The Arid Area Weed Control Centre

International Crops Research Institute for the Semi-Arid Tropics

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Compiled and edited by

G.E. Thierstein

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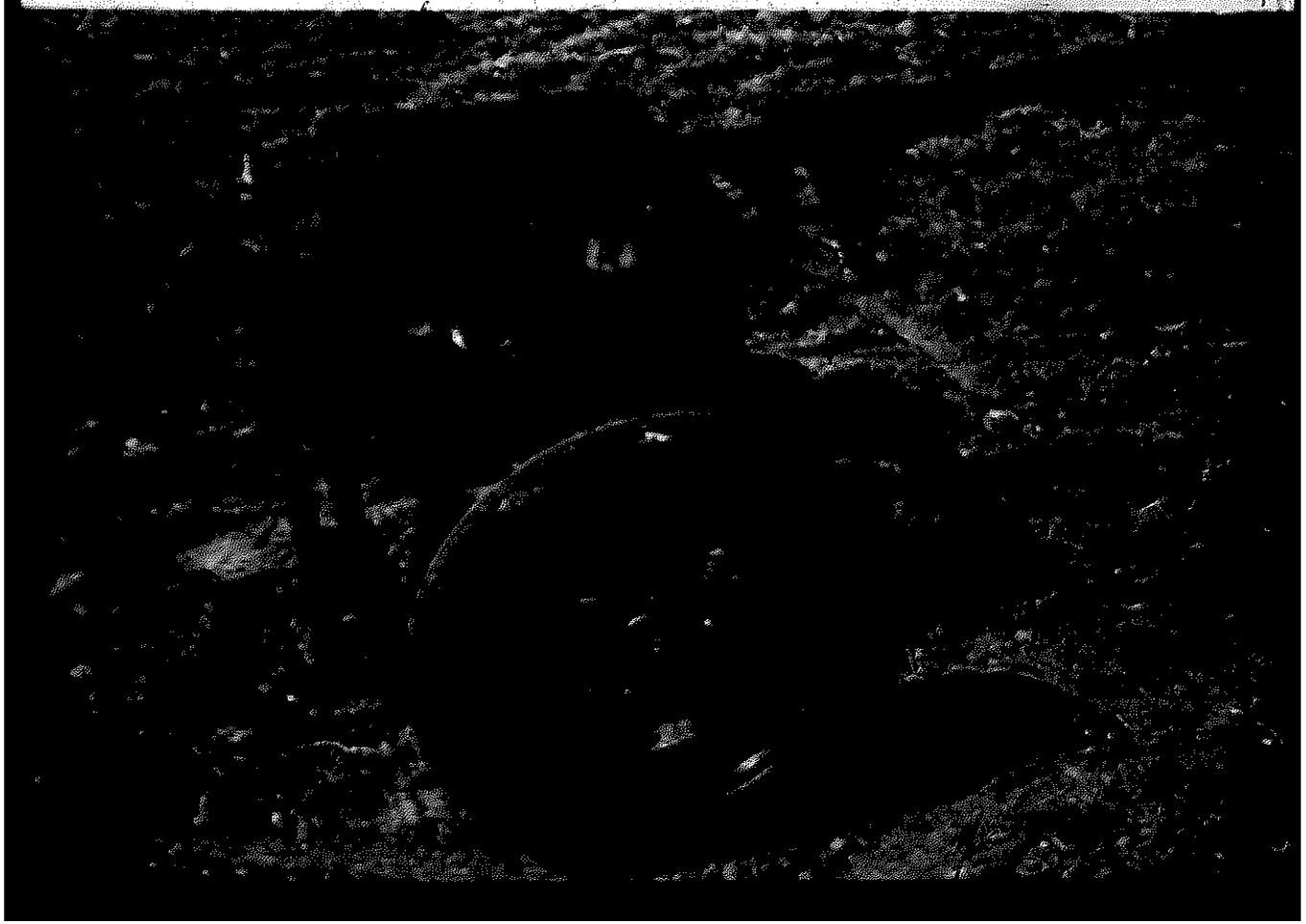
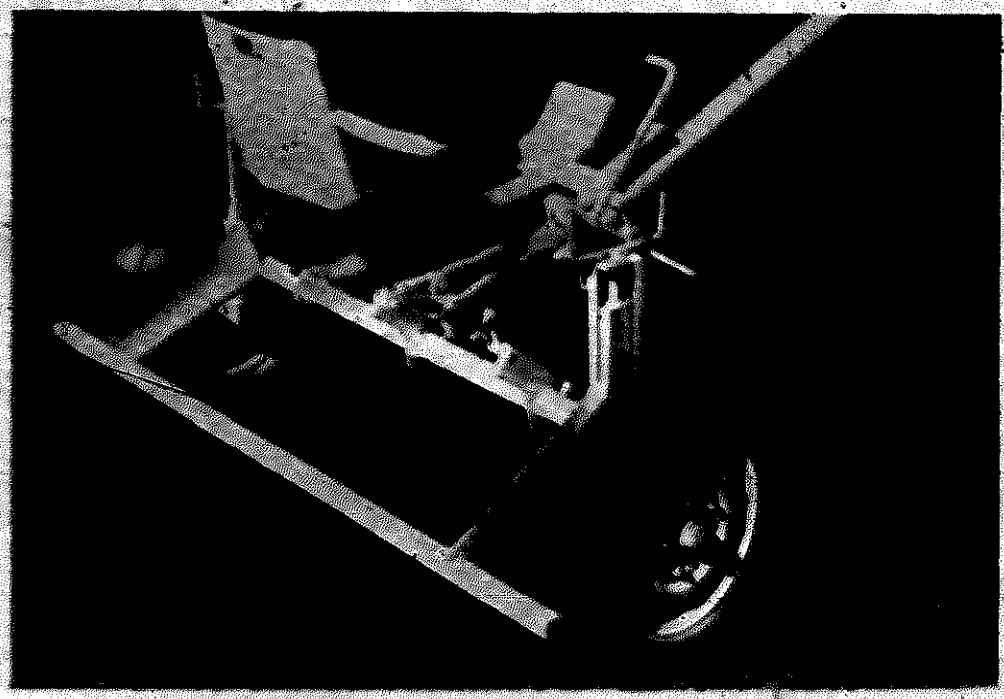
The Animal-Drawn Wheeled Tool Carrier

