

· PN. ABE-297 64713

The Animal-Drawn Wheeled Tool Carrier

International Crops Research Institute for the Semi-Arid Tropics

Information Bulletin no.8

(Revised edition 1983)

Citation: ICRISAT (International Crops Research Institute for the Semi-Arid Tropics). 1983. The animal-drawn wheeled tool carrier. Information Bulletin 8. Revised edn. Patancheru, A.P. 502 324, India: ICRISAT.

Reprinted in 1987.

Revised in 1988.

Compiled and edited by
G.E. Thierstein and R.K. Bansal

The International Crops Research Institute for the Semi-Arid Tropics is a nonprofit, scientific, research and training institute receiving support from donors through the Consultative Group on International Agricultural Research. Donors to ICRISAT include governments and agencies of Australia, Belgium, Canada, Federal Republic of Germany, Finland, France, India, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, United Kingdom, United States of America, and the following international and private organizations: Asian Development Bank, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), International Development Research Centre, International Fund for Agricultural Development, The European Economic Community, The Opec Fund for International Development, The World Bank, and United Nations Development Programme. Information and conclusions in this publication do not necessarily reflect the position of the aforementioned governments, agencies, and international and private organizations.

The opinions in this publication are those of the authors and not necessarily those of ICRISAT.

Where trade names are used this does not constitute endorsement of or discrimination against any product by the Institute.

ISBN 92-9066-166-6

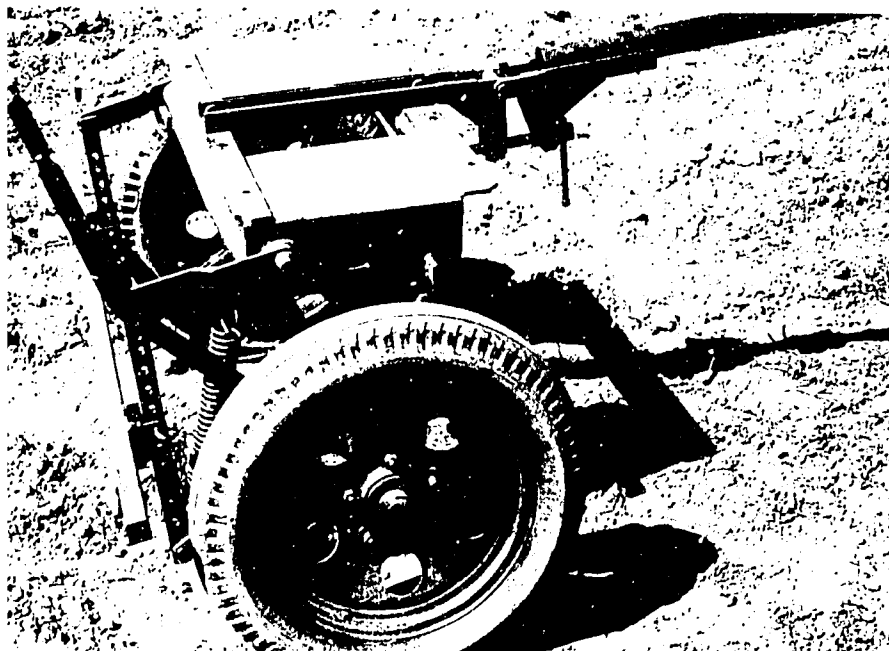
Cover: *Farmers view a Nikart in operation in a farmer's field, Amaravati, Maharashtra, India.*

Introduction

The animal-drawn wheeled tool carrier is a multipurpose machine but designed to perform agricultural operations and provide transport where animals are the main source of power. It can perform virtually all the operations of a tractor, thus providing to many farmers the versatility and precision previously available to only a few. The wheeled tool carrier has been designed to be pulled by oxen (bullocks) although it can also be pulled by buffaloes, horses, mules, and camels.

The concept of an animal-drawn wheeled tool carrier is not new. Approximately 30 years ago such machines could be found in eastern Africa, India, and Senegal. The early models had various design and functional weaknesses, but these have been removed through many years of experience and development. Various models are now available: the Tropiculor, the Nikart, and the Agribar are three examples illustrated here. These machines permit tilling, planting, fertilizing, and weeding operations to be done with greater speed and precision to increase productivity. The Tropiculor and the Nikart can also be used as carts to provide transport.

