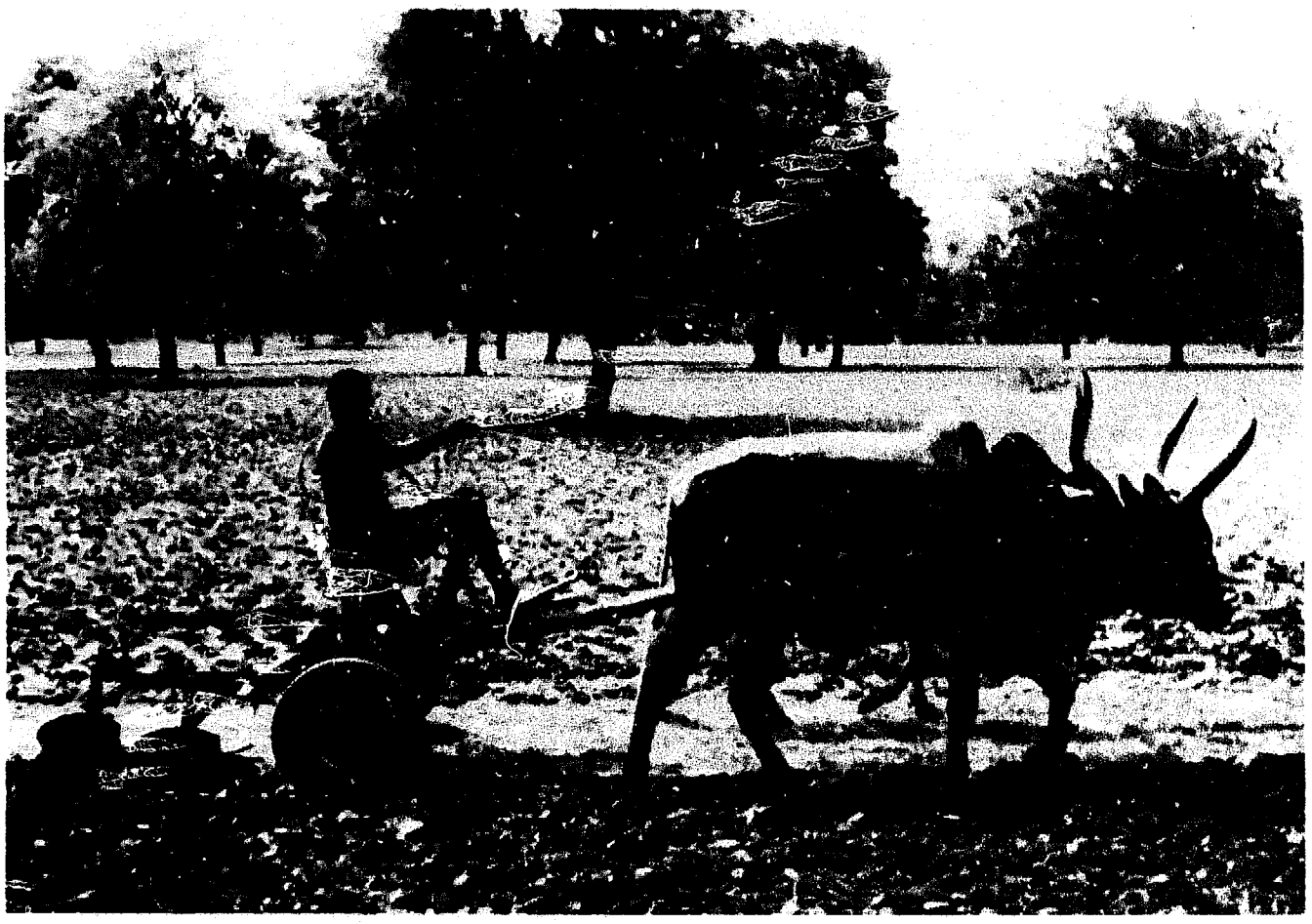
Paul Starkey

Animal-Drawn Wheeled Toolcarriers:

Perfected yet Rejected

Aus der Arbeit von GTZ



Vieweg

References

Agarwal, A. (1986): Personal communication with Managing Director, Mekins Agro Products Private Ltd., Hyderabad, India.

Agricultura Parana (1984): Programa de desenvolvimento da traçao animal. Secretario de Estado do Parana da Agricultura, Brazil. 15 p. (P).

Ahmed, I. and Kinsey, B.H. (Editors) (1984): Farm equipment innovations in Eastern and Central Southern Africa. Gower Publishing, Aldershot, U.K. 345 p. (E).

Akou, A.E. (1975): Oxen are never written off. Department of Agriculture, Ministry of Agriculture and Animal Resources, Entebbe, Uganda. 26 p. (E).

Akou, A.E. (1986): Personal communication with Head of Ox Unit, Serere Agricultural Research Station, P.O. Soroti, Uganda.

Akubuilo, C.J.C. (1978): An introduction to practical agriculture for West Africa. Macmillan, London, U.K. 154 p. (E).

Anderson, F. (1986): Personal communication with Team Leader, Highlands Programme, ILCA, Addis Ababa, Ethiopia.

Anibaloye, I.S. (1970): The place of animal draught in agricultural mechanization in Gasau local government area, Sokoto State, Nigeria. Project report as part of Higher Diploma in Agricultural Mechanization, College of Agriculture, Ahmadu Bello University, Zaria, Nigeria. (Unpublished). (E).