The animal-drawn wheeled tool carrier is a multipurpose machine designed to perform agricultural operations and provide transportation where animals are the main source of power. It can perform virtually all operations that a tractor can, 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 25 years ago such machines could be found in East Africa, India, and Senegal. The early models had various design and functional weaknesses, however, these have been improved through many years of experience and development. Various models are now available; the Tropicultor and the Nikart

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





The Nikart is a newer model of the wheeled tool carrier, designed by the National Institute of Agricultural Engineering, U.K. in collaboration with ICRISAT.

are two examples illustrated here. These machines permit tilling, planting, fertilizing, and weeding operations to be done with greater speed and precision to increase productivity. As a bonus, the tool carrier can be used as a cart to provide transportation.

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 the working position; a locking device holds the implement firmly in either position.

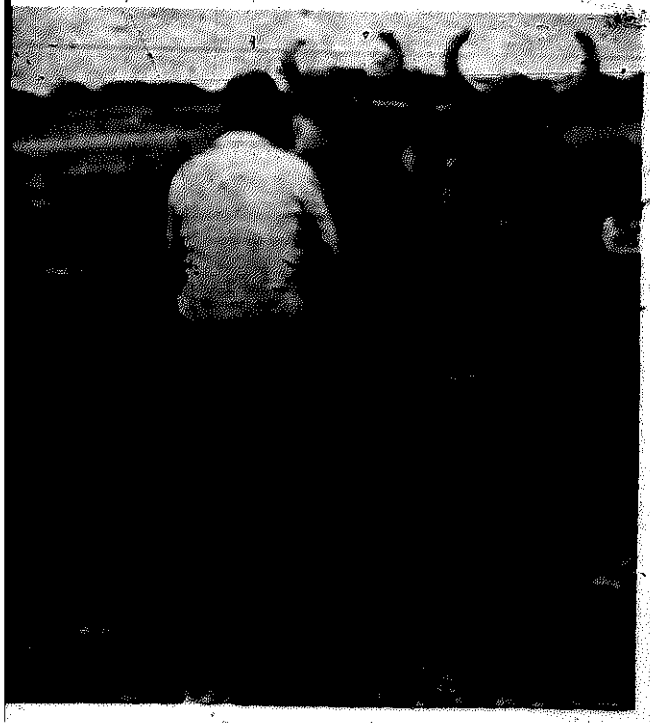
The weight of a tool carrier, including wheels and tires, usually ranges from 150 to 200 kg; the pneumatic tires and roller bearings keep the rolling resistance to about 10 to 25 kg.