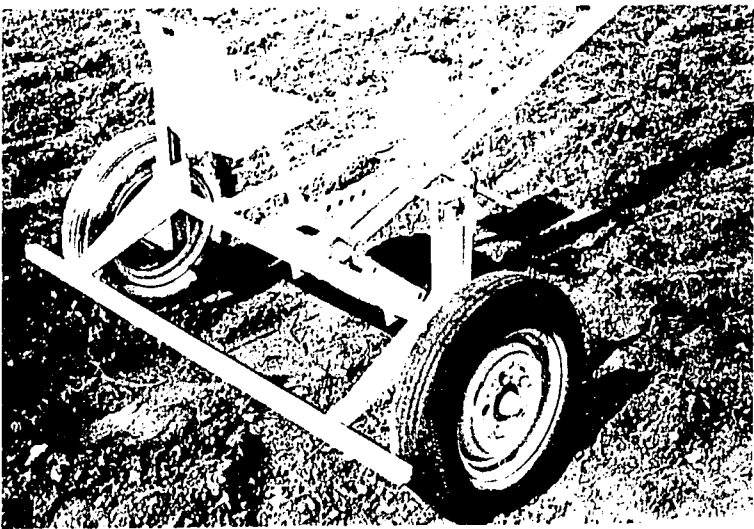
The Tropiculor, designed by a French engineer, Jean Nolle, was the first wheeled tool carrier successfully used at ICRISAT.



The Tropiculcor was the first machine successfully used for farming operations at ICRISAT Center, India. This machine worked well in research station and on-farm tests. ICRISAT then purchased design rights from Mr Jean Nolle and promoted local manufacturing. However, due to patent restrictions it was not feasible to take the Tropiculcor to other countries for evaluation. For this reason, and to reduce weight and cost of the tool carrier, a different design was developed in collaboration with the Agriculture Food and Forestry Research Council (AFRC) Institute of Engineering Research (formerly known as National Institute of Agricultural Engineering), UK. This second design, called the Nikart, could be manufactured in small workshops and was cheaper. Whereas the Tropiculcor's price without any attachments, was Rs 5600 (US \$ 430), the Nikart cost Rs 4000 (US \$ 310). However, this reduction in cost was not enough and the Nikart also did not become popular with farmers.

Wheeled tool carriers continued to be an important element in the improved soil- and crop-management technologies developed at ICRISAT for Vertisols. Thus the need for a substantially low-cost machine led us to develop a third design called the Agribar. The Agribar is a relatively light-weight machine of simple construction. It performed satisfactorily in research station tests and is now

The Nikart wheeled tool carrier, designed by the AFRC Engineering, UK, in collaboration with ICRISAT.





The Agribar is a newer low-cost wheeled tool carrier designed at ICRISAT.

being introduced to the market by some manufacturers. The lower cost of the Agribar (less than Rs 2000 or US \$ 150) is expected to make it more acceptable in those regions where there is a need for improved animal-drawn equipment.

Description of the machine

The tool carrier usually consists of a frame mounted on two wheels (normally with pneumatic tires) with a beam or drawpole to which a bullock yoke is fastened. The basic frame has a toolbar onto which a variety of implements can be mounted. A mechanical lifting device is provided to raise the implement into a transport position and lower it into a working position; a locking device holds the implement firmly in either position.

The weight of the Tropicultor is 200 kg and that of the Nikart 160 kg, approximately. Both of these machines have pneumatic wheels supported on roller bearings that keep the rolling resistance to about 10-25 kg. The Agribar weighs about 100 kg and has rubberized wheels of 300-mm diameter supported on ball bearings.

Use of the wheeled tool carrier

1. Tillage

- Primary tillage can be done either with a reversible or with a nonreversible disk or moldboard plow and also by using a ridger or chisel plow. The Nikart has a fixed wheel track, the beam is moved laterally to an alternative position on the right to maintain a straight line between the center of the plow and the point of pull where the yoke is attached to the beam. The Tropicultor and the Agribar have adjustable wheel tracks so the right wheel is moved to the inside of the frame to keep the plow in line with the beam.
- The seedbed can be prepared with a spike-tooth harrow, cultivator, spring-tooth harrow, or blade harrow.
- Ridgers and a chain can be used for shaping broadbeds.

