The use of equids for agricultural work in Cuba

by

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Summary

In Cuba, horses, mules and donkeys are mainly used for transport. Oxen have been the work animals employed for soil tillage. The agricultural mechanisation institute, IIMA, working with French colleagues, undertook a two-year programme of on-station tests using heavy Percherons and light Creole horses, with fieldwork in Pinar del Rio Province. Different harnesses were tested, and it was concluded that collar harnesses with breeching straps were appropriate, with a small saddle for implements with shafts (such as carts). Soil tillage equipment of different types was tested. Single horses could not easily pull implements with high draft requirements. They could successfully work with small or medium plows, harrows, cultivators, seeders and multipurpose toolbars. The working characteristics of these are reported here. The '6 in 1' toolbar seemed a suitable multipurpose implement and could be used in conjunction with a mouldboard plow, light harrow, five-tined cultivator and the SG1 seeder. It is concluded that horses can be used effectively for agricultural work in Cuba, and further promotion is warranted.

Introduction

Equids include horses, mules and donkeys. In Cuba, these are primarily used for transport, in conjunction with various devices such as saddles, pannier bags, chains, sledges, carts, carriages and wagons. Horses are also used for recreation and competition. Equids have sometimes been used for agricultural work and powering sugar mills, but oxen are the animals traditionally used for farm work. All animals have acquired greater importance in the last few years as a result of the scarcity of fuel and other inputs needed for motor-powered mechanisation.

Indigenous Cuban communities had no knowledge of equids. The first horses were ridden by the conquistadors. These caused terror in the native population who at first believed them to be gods. The equids were able to adapt to the climatic conditions in Cuba and reproduced successfully.

Animal power is now extremely important in Cuba, for economic, political, social and cultural reasons. In recent years, animal traction has enabled the level of agricultural production to be maintained despite lower levels of motor power and inputs. The tradition of the ox team handler has been revived, along with the skills of blacksmiths and artisans. Animal traction technology represents a sustainable production model that can help to conserve soils and reduce pollution. Whatever the level of motorised mechanisation, animal traction will always be relevant for certain activities for which it is particular efficient. These include the cultivation of land where tractor use is difficult (sloping land, soils with many stones or tree stumps) and in small family farms.

Equids can be used for soil preparation, planting, crop cultivation and harvesting, in addition to their transport work. There are about 300 000 horses capable of fieldwork, as well as more than 4000 donkeys and 30 000 mules (MINAGRI, 1999). Horses are mainly of the Creole type or crossbreds, and there is the possibility of introducing alternative breeds suitable for farm work. The present socio-political conditions in the country are favourable for promoting the use of equids for agricultural operations. The training infrastructure is in place, with training centres for ox-drivers (*boyeros*) available across the country. There are also polytechnics and universities with experience in providing courses in animal traction.

The use of equids for agricultural power should be productive and highly beneficial, provided that they are harnessed to suitable implements and used in conjunction with soil conservation practices.

To investigate this, the Institute of Agricultural Mechanization (IIMA) in collaboration with the French organization Socorro Popular Francés undertook a two-year programme of on-station implement testing and related promotional work in Pinar del Río Province. This paper summarises this work.

Objectives

In 1998, a project aiming to promote the use of equids for farm work in Cuba was funded by Socorro Popular Francés (a French NGO) and implemented by the Cuban Association of Animal Production (ACPA) and IIMA. Operations addressed included primary tillage, seedbed preparation, sowing, crop cultivation and harvesting. The project focused on locations where there was little use of tractors, due to hilly conditions, small fields or unsuitable soils. Since the technology was new to the country, it was essential to consider the socio-economic conditions, the infrastructure and the local traditions which are fundamental for a successful introduction. For the initial phase, the San Cristóbal and Bahía Honda area of Pinar del Río Province was selected for developing pilot training activities. This area had a long tradition of animal traction use and a high potential for farmers to adopt the technology. The area was relatively close to IIMA (Havana) and had suitable farms for the testing work, including the El Vaquerito farm, San Juan de Guacamaya mule farm and the state animal farms at San Cristóbal and Bahía Honda (Sotto, Wong and Armada, 2000).

