

# The use of animal traction in Pinar del Río Province, Cuba

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## Abstract

In Pinar del Río, Cuba's westernmost province, the use of draft cattle dates back to the beginning of Spanish colonization. In this region, animal traction remains a vital option for agricultural production and transportation, and is widely used by farmers and in everyday life, both rural and urban. A diagnostic assessment was conducted to understand the current use of animal traction in Pinar del Río. The study covered the entire province. Information was obtained through surveys, and small farmers were contacted. Using participatory methods, a diagnostic survey was conducted in Pinar del Río province. The survey was designed to determine the level of animal traction use. The study showed that animal traction constitutes an important and widely used source of energy. In Pinar del Río province, animal traction has been of great importance throughout history, especially in the agricultural sector and particularly among tobacco producers. Oxen are the most commonly used draft animals in rural areas for agricultural mechanization and transportation. Draft cattle, a source of power, have consolidated traditions in Pinar del Río and are part of the region's history. Draft cattle will forever be an indelible part of Pinar del Río's rural culture.

## Résumé

À Pinar del Río, province dans l'ouest de Cuba, l'utilisation de la traction bovine remonte au début de la colonisation espagnole. Dans cette région, la traction animale demeure une option essentielle pour la production agricole et le transport, et est largement utilisée par les agriculteurs et dans la vie quotidienne, tant en milieu rural qu'urbain. Une évaluation diagnostique a été menée afin de comprendre l'utilisation actuelle de la traction animale à Pinar del Río. L'étude a porté sur l'ensemble de la province. Les informations ont été obtenues par le biais d'enquêtes et les petits agriculteurs ont été contactés. À l'aide de méthodes participatives, une enquête diagnostique a été menée à bien dans la province de Pinar del Río. L'enquête visait à déterminer le niveau d'utilisation de la traction animale. L'étude a montré que la traction animale constitue une source d'énergie importante et largement utilisée. Dans la province de Pinar del Río, la traction animale a joué un rôle crucial tout au long de l'histoire, notamment dans le secteur agricole et surtout chez les producteurs de tabac. Les bœufs sont les animaux de trait les plus couramment utilisés en zone rurale pour la mécanisation agricole et le transport. Le bétail de trait, source d'énergie, ont consolidé les traditions à Pinar del Río et font partie intégrante de l'histoire de la région. L'attelage bovin restera à jamais une partie indélébile de la culture rurale de Pinar del Río.

## Kurzfassung

In Pinar del Río, der westlichsten Provinz Kubas, reicht der Einsatz von Zugvieh bis in die Anfänge der spanischen Kolonialisierung zurück. In dieser Region ist die Zugkraft von Tieren nach wie vor eine wichtige Option für die landwirtschaftliche Produktion und den Transport und wird von Landwirten und im Alltag sowohl auf dem Land als auch in der Stadt häufig genutzt. Um die aktuelle Nutzung der Zugkraft von Tieren in Pinar del Río zu verstehen, wurde eine diagnostische Bewertung durchgeführt. Die Studie deckte die gesamte Provinz ab. Informationen wurden durch Umfragen gewonnen und Kleinbauern kontaktiert. Mittels partizipativer Methoden wurde in der Provinz Pinar del Río eine diagnostische Umfrage durchgeführt. Ziel der Umfrage war es, den Umfang der Nutzung tierischer Zugkraft zu ermitteln. Die Studie zeigte, dass die Zugkraft von Tieren eine wichtige und weit verbreitete Energiequelle darstellt. In der Provinz Pinar del Río hatte die Zugkraft von Tieren im Laufe der Geschichte eine große Bedeutung, vor allem im Agrarsektor und insbesondere bei Tabakproduzenten. Ochsen sind die am häufigsten eingesetzten Zugtiere in ländlichen Gebieten für die landwirtschaftliche Mechanisierung und den Transport. Zugvieh als Kraftgeber hat in Pinar del Río Traditionen gefestigt und ist Teil der Geschichte der Region. Zugvieh wird für immer ein unauslöschlicher Teil der ländlichen Kultur von Pinar del Río sein.