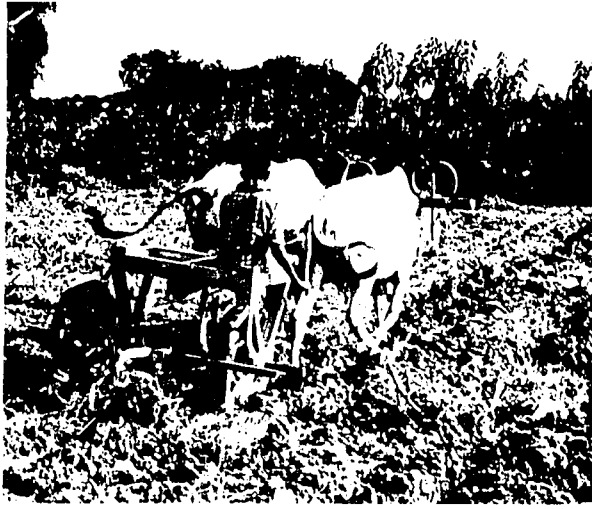


Versatility and precision are key advantages that the wheeled tool carrier offers. This multipurpose machine can be used for plowing and burying crop residues.

Plowing with a Multicultor CPATSA II in Brazil

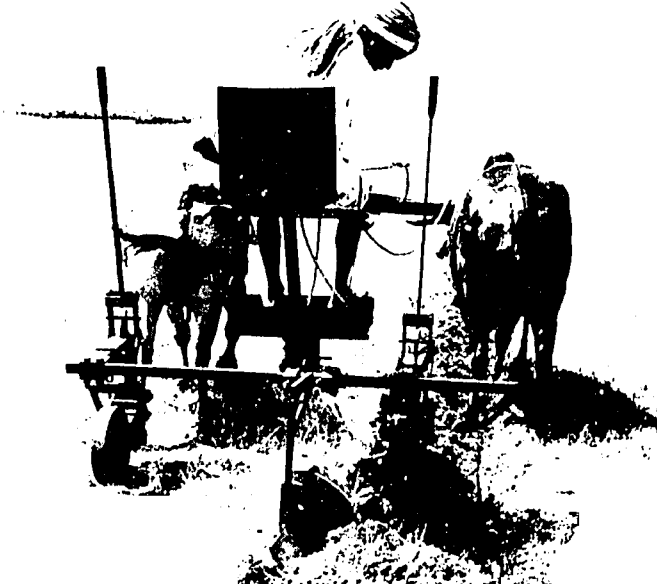


*Using a reversible plow with a
Policultor 1500 to eliminate
dead furrows (Brazil).*



Plowing with an Agrikart (India).

Plowing with Agribar.



Plowing with a Tropicultor in Mozambique. The curved standard provides good clearance for grass, weeds, or crop residues.



Primary tillage on 150-cm permanent raised beds, with wheeled tool carriers (left to right, Agrikart, Nikart, and Tropicultor) at ICRISAT Center.



2. Planting and fertilizer application

- A wide range of crops, such as pearl millet, sorghum, maize, pigeonpea, chickpea, groundnut, castor, and safflower can be planted in any arrangement, from row-to-row spacing of 25 cm

Making ridges with the Nikart in Botswana. On the left, the setting is at 150 cm; on the right (on the second pass) at 50 cm.

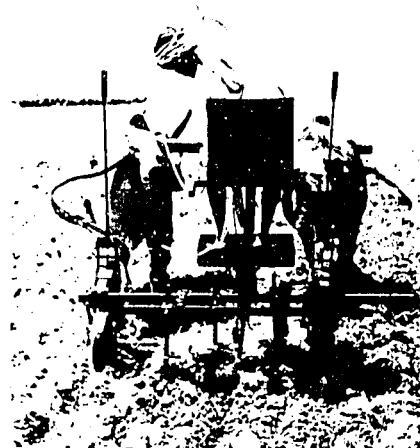
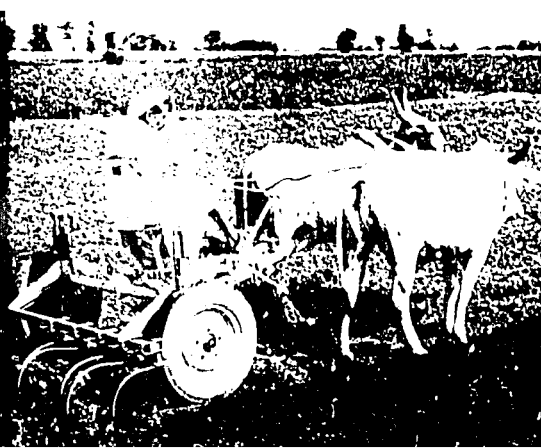


upwards. Different crops can be planted in adjacent rows for intercropping.