The programme aimed to:

- Study harnesses and develop recommendations on the most appropriate harnesses for farm work with equids.
- Improve existing animal traction farm implements and introduce others more suited for use with both light and heavy equids.
- Develop recommendations on systems for using equids in farm work in Cuba and on the most appropriate technologies.
- Promote the use of equids for agricultural work.

Harnesses for agricultural work with equids

The study on appropriate harnessing for equids for agricultural tasks, started with a review of existing harnessing systems. In Cuba, there has been a long tradition of using yokes with oxen because they have strong and resistant heads and necks. By contrast equids tend to be much weaker in these areas, whilst their chests and backs are strong and wide. For this reason, collar and breast harnesses are generally used with equids.

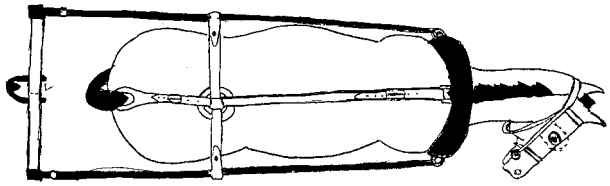
In many parts of the world, collars are considered the best option for equids in high-draft operations such as plowing and pulling heavy carts. Collar harnesses consist of two linked hames of wood or metal and a collar of padding, together with the traces and adjustable straps to maintain its position. For agricultural work, harnesses should be as light and simple as possible. It is always important to avoid chafing and wounds by ensuring the collar fits the anatomy of the animal and by protecting the animal from chafing traces. The collars, girth straps and bridles (head harnesses) should be well adjusted so as not to rub the animals. All the harness parts should be kept clean and, when they are put on the animal, care must be taken to place and adjust them properly to avoid friction and pinched hide under the straps.

The project decided to recommend the use of a full collar harness, complete with breeching strap and crupper. A simple saddle should be added when pulling carts and carriages (Figure1).

Figure 1. Horse fitted with harnessing system with collar

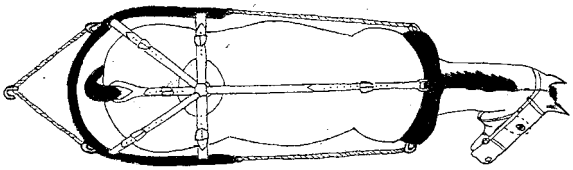
For agricultural work using a collar system, the traditional arrangement is for the traction chains to pull a metal or wooden swingle-tree connected to the implement (Figure 2).

Figure 2. Traction system with collar, traces and a swingle-tree



The swingle-tree can damage tall plants and the chains may become entangled with the animal's hind legs, resulting in lost working time. To overcome these difficulties, the project worked with French specialists and developed a traction hoop that they considered more effective (Figure 3).

Figure 3. Harness system with collar and traction hoop



Evaluation of agricultural implements for use with equids

Implements used with equids should de correctly designed and constructed to ensure productive and efficient work. Donkeys, mules and light horses are normally used in low-draft work such as weeding, furrowing, ridging and sowing, whilst heavy horses or teams of two or more animals can be used for soil preparation, root crop harvesting and other heavy work.

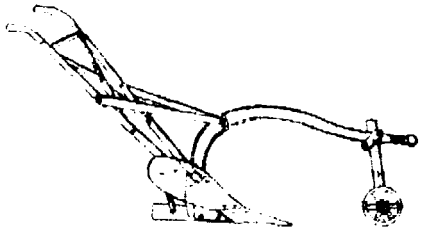
The project started by using the same implements used with oxen, including the mouldboard plow (*arado americano*), the five-tined cultivator (*araña*) and the spike-toothed harrow. New implements developed for oxen were also assessed, including the six-in-one multi-purpose toolbar (*multiarado*) and the SG1grain seeder.