## Resumen

En Pinar del Río, la provincia más occidental de Cuba, el uso del ganado de tiro se remonta a los inicios de la colonización española. En esta región, la tracción animal sigue siendo una opción importante para la producción agrícola y el transporte, y es ampliamente utilizada tanto por agricultores, así como en la vida cotidiana, tanto rural como urbana. Se realizó una diagnóstico para comprender el uso actual de la tracción animal en Pinar del Río. El estudio abarcó toda la provincia. La información se obtuvo mediante encuestas y contactando a pequeños agricultores. Se realizó una encuesta en la provincia de Pinar del Río utilizando métodos participativos. El objetivo era determinar el nivel de uso de tracción animal. El estudio demostró que la tracción animal constituye una importante fuente de energía ampliamente utilizada. En la provincia de Pinar del Río, la tracción animal ha tenido gran importancia a lo largo de la historia, especialmente en el sector agrícola y particularmente entre los productores de tabaco. Los bueyes es el ganado de tiro más utilizados en las zonas rurales para la mecanización agrícola y el transporte. El ganado de tiro, como fuente de energía, ha consolidado tradiciones en Pinar del Río y forma parte de la historia regional. El ganado de tiro será siempre una parte indeleble de la cultura campesina pinareña.



## Introduction

The use of work animals in Pinar del Río Province (as in all Cuban regions) dates from the early European colonisation of the island. Animal power in this most westerly region of the country remains a vital option for agricultural production and transport, and is widely used by both large-scale and small-scale farmers, and in the daily round of rural and urban life. The renewable bio-energy source provided by work animals is very important for mechanized cropping in the agricultural production systems of Pinar del Río Province. Animal traction plays a vital role in the production of tobacco, which is grown by individuals and cooperatives and is the most important crop of the Province.

Agricultural production in its evolution towards more commercial models develops production systems that are characterized by monoculture, overexploitation of natural resources and dependence on export markets. In this model of agro-industrial agriculture, based on the concept of the Green Revolution, there is evidence of an increase in the dependence on external inputs, thereby causing negative impacts on soils, biodiversity and forests, with high rates of soil erosion, deforestation, environmental pollution, coupled with high energy consumption and an increasing increase in production costs, among other undesirable effects<sup>1</sup>.

Since its inception, agriculture has been an activity requiring considerable energy consumption. From ploughing the land to harvesting and food processing, each stage of the agricultural cycle requires a significant energy input. In the modern era, with the mechanization and industrialization of the agricultural sector, energy consumption has increased even further, posing significant challenges and opportunities for the sustainability and efficiency of the global food system<sup>2</sup>.

The development of agriculture in Cuba was characterized by a broad boom in mechanization that benefited all agricultural crops and livestock. More than a thousand combines were introduced into rice cultivation, which mechanized its harvest to 100 percent, and sowing with seeding machines and aircraft was introduced. Irrigated areas increased significantly from 160,000 to 580,000 hectares, and water reservoir capacity increased more than 100-fold. In sugarcane cultivation, in the 1970s, collators were introduced that carried 98% of the manually cut cane, and more than a thousand combines cut 25% of the canes<sup>3</sup>.

At the height of agro-industrial development in Cuba during the 1970s and 1980s, Cuban agriculture was characterized by the massive introduction of tractors, harvesters, large-scale irrigation systems, hybrid seeds and an emphasis on production of monoculture in large areas. In addition, 48% of chemical fertilizers and 82% of pesticides were imported<sup>4</sup>.

One of the main aspects to consider when it comes to energy consumption in agriculture is the use of agricultural machinery and equipment. From tractors and combine harvesters to irrigation and storage systems, agricultural

machinery relies heavily on fossil fuels to operate. This energy consumption not only entails significant economic costs for farmers but also contributes to greenhouse gas emissions and climate change<sup>5</sup>.