- Fertilizer can be applied in a band either separately or in combination with planting.

3. Interrow cultivation

- A steerable toolbar fitted with weeding tools provides the necessary flexibility for accurate weeding between crop rows. The available range of weeding tools consists of rigid and spring tine cultivators with duckfoot sweeps and blade harrows in appropriate widths.



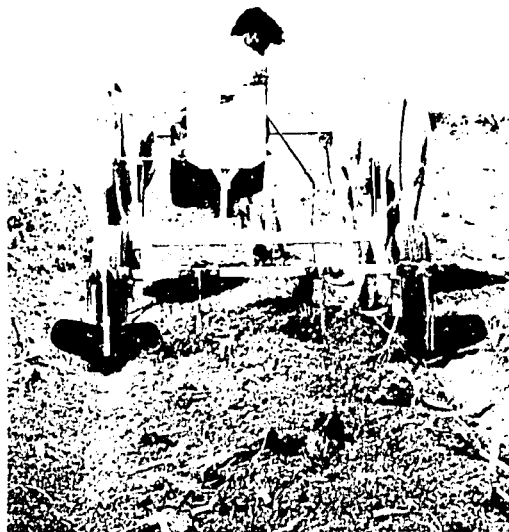
Preparing the seedbed using a spring tine cultivator (left). Preparing seedbed using five rigid tines fitted to an Agribar (right).

4. Harvesting

- Groundnut lifting

5. Transportation

6. Land shaping



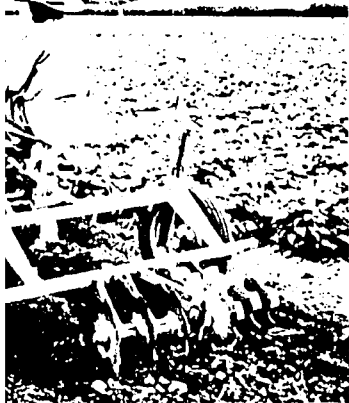
Using a 1.2-m blade harrow for secondary tillage before final bed shaping.



Preparing the seedbed with a disc harrow in Mexico.

Final shaping of raised beds using a Tropicultor in India.



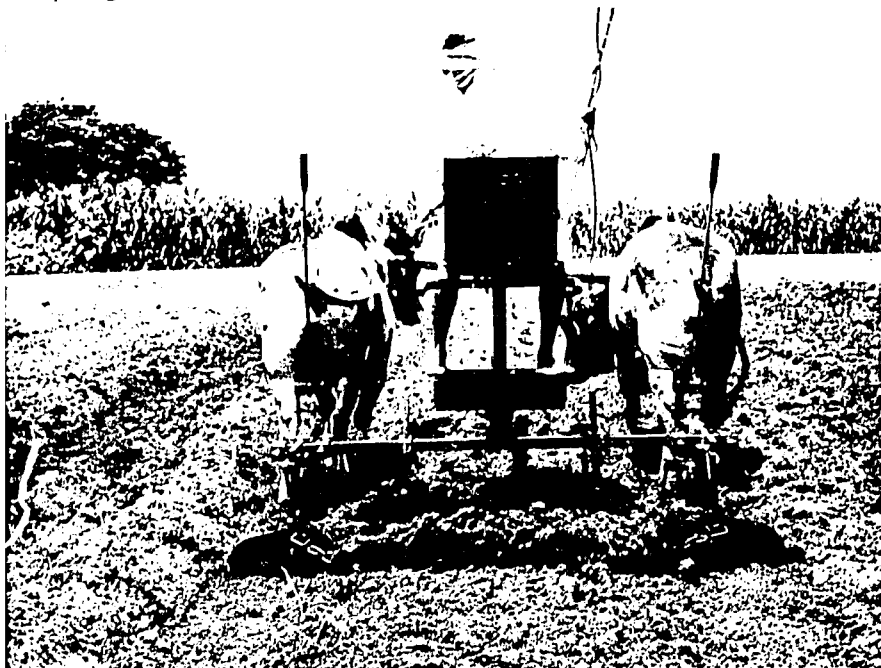


Harrow attached to a Yunicultor in



Planting with a set of unit planters.