Awadhwal, N.K., Bansal, R.K. and Takenaga, T. (1985): Improved agricultural implements for selected SAT regions: an ICRISAT approach. Paper prepared for conference on "Small Farm Equipment for Developing Countries: Past Experience and Future Priorities" held IRRI, Philippines, September 1985. Informally reproduced by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 21 p. (E).

Bansal, R.K. (1986): Farm machinery research at ICRISAT. RNAM Newsletter (Regional Network on Agricultural Machinery, Philippines), 25: 19. (E).

Bansal, R.K., Awadhwal, N.K. and Takenaga, T. (1986): Farm power and equipment research at ICRISAT: a discussion paper for internal circulation. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 13 p. (Unpublished). (E).

Bansal, R.K., Klaij, M.C. and Serafini, P.G. (1986): Animal traction in improved farming systems for the semi-arid tropics: the ICRISAT experience from India and West Africa. Paper prepared for workshop on Animal Power in Farming Systems, held September 1986 in Freetown, Sierra Leone. Informally reproduced by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 16 p. (Awaiting publication). (E).

Bansal, R.K., Kshirsagar, K.G. and Sangle, R.D. (1985): Efficient utilization of energy with an improved farming system for selected SAT regions. Paper prepared for the 1985 Summer Meeting of the American Society of Agricultural Engineers, held Michigan State University, East Lansing, USA. Informally reproduced by International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 17 p. (Unpublished). (E).

Bansal, R.K. and Srivastava, K.L. (1981): Improved animal-drawn implements for farming in the semi-arid tropics. Agricultural Mechanization in Asia, Africa and Latin America. Spring 1981: 33–38. (E).

Bansal, R.K. and Thierstein, G.E. (1982): Animal-drawn multi-purpose tool carriers. Agricultural Mechanization in Asia, Africa and Latin America. Autumn 1982: 27–36. (E).

Barbosa dos Anjos, J. (1985). Equipements à traction animale développés par le CPATSA pour les cultures de la région tropicale semi-aride du Brésil. Machinisme Agricole Tropical 91: 60–63. (F).

Bartling, M. (1987): Personal communication with SIDA consultant. c/o Agriculture Division, Swedish International Development Authority, S-10525 Stockholm, SWEDEN.

Barton, P.S. (1986): Report of animal traction consultancy for Bay Region Agricultural Development Project, Somalia. John Bingle Pty. Ltd., Sydney, Australia. (Unpublished). (E).

Barton, D., Jeanrenaud, J.P. and Gibbon, D. (1982): An animal-drawn toolcarrier for small farm systems. Discussion Paper 110, School of Development Studies, University of East Anglia, Norwich, U.K. 24 p. (E).

Barwell, I. (1983): The real test for technology: can local manufacturers use it? Ceres 16, 1: 35–37. (E,F,S).

Bertaux, S. (1985): Le développement de prototypes d'équipements à traction animale au Brésil dans le cadre de la convention EMBRAPA-EMBRATER-CEEMAT. Paper presented at Journée d'étude sur la culture avec traction animale, held 7 March 1984, CEEMAT, Antony, France. (Unpublished). 9 p. (F). Summarized (1985) in Machinisme Agricole Tropical 91: 63–65. (F).

Bigot, Y. (1985): La culture avec traction animale. Afrique Agriculture 122: 16–20. (F).

Binswanger, H. (1986): Personal communication with Head of Agricultural Research Unit, World Bank, Washington DC, USA.

Binswanger, H.P., Ghodake, R.D. and Thierstein, G.E. (1980): Observations on the economics of tractors, bullocks and wheeled tool carriers in the semi-arid tropics of India. pp. 199–212 in: Socioeconomic constraints to development of semi-arid tropical agriculture. Proceedings of an international workshop held February 1979, Hyderabad, India. ICRISAT, Patancheru, India. 436 p. (E).

Bordet, D. (1985): Une tentative de développement de la culture attelée au Nicaragua. Machinisme Agricole Tropical 91: 33–36. (F).

Boyd, J. (1976): Tools for agriculture: a buyer's guide to low-cost agricultural implements. Intermediate Technology Publications, London, U.K. 173 p. (E).

Brumby, P.J. and Singh, K. (1981): India: animal-powered agriculture and improved technology. World Bank, Washington, U.S.A. 17 p. (Unpublished). (E).

CADU (1970): Progress report 1 and 2, Publications 32 and 52, Implement Research Section, Chilalo Agricultural Development Unit, Addis Ababa, Ethiopia. (E).

CEEMAT (1964): Problèmes techniques intéressant les barres polyvalentes. Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony, France. 12 p. (Unpublished). (F).

CEEMAT (1971): Manuel de la culture avec traction animale: techniques rurales en Afrique. Centre d' Etudes et d'Expérimentation du Machinisme Agricole Tropical et Ministère de la Coopération, Paris, France. 336 p. (F).

CEEMAT (1974): Aide-mémoire du moniteur de culture attelée. Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, Antony, France. 147 p. et 48 p. (F).

CEMAG (undated): Policultor CEMAG: um novo conceito em implementos a traçao animal. Ceara Maquinas Agricolas, Fortaleza, CE, Brazil. 6 P. (P).

Chalmers, G.R. and Marsden, R.H. (1962): Animal-drawn equipment for tropical agriculture. J. agric. Eng. Res. 7: 254–257. (E).