According to Ríos, 2017, in 1989 an acute economic crisis began in Cuba with the collapse of the European socialist block and the disappearance of the Soviet Union. At that time, 85% of Cuban trade was with socialist countries and only about 10% with capitalist countries. This caused purchasing power to be reduced to 40% and fuel imports to fall to a third.

During the 1990s, Cuba needed to make urgent transformations in its agricultural production model, based on an almost total reconversion of its agro-industrial production model, transforming it into a subsistence agriculture model, due to the sudden collapse caused by the lack of inputs, caused by the disintegration of the socialist camp in Eastern Europe and the USSR<sup>6</sup>.

A series of important challenges are looming in Cuba's agricultural sector, which must be addressed with appropriate techniques and technologies. Climate change has been occurring in Cuba for several years, reflecting global phenomena and the particularities of Cuba's geography. These changes have had repercussions on the production of some agricultural crops. For these reasons, it is very important to implement strategies and develop tools that facilitate the adaptation of agriculture to the changes the climate is experiencing and will continue to experience in the future<sup>7</sup>.

In many cases, tractors are used to perform certain tasks where animal traction may be more economical or convenient. Despite the great advances in motorized power in agriculture, draft animals will continue to be the primary source of power on farms in many regions where the use of tractors and tractor-drawn machinery is not profitable. It should not be forgotten that the use of machinery can only be achieved where agricultural systems generate sufficient income to cover the costs of acquiring, operating, maintaining, repairing, and depreciating said machinery<sup>8</sup>.

Animal-drawn mechanization has currently been revitalized in the country. This technology preserves soils and reduces air pollution. The use of this energy source will always be relevant in a group of tasks where its efficiency has been demonstrated in areas that are difficult to mechanize due to slopes, stony terrain, and obstacles; in small garden plots, for personal consumption<sup>9</sup>.

According to Suárez-León and Ríos-Hernández, 2019, 25% of the energy capacity of Cuban agriculture corresponds to oxen, which contributes to fuel savings. This behaviour allows promoting and encouraging the use of animal traction in all those tasks where it is convenient from a technical and economic point of view in the agricultural sector.

### The objective of this work is:

Show evidence and experiences of the use of draft cattle in Pinar del Río province of Cuba

1 Funes 2017; FAO 2019.

2 Gutiérrez Soto y López Sandin 2024.

3 Ríos 2017.

4 Machín et al. 2010.

5 Gutiérrez Soto y López Sandin 2024.

6 Díaz y Vento 2015.

7 García 2020.

8 Olivet Rodríguez et al. 2020.

9 Olivet et al. 2018.



**Fig. 1** Province of Pinar del Río (TUBS, CC BY-SA 3.0 <<https://creativecommons.org/licenses/by-sa/3.0>>, via Wikimedia Commons: [https://commons.wikimedia.org/wiki/File:Pinar\\_del\\_Rio\\_in\\_Cuba.svg](https://commons.wikimedia.org/wiki/File:Pinar_del_Rio_in_Cuba.svg)).



**Fig. 2** Topography of Pinar del Río (Google Earth (Data SIO, NOAA, U.S. Navy, NGA, GEBCO, <https://shorturl.at/HqMYT>).

## Development

### Brief description of the province of Pinar del Río.

The Republic of Cuba consists of an archipelago with an area of 110 860 km<sup>2</sup> and a population of 11 million. The relief is generally flat, with 77% of the country less than 100 metres above sea level. Twenty-two percent of the country is in the range 100 m to 200 m and only 1.3% is over 500 m. Cuba has a tropical climate with average temperatures around 25–26°C. Annual rainfall varies between 1200 and 1500 mm. The tropical climate influences many aspects of animal power, including animal breed and disposition, management systems, working hours, feed quality and quantity and farm production systems. Pinar del Río Province is located in the west of the island of Cuba. Figure 1 shows an image of the province of Pinar del Río.

