivation in the establishment of small scale plantations or woodlots in Nigerian savanna areas.**
s.n., s.l. 3. Annual Conference of the Forestry Association of Nigeria, Benin (Nigeria), Nov 1972, 13p., 2 tables; 6 ref. **En** (En)
☐*Presents results of trials at Samaru, northern Nigeria, in which small plots of pines or eucalypts were established using bullocks with Ariana equipment for plowing and inter-row weeding. Costs were compared with those of tractor operations and plowing with bullocks appeared economically marginal. Notes constraints to the use of bullocks.*
Mic.No: 80227

1323 Anon. 1983. **Extraction using draught animals.**
Forskningsstiftelsen Skogsarbeten, Spanga (Sweden). In: Swedish forestry techniques with possible applications in the third world, p. 99–139, illus. A project sponsored by SIDA, ISBN 9-17614-141-7 **En** (En)
☐*Describes and illustrates equipment for timber extraction using draft animals including horse harnesses, shoeing, types of stakes (stanchions), articulation and bunks, shafts and drag-lines, draglines, skidding tongs, a shafted bunk sled, a shafted sled-type logging arch, skidding pans, log sleds, skidding bogies, drays and log wagons and includes a brief discussion of suitability of such equipment for various conditions.*
Mic.No: 80919

1324 Aykut, T. 1972. **A study of forest transport in Bolu region from the viewpoint of transport technique.**
Istanbul Universitesi Orman Fakultesi Yayinlari (Turkey), 252p., 35 tables; 77 ref. **Tr**
☐*Reports studies carried out in north central Turkey on skidding with oxen or buffaloes, loading of logs on lorries and road haulage on lorries or tractor-drawn trailers, with a linear regression analysis of time on volume.*
Mic.No: 80728

1325 Berry, A. 1982. **Draught animal power in forestry.**
Indian Inst. of Management, Bangalore. In: National seminar on draught animal power system in India. Seminar papers, National Seminar on Draught Animal Power System in India, Bangalore (India), 16–17 Jul 1982, 15p., 1 table; 5 ref. **En**
☐*Discusses the use of draft animal power (DAP) in forestry operations in India, mentioning the production and requirement of forest products in the country, details of different animals commonly used for forestry operations, and major data gaps and research needs regarding DAP in forestry.*
Mic.No: 80609

1326 Bonilla Mora, X.M. 1986. **Diseno, construccion y evaluacion de dos aditamentos para la extraccion de madera con bueyes. (Design, construction and evaluation of two implements for the extraction of timber with oxen)**
Instituto Tecnologico de Costa Rica, Cartago. Dept. de Ingenieria Forestal, 68p., 18 fig., 22 tables; 14 ref. Ingeniero Forestal. **Es** (Es)
☐*Describes the effect of use of a cone and platform for reducing friction between logs and the ground on efficiency of logging operations with oxen in Costa Rica.*
Mic.No: 80393

1327 Cordero Quesada, W. 1985. **Directrices para la extraccion forestal con bueyes. (Guidelines for timber extraction using oxen)**
Instituto Tecnologico de Costa Rica, Cartago, 35p., 20 fig. **Es**
☐*Reviews the use of oxen for logging operations in Costa Rica and equipment involved.*
Mic.No: 80394

1328 Cordero Quesada, W.; Jimenez, F.; Serrano, R. 1986. **Costos y rendimientos en la extraccion de madera con bueyes y procesamiento con aserradero portatil. (Costs and benefits of the extraction of timber using oxen and the processing of timber using chain-saws)**
Instituto Tecnologico de Costa Rica, Cartago. 1. Congreso Forestal Nacional, San Jose (Costa Rica), 10–14 Nov 1986, 15p., 8 tables; 5 ref. **Es** (Es)
□*Presents results of a study of costs of timber extraction using oxen and a portable Wood-mizer saw.*
Mic.No: 80397

1329 Cordero Quesada, W. 1986. **Ox-logging – traditional methods used in Costa Rica.**
Instituto Tecnologico de Costa Rica, Cartago. 18. IUFRO Conference, Subject Group – Forest Operations in the Tropics, Ljubljana (Yugoslavia), Sep 1986, 13p., 1 fig., 5 tables; 8 ref. **En**
□*Presents data on traditional methods of training and skidding wood with oxen in Costa Rica and on production and costs following time-and-motion studies. Compares costs using oxen and tractors.*
Mic.No: 80395

1330 Cordero Quesada, W. 1986. **The role of animal traction in the harvesting of rain forests.**
Vukina, M.A.T. In: Proceedings of the meeting of the Group of 77, Meeting of the Group of 77: Cultivation and Exploitation of Forests, Wood Processing, Timber and Wood Industries and Pulp and Paper Industry, Zagreb (Yugoslavia), 4–6 Dec 1985, p. 69–78 **En**
□*Discusses the role of animal traction in general, characteristics of forests and terrains which favour use of draft animals for extraction of forest products (product size, skidding distance, slopes, soil type and volume of operation), characteristics of countries (availability of machinery, equipment, foreign currency, hydrocarbons and labour and tradition of use of animal traction) and cost relations and social impact, ox traction for timber extraction generating 2.87 times more employment than mechanical traction. Concludes that the potential of animal traction is insufficiently recognized and that it could be used in most underdeveloped countries especially for forestry operations.*
Mic.No: 80396

1331 Cornelius, D.W.; Broadley, J. 1974. **Consideration for the use of oxen for the main extraction of pulpwood from the Viphya Project forests. Oxen-use feasibility study, Chile, South America, February/March 1974.**
Malawi. Ministry of Agriculture and Natural Resources, 50p., 42 photographs **En** (En)
□*Presents results of a study tour to see in practice large-scale methods of pulpwood log extraction by oxen in Chile and to assess the technical and economic feasibility of such methods for the Viphya Pulpwood Project in Malawi. Concludes that the use of oxen should be considered and immediate steps taken to train oxen using the "Head Yoke" system of extraction instead of the "Neck/Shoulder Yoke" system used at present.*
Mic.No: 80450

1332 Elkington, P. 1987. **Development of logging oxen equipment for construction and use in Malawi.**
Forestry Department. Lilongwe (Malawi), 20p., 6 illus. **En** (En)
□*Describes the local construction and testing of a prototype sulky and sled designed to improve the productivity of log extraction in Malawi. Discusses the capabilities and interest of local workshops in producing or modifying such equipment.*
Mic.No: 80523

1333 Hawkes, M.D. 1989. **Plantation logging with oxen.**
Oxford Univ. (UK). Forestry Inst., 99p., 3 photographs; 20 illus.; 44 ref. M.Sc. **En** (En)
□*Briefly reviews the history of draft technology, requirements for draft animal power, current population levels of draft animals in less-developed countries, draft animal utilization especially in plantation forestry and discusses whether use of animal traction in forestry is an appropriate technology. Gives details of basic mechanical principles involved, alternative species for logging (mules, horses), breeding, selection, training, health care of logging oxen, housing, roading considerations, harvesting practice, harnessing and implements, with special emphasis on Malawi.*
Mic.No: 80542

1334 Hedman, L. 1986. **The horse in forestry.**
University of Agricultural Sciences. (Sweden). Small Scale Forestry, 1/86, p. 13–17, 7 photographs, 4 illus. **En** (En)
□*Discusses recent increased interest in using horses for forestry in Sweden where they appear to be a viable alternative to machines for use in very small areas of final felling, thinning where the strip road network is sparse, extracting seed trees and wind-thrown timber, in difficult terrain and extraction of fuelwood in clearings. Briefly discusses possible applications in developing countries.*
Mic.No: 80522

1335 Humar, I.F. 1984. **Animal logging mission to Tanzania, 7–22 May 1984. Oxen logging potential in Tanzania.**

FAO, Rome (Italy), 53p. **En**
□*Reports on a fact-finding trip made to various parts of Tanzania in order to assess the feasibility of employing animal draft in forestry operations, discussing the suitability of oxen for logging and transportation; topographical, climatic and physical considerations in the use of oxen; and training requirements in off-road transport. Includes project proposal for the establishment of an Oxen Logging Training and Demonstration Centre.*
Mic.No: 80005

1336 Mata Acuna, D. 1987. **Evaluacion tecnico-economica del sulky como aditamento para la extraccion de madera con bueyes. (Technical and economic evaluation of a logging "sulky" to supplement extraction of timber with oxen)**
Instituto Tecnologico de Costa Rica, Cartago. Dept. de Ingenieria Forestal, 100p., 14 fig., 23 tables, 6 graphs; 11 ref. Ingeniero Forestal. **Es** (Es)
□*Presents results of a technical and economic evaluation of the use of a sulky in timber extraction operations with oxen in Costa Rica.*
Mic.No: 80399

1337 Rodriguez, E.O. 1986. **Wood extraction with oxen and agricultural tractors.**
FAO, Rome (Italy). FAO Forestry Paper, no. 49, 92p., 32 fig., 22 tables; ref. **En** (En)
□*Presents results of a study carried out in Chile in order to demonstrate the use of oxen to skid logs in plantation and natural forests, comparing output and costs with those obtained from using tractors. Includes general information on oxen in forestry work, morphological characteristics, the commonest diseases that can be diagnosed by the ox-driver, feeding and equipment.*
Mic.No: 80638

1338 Solberg, B.; Skaar, R. 1986. **A technical and socio-economic study of skidding with oxen in Malawi.**
Agricultural Univ. of Norway, Aas. Agricultural University of Norway Occasional Paper. Series B, no. 5, 76p., 5 fig., 13 tables; 15 ref., ISSN 0801-0803. **En** (En)
□*Presents a description and estimates of oxen-skidding of logs in softwood thinnings and clear-felling in Malawi, evaluating equipment and working methods used; influence of skidding distance, log volume, load volume, terrain type etc. on skidding production; costs involved; and comparative benefits of tractor or oxen-skidding from a technical and socio-economic point of view. Includes recommendations for future research.*
Mic.No: 80525

1339 Soto, S.D. 1971. **Study of logging with horses.**
Informe Tecnico, Instituto Forestal (Chile), no. 39, 55p. **Es**
□*Presents results of studies undertaken in Chile on the performance and costs of skidding pulpwood and logs by horses using four types of equipment; compares data with those for skidding by oxen.*
Mic.No: 80729

1340 Vis, J. 1990. **The use of horse traction in Dutch forests and the training of teamsters and horses.**
s.n., s.l., 2p. **En**
□*Presents, in note form, information on Dutch forests, why horses are used, their limitations, skidding techniques used, costs and training of animals and users.*
Mic.No: 80916

1341 Wartono Kadri; Soewito; Muharam. E.H. 1970. **Experiences in research on skidding with draught cattle at Tjepu forest district (in Java).**
Laporan, Lembaga-Lembaga, Penelitian Kehutanan, 27p., 1 table **In**
□*Reports results of a study on the use of 1-5 pairs of animals to increase efficiency in the traditional technique of extracting teak logs in Java, examining effects of size of load, slope and number of animals on skidding time and draft power.*
Mic.No: 80733

SUBJECT INDEX

Agricultural Development
0006 0013 0031 0084 0096 0143 0153 0160 0190 0193 0204 0209 0229 0363 0375 0396 0402 0425 0669 1143 1244