Preparing seedbed on 150-cm raised beds using two ridgers and a 120-cm blade harrow.

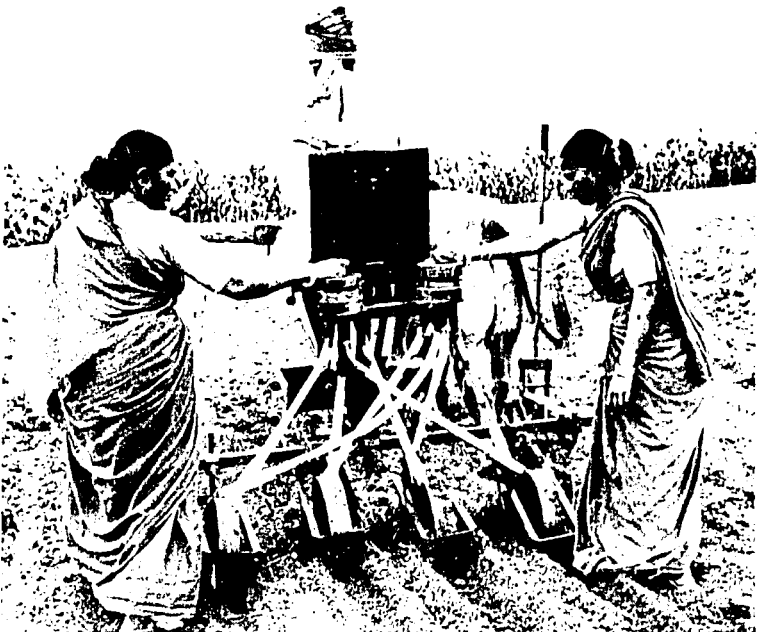


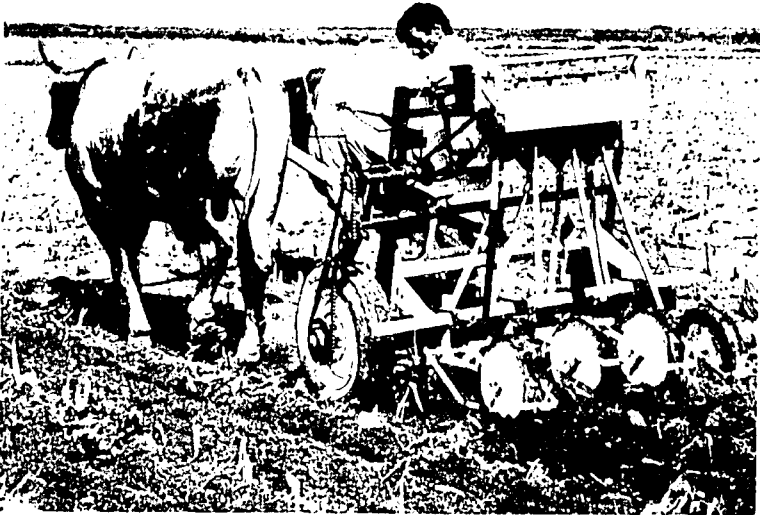
Working capacity of the tool carrier

The area that can be covered in a day depends on many factors, such as the width of the machine, speed of operation, and field efficiency. The speed of operation depends upon the draft or load of the implement, soil conditions, size of animal, and climate. The walking speed of oxen is about 2.5–3.5 km h⁻¹; horses and mules will usually walk a little faster. Oxen can usually pull 7.5–20% of their weight, depending on the breed and physical condition. A pair of oxen weighing 350 kg each will normally be able to pull at least 100 kg working at 1 hp. Experience has shown that farmers owning small bullocks can also use the tool carrier effectively if they adjust the load to the capability of the animals.

Field efficiency (the percentage of time that a machine is performing useful work) ranges from 50% to 80%, depending on such factors as the skill of the operator, size of field, condition of field, and type of operation being done. If the field is long, less time is

Fertilizer application and sowing of four rows with a low-cost hand metering device attached to an Agribar.