The province of Pinar del Río can be divided into two broad agro-ecological zones, a mountain area named Guaniguanico mountain range, with altitudes ranging from 100 to 800 metres, dominates the northern zone. The southern zone is characterized by flat plains, with slopes of 0 to 15%. In both zones, the topography of areas under agricultural crops is relatively flat or gently rolling, although farmers in the mountainous regions may work on slopes of between 12 and 30%.

The region studied presents a marked diversity of soils, with generally light, sandy soils predominating. They are soils at high risk of erosion due to their physical characteristics and low organic matter content. Soil erosion is significant in the region, and it is estimated that approximately 75% of agricultural soils show significant levels of erosion.

Pinar del Río Province is largely agricultural and most of its gross domestic product derives from agriculture and forestry. The principal crops grown are tobacco, coffee, rice and other crops. Forestry is also important, as is pastureland. Tobacco, forestry, coffee and rice have the greatest economic importance in the Province. Generally, in the southern zone there are abundant irrigation systems, and practically all producers have access to water. In the mountain zone, the broken terrain and the limited access to suitable water supplies limit irrigation systems.

### Methodology used in the development of this work

Using participatory methods, a diagnostic survey was undertaken in Pinar del Río Province. The survey was designed to ascertain the level of use of animal power. The participatory methodology involved visits within the study areas, surveys of farmers, meetings with farmers and agriculturalists and workshops.

### Farming systems in Pinar del Río

According to Díaz and Vento, 2015, to understand the emergence and development of Urban Agriculture in Cuba, it is useful to understand the process of evolution of agriculture on the island. There have been four significant periods, differentiated as follows:

First: Up to 1959 agricultural production was characterised by sugar grown practically as a monoculture, with some important commercial production of tobacco. There was limited development of technology, and it is reported that the sector only had 9,000 low-powered tractors.

Second: After the Cuban Revolution in 1959, there was an urgent need to increase agricultural production to

better feed the country's population. The country decided on the path of industrialized agriculture. So, with the help of other socialist countries, and inspired by the success of the Green Revolution, the number of tractors was increased significantly, reaching figures of over 90,000 (with a range of power) by the decade of the 1980s. With the associated agricultural implements and combine harvesters, crops were completely mechanised and reached levels of sophistication on a par with those in first world countries. It also allowed expansion of the cultivated area, an increase in the diversity of crops produced, widespread use of fertilisers and irrigation, genetic improvement of crops and animals, and an intensive use of agrochemicals. All this was, of course, energy intensive and required the use of huge volumes of fuel.

Third: In the 1990s, with the collapse of the USSR and the socialist bloc in Europe and the disappearance of the Council for Mutual Economic Assistance (CAME or COM-ECON), Cuba was suddenly left without access to the inputs necessary to sustain the high technological level of its agro-industrial agricultural model. At the same time, of course, the sector lost the negative impacts of the system, including the economic, energy related, environmental, social and cultural impacts faced by intensive agricultural systems throughout the world. Cuba was faced with the choice of transforming its agricultural production model or perish.

Fourth: From the end of the 1990s to the first decades of the 21st century was a period of transition for Cuban agriculture. The trend was now toward more sustainable models of agroecological production and the development of the programmes of urban and peri-urban agriculture. Family farming was invigorated and production was more environmentally friendly. This is not to say that high technology production options were not pursued in specific sectors, if that was deemed appropriate.