Agricultural Engineering
0395 0403 0424 0426 0443 0540 1311

Agricultural Policies
0101 0178 0629

Agriculture
0014 0030 0040 0065 0101 0114 0340 0624 1243

Agro-industrial Byproducts
0796 0802

Animal Diseases
0044 0748 0749 0757

Animal Feeding
0044 0171 0206 0212 0285 0300 0394 0687 0715 0720 0794 0797 0802 0804 0811

Animal Genetics
0770 0774 0776

Animal Health
0042 0158 0162 0216 0256 0367 0394 0409 0423 0687 0707 0715 0718 0727 0735 0742 0743 0748 0752 0753 0754 0756 0760 0761

Animal Nutrition
0125 0220 0535 0729 0780 0798 0800 0806 0807 0808 0810 0812 0813 0827 0828 0829 0833 0838 0841 0862

Animal Performance
0060 0062 0303 0394 0615 0759 0771 0791 0800 0814 0837 0842 0848 0862 0885 0888 0889 0890 0892 0893 0895 0897 0898 0901 0902 0903 0905 0907 0908 0910 0911 0912 0913 0914 0915 0916 0917 0919 0921 0923 0925 0926 0927 0928 0929 0941 1065

Animal Physiology
0044 0535 0860 0861 0865 0867 0902 0908 0912

Animal Power
0002 0059 0065 0105 0106 0106 0107 0108 0111 0125 0126 0141 0142 0143 0147 0233 0329 0330 0342 0349 0364 0480 0534 0667 0898 0924 1289 1290

Animal Production
0004 0012 0047 0048 0049 0158 0160 0162 0187 0204 0216 0244 0272 0282 0297 0306 0307 0499 0537 0610 0669 0699 0706 0707 0715 0738 0751 0765 0788

Animal Response
0760 0809 0855 0859 0861 0863 0865 0867 0872 0873 0875 0877 0878 0879

Animal Selection
0704 0724

Animal Training
0450 0571 0695 0702 0704 0705 0716 0717 0724 0726 0727 0736 0739

Animal Welfare
0698 0703 0719 0741 0888

Appropriate Technology
0001 0004 0059 0102 0106 0106 0108 0111 0121 0178 0241 0437 0442 0590 0845 0967 1018 1021 1029 1041 1132 1230 1244 1261 1273 1289 1290 1291 1304 1307 1310 1312 1320

Blood
0844 0859 0860 0862 0863 0878

Breed Characters
0310 0355 0362 0887

Breed Selection
0268 0732 0739 0775

Brown Swiss Cattle
0849 0870

Buffaloes
0046 0053 0144 0306 0322 0342 0343 0381 0610 0654 0705 0717 0722 0752 0767 0768 0773 0777 0778 0779 0780 0787 0789 0805 0828 0833 0838 0839 0841 0842 0844 0846 0848 0848 0860 0863 0867 0869 0872 0873 0874 0877 0895 0899 0906 0909 0931 0953 0969 0987 1001 1209

Bund Farmers
1032 1072

Camels
0026 0033 0044 0227 0378 0417 0715 0718 0720 0728 0733 0924 0984 0986 1009 1296

Carts
0140 0974 0977 0978 0979 0980 0981 0982 0983 0985 0988 0989 0990 0991 0992 0994 0995 0996 0997 0998 0999 1003 1004 1005 1006 1007 1008 1010 1011 1028 1162 1214

Cattle
0033 0038 0144 0189 0190 0216 0249 0272 0285 0297 0300 0316 0322 0367 0380 0381 0394 0396 0428 0430 0525 0559 0610 0658 0737 0740 0750 0762 0768 0776 0779 0781 0787 0796 0801 0814 0833 0836 0838 0839 0841 0846 0847 0851 0860 0868 0874 0882 0935 0969 0988 1341

Collars
0936 0959 0969 0973

Constraints
0061 0133 0141 0147 0301 0332 0370 0441 0504 0522 0542 0543 0544 0578 0675 0680 0682 0927

Cows
0263 0279 0773 0779 0782 0783 0784 0785 0786 0788 0790 0815 0818 0834

Crop Production
0021 0155 0169 0206 0242 0255 0263 0334 0337 0365 0406 0537 0617 0657 0930 0949 1027 1128 1205 1252

Cropping Systems
0074 0095 0150 0159 0183 0209 0240 0241 0250 0302 0326 0334 0393 0406 0425 0443 0449 0612 0627 1017 1222 1247 1249 1256 1272

Crossbreds
0771 0791 0826 0837 0849 0861 0870 0875 0878 0885 0887 0889 0895 0899 0903 0907 0909 0917 0919 0920 0926 0928

Crossbreeding
0268 0767 0771 0777 0906

Crust Breakers
1095 1096 1099 1237

Cultivation
0090 0229 0236 0240 0526 0566 0611 1103 1106 1117 1168 1174 1247 1248

Cultivators
0095 0662 1025 1034 1065 1073 1081 1084 1099 1108 1208 1235 1247

Data Logging
1152

Dehydration
0857 0858 0859

Development Projects
0102 0116 0143 0164 0204 0215 0306 0307 0346 0356 0391 0402 0408 0418 0428 0430 0449 0460 0476 0486 0503 0515 0519 0520 0523 0525 0527 0541 0708 1074

Donkeys
0214 0225 0272 0379 0404 0417 0513 0693 0699 0723 0738 0745 0749 0763 0813 0850 0857 0858 0859 0884 0945 0946 0947 0957 0975 0992 0993 1014 1016 1189

Economic Analysis
0013 0611 0617 0635 0642 0659 0683

Economic Aspects
0042 0055 0200 0251 0269 0293 0353 0370 0415 0493 0503 0559 0596 0601 0604 0619 0623 0631 0632 0644 0648 0650 0651 0656 0661 0674 0691 0755 0781 1074

Energy
0013 0065 0114 0250 0910 0922 1321

Energy Requirements
0792 0823 0832 0845 0847 0851 0854 0864 0868 0869 0871 0882 0884 0930 0980

Energy Sources
0040 0147 0624 1302

Evaluation
0545 0595 0897 1226 1239

Extension Activities
0130 0148 0169 0183 0200 0276 0391 0461 0476 0483 0485 0518 0621 0689 0692 1036 1252

Farm Implements
0010 0016 0035 0043 0059 0061 0062 0071 0074 0075 0091 0096 0118 0121 0134 0136 0140 0143 0147 0148 0151 0152 0167 0172 0203 0255 0261 0300 0331 0340 0356 0365 0389 0395 0396 0399 0401 0408 0410 0411 0416 0422 0425 0429 0430 0439 0440 0442 0443 0447 0464 0468 0470 0477 0478 0492 0495 0496 0508 0517 0527 0536 0545 0571 0628 0630 0677 0682 0685 0688 0691 0708 0732 0830 0897 0900 0918 0929 0930 0948 0949 0965 0972 0979 0981 0983 0989 0994 0995 0996 0997 0998 1003 1005 1006 1010 1017 1019 1020 1022 1023 1026 1027 1029 1031 1032 1033 1035 1037 1038 1039 1040 1041 1042 1043 1044 1045 1047 1048 1055 1056 1064 1065 1066 1067 1068 1069 1070 1071 1072 1073 1075 1076 1077 1078 1080 1081 1082 1083 1085 1086 1087 1089 1090 1091 1092 1093 1094 1095 1096 1098 1100 1101 1102 1103 1104 1106 1108 1111 1114 1115 1116 1117 1118 1119 1120 1121 1122 1124 1127 1128 1129 1130 1131 1133 1134 1136 1137 1141 1143 1144 1146 1147 1148 1149 1150 1151 1153 1154 1160 1161 1166 1167 1168 1169 1170 1172 1173 1175 1176 1177 1178 1179 1180 1184 1185 1186 1187 1188 1189 1190 1192 1193 1194 1195 1196 1198 1199 1200 1201 1204 1205 1206 1208 1209 1210 1214 1215 1216 1220 1221 1222 1223 1225 1226 1227 1228 1229 1230 1231 1232 1233 1234 1236 1238 1239 1240 1242 1243 1244 1245 1246 1249 1254 1256 1259 1264 1268 1273 1277 1279 1294 1299 1302 1308 1318 1321 1332

Farm Management
0427 0621 0623

Farming Systems
0029 0054 0068 0069 0075 0082 0100 0101 0119 0128 0138 0142 0143 0146 0148 0155 0163 0164 0186 0188 0192 0211 0213 0217 0220 0221 0226 0231 0232 0238 0239 0253 0258 0265 0266 0274 0276 0277 0280 0282 0286 0290 0309 0321 0326 0330 0340 0343 0347 0352 0353 0359 0360 0372 0395 0398 0403 0424 0425 0426 0434 0467 0483 0494 0515 0534 0535 0540 0561 0563 0584 0591 0592 0598 0602 0604 0612 0615 0618 0627 0639 0641 0647 0652 0653 0661 0683 0786 0794 0818 0966 1190 1202 1263 1265 1284 1287

Feed Intake
0795 0805 0815 0819 0822 0826 0831 0837 0840 0857

Feed Requirements
0804 0811 0830 0834

Fertilizer Applicators
1033 1077 1096 1102 1104 1179 1216 1279

Forestry
0082 0087 1318 1323 1325 1326 1327 1328 1329 1330 1331 1332 1333 1334 1335 1336 1339 1340 1341

Genetic Improvement
0125 0394 0765 0767 0768 0774 0778

Groundnut Lifters
1076 1097 1114 1146

Groundnut Production
0677 1098 11[illegible]

Growth Rates
0769 0821 0899

Harnesses
0024 0140 0148 0227 0737 0929 0931 0934 0935 0937 0939 0940 0941 0942 0944 0945 0946 0947 0949 0952 0953 0954 0955 0956 0959 0961 0962 0963 0964 0966 0967 0969 0970 0972 0998 1122 1198 1213 1242

Harrows
1031 1057 1075 1169 1208 1225

Harvesters
1240 1318

Haryana Cattle
0885 0891 0892 0908 0917 0926 0928

Heart Rate
0854 0921

Heat Stress
0746 0857 0866

Historical Aspects
0036 0039 0120 0578 0984

Holstein Friesian Cattle
0855 0885

Hooves
0698 0703 0719 0723 0741

Horses
0024 0045 0066 0067 0073 0079 0087 0099 0103 0103 0117 0145 0223 0224 0272 0323 0379 0723 0730 0741 0746 0747 0757 0758 0763 0774 0792 0809 0810 0821 0823 0824 0829 0832 0851 0852 0853 0854 0864 0865 0890 0894 0915 0924 0957 0985 1223 1271 1334 1339 1340

ICRISAT
1096 1228 1272

ILCA
0028 0064 0353 0376 0390 0405 0407 0418 0431 0458 0467 0590 1247 1248 1260

Information Flow
0126 0129

Innovation Adoption
0057 0265 0276 0283 0287 0374 0454 0589 0609 0628 0671 1229

Intercropping
0425 1268

Jersey Cattle
0861 0907 0916

Labour
0159 0314 0337 0593 0612 0672 0672 1272

Land Preparation
0562 0638 0657 0662 1129 1234 1251 1257 1262 1272 1276

Levellers
1024 1067 1225

Livestock Management
0016 0061 0062 0070 0124 0182 0262 0300 0303 0409 0691 0696 0702 0704 0710 0718 0721 0722 0727 0728 0729 0730 0732 0733 0735 0740 0761 0828