Cham, P.A. (1979): The use of appropriate technology in Gambian agriculture. pp. 59–63 in Report of West Africa Rural Technology Meeting held 14–22 May 1979 at Yundum, The Gambia and Dakar, Senegal. Commonwealth Secretariat, London. 111 p. (E).

Champigny, P. (1986): Rapport d'évaluation du porte-outil Lanark. Centre Canadien d'Etudes et de Coopération Internationale (CECI), Montreal, Canada. (Unpublished). (F).

CIAE (1985): Annual Report 1984 and Proceedings of XIV Annual Workshop. Central Institute of Agricultural Engineering, Bhopal, India. 224 p. (E).

Constantinesco, I. (1964): Development of ox-drawn toolframes. E. Afr. agric. For. J. 29: 187–191. (E).

da Cunha Silva, F. (1982): Traçao animal, fonte de inovacoes. R. Bras. Ext. Rural, Brasilia, 3 (4/5): 8–13. (P).

Davidson, H. (1964): Oxenisation in The Gambia: Training method and purport and additional note on oxploughing equipment. Department of Agriculture, Bathurst (Banjul), The Gambia. 5 p. (unpublished). (E).

Development Forum (1978): Appropriate technology: selling animal power. International development news. Development Forum (Kuala Lumpur, Malaysia): May 1978. (E).

Devnani (1986): Personal communication with Project Coordinator, All India Coordinated Scheme on Research and Development of Farm Implements and Machinery, Prototype Manufacturing Workshops and Implement Testing Units for Testing Improved Implements under Actual Field Conditions, Central Institute of Agricultural Engineering, Bhopal, India.

DMA (1976): Compte rendu d'essai du polyculteur équipé de sa charrue simple. Annexe "Essais réalisés par la Section Essai, Rapport 1974–1976, Division du Machinisme Agricole, Ministère de l'Agriculture, Bamako, Mali. 3 p. (Unpublished). (F).

Doherty, V.S. (1980): Human nature and the design of agricultural technology. pp. 107–119 in: Socioeconomic constraints to development of semi-arid tropical agriculture. Proceedings of an international workshop held February 1979, Hyderabad, India. ICRISAT, Patancheru, India. 436 p. (E).

EFSAIP (1977): Report No 1, November 1977, Animal draft systems study. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 167 p. (E).

EFSAIP (1978): Report No 2, November 1978, Animal draft systems study. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 106 p. (E).

EFSAIP (1979): Report No 3, 1979. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 46 p. (E).

EFSAIP (1980): Report No 4, 1979–1980. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 81 p. (E).

EFSAIP (1981): Report No 5, 1980–1981. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 149 p. (E).

EFSAIP (1982): Report No 6, 1981–1982. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 188 p. (E).

EFSAIP (1983): Report No 7, 1982–1983. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 129 p. (E).
EFSAIP (1984): Final Report No 8, 1976–1984. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP), Ministry of Agriculture, Gaborone, Botswana. 116 and 403 p. (E).
Eshleman, R. (1975): The Mochudi Toolbar. Ministry of Agriculture, Gaborone, Botswana. 17 p. (E).
FAO/CEEMAT (1972): The employment of draught animals in agriculture. FAO, Rome, Italy. 249 p. (E).
Farrington, T. and Riches, C.R. (1983): Draught power in Botswana: II The design and testing of solutions. Paper presented at networkshop on draught power and animal feeding, held Ezulwini, Swaziland, October 4–6, 1983. Summarized in: Networking Workshops Report 2. CIMMYT Eastern and Southern Africa Economics Programme. Mbabane, Swaziland. 93 p. (E).
Fieldson, R.S. (1984): Study of the adoption of animal-drawn wheeled toolcarriers in India. Overseas Division Report OD/84/5, National Institute of Agricultural Engineering (NIAE), Silsoe, U.K. 67 p. (Unpublished). (E).
Garg, B.K. and Devnani, R.S. (1983): Animal-drawn multipurpose tool carriers. Technical Bulletin CIAE 83/41, Central Institute of Agricultural Engineering (CIAE), Bhopal, India. 81 p. (E).
Ghodake, R.D., Ryan, J.G. and Sarin, R. (1981): Human labour use with existing and prospective technologies in the semi-arid tropics of South India. J. Development Studies 18, 1: 25–46. (E).
Ghodake, R.D. and Meyande, V.M. (1984): An economic analysis of the supply price of the wheeled tool carrier. Economics Program, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 17 p. (Unpublished). (E).
Ghodake, R.D. (1985): Improved dryland technology for deep black soils: economic evaluation and implications for credit policy. Paper prepared for seminar on Linking Agricultural Research System with Commercial Banks held July 1985 in Pune, India. Economics Program, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 21 p. (E).
Gibbon, D. (1985): Multi-purpose toolbars. pp. 45–49 in: Tools for agriculture: a buyer's guide to appropriate equipment. Intermediate Technology Publications, London. 264 p. (E).
Gibbon, D. (1987): Multi-purpose toolbars. Tools for Agriculture Series, Intermediate Technology Publications, London. 16 p. (E).
Gibbon, D., Harvey, J. and Hubbard, K. (1974): A minimum tillage system for Botswana. World Crops 26, 5, 229–234. (E).
Gibbon, D., Heslop, C. and Harvey, J. (1983): Animal-drawn equipment development in the Western Sudan dry savanna: the Hashasha and Atulba toolbar. Discussion Paper 21, School of Development Studies, University of East Anglia, Norwich, U.K. 40 p. (E).
Goe, M.R. (1987): Animal traction on smallholder farms in the Ethiopian highlands. Ph.D. Thesis, Cornell University, Ithaca N.Y., USA. 408 p. (Unpublished). (E).
Goe, M.R. (1987): Personal communication with Animal Scientist (Animal Traction), International Livestock Centre for Africa (ILCA), Addis Ababa, Ethiopia.
Havard, M. (1985) (a): Principales caractéristiques et contraints de gestion du parc de matériels de culture attelée au Sénégal. Document de Travail 1985: 2. Département Systèmes et Transfert, ISRA, Dakar, Senegal. 94 p. (F).
Havard, M. (1985) (b): Principales caractéristiques et contraints de gestion du parc de matériels de culture attelée au Sénégal. Machinisme Agricole Tropical 91, 19–23. (F).
Havard, M. (1985) (c): Les principaux types de travaux du sol effectués par la traction animale au Sénégal. pp. 120–136 in: Actes de l'atelier "La recherche agronomique pour le milieu paysan" 5–11 May, 1985. Institut Sénégalais de Recherches Agricoles (ISRA), Dakar, Senegal. 308 p. (F).
Horspool, D. (1986): Personal communication with Agricultural Engineer, Farm Machinery Development Unit, Sebele Agricultural Research Station, Gaborone, Botswana.
Hubbard, K., Harvey, J. and Gibbon, D. (1974): The Versatool: an animal-drawn toolcarrier for crop productions systems in semi-arid regions. Technical Bulletin 6, Division of Agricultural Research, Ministry of Agriculture, Gaborone, Botswana. 28 p. (E).
Hunt, D. (1975): Credit for agricultural development: a case study of Uganda. East Africa Publishing House, Nairobi. 194 p. (E).
ICRISAT (1975): Annual report 1974–75. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. (E).
ICRISAT (1976): Annual report 1975–76. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. (E).
ICRISAT (1977): Annual report 1976–77. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. (E).
ICRISAT (1979): ICRISAT improving implements for SAT farmer. pp. 1–2 in: At ICRISAT (Newsletter of the International Crops Research Institute for the Semi-Arid Tropics, Patancheru, India). October–December 1979. (E).