The organisation of agricultural production is characterized by a combination of private and state farms:

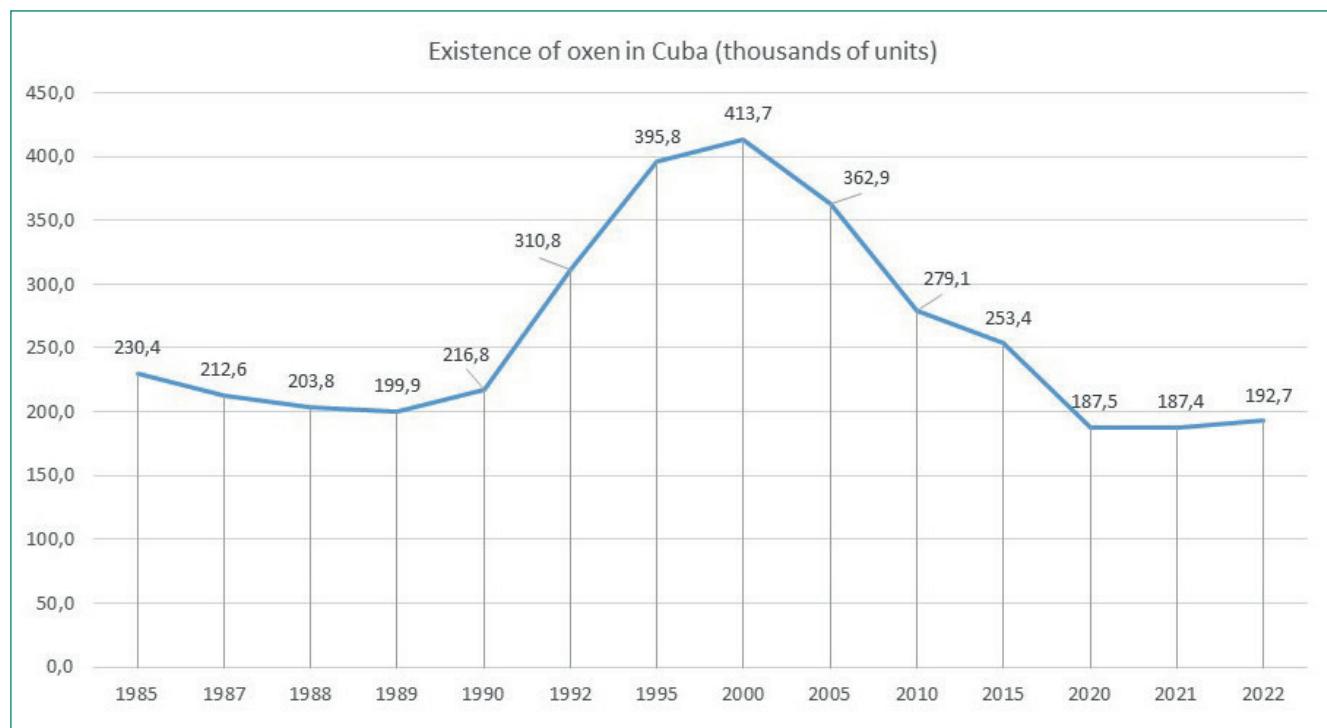
- Credit and Services Cooperatives (CCS)
- Agricultural Production Cooperatives (CPA)
- Basic Units of Cooperative Production (UBPC)
- Un-associated private farmers
- State enterprises

The size of the farms varies according to the principal crop, the condition of the land and particular characteristics of the region. A tobacco farmer may commonly have 5 ha to 67 ha and there are cases of farmers with more than 130 ha. Amongst farmers of horticultural and vegetable crops, the property sizes range from 5 ha to 67 ha. In the mountain areas, the size of farmer holdings is subject to greater limitations and varies between 2.5 ha and 20 ha.

### Use of animal traction in Cuba.

The farmer commonly employs work animals for ploughing, ploughing, ridging, weeding and transport, as do the larger farms in the region. The most frequently used animals in Pinar del Río are bovines (oxen and bulls and some cows). Oxen are mainly used for field work and transport (sledges and carts).