Livestock Production Systems
0158 0164 0262 0380 0409 0428 0659 0715 0764

Loans
0581 0595 0607

Logging
1323 1324 1332 1333 1334 1335 1337 1338

Manufacture
0140 0442 1121 1154 1172 1227

Measurement
0900 0904 0905 0910 0913 0915

Meat Production
0161 0216 0243 0316 0767

Mechanization
0010 0029 0031 0035 0039 0059 0071 0074 0075 0077 0091 0100 0120 0175 0177 0190 0192 0194 0219 0234 0248 0252 0255 0260 0265 0267 0294 0295 0327 0368 0375 0452 0469 0492 0507 0532 0555 0594 0596 0601 0603 0616 0629 0638 0647 0674 0701 1036 1128 1132 1154 1245 1311

Milk Production
0161 0243 0773 0783 0789 0883

Mills
0143 1290 1294 1295 1319

Mixed Farming
0153 0160 0196 0233 0238 0271 0291 0296 0372 0537 0658

Models
0001 0091 0645 0874

Mowers
1123 1211

Mulchers
1023 1090 1091

Mules
0026 0087 0145 0377 0719 0723 0854

Ndama Cattle
0354 0355 0760 0766 0769 0771 1162 1174

Networks
0064 0143 0480

Nikart
1080 1161 1162

Nutrient Utilization
0809 0826 0837

Nutritional Requirements
0262 0798 0799 0810 0816 0817 0818 0824

Oxen
0051 0052 0070 0073 0074 0079 0098 0099 0118 0119 0127 0149 0155 0157 0163 0166 0177 0187 0229 0235 0240 0241 0254 0256 0269 0277 0279 0299 0304 0314 0315 0344 0345 0346 0350 0354 0357 0366 0385 0386 0387 0392 0399 0437 0454 0489 0490 0501 0509 0513 0514 0558 0560 0562 0564 0565 0566 0567 0568 0569 0587 0593 0595 0599 0600 0602 0609 0619 0641 0642 0648 0649 0650 0656 0657 0660 0662 0663 0664 0670 0685 0686 0687 0688 0696 0698 0702 0703 0704 0710 0711 0712 0713 0716 0721 0724 0725 0726 0727 0733 0736 0739 0741 0742 0743 0744 0756 0760 0766 0795 0799 0803 0813 0815 0816 0822 0826 0827 0831 0834 0835 0837 0843 0844 0849 0861 0869 0876 0878 0879 0880 0885 0887 0889 0891 0892 0896 0897 0900 0901 0907 0908 0909 0911 0912 0913 0916 0917 0919 0920 0922 0923 0924 0925 0926 0928 0933 0934 0938 0947 0950 0954 0955 0957 0958 0959 0960 0961 0965 0970 0971 0973 0983 0990 0991 0995 0999 1002 1004 1006 1010 1083 1084 1098 1120 1173 1174 1182 1208 1215 1222 1224 1233 1240 1241 1250 1316 1320 1322 1326 1327 1329 1331 1332 1333 1336 1337 1338

Pastoralism
0212 0673 0803 1009

Performance Testing
0886 0894 0896 0925 0959 1039 1049 1050 1051 1052 1053 1054 1057 1058 1059 1060 1061 1062 1063 1178 1236

Physical Activity
0362 0760 0784 0787 0792 0805 0810 0815 0816 0821 0824 0829 0837 0840 0843 0844 0847 0849 0851 0852 0853 0854 0855 0856 0861 0864 0865 0867 0868 0869 0870 0871 0872 0873 0874 0875 0877 0878 0879 0880 0882 0884 0890 0925 0927 0928

Planning
0055 0063 0262 0418 0635

Plant Production
0160 0263 0282 0333 0642 0765 1233 1283

Planters
0886 1068 1096 1102 1118 1126 1133 1135 1149 1170 1208 1241

Plowing
0593 0889 0968 1247 1251 1280

Plows
0118 0157 0374 0386 0439 0487 0886 1017 1019 1030 1037 1049 1050 1051 1052 1053 1058 1059 1060 1061 1062 1063 1133 1137 1145 1156 1157 1163 1191 1199 1208 1210 1212 1213 1215 1254 1259 1269 1271

Polycultur
1047

Ponds
0005 0385 0386 0682 1018 1250 1260

Power Gears
1288 1298 1309 1312

Productivity
0074 0144 0238 0253 0262 0316 0319 0331 0341 0362 0734 0751 0803 0827

Profitability
0141 0594 0613 0643

Pumps
0576 1292 1293 1296 1302 1304 1305 1314 1316 1317

Red Bororo Cattle
0268

Red Sindhi Cattle
0861 0883 0907

Reproduction
0044 0715 0770 0773 0779 0780 0784 0787 0833

Research
0004 0017 0019 0020 0023 0063 0102 0123 0129 0130 0131 0150 0154 0162 0163 0164 0189 0190 0220 0238 0243 0257 0266 0276 0282 0330 0351 0359 0360 0371 0376 0393 0414 0418 0421 0451 0452 0455 0458 0467 0475 0486 0498 0499 0502 0533 0534 0537 0538 0563 0586 0598 0625 0664 0683 0794 0881 0888 1029 1036 1162 1188 1192 1228 1338

Research Programmes
0028 0131 0390 0405 0407 0431 0570

Respiration
0853 0854 0858

Ridgers
0326 0370 1135 1136 1168 1201 1256

Role of Women
0041 0678

Rollers
1046 1088 1109 1113

Rolliculteur
1234 1235 1236

Rope Engines
1321

Rural Artisans
0208 0981 1122 1125 1159 1169

Sahiwal Cattle
0849 0870 0916

Scoops
0005 0385 0386 0682 1018 1066 1260 1260

Seeders
0471 1026 1033 1086 1099 1119 1141 1279 1281

Sledges
0999

Small Scale Farming
0034 0054 0063 0150 0152 0155 0163 0230 0235 0236 0238 0239 0240 0242 0258 0353 0649 0676 0683 0788 1022 1144

Socioeconomic Aspects
0044 0190 0264 0271 0283 0305 0374 0388 0525 0668 0681 1330

Sociological Aspects
0199 0507 0604 0674 0676 0678

Soil Management
0184 0184 0197 0257 0486 0529 0639 0652 0886 1013 1018 1032 1094 1234 1251 1255 1264 1273 1276

Soil Preparation
0918 1277 1282

Specifications
1023 1024 1025 1026 1028 1030 1031 1032 1033 1034 1037 1178

Sprayers
1096 1224

Supplementary Feeding
0350 0659 0796 0797 0801 0803 0804 0820 0822 0835 0836 0839

Surveys
0159 0304 0324 0329 0332 0364 0433 0483 0497

Swiss Collar
0932 0963 0964

Technology
0034 0258 0638 0642

Technology Transfer
0057 0058 0152 0264 0276 0287 0336 0500 0516 1124

Thermoregulation
0846 0858 0875 0876 0880

Threshers
1022 1054 1088

Tie Ridgers
1083

Tillage
0101 0143 0326 0398 0545 0794 0895 0919 0930 1065 1068 1133 1190 1236 1255 1256 1257 1261 1264 1266 1267 1270 1272 1285

Tines
1017 1034 1234 1235 1236 1256

Toolbars
0404 0443 0484 1022 1038 1069 1071 1079 1085 1128 1129 1136 1147 1148 1150 1189 1191 1201 1246 1269 1283

Toolcarriers
0397 0400 0440 0442 0477 0576 0602 0618 0652 0653 0685 1035 1043 1047 1080 1084 1094 1096 1100 1101 1104 1105 1107 1120 1127 1130 1131 1153 1155 1158 1161 1165 1166 1176 1177 1182 1183 1184 1192 1194 1196 1198 1217 1218 1219 1229 1230 1265 1273 1284

Traditional Farming
0271 0296 1190 1199

Training
0156 0252 0450 0461 0465 0478 0486 0525 0550 0586 0692 0700 1036 1093

Transport
0030 0032 0326 0562 0974 0975 0990 0993 0997 0998 0999 1000 1002 1004 1005 1009 1010 1012 1013 1015 1016 1324 1335 1339 1341

Tropiculteur
1105 1198 1228

Trypanosomiasis
0744 0745 0747 0749 0758

Trypanotolerance
0355 0751 0760 0762

Vertisols
0184 0184 0233 0257 0258 0386 0486 0529 0617 0618 0639 0652 0653 1094 1237 1284

Water Buffaloes
0012 0017 0033 0046 0047 0048 0049 0161 0176 0243 0244 0307 0319 0706 0707 0767 0784 0866 1210

Water Lifting
0030 0140 0143 0511 0658 0848 1289 1290 1297 1297 1300 1301 1302 1306 1307 1308 1310 1315 1317 1318 1319 1320

Weeders
1067 1068 1070 1078 1083 1090 1091 1129 1133 1136 1151 1220 1274

Weeding
1135 1151 1190 1220 1275 1283

Wheels
0981 0994 0997

Zebu Cattle
0268 0784 0791 0859 0909

AUTHOR INDEX

Abalu, G.O.I. 0645 0646
Abate Tedla 0233 0258 0617
Abdullah, R.S. 0722
Abel, N. 0663
Abeyratne, F.0219 0654
Abiye Astatke 0005 0150 0240 0258 0376 0385 0466 0487 0533 0791 1017 1018 1157 1247 1248 1249 1250 1318
Abiye Haile Selassie 0386
Acebedo, V. 0537
Acharya, S. 0885
Adams, J.W. 0723
Addrah, E.C.C. 0151
Adelhelm, R. 0593
Adifon, L. 1019
Aduku, A.O. 0646
Afantonou, L.A. 1020
Aganga, A.A. 0646
Agarwal, S.P. 0842 0843 0844
Agarwal, V.K. 0842 0843 0844
Ahmad, M. 0789
Ahmad, Z. 0789
Ahmed, A. 0863
Ahmed, H.U. 0058 0232 0304
Ahmed, I. (ed.) 1021
Ahmed, J.U. 0759
Aho, F.S. 1019
Ajidagba, P.O.A. 0749
Akou, A. 0685
Akpokodje, J.U. 0749
Alarcon, R.H. 1167
Albarran Simon, J. 1217 1219
Alexandratos, N. 0001
Ali Yusran, M. 0764
Ali, I. 0152
Ali, N. 1287
Alikhani, Z. 0886
Alkali, M.M. 0153
Allafort, M.T. 0083
Allagnat, P. 0181 0387 0388 0664 0665
Allen, T.G. 1322
Amadou, A. 0389
Amann, V.F. 0054
Amegavie, K. 0714
Amegbeto, K.N. 0589 0594
Anand, U. 0887
Anderson, C.E. 0792
Anderson, F.M. 0002 0003 0004 0005 0154 0155 0238 0240 0242 0390 0467 0487 0782 1157 1250
Anderson, M.J. 0855
Andromeders, J.N. 0845
Anne, S. 0191
Apetofia, K.V. 0358 0359 0434
Aquine, R. de la T. 1167
Aragon, R.A. 0922 1216
Aremu, J.A. 1255
Arpalilange, J. 0435
Ashburner, J. (ed.) 1180
Ashburner, J.E. 1256
Attiogbe, A.Y. 0797
Audi, P.O. 0324
Awadhwal, N.K. 1094 1095 1096 1097 1098 1099 1103
Aykut, T. 1324
Ayre, M. 0934 0935 0937
Baconawa, E.T. 0176
Badouin, R. 0596
Bah, M.S. 0177 0666 0742 0743
Bah, O.A. 0701
Bahttarai, A.N. 1168
Bailey, J. 0981
Baker, D. 0597 0630
Baker, R. 0178
Bako, S. 0179
Bakrie, B. 0846
Balo, M.R. 0180
Bamualim, A 0780
Bamualim, A. 0798 0805 0806
Bangura, A.B. 0181 0182 0436 0437
Bangura, J.V. 0438 0439
Bankole, I.A. 0183
Bansal, R.K. 0184 0185 0440 1094 1096 1100 1101 1102 1103 1104 1105 1106 1177
Baqui, M.-A. 1292 1293
Barbosa dos Anjos, J. 1107 1263
Barker, B.O. 0855
Baron, S. 0186
Baron, V. 1206 1263
Barreaud, D. 0441
Barrett, E. 0799
Barrott, V. 0597
Bartlett, J. 0034 0799
Barton, D. 0073 0325 0702 0800 0936 1108 1155
Barwell, I. 0442 0937
Basse, P.A.O. 0483
Basuno, E. 0598
Bates, A. 0703
Batoure, I. 0526
Becker, H. 0599 1109
Bell, R.D. 0035 0443 0600
Bembridge, T.J. 0187 0188
Bengtsson, G. 0894
Bennett, J.L. 0778
Bernoit-Cattin, M. 0189 0190
Berg, C. 0850
Berger, M. 0294
Berkovitch, I. 0888