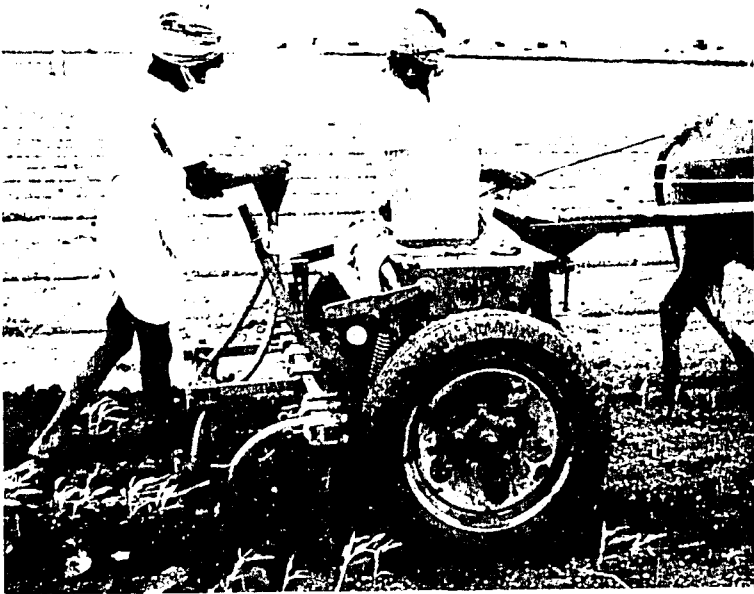


A Nikart is used to apply fertilizer and plant seed in dry soil just before the rainy season starts.

wasted in turning than if turning has to be done frequently in a short field. A pair of animals walking at 3 km h^{-1} pulling a 15-cm wide plow and operating at 75% field efficiency will cover 0.03 ha h^{-1} or 0.2 ha in a 6-h day. If the same animals are used to pull a light cultivator of 150-cm width, it is possible to cover 2 ha in a 6-h day.

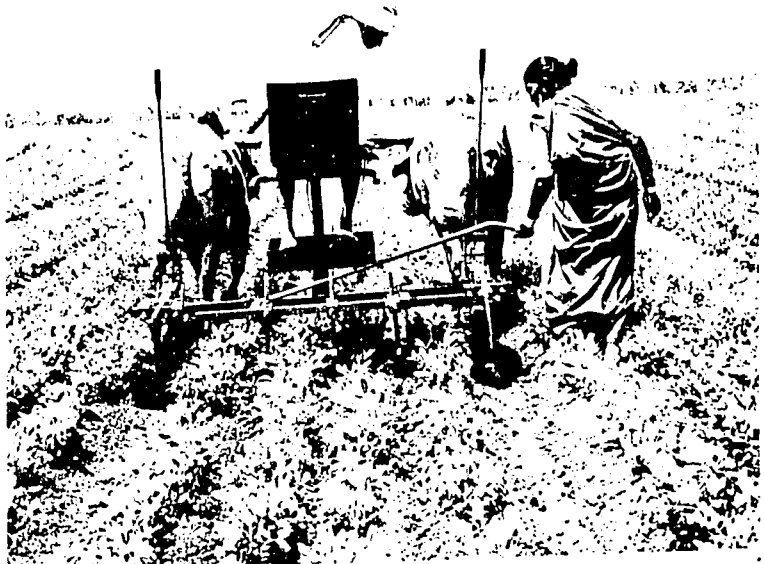
The draft or force required to pull a machine depends on the type of implement being used, the width and working depth of the implement, and the type and condition of the soil. Thus it is difficult to specify value of the draft for any particular operation. Indian farmers' experience has shown that all operations can normally be done using a medium-sized pair of oxen (300 kg each). It is advisable to do heavy operations such as plowing when soil conditions are reasonably good.