Uses of the wheeled tool carrier

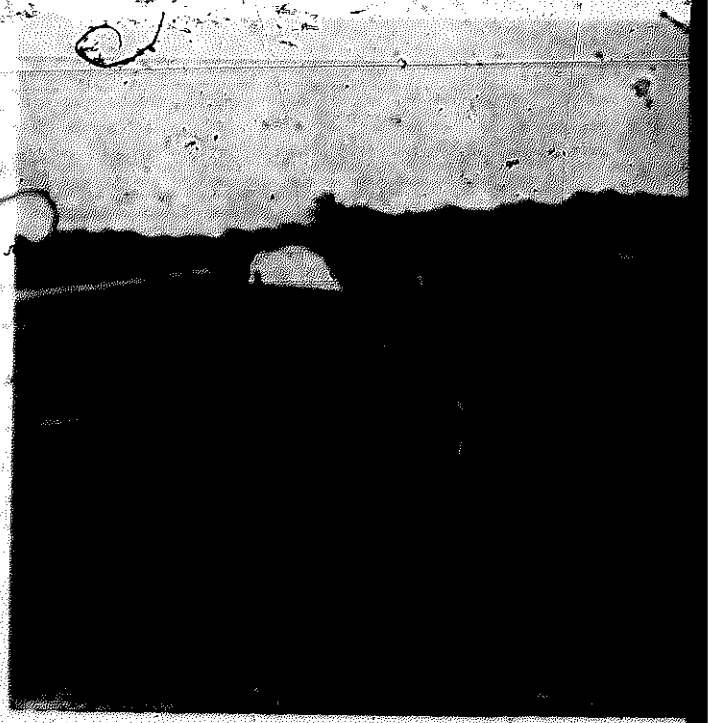
1. Tillage

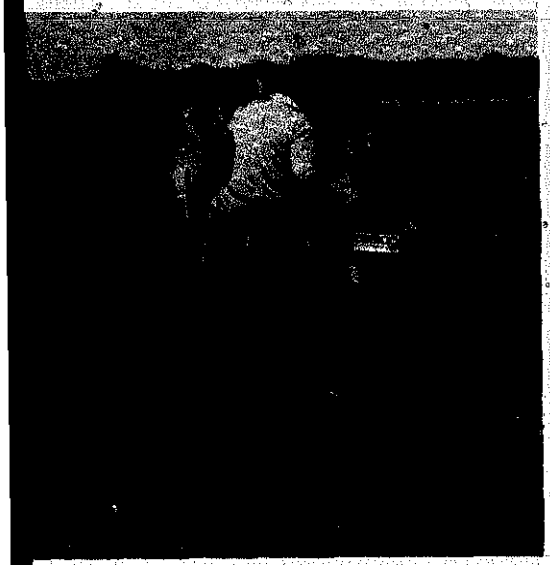
- Primary tillage can be done with either a reversible or a nonreversible disk or moldboard plow and also by using a ridger or chisel plow. Since the Nikart has a fixed wheel track, the beam is moved laterally to an alternative position on the right to maintain a straight line between the center of the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

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.

Plowing with an Agricart.

2. Planting and fertilizer application

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

Primary tillage on 150-cm permanent raised beds, with a Wheeled Tool Carrier (left to right, Agricart, Nikart, and Tropicultor).

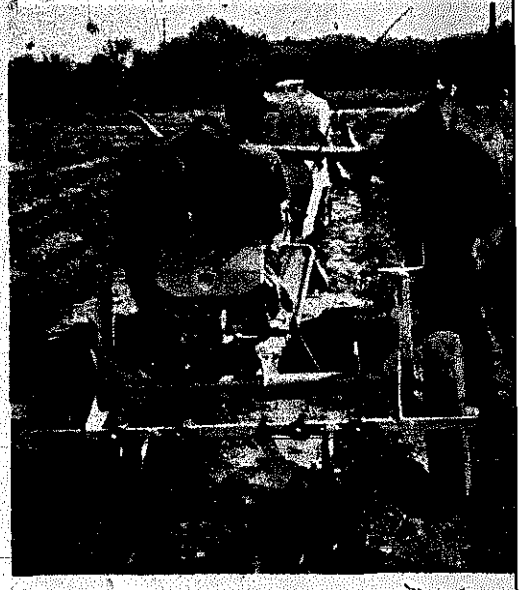
Plowing with a Tropicultor in Mozambique. The curved standard provides good clearance for grass, weeds, or crop residues.