Bernsten, R.H. 0305
Berry, A. 1325
Bertaux, S. 1110
Berthe, A. 0546
Betker, J. 0982
Beyene Megersa 1111
Bhatnagar, D.S. 0909
Bhattacharya, P. 0781 0908
Bhosrekar, M.A. 0889
Bielenberg, C. 1294
Biesalski, E. 1143
Bigot, Y. 0036 0037 0038 0083 0100 0191 0192 0193 0194 0195 0444 0445
Bigot, Y. (ed.) 0112
Binechin, B.D. de 0196
Binswanger, H.P. 0039 0100 0197 0601 0602
Bisen, H.J. 0983
Bisson, P. 0198
Bizimana, A. 0446
Blench, R.M. 0199
Blondin, M. 0200 1257 1258
Bloom, R. 0116
Boarer, C.D.H. 0859
Bodet, P. 0040
Bole, W. 1295 1309
Bokalders, V. 0076
Boniface, B. 0201 0202 0203
Bonilla Mora, X.M. 1326
Bonnabaud, R. 0204
Bordet, D. 0205 0447 0603 0604 1112 1234 1235 1236
Bordet, D. (ed.) 0112
Bossi, M.T. 0605
Bouchier, A. 0640
Boudet, G. 0206
Bourn, D. 0744
Bowers, R.D. 0448
Bowmaker, R.J. 0704
Boyne, A.W. 0847
Boyt, W.P. 0745
Brandon, P.G. 1296
Bratton, M. 0667
Braun, H.J. 0449
Briat, M. 0207
Brigden, R. 1259
Brin, E. 0208
Broadley, J. 1331
Brockbank, R.B. 1113
Brockway, J.M. 0847 0868
Brody, S. 0851 0854
Brown, S.R.H. 1114
Brownbridge, J.M. 0209
Bruinsma, J. 0001
Brumby, P.J. 1115
Bubl, B. 1116
Bujarbaruah, K.M. 0210
Bullet, R.W. 0984
Bunger, B. 1319
Bunning, S. 1250 1260
Bunyavejchewin, P. 0211 0848
Burchaus, E.-M. 0041
Burgess, P. 0985
Bursey, E.C. 1320
Bursley, E.C. 1319
Burton, J.D. 1297
Burton, R. 0752
Busquets, E. 1298
Butterworth, M.H. 0791 0831
Calmels, G. 0568
Campbell, R.S.F. 0042
Canard, P. 0708
Carbuccia, J.L. 0986
Carlson, G.P. 0746
Casse 0043
Cauvet, C. 0044
Chabala, C. 0450
Chacafi, M. 0801
Chaidirek, P. 0848
Chakkaphak, C. 1209
Cham, P.A. 0451 1117
Chan, L.C. 0717 1001
Chandler, M.L. 0829
Chantalakhana, C. 0211 0767 0768 0848
Chau Ba Loc 0055
Chaudhuri, D. 0254
Chelemu, K. 1178
Chem, A.M.J. 0802
Chepete, E.M. 0452
Chiche, J. 0613
Chikwanda, B. 0727
Chimganda, D. 0267
Chimwaza, J. 1118
Chin, L.K. 0987
Chiteta, K. 0453
Chiumia, R.B.C. 0454
Chivers, K. 0045
Choudhary, M.A. 1119
Chu, C.L. 0705
Cissoko, C.O. 0519
Cockrill, W.R. 0046 0047 0048 0049 0706
Cockrill, W.R. (ed.) 0707
Coleman, V. 0663
Collins, E.V. 0809 0810
Conroy, D. 0938
Constantinesco, I. 1120
Cooke, F.C. 0802
Coon, C.N. 0824
Copland, J.W. 0050
Coppock, D.L. 0212
Corbel, H. 0606 0607 0608
Cordero Quesada, W. 1327 1328 1329 1330
Cornelius, D.W. 1331
Cossins, N.J. 0386
Coulibaly, D. 0295
Coulibaly, D.B. 0803
Courtney, C.C. 0792
Crawford, E.W. 0597 0609
Creasey, J.S. 0051 0052
Croxton, S. 0213
Culbertson, C.C. 0809 0810
Dalgliesh, R.J. 0748
Dalzell, R. 0053
Dam, K. van 1121
Danckwerts, B. 0988
Darsana, R. 0752
Dawa, O. 0296

Dawson, W.M. 0890
DeBoer, A.J. 0610
Delamarre, M.J.-B. 0939 1137
Delgado, C.L. 0611 0612
Delobre, J. 0571
Demain, H.M. 1122
Deshpande, S.D. 0989 0990 0991
Devadattam, D.S.K. 0861 0891 0892
Devnani, R.S. 0940 0941 0942 1127
Diallo, A.K. 0455
Dibbits, H.J. 0375 0456 0457 0893 0943 0944 0945 0946 0947 0948 1188
Dicko, M.S. 0458 0804
Dihenga, H. 1261
Dili, D.B. 0884
Dima, S.A. 0054
Dineur, B. 0708
Diomande, V. 0198
Diop, A.T. 0214
Diouf, B. 0636
Dixon, J. 0372
Doerksen, A. 0459
Dogbe, L.A. 1093
Domingo, M. 0215
Donahue, R.L. 0075
Donovan, G. 0460
Dorward, D.C. 0747
Dossou, R. 0216
Dronne, M. 0668 0669
Duchenne, T. 0709 0949
Dugue, P. 1262
Dumas 0043
Dumas, R. 1123
Duret, T. 1263
Durkin, J.W. 0155 0242
Dutta, S. 0908
Dwaraknath, P.K. 0842 0843 0844 0873
Dyck, E.H. 0992
Dyrendhal, S. 0894
Edwards, R. 0217
Ehrlein, H.-J. 0852
Elhimdy, B. 0613
Elkington, P. 1332
Ellis, J.E. 0212
Ellman, A. (comp.) 1124
Elmer, L.A. 0710 0711
Engelihardt, W.V. 0852
Esbroeck, D. van 0479
Esparon, N.M. 0614 0615
Evans, C.L. 0377
Eyre, C.V. 0461
Fall, A. 0218 0295 0462 0463 0464 0636 1125
Falvey, J.L. 0055 0056
Farouk, S.M. 1212 1213
Farrington, J. 0219 0654
Farrington, T. 0220
Fauzi, S. 0752
Faye, A. 0137 0221 0222 0223 0224 0247 0640
Faye, A. (ed.) 0143
Fenton, A. 0950 0951
Ffoulkes, D. 0780 0805 0806 0866
Fielding, D. 0225 0993
Fieldson, R.S. 1165
Finn, S. 1299
Fischer, R. 0465 0712 0713
Fischer, R.C. 1209
Fitzpatrick, J. 0994
Fletcher, I.C. 0780
Fleur, D.-G. 1264
Flora, C.B. (ed.) 0226
Fofana, A. 0256
Fort, J. 0227
Foster, J.D.G. 1126
Fournier, A. 0228
Francis, P.A. 0229 0230
Frankenberger, T.R. 0231
Freeland, D.V. 0884
Freitas, E.K. (ed.) 0754
Frisch, J.E. 0778
Froese, C. 0952
Fujioka, K. 0057
Gai, B. 0763
Gaihotra, M.M. 0867
Garcete, E. 0994
Garg, B.K. 1127
Garg, S.K. 0873
Garillo, E.P. 0895
Garin 0043
Garin, P. 1282
Garner, J.K. 0953
Gaudefroy-Demombynes, P. 0769
Gauthier-Pilters, H. 1300
Gboku, M.L.S. 0670 0671
Gefu, J.O. 0058 0232
Gemmill, G.T. 0616
Georgie, G.C. 0849 0870
Gerner-Haugh, I. 0470
Getachew Asamenew 0233 0240 0242 0258 0617
Ghodake, K.G. 0639
Ghodake, R.D. 0529 0602 0618 0672
Gibb, J.A.C. 1128
Gibbon, D. 0034 0073 0511 0663 0702 0799 1108 1129 1130 1131 1153 1155 1265
Gifford, R.C. 0059 1132
Gilbert, E. 0365 0763
Gill, G.J. 0234
Gill, R.A. 0789
Gladden, R. 1133
Gninofou, A. 0714
Goe, M.R. 0060 0061 0062 0063 0064 0235 0236 0239 0466 0480 0533 0572 1318
Goel, B.B.P.S. 0065
Goubert, D. 1301
Goyal, D. 0619 0624
Graham, N.McC. 0807
Gray, R. 0850
Green, D.A.G. 0075
Gregoire, R. 0237
Gryseels, G. 0063 0155 0238 0239 0240 0241 0242 0282 0467 0782
Gueguen, R. 1134
Guevara, O.L. de 1167 1199
Guha, H. 0920
Guillet, I. 0715
Guilman, D. 1135
Gunawan, B. 0770