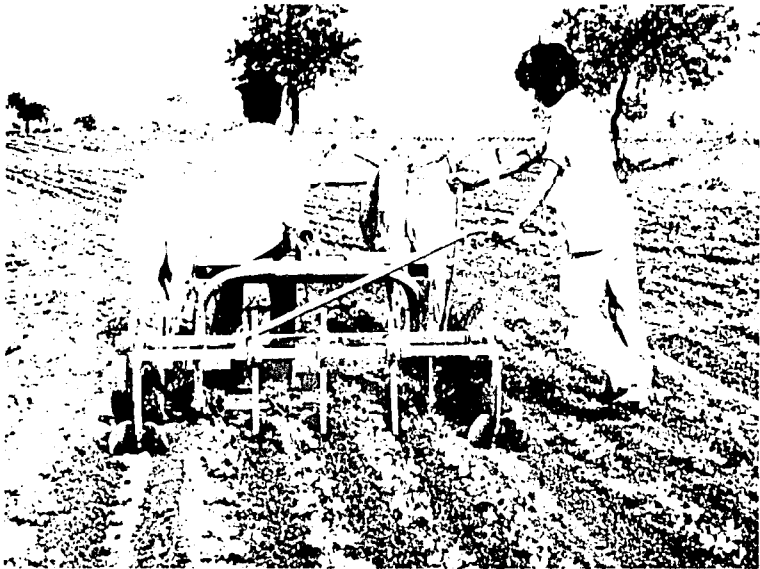
The equipment offers valuable time-saving advantages to farmers. A traditional wooden plow in India with a maximum working width of 15 cm requires the farmer to travel 67 km when his oxen cover 1 ha. A 75-cm blade harrow requires 13 km of travel. For light operations, where the working width is 150 cm, the distance traveled per hectare by the wheeled tool carrier is 7 km—only 10% of that required by the traditional plow.



An Indian farmer uses a low-cost hand-metering device attached to a Tropicultor to apply fertilizer as a top dressing.

Interrow cultivation on 150-cm raised beds with four rows of soybean.





A steerable toolbar being used for interrow cultivation in a farmer's field in India.

Cart attachments on the Tropicultor used to carry forage and farm produce.



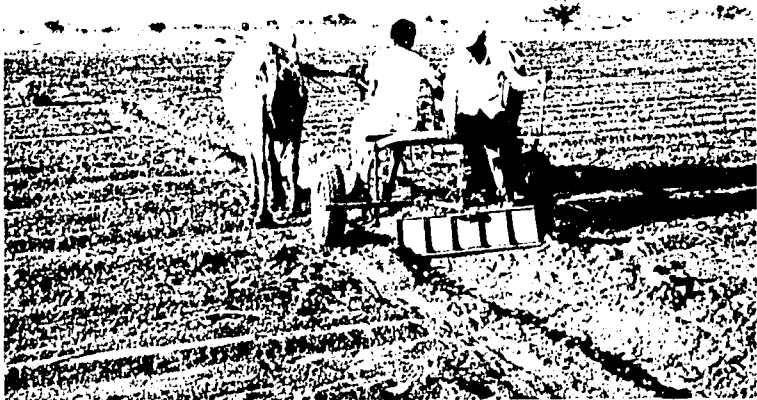
Advantages of the tool carrier

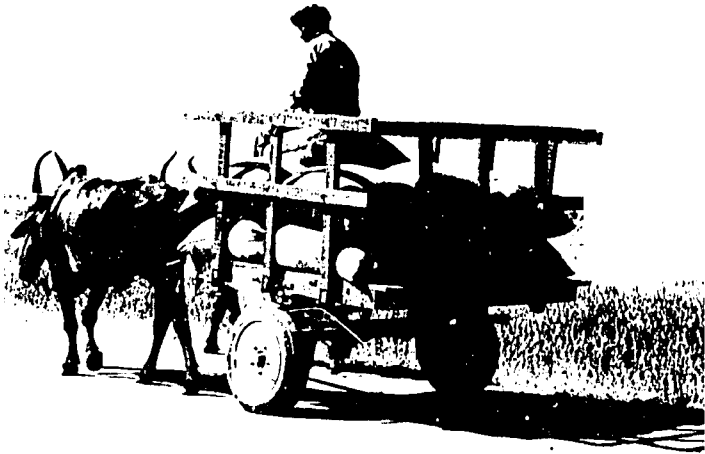
- Reduces drudgery for the operator, who can ride on the machine instead of having to walk behind it.
- Provides more uniform operations through good depth control; the more uniform draft that results is also less tiring to the animals.
- Allows year-round use because of its multipurpose capability.
- Some models can be used as a cart for transport.

Drawbacks of the tool carrier

- Costs more than the small farmer can normally afford, although these costs can be spread over many operations on larger areas.
- Requires maintenance, especially of pneumatic tires, that may not be available under village conditions. However, the problem from pneumatic wheels does not arise in the case of the Agribar.