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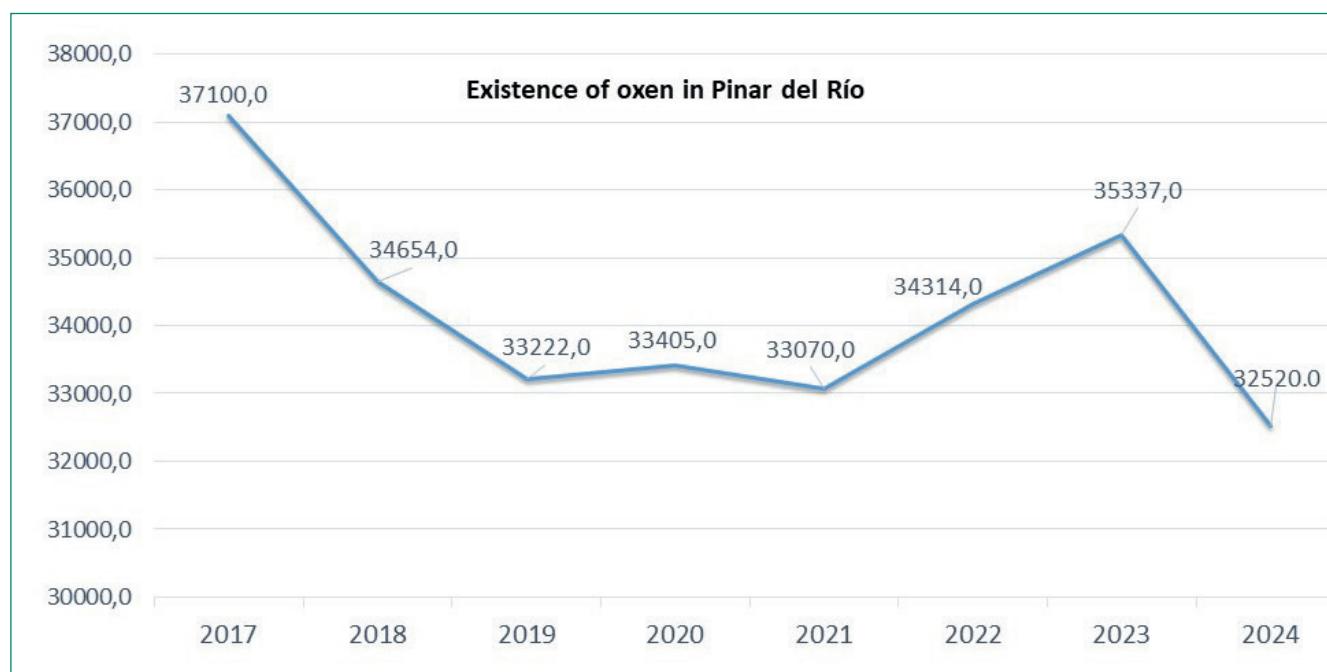
**Fig. 3** Total number of draft oxen in Cuba from 1985-2022 (Graph R. Tielves).

the larger farms in the region. With the introduction of large numbers of tractors into Cuban agriculture in the 1960s and following years, the number of draft animals employed in agricultural work decreased. At the beginning of the 1990s, Cuba experienced an economic crisis that was exacerbated by changes in the world order, especially the disappearance of the socialist block in Europe. The shortage of petroleum products was a catalyst for an increase in the use of draft animals by many types of cooperative and large-scale production units, as economic possibilities declined for using tractors in mecha-

nized agriculture. Figure 2 shows the changes in the work oxen population in Cuba.

### Use of draft cattle in Pinar del Río

In the province of Pinar del Río, animal traction has been of great importance throughout history, especially in the agricultural sector and particularly among tobacco producers. This has allowed farmers to develop methods of training and using animal power in their agricultural and transportation work for years, making it a traditional legacy.



**Fig. 4** Total number of oxen in the province Pinar del Río from 2017-2024 (Graph R. Tielves).



The most common and widespread draft animal in the agricultural sector in Pinar del Río is the Bovine, especially the ox. It is used to make multiple contributions to agricultural production, performing different tasks on crops and in transportation activities inside and outside the farms. In short, it is designated that the integral use of animals in tasks such as ploughing, furrowing, sowing, fertilizing, weeding and transportation, among other tasks, makes it an important source of energy on agricultural production farms.