Gunthart, A. 0954 0955
Gupta, A.K. 0657
Gupta, B.N. 0837
Gupta, V.K. 0872
Guzman, M.R. de Jr. 0243 0244
Gwani, E.S. 0058 1136
Habshey, T.M. 0995
Hall, W.C. 0851
Hamon, R. 0771 0772
Harder, J. 1275
Harder, K.K. 1275
Harouna, S.A.S. 0468
Hart, E. 0066 0067
Hartley, K.T. 0808
Hartmann, K. 0469
Harvey, A.L. 0809 0810
Harvey, J. 1129 1153 1265
Haudricourt, A.G. 1137
Haugh, H. 0470
Havard, M. 0222 0245 0246 0247 0248 0281 0299 0471 0472 0473 0474 0475 1138 1139 1140 1141 1142 1266
Havnevik, K. 1185 1186
Hawkes, M.D. 1333
Hayes, J.A. de 0196
Hayton, S. 0913
Hedman, L. 1334
Hedrick, D.S. 0992
Heinrich, G. 0813
Henderson, A.J. 0068
Her[illegible], J. 0476
Hervlot, G. 1267
Hermans, C. 0620
Hermoza, R. 1199
Heslop, C. 1129
Hill, D.H. 0749
Hintz, F. 0823 0864
Hinz, H.-J. 0996 0997
Hodjakpodji, C. 0249
Hoffmann, D. 0748
Hoffmann, D. (ed.) 0069
Hofkes, E. 1302
Hogan, J.P. 0535 0833 0846
Holmes, A. 0850
Hopfen, H.J. 1143 1144
Hopkins, E. 0621
Hornicke, H. 0852 0853
Hornsby, R. 1145
Horowitz, M.M. 0673
Horspool, G.D. 0477 0540 1146 1147 1148 1149 1150
Horst, P. 0762 0788
Hossain, M.M. 0956
Hoste, C. 0715
Houndekpondji, G. 1019
Howard, C.R. 0070
Howe, J. 0998
Howell, J.M. 1151
Howell, P.J.L. 0910 1152
Hrabovszky, J. 0001 0811
Hubbard, K. 1153 1265
Huelst, H. von 0071
Huet, P. 0478
Hughes, I.M. 0824
Humer, I.F. 1335
Hume, I.D. 0821
Hussain, A.A.M. 0250
Hussain, M.D. 0956
Hussain. A.A.M. 0956
Huybens, E. 0251 0479 0622
Hyernaud, J. 0252
Ibrahim, M.N.M. 0812
Ikavalko, E. 0233
Ikede, B.O. 0749
Imboden, R. 0468 0480 0526
Immers, B.H. 0999
Ingawa, S.A. 0179 0645
Ingram, J.F. 0847
Inns, F. 0072 1154 1268
Islam, A. 0759
Islam, S.O. 0481 1269
Ismail, A. 0722
Iversen, E.H. 1000
Jabbar, M.A. 0783
Jacobi, C. 1303 1304 1305 1306 1307
Jacobs, G. 1314
Jaeger, R. 0482
Jaeger, W.K. 0253 0623
Jagne, N.T. 0483
Jainudeen, M.R. 0784
James, D.P. 0631
Jana, D.N. 0254
Jannaud, G. 0255
Janzen, N. 0459
Jarju, S.M. 0484
Jay, G. 0485
Jayasuriya, M.C.N. 0814
Jeanrenaud, J.P. 0073 0702 1155
Jego, Y. 0323
Jennings, B.A. 1156
Jimenez, F. 1328
Jimenez, R.R. 1216
Johnston, B.F. 0674 1203 1221
Johnston, B.F. (ed.) 1244
Jones, A. 0675
Joshi, B.R. 0619 0624
Joubert, M. 0814
Jourdain, G. 0256
Jutzi, S. 0233 0257 0258 0486 0487 0617 1157
Kabeya, D.S 0488
Kalb, D. 0676
Kalkat, H.S. 1158
Kalla, J.C. 0624
Kallah, M.S. 0304
Kamara, J.A. 0489
Kampen, J. 0197
Kamuanga, M. 0308
Kantao, A. 0383 0384
Kanu, B.H. 0490 0491 0573 0716 1159
Kapesebele, P.M. 0492
Kapinga, C. 0750
Karbe, E. (ed.) 0751
Kartiarso 0798 0860
Kasryno, F. 0493
Katsina, A.L. 0259
Kaufmann, R. von 0820

Kaul, R.N. 1158 1202 1270
Kaushal, M.L. 1308
Kayumbo, A.K. 0260 0261 1160
Keegan, T. 1271
Kehoe, M.M. 0705 0717 1001
Keijzer, N. 0479
Kellermann, J. 0255
Kemp, D.C. 0600 0896 0897 0898 0905 0910 0911 0912 1161 1162
Kennedy, P.M. 0846
Kenyon, S. 0752
Ker, A.D.R. 0494
Kerman, C. 0957 1163
Khelil, M.K.B. 1164
Khepar, S.D. 1308
Kibler, H.H. 0854
Kibria, Q.G. 0262 0263
Kidd, D.W. 1175
King, J.G.M. 1002
Kinsey, B.H. 0625
Kinsey, B.H. (ed.) 1021
Kirk, M. 0264 0265
Kivikko, R. 0958 0959
Kjaerby, F. 0074 0495 0496 1185 1186
Klaij, M.C. 0185 1272
Kleene, P. 0548
Kline, C.K. 0075
Klutse, A. 0589
Klutse, M. 0753
Koch, B. 0813 0850
Kokoye, S.J. 0626
Konanta, C. 0899
Konanta, S. 0899
Kone, B. 0497
Koroma, B. 0665
Koroma, J. 1309
Kramer, D. 0960
Krantz, B.A. 0266
Kreider, J.L. 0792
Kristoferson, L. 0076
Kroeker, D. 0459
Kruit, F. 0498
Kshirsagar, K.G. 0184 0529 0639 1165
Kumar, A. 0970
Kumarasuntharam, V.R. 0814
Kume, S. 0871
Kumwenda, W.F. 0077 0267
Kundu, P.B. 0078
Kunkwenzu, E. 0267
Kutzbach, H.D. 0982
Kwiligwa, E.M. 1010
Lacca, M.L. 0498
Lachaux, P. 0366 0367
Ladrette, C. 0546
Lal, H. 1166 1273
Lall, H.K. 0785
Lamb, R.C. 0855
Lambourne, J.L. 0815
Landais, E. 0268 0445
Landais, E. (ed.) 0499
Langdon, J. 0079
Lassailly, F. 0080
Lassiter, G.C. 0597 0609
Laurent, C.K. 0269
Lawrence, P.R. 0816 0869 0900 0901 0902
Lawson, L.T. 0500
Leaman, S. 0501
Leavis, H. 0745
Lecca, M. 0724 0725 1180
Lee, P.G. 0502
Leese, A.S. 0718
Legast, P. 0503
Lekezima, P. 1274
Lemmer, von B. 0719
Leng, A. 0856
Leng, R.A. 0821
Leonard, A.G. 0720
Leroy, E. 0753 0754
Lewis, J. 0270
Lewis, L.D. 0829
Lewis, R.E. 0845
Lexa, J.P. 0271
Lhoste, P. 0081 0272 0273 0274 0275 0504 0640 0721
Lianabo, S. 0276
Liang, J.B. 0722
Lichte, J.A. 0102 0116 0505
Liem, C. 0534
Limsakul, A. 0899
Lippitz, K. 0277
Litschauer, J.G. 0506
Lloyd, D.H. 0755
Loewen-Rudgers, L. 1275
Losch, B. 0507
Lowe, P. 1303 1304 1305 1306 1310 1311 1312
Lugassy, J. 1122
Lumphezi, E.Y.K. 1276
Lungwitz, A. 0723
Luque, V.R. 1167
Luthra, P.L. 1191
Lyimo, E.S. 0508
Lyons, T. 1168
Ma'sum, K. 0764
Mack, R.-P. 0509
Mack, von R.P. 0903
Mackay, B. (comp.) 1124
Mackenzie, P.K.I. 0745
Macmillan, R.H. 0904
Macpherson, G.A. 1169
Madan, M.L. 0878 0879 0880 0881 0925 0926 0928
Madeley, J. 0510
Madjid, R. 1170
Madsen, M.A. 0915
Magumise, J. 0727
Mahabile, W. 0850
Mairs, T.I. 1003
Major, J.K. 1313
Makin-Taylor, D.C. 0082
Malcolfe, C. 0196
Maldonado, S.J. 1221
Malipaard, E.J. 0999
Malle, B.N. 1171 1172
Maloly, G.M.O. 0857 0858 0859
Mamane, Y. 1256
Mamtani, I.J. 1011

Mandjoba, C. 0445
Mangurkar, B.R. 0889
Manigui, A.S. 0278
Marong, A.J. 0484
Marti, A. 0083 0084
Martin, A. 0511
Martin, D. 0860
Mase, C.L. 0452
Maseng, L. 1314
Masikara, S. 0813
Mason, I.L. 0085
Mata Acuna, D. 1336
Mathers, J.C. 0817 0818
Mathieu, P. 0279
Mathur, D.C. 0657
Mation, P.J. 0086 0116 0512 0513
Matswe, S. 0506
Matthewman, R.W. 0786 0818
Matthews, M.D.P. 0905 0906 0961 0962 1173 1174 1247 1248 1249 1277
Mattho, W. 0813
Mattick, A. 0087
Maurya, N.L. 0861 0892 0907
Mavua, J.K. 0324
Mayande, V.M. 1103 1165 1175 1176 1177
Maynard, T.G. 0280
Mbengue, H.M. 0248 0281
McDowell, R.E. 0060 0088
McEvoy, M.G. 0559
McIntire, J. 0233 0282 0512 0611 0612 0617 0627 0628 0629
Mckenzie, F. 0089
McKinlay, W. 0756
Meda, M. 0819
Medenou, K.C. 0278
Meier, H. 1167
Meijer, R.A. 0514 1178
Meixner, R. 0855
Menon, R.G. 1179 1224
Merafe, Y. 0515 0630
Merwe, H.J. van der 0730
Mesfin Abebe 0257
Mettrick, H. 0516 0631
Michael Hailu 0061
Michieka, R.W. 1188
Micuta, W. 0963 0964
Mignolet, B. 0724 0725 1180
Mirchaulum, P.T. 0283
Mishra, D.K. 0632
Mishra, M. 0885
Mishra, T.N. 0970
Moens, A. 0517
Mohamed-Saleem, M.A. 0820
Moigne, M. le 0090 1181
Momongan, V.G. 0773 0787
Monnier, J. 0091 0092 0445 0633 1182 1183 1184 1278
Moody, T. (comp.) 1124
Morales, E. 0994
Moreno Rico, D. 1217 1219
Morieres, G. 0708
Morin, J.-P. 0284
Mothander, B. 1185 1186
Msango, A.S.D. 0634
Muchiri, G. 1187 1188
Mudimu, G.D. 0285
Muharam. E.H. 1341
Muiruri, H.K. 0286
Mukai, A. 0871
Mukherje, D.P. 0908
Mullen, P.A. 0862
Muller, H.E. 0287 1004
Mulugetta Mekuria 0372
Mungroop, R.R. 0518 0519 0546 0548 0726 1189
Munzinger, P. 0093 0288 0520 0521 0522 0523 0588 0635 1279
Munzinger, P. (ed.) 0094
Murray, R.M. 0846
Musa, H.L. 0289 0290 1190
Musangi, R.S. 0291
Mwaita, S.K. 1269
Mwinjilo, M.L. 0292
N'Daw, P. 0192
N'Diaye, A.D. 0677
Nagaiah, B.B. 0734
Nagpaul, P.K. 0909
Naik, V.A.P. 1005
Nair, K.N. 0095 0293
Namane, T. 1207
Nana 0364
Nangia, O.P. 0863 0867 0872 0873
Nari, J. (ed.) 0069
Nasir, A.M. 0722
Nauleau, G. 0294
Nayak, J.B. 0885
Ndiame, F. 0218 0295 0524 0636 0637 1125
Ndiame, F. (ed.) 0142
Ndiaye, A.L. 0296
Neil, A.J. 0322
Nelson, W.E. 0832
Nelson-Fyle, M.R. 0678
Neogi, A.K. 0920
Neric, S.P. 0828 0895
Neugbauer, J. 0727
Neunhauser, P. (ed.) 0525
Newham, M. 0076
Nguyen, B.P. 0297
Nhieu, J.T. van 0298
Niang, L. 0221 0640
Niang, M. 0299
Nicolas, F. 0366 0367
Nielsen, K. 0498
Nielson, H. 0965
Nirmal, T.H. 1191
Nolle, J. 0096 1192 1193 1194 1195 1196 1197 1198
Norman, D. 0630
Nourrissat, P. 0300
Nsibande, J.M. 0301
Nunez, D. 1199
Nyirongo, K.G. 1200
O'Neill, D.H. 0910 0911 0912 0913
O'Neill, M.K. 0526
Odell, M.L. 0302
Ogborn, J.E.A. 1201