ICRISAT (1980): Report of work, 1979–80: Farm Power and Equipment Sub-program of the Farming Systems Research Program. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 138 p. (E).
ICRISAT (1981): The animal-drawn wheeled tool carrier. Information Bulletin No. 8, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 9 p. (E).
ICRISAT (1981): Improving the management of India's deep black soils. Proceedings of workshop held May 1981 in New Delhi, India. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 106 p. (E).
ICRISAT (1982): ICRISAT: Challenge and response. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 48 p. (E).
ICRISAT (1983): ICRISAT and the Commonwealth. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 20 p. (E).
ICRISAT (1983): ICRISAT research highlights 1983. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 20 p. (E,F).
ICRISAT (1983): The animal-drawn wheeled tool carrier. Revised edition. Information Bulletin No. 8, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 12 p. (E).
ICRISAT (1983): Le polyculteur: porte-outils à traction animale à roues. Bulletin d'information No. 8, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 12 p. (F).
ICRISAT (1983): El portaherramienta de ruedas tirado por animales. Boletin Informativo No. 8, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 12 p. (S).
ICRISAT (1983): Report of work, 1983: Farm Power and Equipment Sub-program of the Farming Systems Research Program. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 26 p. (E).
ICRISAT (1984): Watershed-based dryland farming in black and red soils of Peninsular India. Proceedings of workshop held October 1983 at Patancheru, India. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 95 p. (E).
ICRISAT (1984): Farm Power and Equipment, Farming Systems Research Program, Five-year report 1978–83. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 26 p. (E).
ICRISAT (1985): The Tropicultor operator's manual: field operations. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 62 p. (E).
ICRISAT (1985): Report of work, 1984: Farm Power and Equipment Sub-program of the Farming Systems Research Program. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 55 p. (E).
ICRISAT (1985): Training needs for dryland agriculture with particular reference to deep Vertisol technology. Proceedings of workshop held July 1985 at Patancheru, India. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 48 p. (E).
ICRISAT (1986): ICRISAT research highlights 1985. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 48 p. (E).
ICRISAT (1986): Report of work, 1985: Farm Power and Equipment Sub-program of the Farming Systems Research Program. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 84 p. (E).
ICRISAT (1986): Resource Management. pp. 266–341 in: Annual report 1985. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. (E).
ICRISAT (1986): Future research on farm power and equipment within the resource management program. Proceedings of an internal working group meeting held August 1986 at Patancheru. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 12 p. (Unpublished). (E).
ICRISAT (1986): ICRISAT in Africa. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 60 p. (E,F).
Inter Tropiques (1985): Le polyculteur à traction animale: un porte-outils polyvalent qui économise le temps. Inter Tropiques Agricultures 11 (juin): 28–29. (F).
ITDG (1985): Tools for agriculture: a buyer's guide to appropriate equipment. Intermediate Technology Publications, London. 264 p. (E).
ITP (1987): Multi-purpose toolbars. Tools for Agriculture Series, Intermediate Technology Publications, London. 16 p. (E).
Jeanrenaud, J.P., Barton, D. and Gibbon, D. (1982): An animal-drawn toolcarrier for small farm systems. Discussion Paper 110, School of Development Studies, University of East Anglia, Norwich, U.K. 24 p. (E).