Implements were evaluated in the small food-production plots of the State livestock farms of Bahía Honda and San Cristóbal. Light Creole horses were used, as well as some heavy Percheron horses and Creole mules. Topographical conditions varied from flat to undulating and to mountain foothills. The soils were medium and heavy textured and some were compacted.

Mouldboard plows

The medium sized mouldboard plow (*arado americano* No 2) was found to be too heavy for single equids (even a Percheron) and also for one pair of oxen. Its use cannot be recommended under the conditions of the trials (Sotto, Wong and Armada, 1999).

Figure 4. Mouldboard plow (arado americano)



Tests carried out with the smaller available mouldboard plow (*arado americano No 1½,* see Figure 4) showed that it could be used for land preparation by both light and heavy horses, provided the soil is not too compacted (Table 1). It can be recommended for weed control in plantations and tillage that involves soil inversion (for burial of weeds and crop residues).

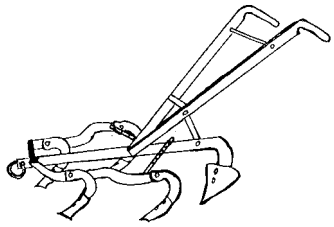
Table 1. Some technical characteristics of plow No 1½

Characteristic	*Performance*
Width of work	*20-22 cm*
Depth of work	*12-14 cm*
Productivity: initial plowing, crossing and re-crossing	*0.40 ha day^{-1}*
Productivity: ridging	*0.73 ha day^{-1}*

Cultivators

Cultivators (*arañas* or *grillas*) comprise a steel frame to which three or five cultivation tines are attached. The soil acting points can be triangular for weeding or chisels for harrowing (Figure 5).

Figure 5. Five-tined cultivator



Both light horses and mules can work well with this implement, even in hilly areas. It can be recommended for weeding in many crops including beans, maize and soya and it can also be used to mark and split ridges. Some characteristics are given in Table 2.

Table 2. Some technical characteristics of the tined cultivator

Characteristic	*Performance*
Width of work	*90 cm*
Depth of work	*5-10 cm*
Productivity: weeding	*0.94 ha day^{-1}*

Spike-toothed harrow

The traditional harrow (*pincho*) consists of a triangular frame, a traction ring, skids for transport and a number of spikes that depends on the size of the implement. Spikes are made from pointed cylindrical steel bars, attached to the frame with bolts. During field trials, the traditional ox-drawn implement proved to be too heavy for equids. A lighter design was recommended and an adjustable prototype harrow was made (Figure 6). This has handles to improve its stability and control, and proved easy to use and adjust. It produced a fine tilth and is recommended for weed control and to remove sweet potato vines and crop residues. Some characteristics are given in Table 3.

Figure 6. Prototype adjustable harrow

Table 3. Some technical characteristics of the spike-toothed harrow (light version)

Characteristic	***Performance***
Constructed width	*1.10 – 1.5 m*
Width of work	*1.10 m (or more)*
Depth of work	*10-20 cm*
Distance between spiked-tines	*25 cm*

Multi-purpose '6 in 1' toolbar (*multiarado*)

This multi-purpose implement comprises a straight or curved main beam provided with a hake adjustment, adjustable depth-wheel, handles and a vertical bar onto which a range of tools can be bolted (Figure 7).

The soil-engaging implements include a chisel point, and sweeps (200 mm, 300 mm and 400 mm), ridgers, mouldboard plow (size 1½), root-crop lifters and a seed-bed former (*montador de cantero).* This implement can be used for modern soil tillage systems based on applying a horizontal cut to the soil for sub-soiling, primary plowing, secondary plowing, weeding and ridging. It can also be used for harvesting vegetables and tubers. The various functions require changing the soil-working pieces on the implement main-frame, and some of the options are given in Table 4.