Ogier, M. 0527
Ogungbile, A.O. 1202
Ojha, T.P. 0983 0990 0991
Oldenhof, M.J.H. 0999
Oli, K.P. 0303
Olmstead, A.L. 1203 1221
Olorunju, S.A.S. 0232 0304
Oluoch-Kosura, W. 0638 1188
Onwan, N. 0899
Onyango, S.O. 0528
Oppen, M. von 0529 0639 0653
Orev, Y. 0097 0966 1280
Orsini, J.P.G. 0640
Orton, R.K. 0821
Otchere, E.O. 0058 0232 0304
Oule, J.M. 0822
Outtara, Z. 0530
Oxley, J. 0102
Pagau, J.D. 0823
Paice, M.E.R. 0910 1152
Pandey, K.P. 0983
Pandey, M.M. 1287
Pandey, R.N. 0632
Pandey, V.K. 0632
Panin, A. 0641 0642 0643
Pargasam, A.R.A. 1315
Parker, B.A. 0773
Parmar, D.J. 0335
Parthasarathy, N.S. 1006
Partoutomo, S. 0757
Patel, K.V. 1241
Pathak, B.S. 0531 0728 0914 1204 1205
Patterson, P.H. 0824
Payne, I. 0747 0758
Pazan, J.D. 0864
Pearson, R.A. 0729 0818 0865 0875 0900 0902
Perdok, H.B. 0814 0825
Pereira de Rezende, C.A. 0098
Perkins, J. 0329 0364 0535 0644
Perkins, J.A. 0099
Persoons, C. 0532
Petheram, R.J. 0305 0329 0364 0533 0534 0535
Petheram, R.J. (ed.) 0069
Peyre de Fabreques, B. 0715
Phillip, D.O.A. 0645 0646 1202
Phillips, R.W. 0915
Pietersen, R. 0866
Pilson, R.D. 0745
Pingali, P.L. 0100 0101
Plessard, F. 1184 1316
Poats, S.V. 0102
Poitrineau, E. 0536
Polhill, R.T. 1269
Polikhronov, D.S. 0306 0307
Pollard, S.J. 0647 0648 0649
Pollmann, U. 0853
Posner, J.L. 0308
Potter, G.D. 0792
Pousset, J. 0103
Pragasam, A.R.A. 0967
Pretot, C. 0192
Price, E. 0537
Prinz, D. 0309
Priyo, Y. 0764
Pullen, D.W.M. 1173 1174
Purohit, M.L. 0656
Qiang, W.M. 0310
Quines, O.D. 0895
Quinn, C.R. 0829
Rahman, A. 0759
Rakotovaovahy, M.R. 0311 0312
Rakotovoavahy, M.R. 0313
Ramaiyan, G. 1006
Ramanma, R. 0662
Ramaswamy, N.S. 0104 0105 0106 0107 0108 0109 0110 0111 1007
Rana, R.D. 0863 0867
Ranjhan, S.K. 0773 0895
Rao, A.R. 0314
Rao, M.V.N. 0826 0837 0876 0877 0881 0909 0916 0917 0925
Rapte, S.L. 0918
Rastogi, B.K. 0650
Rauch, F. 0309 0315
Raut, K.C. 0827
Rautaray, S.K. 0919
Ravindran, S. 0760
Raymond, G. (ed.) 0112 0113
Razdan, M.N. 0849 0870
Reddy, C.V. 0114
Reddy, M.S. 1284
Reddy, S.K. 0538
Reddy, Y.V.R. 0650
Reed, J.D. 0791 0831
Reh, I. 0316 0761 0762 0788
Reis, O.G. 1206
Rempel, E. 0459 1275
Remy, G. 0539
Renaut, G. 0317
Reynolds, L. 0318
Ribeiro, J.M. de C.R. 0868
Richard, D. 0715
Richards, J.I. 0869
Richardson, G.L. 1207
Riches, C.R. 0220 0540
Rickards, C.E. 1208
Rico, D.M. 1220
Rizwan-ul-Muqtadir 0789
Robinson, D.W. 0319
Robinson, G. 0320
Rocha, A. 0321
Rochez, A. 0541 0542 0543 0544
Rodriguez, E.O. 1337
Roesyat, A. 0362
Rojanasaroj, C. 1209
Rollins, W. 0774
Rollinson, D.H.L. 0322
Romero, G. (ed.) 1180
Ronohardjo, P. 0757
Roosenberg, R. 0679 0958 0960 1210
Ross, S.D. 0808
Rossi, M.T. 0651
Rossler, E. 0323
Rouge, B. 0115
Roux, L.L. 0730
Roy, S.R. 0920

Rukandema, M. 0324
Rusastra, I.W. 0364 0493
Russo, S.L. 0102
Ryan, J.G. 0363 0652 0653 0655 0672
Ryan, J.G. (ed.) 0680
Ryan, M. 0654
Saadullah, M. 0325
Sabi, I. 0326
Sahu, S.D. 0327
Salas, G.G. 0895
Sall, S. 0308
Salle, B. 0328
Salmon, D.J. 0545
Sambou, P. 0731
Sanborn, J.W. 1211
Sandhu, R. 0678
Sangare, M.I. 0546 0547 0804
Sanghi, N.K. 1175
Sangle, R.D. 0184 1177
Sanogo, B. 0548
Sanogo, M. 0519
Santos, E.B. de los 0773
Santoso 0329 0330 0364
Sargent, M.W. 0116
Sarin, R. 0652 0655 0672 1175 1176
Sarkar, J. 0331
Sarker, M.M. 1212
Sarker, M.N. 1213
Sarr, D.M. 0332 0484
Sarr, D.Y. 0221
Sasimowski, E. 0117 0732 0775
Sastry, N.S.R. 0733 0849 0870
Sathasivampillai, R. 0333
Sayer, W. 1214
Scheinman, D. 0549
Scheper, W. 0550
Scherrer, J. 0334 0968
Schleich, K. 0551 0552
Schmidt Leplaideur, M.-A. 0118
Schmidt, H. 0593
Schmitz, H. 1281
Schneider, R.M. 1008
Schwartz, H.J. 1009
Scott, J.M. 0744
Second, C. 0084
Sehara, D.B.S. 0656
Semall, A. 0644
Senakas, U. 0828
Sene, M. 1282
Serafini, P.G. 0185 1272
Serrano, R. 1328
Seubert, C. 1215
Shankar, J. 0335
Shapiro, B. 0526
Sharma, K.C. 0119
Shetto, R.M. 0921 1010
Shibata, M. 0871
Shulman, R. 0336
Shumba, E. 0337 0338
Sidibe, C. 0553
Sigaut, F. 0120
Simatupang, P. 0493
Simon, J.A. 1220
Sims, B.G. 0554 0555 0913 0922 1203 1216 1217 1218 1219 1220 1221 1231
Sindazi, M. 0457 0556
Singa, D.D. 0339 0340
Singh, B. 1222
Singh, C.B. 0909
Singh, D. 0341
Singh, I.J. 0314
Singh, J. 0657
Singh, K. 1115
Singh, K.B. 0065
Singh, N. 0842 0863 0867 0872 0873
Singh, R.A. 0733
Singh, R.K. 0341
Singh, R.P. 0529 0639 0970
Singh, V. 0734
Singh, V.K. 0341
Singhal, O.P. 0923
Siriweera, W.I. 0342 0343
Sisler, D.G. 0658
Sitorus, P. 0362
Situmorang, P. 0779
Sivaguru, N. 1011
Sizilande, B.J. 0344
Skaar, R. 1338
Skromme, L.H. 0121
Slade, L.M. 0829
Sleeper, J.A. 0345 0659
Slingerland, M.A. 0924
Smid, J. 0346
Smith, A.J. 0122 0123 0124 0125 0557 0735 0818 0830
Smith, D.J. 1223
Smith, H.H. 0915
Smith, T.L. 0347
Smotzok, M. 0558
Sneddon, J.C. 0818 0874
Snyman, N. 1317
Soejoto, B. 0559
Soewito 1341
Soko, D.L. 0560
Sokona, F. 0561
Solberg, B. 1338
Soller, H. 0831
Sommer, W. 0562
Sonko, M.L. 0348 0349 0636
Soto, S.D. 1339
Soumare, S. 0350 0835 0836
Sowe, J. 0763
Spencer, D.S.C. 0351 0352
Spurgeon, D. 0353
Srisan, Y. 0899
Srivastava, K.L. 1100
Srivastava, N.S.L. 0563 0919 1179 1224
Starkey, M.P. 0139
Starkey, P.H. 0102 0126 0127 0128 0129 0130 0131 0132 0133 0134 0135 0136 0137 0138 0139 0140 0141 0181 0354 0355 0356 0357 0358 0359 0360 0480 0564 0565 0566 0567 0568 0569 0570 0571 0572 0573 0574 0575 0576 0577 0578 0579 0660 0681 0736 0737 0776 0969 1012 1225 1226 1227 1228 1229 1230 1231 1283 1318
Starkey, P.H. (ed.) 0142 0143