Kalkat, H.S. and Kaul, R.N. (1985): Interim report on the assessment of animal-drawn toolbars in local farming systems. Agricultural Mechanization Research Programme, Institute for Agricultural Research – Samaru, Ahmadu Bello University, Zaria, Nigeria. (mimeo). 21 p. (E).

Kemp, D.C. (1978): The role of UK manufacturers in the supply of ox-cultivation implements with particular reference to The Gambia since 1971. pp. 47–50 in Mettrick, H. 1978. Oxenisation in The Gambia. Ministry of Overseas Development, London. 68 p. (E).

Kemp, D.C. (1980). Mise au point d'un nouveau porte-outils à traction animale pour le travail en zones sèches. Machinisme Agricole Tropical 72: 10–14. (F).

Kemp, D.C. (1983): The NIKART: a new animal-drawn implement for cultivation and transport. Appropriate Technology 10, 1. 11–13 (E).

Kemp, D.C. (1986): Personal communication with Head of Animal Traction and Small Equipment Section, Overseas Division, AFRC-Engineering (formerly NIAE), Silsoe, Bedford, U.K.

Ker, A.D.R. (1973): The development of improved farming systems based on ox-cultivation. pp. 291–320 in V.F. Amann (Editor): Agricultural policy issues in East Africa. Makerere University, Kampala, Uganda. (E).

Khan, A.U. (1962): Machinery for the tropics: Indian engineer's suggestions. Farm Mechanization June, 218–219. (E).

Kinsey, B.H. (1976): Economy research and farm machinery design in Eastern Africa. Discussion Paper 10, School of Development Studies, University of East Anglia, Norwich, U.K.. 20 p. (E).

Kinsey, B.H. (1984): Equipment innovations in cotton-millet farming systems in Uganda. pp. 209–252 in: Ahmed, I. and Kinsey, B.H. (Editors). Farm equipment innovations in Eastern and Central Southern Africa. Gower Publishing, Aldershot, U.K. 345 p. (E).

Kinsey, B.H. (1984): The potential for farm equipment innovations in Malawi. pp. 273–304 in: Ahmed, I. and Kinsey, B.H. (Editors). Farm equipment innovations in Eastern and Central Southern Africa. Gower Publishing, Aldershot, U.K. 345 p. (E).

Kjaerby, F. (1983): Problems and contradictions in the development of ox-cultivation in Tanzania. Research report 66, Scandinavian Institute of African Studies, Uppsala, Sweden. 164 p. (E).

Kosakiewicz, A. and Orlikoswski, P. (1966): Wielorak: uniwersalnykinny P 702/0–2 (WUK). Instruckcja Obslugi, Wydawca, Centrala Techniczna Biuro, Wydawnictw, Warzarawa, Poland. 112 p. (Pl).

Kshirsagar, K.G., Fieldson, R.S., Mayande, V.M. and Walker, T.S. (1984): Use and prospective demand for wheeled tool carriers in India. Economics-RMP Progress Report 64. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 34 p. (E).

Kumar, M.L. (1986): Tropicultor: a unique two in one. Mekins Agro Products Ltd., Hyderabad, India. 23 p. (Unpublished). (E).

Kumwenda, W. (1986): Personal communication with Head of Farm Machinery Unit, Chitedze Research Station, Lilongwe, Malawi.

Labrousse, G. (1958): Journées du machinisme agricole de l'A.O.F., Centre de Recherches Agronomiques de Bambey, Senegal. Agronomie Tropical 13, 6: 770–779. (F).

Lal, H. (1985): Final report of consultancy on agricultural mechanization for Northeast Brazil. Inter-American Institute for Cooperation on Agriculture (IICA-EMBRAPA-CPATSA), Petrolina, Brazil. 29 p. (Unpublished). (E).

Lal, H. (1986): Low-cost animal-drawn wheeled tool carrier. FAO World Animal Review 59: 24–28. (E,F,S).

Lal, H. (1986): Development of appropriate mechanization for the W-form soil management system. Soil Tillage Res. 8: 145–159. (E).

Lawrence, P.R. and Pearson, R.A. (1985): Factors affecting the measurement of draught force, work output and power of oxen. J. agric. Sci. Camb. 105: 703–714. (E).

Le Moigne, M. (1966): Possibilités de travail "en sec" en culture attelée bovine: essais complémentaires menés en 1966. Centre National de Recherche Agronomique de Bambey, Senegal. 7 p. (Unpublished). (F).

Le Moigne, M. (1980): Animal-draft cultivation in Francophone Africa. pp. 213–220 in: Socioeconomic constraints to development of semi-arid tropical agriculture. Proceedings of an international workshop held February 1979, Hyderabad, India. ICRISAT, Patancheru, India. 436 p. (E).

Le Moigne, M. (1980): Culture attelée en Afrique francophone. pp. 415–423 in: Socioeconomic constraints to development of semi-arid tropical agriculture. Proceedings of an international workshop held February 1979, Hyderabad, India. ICRISAT, Patancheru, India. 436 p. (F).

Le Thiec, G. (1987): Personal communication with Animal Traction Specialist, Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical (CEEMAT), Antony, France.