- 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-time cultivators with duckfoot sweeps and blade harrows in appropriate widths.

Making ridges at 150 cm with the Nikart in Botswana.



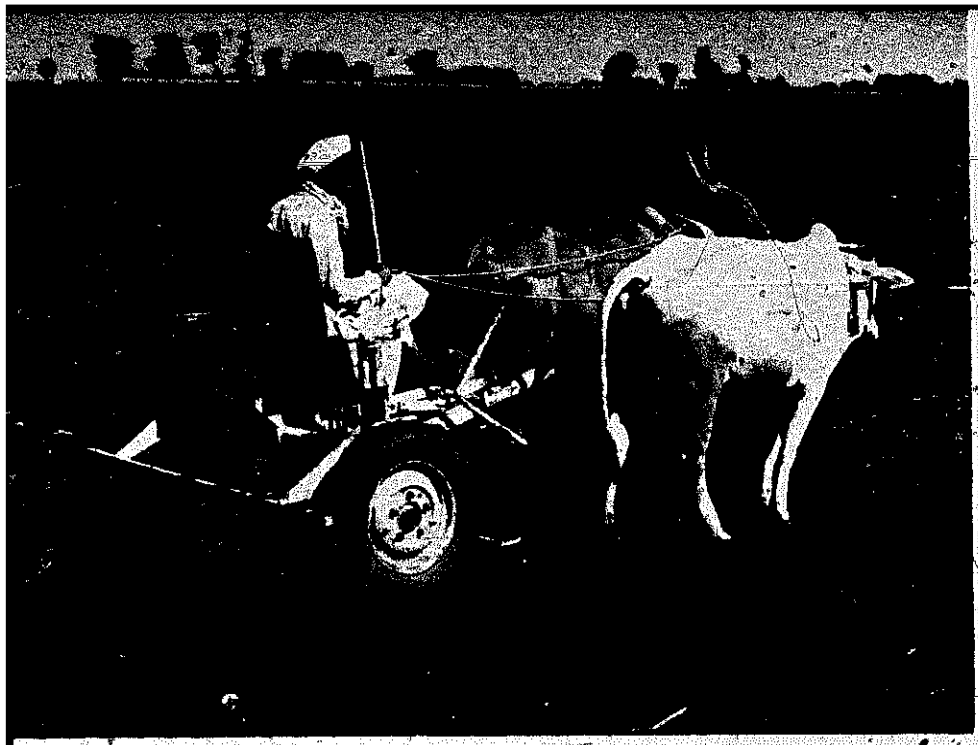
Ridges are first at 150 cm with a Nikart in Botswana, with a second pass, ridges can be made at 50 cm.

4. Harvesting

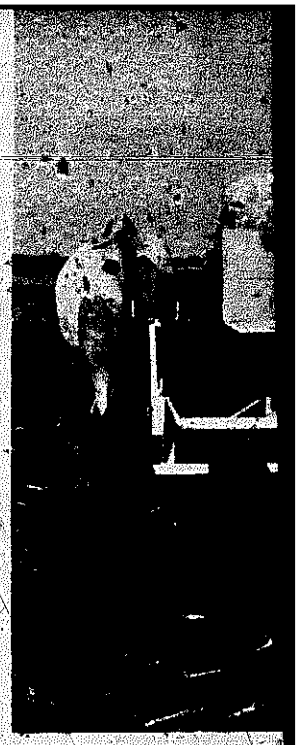
- Groundnut lifting.