Steiner, K. 0551
Steinfold, H. 0682
Stephen, J. 0361
Stevenson, P. 0757
Stillions, M.C. 0832
Stokes, A.R. 1232
Stout, B.A. 0075
Strubenhoff, H.W. 0661
Sturgess, N.H. 0614
Subandriyo 0362
Subrahmanyam, K.V. 0363
Sum, M. 0087
Sumanto 0329 0330 0364 0534
Sumberg, J. 0365 0763
Sundaresan, D. 0144 0887
Svendsen, E.D. (comp.) 0738
Swamy Rao, A.A. 0934
Swift, D.M. 0212
Tacher, G. 0366 0367
Taddesse Tessema 0385
Talmi, V. 0619
Talish, J.A.R. 1319 1320
Takenaga, T. 1094 1096 1097
Tapson, D. 0368
Taregue, A.M.M. 0369
Tchougoune, M. 0370
Teclemariam Berhane 1233
Tsleni, E. 0535 0833 0860
Tembo, S. 0371
Teslaye Zegeye 0372
Teuscher, T. 0903
Thahar, A. 0305
Thiam, A. 0221
Thiou, G. le 0580 1234 1235 1236
Thierstein, G.E. 0602 1101 1102 1104 1175 1176 1237
Thomas, B.H. 0809 0810
Thomas, C.K. 0733 0875
Thomas, T. 1321
Tibbs, P. 0581
Tinker, D.B. 0582
Tomar, S.S. 0923
Toulmin, C. 0373
Toure, A. 1286
Toure, G. 1013
Toure, M. 1286
Tourte, R. 0834
Traore, A. 0547 0835 0836
Traore, B. 0583
Traore, M. 0584
Traverse, S. 0585
Travis, L. 0145
Treephan, V. 0899
Tumwasorn, S. 0777
Upadhyay, R.C. 0739 0826 0837 0876 0877 0878 0879 0880 0881 0916 0925 0926 0927 0928 0929
Uzureau, C. 0146 1238
Veerenbergh, R. van 0586
Vail, D.J. 0683
Valtilingom, G. 1239
Vannoppen, J. 0479
Vargas, J.M. 1167
Varma, S.R. 1240
Varshney, A.C. 1241
Varshney, B.P. 0970 1222
Vaugh, M. 0971
Veerasit, P. 0848
Venkataram, J.V. 0662
Vera, E. 1167
Verbeek, A.C. 0587
Vercoe, J.E. 0770 0778 0882
Verhaeghe, H. 0660 1225 1283
Verma, S.R. 1308
Viebig, U. 1242
Vierich, H. 0512 0513
Vietmeyer, N. 0147 0972
Virmani, S.M. 0197 1284
Vis, J. 1340
Wagner, C.M. 0588
Wahg, L.N. 1243
Wahid, A. 0883
Wainaina, C.K. 0647 0648 0649
Walker, T.S. 1165
Walley, V.P. 0740
Walters, J.L. 0855
Wanapat, M. 0838 0839
Wanders, A.A. 0517
Wartono Kadri 1341
Watson, P. 0148
Webster, A.J.F. 0868
Woll, P.M. 0374
Wenger, H. 0973
Weniger, J.H. 0903
Westley, S.B. (ed.) 1244
Westneat, A.S. 0589
Weston, R.H. 0840
Wevers, J.D.A. 0375
Whalen, I.T. 0590
Whalley, J. 0376
White, P. 0178
Wiggins, L.L. 0377
Wignolle, P. 0790
Wilcock, D. 0597
Wilde, J.C. de 1245
Wilfred, N.M. 0591
Willcocks, T.J. 0930 1246 1285
Willey, R.W. 1284
Williams, K. 0847
Wilson, A.J. 0757
Wilson, R.T. 0004 0378 0379 0380 1014 1015 1016
Windsor, R. 0850
Winugroho, M. 0535 0779 0841
Wiseman, R.F. 0741
Yamashita, L.M. 1167
Yang-Lian, F. 0381
Young, B.A. 0778
Yousef, M.-K. 0884
Zambrano, L. 1167
Zarembka, D. 0149
Zelleke Getahun 0815
Zerbo, D. 0382 0383 0384 1286
Zulbendi, M. 0362
Zweier, K. 0592 0684

COUNTRY INDEX

Africa
0002 0003 0007 0008 0016 0028 0038 0060 0063 0081 0085 0093 0094 0112 0113 0126 0129 0130 0133 0136 0225 0237 0296 0409 0499 0586 0629 0635 0676 0751 0761 0776 0830 0831 0943 0993 0999 1012 1019 1021 1201 1204 1227 1230 1242 1297

Algeria
0136 0986

Angola
0136 0320

Arid Zones
0212 1144

Asia
0016 0018 0060 0085 0107 0109 0129 0138 0243 0244 0531 0586 0620 0767 0777 1204

Australia
0019 0533 0846

Bangladesh
0019 0234 0250 0262 0263 0325 0331 0369 0620 0631 0759 0783 0800 0903 0956 1212 1213 1292

Benin
0136 0146 0151 0183 0186 0216 0249 0278 0394 0396 0406 0428 0429 0430 0435 0527 0536 0541 0626 0679 0691 0708

Bolivia
0020 0023 1167

Botswana
0023 0027 0136 0159 0169 0173 0217 0220 0302 0361 0393 0395 0397 0398 0400 0401 0403 0410 0416 0424 0426 0427 0443 0452 0477 0502 0506 0515 0540 0545 0572 0630 0658 0813 0850 0930 0952 0966 1035 1041 1042 1079 1116 1126 1133 1153 1161 1235 1265 1280 1285 1314

Brazil
0098 0170 0347 1107 1110 1206 1263 1281

Burkina Faso
0037 0086 0136 0174 0196 0201 0202 0203 0253 0294 0399 0480 0504 0512 0513 0539 0597 0605 0627 0687 0690 0697 0721 0819 0822 0979 1122 1235 1262 1267 1290 1291 1298

Burundi
0136 0482 0936

Cameroon
0136 0156 0180 0228 0264 0265 0309 0315 0391 0503 0510 0525 0550 0551 0552 0588 0591 0592 0684 0690 0712 0713 1123

Central Africa
0009 0318 1124

Central African Republic
0136 0252 0255 0690 1290 1291 1298

Chad
0136 0268 0366 0367 0668 0669 1135

Chile
1331 1337

China
0019 0039 0049 0310 0381

Comoros
0136

Congo
0136

Costa Rica
0019 0020 0023 0735 1326 1327 1328 1329 1336

Côte d'Ivoire
0092 0136 0192 0193 0198 0207 0317 0444 0504 0507 0530 0690 0721

Developing Countries
0001 0025 0035 0041 0050 0071 0076 0103 0106 0107 0108 0109 0110 0120 0121 0122 0124 0132 0709 1131 1144 1154

Djibouti
0136

East Africa
0009 0143 0149 0494 0625 0683 0794 1124

Egypt
0136 1310

Equatorial Guinea
0136

Ethiopia
0005 0136 0138 0150 0154 0155 0164 0233 0235 0238 0239 0240 0241 0242 0257 0258 0353 0372 0377 0385 0386 0390 0392 0405 0407 0416 0466 0467 0480 0486 0487 0533 0582 0595 0617 0682 0744 0782 0791 0815 0901 0910 1015 1017 1018 1029 1049 1050 1051 1052 1053 1054 1057 1058 1059 1060 1061 1062 1063 1068 1111 1157 1205 1233 1247 1248 1249 1250 1260 1264

France
0103 0112 0284 0323 0604 0709 0939 1110 1127 1235

Francophone Africa
0057 0090

Gabon
0136

The Gambia
0011 0136 0138 0157 0332 0365 0374 0404 0421 0433 0451 0461 0483 0484 0516 0575 0675 0763 1117 1162 1173 1174

Ghana
0136 0346 0641 0642 0643 0695 0793

Guinea
0037 0136 0181 0194 0195 0251 0288 0455 0622 0766

Guinea Bissau
0136 0557

Honduras
1167

Humid Zones
0318

India
0015 0019 0020 0023 0065 0078 0104 0105 0108 0111 0114 0119 0152 0165 0166 0185 0197 0210 0254 0293 0314 0327 0335 0341 0363 0440 0442 0529 0531 0563 0601 0602 0618 0619 0624 0632 0639 0650 0652 0653 0655 0656 0657 0672 0686 0733 0734 0781 0785 0827 0842 0867 0881 0885 0887 0889 0907 0909 0910 0911 0912 0917 0918 0919 0920 0923 0925 0934 0935 0940 0942 0970 0971 0983 0989 0990 0991 0995 1005 1006 1007 1011 1026 1031 1032 1033 1037 1080 1096 1104 1105 1115 1127 1128 1161 1165 1166 1175 1176 1177 1179 1191 1214 1222 1224 1230 1237 1240 1243 1284 1287 1308 1315 1325

Indonesia
0307 0319 0322 0329 0330 0364 0493 0531 0533 0535 0559 0598 0614 0615 0644 0752 0757 0764 0780 0798 0841 0846 0866 1170 1341

Iran
1088

Kenya
0019 0020 0136 0163 0167 0172 0212 0286 0324 0416 0417 0481 0514 0528 0572 0593 0638 0647 0648 0649 0674 0689 0710 0711 0857 0858 0859 0932 0943 0944 0945 0946 0947 0963 1009 1021 1041 1042 1187 1188 1244 1269

Latin America
1167 1230

Lesotho
0027 0136 0361 0521 1039 1197 1207

Liberia
0136 0570

Libya
0136

Madagascar
0007 0092 0136 0298 0311 0312 0313 0318 0968 1046 1055

Malawi
0027 0077 0136 0267 0292 0339 0340 0344 0454 0520 0574 0599 0616 0634 0688 0704 0965 1021 1113 1114 1118 1146 1147 1148 1149 1150 1276 1331 1332 1333 1338

Malaysia
0053 0717 0722 0987 1091

Mali
0136 0146 0256 0270 0336 0350 0373 0380 0382 0383 0384 0405 0414 0470 0497 0504 0517 0518 0519 0532 0538 0546 0547 0548 0553 0561 0576 0579 0580 0583 0584 0587 0673 0677 0690 0701 0721 0726 0796 0801 0803 0819 0835 0836 1013 1016 1099 1121 1134 1161 1171 1172 1189 1253 1286

Mauritania
0136 1300

Mexico
0020 0087 0554 0555 0922 1161 1203 1216 1217 1218 1219 1220 1221

Morocco
0136 0328 0613 1296

Mozambique
0027 0135 0136 0271 0318 0321

Namibia
0136

Nepal
0020 0023 0303

The Netherlands
1121 1340

Nicaragua
0205

Niger
0007 0115 0136 0171 0200 0227 0334 0370 0389 0408 0449 0458 0468 0478 0480 0498 0724 0725 0924 0982 1122 1180 1256 1257 1258 1272

Nigeria
0058 0136 0179 0199 0232 0236 0259 0269 0283 0289 0290 0304 0375 0645 0646 0755 0808 0820 1008 1022 1067 1136 1158 1190 1202 1232 1255 1270 1322

North Africa
0026 0138

Pakistan
0531 0601

Peru
0020 1040 1064 1167 1199

Philippines
0176 0531 0773 0828 0895 0906

Poland
0019 0117

Rwanda
0136 0175 0279 0446

Sahel
0237 0345 0526 0609 0611 0612 0804 0819 1272 1306

Samoa
0975

Savanna Zone
0113

Semi-Arid Tropics
0184 0185 0680 1094

Semi-Arid Zones
0266 0602 0627 0652 0674 0930 1096 1100 1103 1126 1236 1272 1297

Senegal
0011 0037 0092 0136 0137 0139 0146 0189 0190 0191 0214 0218 0221 0222 0223 0224 0245 0246 0247 0248 0272 0273 0274 0275 0281 0295 0299 0300 0308 0316 0348 0349 0447 0462 0463 0464 0471 0472 0473 0474 0475 0480 0504 0524 0603 0621 0633 0636 0637 0640 0690 0721 0731 0765 0769 0771 0772 0788 0790 0834 1112 1125 1138 1139 1140 1142 1181 1182 1183 1184 1210 1266 1278 1282 1290 1291 1294 1298 1301 1303 1304 1305 1306 1307 1316