Figure. 7 Multiarado ´´6 in 1´´ lighter version

Table 4. Possible operations with the *Multiarado* and tool options

Operation	*Tool options*
Subsoiling and deep scarification	*Chisel*
Non-inversion plowing	*Chisel + sweep 300 mm*
Inversion plowing	*Mouldboard 1½*
secondary tillage	*Chisel + sweep 600 mm*
Ridging and splitting	*Chisel + sweep 400 mm + rider*
Weeding	*Chisel + sweep 300, 400 mm or 600 mm*
Ridging	*Chisel + ridger*
Weeding and earthing-up	*Chisel + sweep 300 or 400 mm + ridger*
Sowing grains	*Chisel + seeder SG1*
Harvesting tubers and vegetables	*Chisel + sweep 300 mm with deflectors*

Grain seeder (Promech design, version SG1)

The Promech seeder was developed in Honduras and promoted in Central America by the Fomenta project. It consists of a covered hopper, rotor, wheel, seed cleaner, seed coverer, attachment point and chain (see Figure 8). It was tested in Cuba and found very suitable, although some small modifications were made (including changing the diameter of the wheels). It is designed to sow beans, maize, soya and rice, and with a change of rotors, it can also be used for sorghum, sesame, sunflower and other seeds. Some characteristics of the modified version (SG1) are given in Table 5.

Table 5. Some technical characteristics of the Promech grain seeder (version SG1)

Characteristic	*Performance*
Hopper capacity	*3.2 kg*
Depth of work	*0-10 cm*
Rate of work	*0.2 – 0.3 ha* h^{-1}
Weight	*10 kg*

Figure 8. SG1 seeder

Kanol toolcarrier

The project also made and tested a *Kanol* tool-carrier, based on a design of the French agricultural engineer, Jean Nolle. The tools of the '6 in 1' toolbar were attached to the Kanol toolcarrier. During field trials and demonstrations the toolcarrier received much approval due to its stability, versatility and use of shafts to pull it (Figure 9).

Figure. 9 The Kanol tool-bar made in IIMA

The technical characteristics of the *Kanol* depend on the many posible tools that can be attached. These include a plow, weeding tines and scarifiers. The shafts can also be used for a light cart. To improve the longitudinal stability during work on slopes, the project designed a hake plate with a series of holes that make it easy to change the attachment point for different directions of work.

Training and promotion

If equids are to contribute more to Cuban agriculture, there will be need for both training and promotion. In each reference area of the project, mules, light and heavy horses have been made available for a study of the implements and harnesses necessary. Two agricultural polytechnic institutes (Tranquilino Sandalio and Grito de Baire) and the cooperating equid breeding centres are expected to contribute to subsequent diffusion.

Training sessions were held at Bahía Honda and San Cristóbal, and 93 people received instruction relating to equid feeding, training, management and hoofcare, harnessing, implements and related blacksmith work. A training manual on these topics has been published (Sotto, Wong and Armada, 1999). A smaller number of people were trained in harness-making and farriery, and appropriate tools and materials were made available for future use.

Conclusions and recommendations

For farm work with equids, light, economical and hardwearing harnesses are required. For agricultural work the basic requirement is for padded collars with breeching strap and crupper, together with a light saddle for use with carts, carriages and certain implements like the *Kanol*.

For soil tillage work the '6 in 1' toolbar can be used with the appropriate tools, such as the mouldboard plow (1½), the light adjustable harrow and the five-tined cultivator. The Kanol is an alternative toolbar option, and a wider range of implement options should be assessed under Cuban conditions. For weeding work the '6 in 1' with cultivator attachment is was found suitable, but the adjustable harrow can also be used. For sowing, the SG1 seeder is available.

Some initial training activities have already been undertaken, and the experience gained from this project should now be extended throughout the country.

Acknowledgement

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