Matthews, M.D.P. and Pullen, D.W.M. (1974): Groundnut cultivation trials with ox-drawn equipment: The Gambia 1973/74. Report Series, Overseas Department, National Institute of Agricultural Engineering, Silsoe, U.K. 127 p. (E).

Matthews, M.D.P. and Pullen, D.W.M. (1975): Cultivation trials with ox-drawn implements using N'Dama cattle in The Gambia. Report Series, Overseas Department, National Institute of Agricultural Engineering, Silsoe, U.K. 62 p. (E). (Based on Matthews and Pullen, 1974).

Matthews, M.D.P. and Pullen, D.W.M. (1976): Cultivation trials with ox-drawn implements using N'Dama cattle in The Gambia. Report Series, Overseas Department, National Institute of Agricultural Engineering, Silsoe, U.K. 49 p. (E).

Mayande, V.M., Bansal, R.K. and Sangle, R.D. (1985): Performance of various animal-drawn wheeled tool carrier systems. J. Agric. Engng, ISAE, 22, 2: 27–34. (E).

Mayande, V.M., Sarin, R. and Thierstein, G.E. (1985): Animal-drawn wheeled tool carrier in India under on-farm conditions. Agricultural Mechanization in Asia, Africa and Latin America. 16, 4: 17–24. (E).

Mekins (undated): Mekins Nikart: operator's manual. Mekins Agro Industrial Enterprises, Hyderabad, India. 18 p. (E).

Mettrick, H. (1978): Oxenisation in The Gambia. Ministry of Overseas Development, London. 68 p. (E).

Mochudi (1975): Makgonatsotlhe: Mochudi tool bar. Technical drawings. Mochudi Farmers Brigade, Kgatleng Development Board, Botswana. 49 p. (E).

Monnier, J. (1967): A propos d'un matériel à traction bovine: premier essai pour une meilleure utilisation de la force des boeufs. Centre National de Recherche Agronomique de Bambey, Senegal. 11 p. (Unpublished). (F).

Monnier, J. (1971): Le matériel à traction bovine dit "à grand rendement": premières réflexions sur son utilisation. Centre National de Recherche Agronomique de Bambey, Senegal. (Unpublished). 18 p. (F).

Monnier, J. and Plessard, F. (1972): Résultats définitifs des recherches entreprises pour la mise au point du matériel à traction bovine dit "A grand rendement". Centre National de Recherche Agronomique de Bambey, Senegal. 30 p. (Unpublished). (F).

Monnier, J. and Plessard, F. (1973): Matériel à "grand rendement" pour traction bovine. (Highlights of 1972 edited by CEEMAT). Machinisme Agricole Tropical, 42: 46–51. (F).

Morin, J.-P. (1985). Réhabilitation de la traction animale en France. Machinisme Agricole Tropical 91: 47–48. (F).

Munzinger, P. (1982) (Editor): Animal traction in Africa. GTZ, Eschborn, Germany. 490 p. (E,F,G).

Munzinger, P.L.P. (1984): Adviser on improved animal-drawn implements: project evaluation and proposals for future development. Ministry of Agriculture, Lesotho, and GTZ, Eschborn, Federal Republic of Germany. 96 p. (Unpublished). (E).

NIAE (1981): NIAE animal-drawn toolcarrier. Publicity announcement and information sheet, July 1981. National Institute of Agricultural Engineering, Silsoe, U.K. 1 p. (E).

Nolle, J. (undated): The Tropiculteur: instruction manual. Unpublished draft. Seen in archives of AFRC-Engineering, Silsoe, Bedford, U.K. 34 p. (E).

Nolle, J. (1985): Le point de vue de l'inventeur. Paper presented at Journée d'étude sur la culture avec traction animale, held 7 March 1985, CEEMAT, Antony, France. 4 p. (Unpublished). (F). Summarized (1985) in Machinisme Agricole Tropical 91: 58–59. (F).

Nolle, J. (1986): Machines modernes à traction animale. Harmattan, Paris. 478 p. (F).

Nourrissat, P. (1965). La traction bovine au Sénégal. L'Agronomie Tropical 9: 823–853. (F).

Olmstead, A.L., Johnston, B.F. and Sims, B.G. (1986): Forward to the past: the diffusion of animal-powered tillage equipment on small farms in Mexico. Agricultural History 60, 1: 62–72. (E).

Peacock, J.M. and associates (1967): The report of The Gambia ox-ploughing survey 1966. Exploration Society, Wye College, University of London, U.K. 65 p. (E).

Peacock, J.M. (1986): Personal communication with J.M. Peacock, ICRISAT, P.O. Patancheru, Andhra Pradesh 502 324, India.

Piters, B.S. (1987): Les différents niveaux de la mécanisation agricole dans un village en zone Mali Sud: étude comparative concernant six exploitations. Koninklijk Institute voor de Tropen (KIT/Royal Dutch Institute), Amsterdam, The Netherlands. (in preparation). (F).

Poats, S., Lichte, J., Oxley, J., Russo, S.L. and Starkey, P.H. (1985): Animal traction in a farming systems perspective. Proceeding of Networkshop held March 1985, Kara, Togo. Network Report 1, Farming Systems Support Project, University of Florida, Gainesville, USA. 187 p. (E,F).

Pousset, J. (1982). Le cheval: énergie douce pour l'agriculture. Editions de la Lanterne, Paris, France. 185 p. (F).