Sierra Leone
0023 0127 0136 0142 0177 0181 0182 0208 0354 0387 0388 0436 0437 0438 0439 0441 0480 0489 0490 0491 0501 0564 0565 0566 0567 0568 0569 0571 0573 0577 0578 0581 0600 0606 0607 0608 0660 0664 0665 0666 0670 0671 0716 0736 0742 0743 0747 0756 0758 0976 1159 1225 1226 1283 1290 1291 1298 1309

Somalia
0136 0992

South Africa
0136 0187 0188 0368 0686

South-East Asia
0042 0211 0305 0535 0748 0839

Southern Africa
0009 0027 0794 1021 1124

Sri Lanka
0017 0019 0160 0219 0306 0333 0342 0343 0402 0531 0654 0812 0825 1320

Sub-Saharan Africa
0014 0021 0036 0037 0064 0100 0101 0131 0194 0195 0282 0351 0486 0663 0924

Subhumid Zones
0820

Sudan
0136 0168 0213 0231 0378 0379 0416 0504 0511 0740 1021 1041 1042 1056 1129 1239

Sudanian Zones
0345 0819

Swaziland
0027 0136 0301 0361 1215

Sweden
0894 1323

Switzerland
0932 0933 0954 0955 0963 0964 0973

Tanzania
0027 0072 0074 0136 0162 0260 0261 0411 0413 0416 0420 0448 0459 0469 0495 0496 0508 0523 0549 0572 0674 0750 0996 1002 1010 1021 1041 1042 1109 1120 1160 1185 1186 1261 1275 1335

Thailand
0610 0838 0839 0848 0899 0931 0953 1209

Togo
0136 0158 0215 0265 0326 0358 0423 0432 0434 0436 0476 0480 0500 0505 0522 0542 0543 0544 0589 0594 0651 0661 0679 0690 0694 0714 0753 0754 0797 1020 1074 1093 1151 1274

Tropical Africa
0006 0010 0022 0029 0031 0075 0206 0291 0628 1245

Tropics
0092 0277 0602 0650 0786 0876 0877 0879 0880 1100 1144

Tunisia
0087 0136 1164

Turkey
1324

Uganda
0054 0136 0416 0494 0674 0685 1021

UK
0019 0020 0023 0024 0051 0052 0066 0067 0079 0087 0099 0125 0735 0799 0905 0936 0950 0951 0977 0981 0985 1044 1127 1130 1145 1155 1223 1259 1271 1313

USA
0087 0226 0915

Vietnam
0297

West Africa
0011 0043 0097 0116 0128 0137 0138 0142 0143 0146 0182 0185 0207 0318 0345 0352 0359 0538 0579 0623 0659 0673 1238 1290 1291 1312

Zaire
0023 0136 0209 0276 0356 0479 0488

Zambia
0020 0027 0136 0178 0229 0230 0280 0287 0412 0415 0416 0419 0422 0450 0453 0456 0457 0492 0509 0556 0558 0560 0562 0999 1004 1021 1041 1042 1178 1200 1208

Zimbabwe
0023 0027 0070 0136 0285 0337 0338 0371 0416 0465 0667 0727 0745 0988 1066 1161

LIST OF ACRONYMS AND ABBREVIATIONS

AAASA	Association for the Advancement of Agricultural Sciences in Africa, Ethiopia
ACIAR	Australian Centre for International Agricultural Research
ADAS	Agricultural Development and Advisory Service (UK)
ADPDP	Animal Draught Power Development Project, Nairobi (Kenya)
AERLS	Agricultural Extension and Liaison Services, Ahmadu Bello University (Nigeria)
AETC	Agricultural Engineering Training Centre (Zimbabwe)
ALDEP	Arid Lands Development Programme (Botswana)
ALPAN	African Livestock Policy Analysis Network
AMP	autumn mouldboard plowing
APIS	animal power irrigation system
ARDP	Arssi Rural Development Project, Assela (Ethiopia)
ARDU	Arssi Rural Development Unit, Assela (Ethiopia)
ARTAP	Association de Recherche sur la Traction Animale et le Portage (France)
ARTI	Agrarian Training Institute, Colombo (Sri Lanka)
ASAE	American Society of Agricultural Engineers, St. Joseph
ASPAC/FFTC	Asian Pacific Carribean/Food and Fertilizer Technology Centre, Taipei City (Taiwan)
ATIP	Agricultural Technology Improvement Project (Botswana)
ATO	animal traction using oxen
ATR	animal traction
BBM	broad-bed maker
BCU	Botswana Cooperative Union
CAB	Commonwealth Agricultural Bureau (UK)
CADU	Chilalo Agricultural Development Unit, Asela (Ethiopia)
CARD	Centre for Animal Research and Development, Bogor (Indonesia)
CARI	Central Agricultural Research Institute (Liberia)
CARM	Centre d'Animation Rurale Mixtes (Mali)
CDR	Centre for Development Research, Copenhagen (Denmark)
CEEMAT	Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical (France)
CENAM	Centre National de l'Artisanat Malagache
CEP	Comité d'Etude et de Propositions pour le Développement des Activités Paysannes, Savoie (France)
CGIAR	Consultative Group on International Agricultural Research

CIAE	Central Institute of Agricultural Engineering, Bhopal (India)
CIMMYT	Centro International de Mejoramiento de Maiz y Trigo, El Batan (Mexico)
CIPEA	Centre International pour l'Elevage en Afrique
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier (France)
CMDT	Compagine Malienne pour le Développement des Textiles
CNEAT	Centre National d'Etudes d'Agronomie Tropicale (France)
CNRA	Centre National de Recherche Agronomique, Bambey (Senegal)
COBEMAG	Coopérative Béninoise de Matériel Agricole, formerly CODAMAG
CPATSA	Centro de Pesquisa Agropecuaria do Tropico Semi-Arido (Brazil)
CTVM	Centre for Tropical Veterinary Medicine, Edinburgh Univ. (UK)
DAP	draft animal power
DEVRAM	Développement Rural des Vallées de Mutara (Rwanda)
DLFRS	Dryland Farming Research Scheme (Botswana)
DLG	Deutsche Landwirtschafts-gesellschaft, e.v., Frankfurt (Germany, F.R.)
DRDR	Direction Régionale de Développement Rural (Togo)
DRSPR	Division de recherches sur les systèmes de production rural, Ministère de l'agriculture (Mali)
EDA	Estacoves de Desenvolvimento Agricola (Angola)
EEC	European Economic Community
EFSAIP	Evaluation of Farming Systems and Agricultural Implements Project (Botswana)
ENDA	Environnement et Développement du Tiers-Monde, Dakar (Senegal)
ESCAP	Economic and Social Commission for Asia and the Pacific, Bangkok (Thailand)
FAO	Food and Agriculture Organization of the United Nations
FSR	farming systems research
FSR/E	farming systems research/extension
FSSP	Farming Systems Support Project, Florida Univ., Gainesville (USA).
GARD	Gambian Agricultural Research and Diversification Project, Cape St. Mary
GATE	German Appropriate Technology Exchange
GOPP	goal-oriented project planning
GRDR	Groupe de Recherches et de Réalisations pour le Développement Rural dans le Tiers-Monde, Paris (France)
GRET	Groupe de Recherche et d'Echanges Technologiques, Paris (France)
GTZ	Geselischaft für Technische Zusammannarbeit (Germany, F.R.)
IAR	Institute of Agricultural Research

IBRD	International Bank for Reconstruction and Development
IBSRAM	International Board for Soil Research and Management, Bangkok (Thailand)
ICAR	Indian Council of Agricultural Research, New Delhi
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics, Hyderabad (India)
IDRC	International Development Research Centre (Canada)
IDS	Institute for Development Studies, Nairobi University
IEMVT	Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, Paris (France)
IFS	International Foundation of Science (Sweden)
IISR	Indian Institute of Sugarcane Research
IITA	International Institute of Tropical Agriculture, Ibadan (Nigeria)
ILCA	International Livestock Centre for Africa
ILO	International Labour Organisation
INIA	Instituto Nacional de Investigacions Agricolas (Mexico)
IRCT	Institut de Recherches du Coton et des Textiles Exotiques, Lomé (Togo)
IRDP	Integrated Rural Development Programme (Zambia)
IRRI	International Rice Research Institute, Los Banos (Philippines)
ISAF	Institut des Sciences Agro-Zootechniques (Guinea)
ISNAR	International Service for National Agricultural Research (The Netherlands)
ISRA	Institut Sénégalais de Recherches Agricoles, Dakar
ITDG	Intermediate Technology Development Group (UK)
IUFRO	International Union of Forestry Research Organisations (Germany, F.R.)
IVMT	improved Vertisol management technology
KIADP	Koinadugu Integrated Agricultural Development Project, Kabala (Sierra Leone)
LWADD	Liwonde Agricultural Development Division (Malawi)
MAMATA	machinisime agricole moderne à traction animale
ME	metabolizable energy
MOA	Ministry of Agriculture
MSU	Michigan State University, East Lansing (USA)
NIAE	National Institute of Agricultural Engineering, Silsoe, Bedford (UK)
NIAE/OLU	National Institute of Agricultural Engineering/Overseas Liaison Unit
NPA	nouvelle politique agricole (Senegal)
NSHA	North Swedish Horse Association

OACV	Operation Arachide et Cultures Vivrières, Mali
OAU	Organization of African Unity
OHV	Opération Haute Vallée, Mali
ORSTOM	Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris (France)
OXFAM	Oxford Committee for Famine Relief
PAFSAT	Project for the Promotion of Adapted Farming Systems based on Animal Traction (Cameroon)
PCA	Projet Culture Attelée (Togo)
PCRDC	Philippine Carabao Research and Development Centre
PIDAC	Projet Intégrée de Développement Agricole de la Casamance (Senegal)
PPM	project planning matrix
PROPTA	Projet pour la promotion de la traction animale, Togo
RASE	Royal Agricultural Society of England, Stoneleigh
RFSP	research with a farming system perspective
SACCAR	South African Centre for Cooperation in Agricultural Research, Gaborone (Botswana)
SADCC	Southern African Development Coordination Conference, Gaborone (Botswana)
SAFGRAD	OAU Semi-Arid Food Grain Research and Development (Burkina Faso)
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SAT	semi-arid tropics
SECAP	Société d'Etudes et de Construction d'Appareils de Précision (France)
SIAS	Scandinavian Institute of African Studies, Uppsala (Sweden)
SIDA	Swedish International Development Authority, Stockholm
SMECMA	Société Malienne d'Etude et de Construction de Matériel Agricole
SMP	summer mouldboard plowing
SOTOCO	Société Togolaise de Coton
TCDC	technical cooperation among developing countries
TIRDEP	Tanga Integrated Rural Development Project (Tanzania)
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNIDIB	Type of equipment developed at Nairobi University
UPROMA	Unité de Production de Matériel Agricole (Togo)
USAID	United State Agency for International Development

WASAT	West African semi-arid tropics
WFP	World Food Programme

s.n.	sine nomine (no publisher)
s.l.	sine loco (no place of publication)
s.d.	sine dato (no date of publication)
v.p.	various pages