5. Transportation

6. Land Shaping



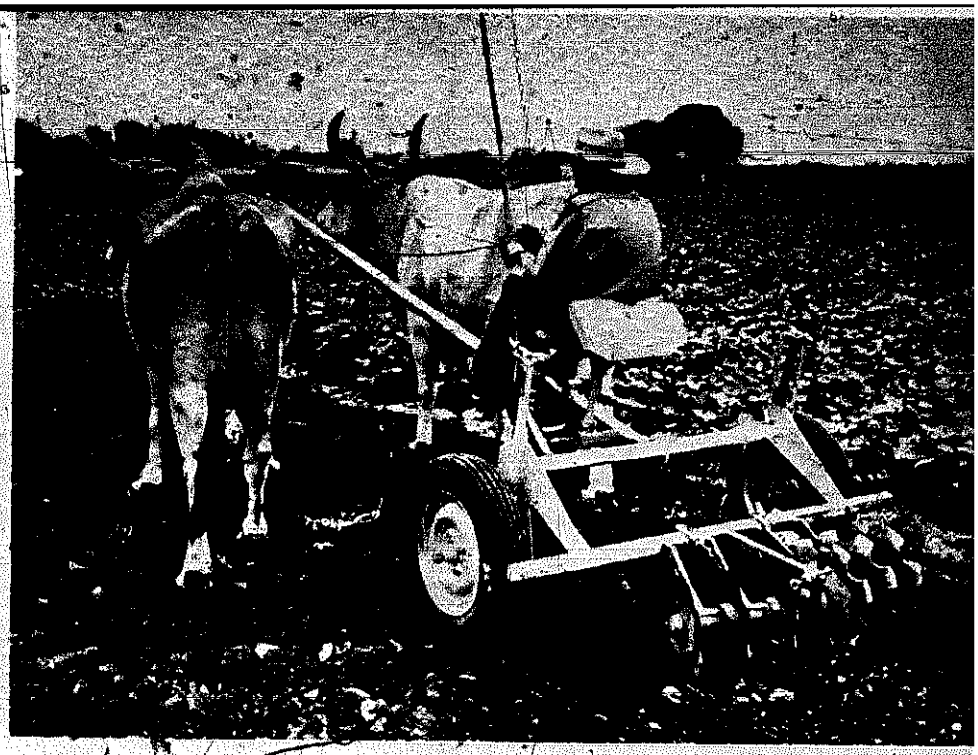
Preparing the seedbed using a spring-tine cultivator.



Using a 1-m. blade ha
tillage before final bed

Final shaping of raised beds using a Tropicultor in India.

Planting with a set of u

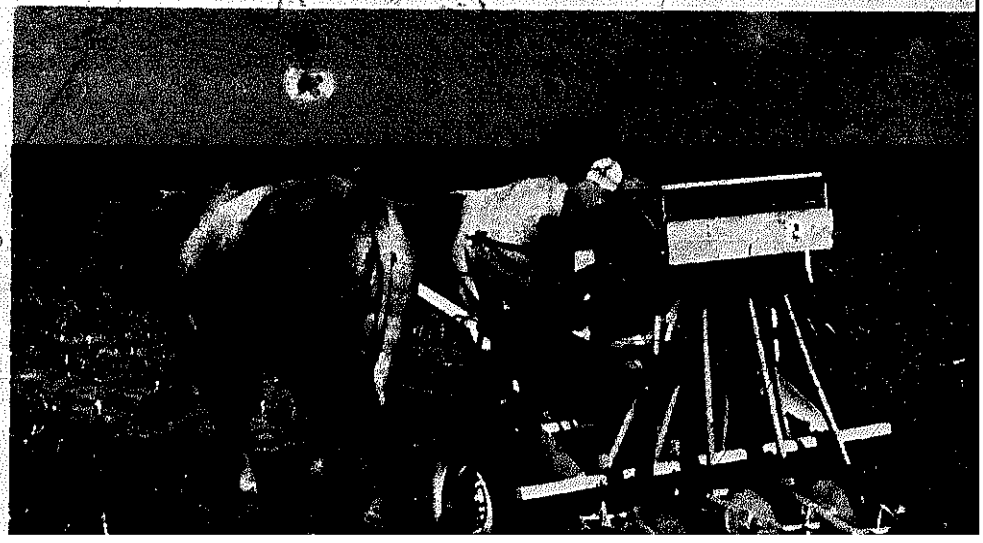


for secondary
ing.

Preparing the seedbed with a disk harrow attached to a Yunticultor in Mexico.

anters.

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



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

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 to 3.5 km/hr; horses and mules will usually walk a little faster. Oxen can usually pull 7.5 to 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 and can provide 1 hp of tractive effort. A pair of oxen weighing 300 kg each has no difficulty in pulling a sustained load of 150 kg or more. Thus experience has shown that farmers owing small bullocks can also use the tool carrier effectively if they adjust the load to the capability of the animals.