Ramanaiah, K.V. (1987): Personal communication with Research Scientist, Faculdade de Agronomia e Engenharia Florestral, Universidade Eduardo Mondlane, C.P. 257, Maputo, Mozambique.

Ramaswamy, N.S. (1981): Report on draught animal power as a source of renewable energy. Food and Agriculture Organization (FAO), Rome, Italy. 150 p. (Unpublished). (E).

Rauch, F. (1986): Personal communication with Technical Adviser, Promotion of Adapted Farming Systems based on Animal Traction Project, WADA, Wum, N.W. Province, Cameroon.

Reddy, V.R. (1986): The Farm Power and Equipment Research at ICRISAT. Draft consultancy report. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 15 p. (Unpublished). (E).

Reis, O.G. and Baron, V. (1985): Machinisme agricole avec traction animale en Brésil. Machinisme Agricole Tropical 91: 24–30. (F).

Rempel, E. (1986): Personal communication with Resource Development Officer, Mennonite Central Committee, Winnipeg, Manitoba R3T 5K9, Canada.

Richards, P. (1985): Indigenous agricultural revolution: ecology and food production in West Africa. Hutchinson, London, U.K. 192 p. (E).

Robinson, G. (1984): Avaliacao do uso do Tropicultor na localidade da Ilha Josina. MONAP, Ministry of Agriculture, Maputo, Mozambique. 6 p. (Unpublished). (P).

Robinson, G. (1986): Personal communication with Coordinator, Project 7, MONAP, Ministry of Agriculture, Maputo, Mozambique.

Ryan, J.G. and Sarin, R. (1981): Economics of technology options for deep Vertisols in the relatively assured rainfall regions of the Indian semi-arid tropics. Paper prepared for seminar on the Management of Deep Black Soils held May 1981 in New Delhi, India. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 24 p. (E).

Ryan, J.G. and von Oppen, M. (1983): Assessment of impact of deep Vertisol technology options. Economics Program Progress Report 59, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 14 p. (E).

Sahall (1985): Publicity brochure: Royal Show 1984 – a new range of animal-drawn implements. Sahall Soil and Water Resources, Garstang, Preston, U.K. 4 p. (E).

SARA (1979): The Bultrac: case for international support. SARA Technical Services Pvt. Ltd., New Delhi, India. 18 p. (E).

Sarin, R. and Ryan, J.G. (1983): Economic assessment of improved watershed-based technology options in on-farm experiments. Economics Program Report 46, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 19 p. (E).

Sarker, M.N. and Farouk, S.M. (1983): On better utilization of animal energy. pp. 86–90 in: Preston, T.R., Davis, C.H., Haque, M. and Saadullah (Eds.). Maximum livestock from minimum land. Proceedings of fourth seminar held in Bangladesh in 1983. Bangladesh Agricultural University, Mymensingh, Bangladesh. 166 p. (E).

Seager, A. (1987): Personal communication with Mr. Andrew Seager, Agricultural Consultant, Swanston Field, Whitchurch RG8 7 HP, U.K.

Serafini, P. (1986): Personal communication with Farm Manager, ICRISAT Sahelian Centre, BP 12404, Niamey, Niger.

Shanmugham, C.R. (1982): Farm machinery and energy research in India. Technical Monograph 82/32, Central Institute of Agricultural Engineering, Bhopal, India. 588 p. (E).

Shetty, S.V.R. (1985, 1986): Personal communication with Principal Agronomist, ICRISAT Mali Programme, BP 34, Bamako, Mali.

Shulman, R. (1979): Strategy for the advancement of animal traction in Mali. USAID, Bamako, Mali. 65 p. (Unpublished). (E,F).

Sims, B.G. (1984): El programa de ingenieria y mecanizacion agricola del tropico humedo de Mexico. Folleto Informativo 1, Secretaria de Agricultura y Recursos Hidraulicos (SARH), Instituto Nacional de Investigaciones Agricolas, Campo Cotaxtla, Veracruz, Mexico. 22 p. (S).

Sims, B.G. (1985): Recherche et développement de la culture attelée dans l'Etat de Veracruz (Mexique). Machinisme Agricole Tropical 91: 36–41. (F).

Sims, B.G. (1986): Personal communication with NIAE/ODA Technical Cooperation Officer, assigned to Instituto Nacional de Investigaciones Agricolas, Campo Cotaxtla, Veracruz, Mexico.

Sims, B.G., Moreno, D.R. and Albarran, J.S. (1984): Conceptos y practicas de cero labranza en maiz para el pequeno agricultor. Folleto Tech. 1, Secretaria de Agricultura y Recursos Hidraulicos (SARH), Instituto Nacional de Investigaciones Agricolas, Campo Cotaxtla, Veracruz, Mexico. 40 p. (S).

Sims, B.G., Moreno, D.R. and Albarran, J.S. (1985): El Yunticultor equipo y uso. Folleto Misc. 1, Secretaria de Agricultura y Recursos Hidraulicos (SARH), Instituto Nacional de Investigaciones Agricolas, Campo Cotaxtla, Veracruz, Mexico. 24 p. (S).

SISMAR (1984): Analyse des commandes enregistrées 1983. Document interne, Société Industrielle Sahélienne de Mécaniques, de Matériels Agricoles et de Représentations (SISMAR), Pout, Senegal. 1 p. (Unpublished). (F).