In the province of Pinar del Río, the use of animal traction makes it a bastion of the use of this source of energy in Cuba. For years, tobacco producers have left an important legacy of tradition in the use of draft cattle, a result that has influenced the existence of draft cattle in the province. Figure 3 shows the existence of draft cattle in the province of Pinar del Río.

According to the Evaluation Report for the First Semester 2024, from the Department of Agricultural Engineering, of the Provincial Delegation of the Ministry of Agriculture in Pinar del Río, it is recognized that despite the existing limitations, outstanding results are achieved in the use of animal traction, which made it possible to face the limitations of diesel fuel and implements for tractors, by having 16,255 yokes of oxen on the producers' properties, with an average of five implements per yoke available for agricultural work.

### Breeds of draft cattle used in the province of Pinar del Río

The types of draft cattle used by farmers in Pinar del Río are *Bos taurus* ('European') and *Bos indicus* ('Asian' or zebu) breeds. All people surveyed and interviewed confirmed that they prefer oxen for field operations. Figure 4 shows examples of these breeds used by farmers.

The farmers said their liking for oxen is due to the following characteristics:

- Oxen are tame and hard working.
- Oxen present little danger to their drivers.
- Oxen are willing to work hard for long periods.



Fig. 5 Different breeds of cattle in Use in Pinar del Rio (Picture: R. Tielves).

The most frequently used draft cattle in Pinar del Río:

- oxen,
- bulls and
- some cows

### The implements for the Draft cattle

For a long time, the most commonly used animal-drawn implements in Cuba have been metal mouldboard ploughs and traditional wooden ploughs, very similar to others widely used in different regions of the world. Harrows, cultivators, wooden rakes, and two-wheeled carts are the basic models.

It is common on farms to have the following module of implements for animal traction:

- Mouldboard plough
- Traditional stick plough
- Spiked tooth harrow
- Disc harrow
- Furrower
- Cultivator
- Transport sled
- Bogie

Depending on their production systems, state farms, production cooperatives (CPAs), and basic cooperative units (UBPCs) may have all these implements, or may have smaller packages. Essentially all have at least one mouldboard plough, wood plough, cultivator and spike-tooth harrow.

The mouldboard ploughs are commonly used for primary tillage, with subsequent passes by spike-tooth harrows or disk harrows. The implements most used for secondary tillage and weed control activities are cultivators.

It is common for some farmers to carry out the initial preparation of the soil with a tractor-mounted plough and disc harrow, and to carry out subsequent tillage operations with animal traction. However, most farmers say that they prefer to do everything with animal traction.

## Which are the biggest limitations and potentials in the use of draft cattle?

According to surveys carried out among farmers, the main limitations to the development of animal traction include the following elements:

- Limited sources of feed and animal care
- Lack of supplies for harnesses, collars, saddles can-vasses and ropes
- Risk of theft of the animals
- Increasing cost of animal care and protection

The main potentials for the development of animal traction in Pinar del Río are expressed in:

- The use of animal traction in Pinar del Río agriculture increases every day as an energy possibility in the face of fuel shortages
- Environmental perspective for the revitalization of conservation criteria in soil management
- Strengthening concepts that involve the rational use of animal traction



**Fig. 6** Farmer and his ox-drawn mouldboard plough in Pinar del Rio province (Picture: R. Tielves).



## Conclusions

The results of this work allow us to define the following conclusions:

- The employment of animal traction is very important in Pinar del Río Province.
- Oxen are the draft animals most used in rural areas in agricultural mechanization and transportation.
- The energy source of Draft Cattle has established traditions in Pinar del Río, and it forms part of the regional history.
- Draft cattle will forever be part of the culture of the farmers in Pinar del Río.

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