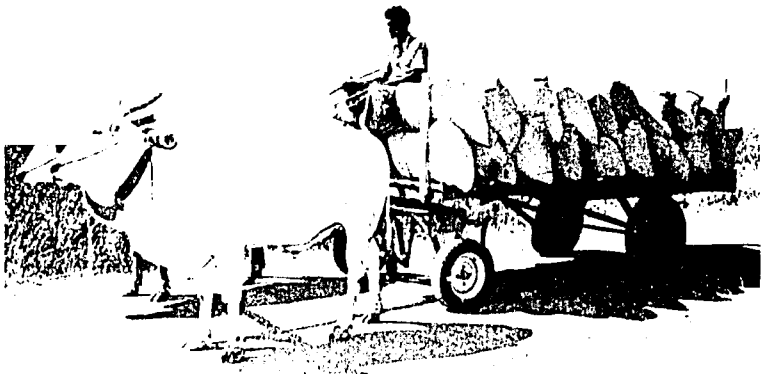
Constructing a waterway using an angled blade scraper.





Nikart being used to carry forage and farm produce.

Transporting farm produce with Tropiculcor converted to a four-wheel cart.



Conclusions

The wheeled tool carrier provides the small farmer with a system of machinery that enables

- rapid and timely execution of cropping operations such as tillage, planting, and weeding;
- efficient application of seed and fertilizer, both in quality and placement;
- precise planting for both sole crops and intercrops;
- transportation of inputs and produce.

At the same time, the wheeled tool carrier reduces labor requirements and costs. Thus, in the long run, it can increase agricultural production and farmers' incomes particularly in regions where the land per farmer is high.

Additional information

Names and addresses of firms manufacturing wheeled tool carriers are listed on the back cover, for the convenience of buyers. There may be other suppliers of whom ICRISAT is not aware. Neither the listing herein should not be taken as an endorsement by ICRISAT, nor is the Institute in any way responsible for the quality of manufacture. For further information, contact manufacturers directly.

Photo credits:

Patankar Photo Studio, Anjangaon Surji, Amravati, India (front cover).

Pontal Material Rondate S/A, Brazil, p. 4, right.

Mr Harbans Lal, p. 4, left.

Caera Maquinas Agricolas S/A, Brazil, p. 5, top left.

Department of Agriculture, Government of Mozambique, p. 6, top right.

National Institute of Agricultural Engineering, UK, p. 6, bottom photographs.

Voltas Ltd., Bombay, India, p. 7, left.

Ministry of Agriculture, Mexico, p. 8-9, top center.

Suppliers of Wheeled Tool Carriers known to ICRISAT in May 1988

Supplier	Brand Name
Ceara Maquinas Agricolas S/A Av. Gaudioso de Carvalho, 217 Bairro Jardim Iracema Caixa Postal D-79 60.000 · Fortaleza · CE BRAZIL	Policultor 1500 ²
Geest Overseas Mechanisation Ltd. White House Chambers Spalding Lincolnshire PE11 2AL, UK	GOM ¹
Kale Krishi Udyog S. no. 31/2/2, Hinge Khurd Vithalwadi, Sinnagad Road Pune 411 051, INDIA	Tropicultor Agribar
Medak Agricultural Centre (Equipment) Cathedral Compound Medak, A.P. 502 110, INDIA	Agrikart ²
Mekins Agro Products Private Ltd. 6-3-866/A Begumpet, Greenlands Hyderabad, A.P. 500 016, INDIA	Nikart ¹ Tropicultor
Officina Vencedora Rua Barao do Rio Branco, 599 56.300 · Petrolina · PE, BRAZIL	Multicultor CPATSA II
Pontal Material Rodante S/A Rua Campante No. 237 Vila Independencia Caixa Postal, 833 01.000 · Sao Paulo · SP, BRAZIL	Policultor Pontal ²
Sergio Solorzano de la Vega Balboa 125 Esquina Jacarandas Fraccionamiento Virginia Veracruz, Ver, MEXICO	Yunticultor ¹

-
1. Nikart, Yunticultor, and GOM are different names for the same machine.
 2. The Agrikart, Policultor 1500, and Policultor Pontal are similar to the Tropicultor in design.