SISMAR (1985): Personal communications with SISMAR staff during visit to factory. Société Industrielle Sahélienne de Mécaniques, de Matérieis Agricoles et de Représentations (SISMAR), Pout, Senegal.

Starkey, P.H. (1986): Appropriate technology for Africa: an evaluation with suggestions for future initiatives. Consultancy report. International Development Research Centre (IDRC), Ottawa, Canada. 34 p. (Unpublished). (E).

Starkey, P.H. and Ndiamé, F. (Editors) (1988): Animal power in farming systems. Proceedings of network-shop held 17–26 September 1986 in Freetown, Sierra Leone. GATE, GTZ, Eschborn, Germany (in preparation). (E,F,).

Starkey, P.H. (1987): Animal-drawn wheeled toolcarriers: a case for caution. Appropriate Technology 14, 1: (10–12). (E).

Starkey, P.H. (1987): Farm power and equipment research at ICRISAT: a review and discussion of future directions. Consultancy Mission Report, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 58 p. (Unpublished). (E).

Stokes, A.R. (1963): Mechanisation and the peasant farmer. World Crops, (December): 444–450. (E).

Swindale (1981): An overview of ICRISAT's research on the management of deep black soils. pp. 17–20 in: Improving the management of India's deep black soils. Proceedings of workshop held May 1981 in New Delhi, India. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 106 p. (E).

TAC (1985): Report of the second external program review of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Technical Advisory Committee of Consultative Group on International Agricultural Research. Food and Agriculture Organization (FAO), Rome, Italy. 119 p. (E).

Thierstein, G.E. (1982): The efficient use of power in dryland agriculture. Paper prepared for seminar on "A decade of dryland agriculture research in India and thrust in the eighties" held January 1982 in Hyderabad. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 19 p. (E).

Thierstein, G.E. (1982): Implements for dryland agriculture. Paper prepared for seminar on Increasing Agricultural Productivity held November 1982 in Bombay. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 26 p. (E).

Thierstein, G.E. (1983): (Official citation: ICRISAT, 1983) The animal-drawn wheeled tool carrier. Information Bulletin 8, International Crops Research Institute for the Semi-Arid Tropics, Hyderabad, India. 12 p. (E,F,S).

Tinker, D.B. (1986): UDA and its programme of adapting designs from other centres. Paper presented to SARH conference: Formacion du una Red de Mecanizacion Agricola para el Pequeno Agricultor held 10–14 November 1986 at Veracruz, Mexico. 2 p. (Unpublished). (E,S).

Tinker, D.B. (1987): Personal communication with TCO Agricultural Engineer, Unidad de Desarrollo y Adaptacion (UDA), Secretaria de Recuros Naturales, A.P. 133, Comayagua, Honduras.

van Nhieu, J.T. (1982): Animal traction in Madagascar. pp. 427–449 in: Munzinger, P. (Editor). Animal traction in Africa. GTZ, Eschborn, Germany. 490 p. (E,F,G).

Viebig, U. (1982): Basic aspects of harnessing and the use of implements. pp. 135–221 in: Munzinger, P. (Editor). Animal traction in Africa. GTZ, Eschborn, Germany. 490 p. (E,F,G).

Virmani, S.M., Willey, R.W. and Reddy, M.S. (1981): Problems, prospects and technology for increasing cereal and pulse production from deep black soils. pp. 21–36 in: Improving the management of India's deep black soils. Proceedings of workshop held May 1981 in New Dehli, India. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 106 p. (E).

von Oppen, M., Ghodake, R.D., Kshirsagar, K.G. and Singh, R.P. (1985): Socioeconomic aspects of transfer of Vertisol technology. Paper prepared for workshop on Management of Vertisols held Patancheru, February 1985. Economics Program, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. 23 p.

von Oppen, M., Ghodake, R.D., Kshirsagar, K.G. and Singh, R.P. (1985): Performance and transfer constraints of improved Vertisol technology. Entwicklung + ländlicher Raum, 19, 6/85: 11–14. (E).

Willcocks, T.J. (1969): Animal-drawn toolbar. Overseas Liaison Unit Technical Bulletin 2, National Institute of Agricultural Engineering (NIAE), Silsoe, Bedford, U.K. 16 p. (E).

Zerbo, D. (1985, 1986): Personal communication with Chef, Division du Machinisme Agricole, Ministère de l'Agriculture, BP 155, Bamako, Mali.

Acknowledgement of illustrations

The author and publishers wish to acknowledge and thank the following individuals and organizations for the use of their illustrations:
AFRC-Engineering, Silsoe, U.K.
Agricultural Information Service, Ministry of Agriculture, Gaborone, Botswana.
N.K. Awadhwal.
Mike Ayre.
Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical (CEEMAT), Antony, France.
Farm Machinery Development Unit, Sebele Agricultural Research Station, Ministry of Agriculture, Botswana.
Food and Agriculture Organization of the United Nations, Rome, Italy.
David Gibbon.
Highlands Programme, International Livestock Centre for Africa, Addis Ababa, Ethiopia.
Institute of Agricultural History, University of Reading, U.K.
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, A.P., India.
A.D.R. Ker.
Harbans Lal.
Peter Lawrence.
J.P. Morin.
Jean Nolle.
Bart de Steenhuysen Piters.
Ransome Collection, Museum of English Rural Life, University of Reading.
J. Rauch.
Eric Rempel.
David Tinker.
The line drawings were prepared by Kerstin Clarke.