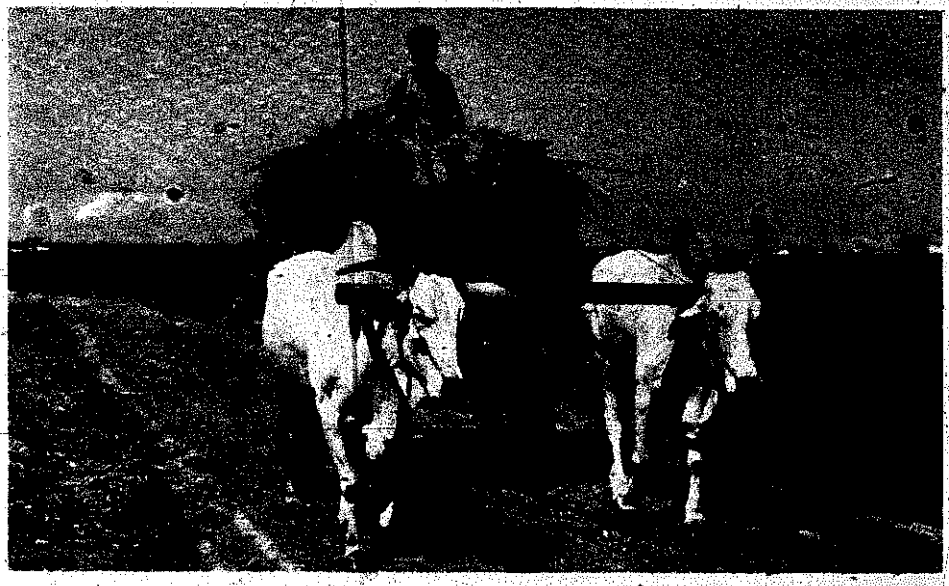
Field efficiency is the percentage of time that a machine is performing useful work; it ranges from 50 to 80%, depending on such factors as the skill of the operator, size of field, condition of field, and type of operation being done. If the field is long, less time is wasted in turning than if turning has to be done frequently in a short field. A pair of animals walking at 3 km/hr pulling a plow 15 cm wide and operating at 75% field efficiency will cover 0.03 ha/hr or 0.2 ha in a 6-hr 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-hr 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 give a precise value to the requirement for any particular operation. Indian farmers' experience has shown that all operations can normallly be done using a medium-sized (300 kg each) pair of oxen. It is advisable to do heavy operations such as plowing when soil conditions are reasonalby good.

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

The equipment offers valuable time-saving advantages to farmers. A traditional wooden plow in India with a maximum working width of 15 cm requires 66.7 km of travel by the farmer and his oxen to cover 1 ha. A 75-cm blade harrow requires 13.3 km of travel. For light operations, where the working width is 150 cm, the distance traveled per hectare by the wheeled tool carrier is 6.7 km—only 10% of that required by the traditional plow.

Transportation is a Wheeled Tool Carrier bonus. Cart attachments on Tropicultor (above) and Nikart (below) are 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.
- Can be used as a cart for transportation.

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 pheumatic tires, that may not be available under village conditions.

Transporting farm produce with Wheeled Tool Carrier converted to four-wheel cart.

Constructing a waterway using an angled blade scraper.

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 quantity and placement;
- precise planting for both sole crops and intercrops; and
- transportation of inputs and produce.

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

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. 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.

Suppliers of Wheeled Tool Carriers known to ICRISAT as of 1 February 1983.

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. West Marsh Road Spalding Lincolnshire PE11 2BD, U.K.	Nikart[1]
Medak Agricultural Centre (Equipment) Cathedral Compound Medak Andhra Pradesh 502 110, INDIA	Agrikart[2]
Mekins Agro Industrial Enterprises S-16, EEI Estate Phase II Balanagar Hyderabad - 500 037, INDIA	Nikart[1] Tropicultor
Oficina 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]
Voltas Ltd. Agro Industrial Products Division 19, J.N. Heredia Marg Ballard Estate Bombay 400 038, INDIA	Krishi Rath[1]

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

ICR 83 - 0612

Photo credits:

Patankar Photo Studio, Anjangaon Surji, Amravati, India, Front Cover.

Pontal Material Rondate S/A, Brazil, p.3, left.

Mr. Harbans Lal, p.3, right.

Ceara Maquinas Agricolas S/A, Brazil, p.4, top left.

Dept. of Agriculture, Govt. of Mozambique, p.4, bottom right.

National Institute of Agricultural Engineering, U.K., p.5, both photos.

Voltas Ltd., Bombay, India, p.6, top left.

Ministry of Agriculture, Mexico, p.6/7, bottom middle; p.7, top right.

ICRISAT

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