

Animal power for agricultural production in Nigeria

by

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Abstract

Reasons for the success of mixed farming in northern Nigeria include good extension networks and veterinary services, credit for purchasing animals and implements, effective training, and significant economic benefits at farm level. Bulls are the most commonly used draft animal, while the donkey is extensively used for transportation. It is still not clear why horses are not used for tillage operations.

Trials have been undertaken with implements including the locally made Emcot ridger and the Kazaure and Strad toolbars. Imported implements tested included the Arara and Ariana toolbars. While the Emcot and Kazaure toolbars are justified on farms over one hectare, the Ariana and Strad implements need farms of at least 4 ha.

The Institute for Agricultural Research (IAR) is working to improve existing implements and hopes to develop others. A detailed animal traction survey of the savanna zones of Nigeria has been initiated by the National Animal Production Research Institute (NAPRI) and IAR. This should yield much up-to-date information on animal traction in Nigeria.

Introduction

The need to increase power in Nigerian agriculture to supplement and possibly replace human labour has long been recognized. This has led to the introduction of both animal and mechanical sources of power to boost production. Since the early 1970s, efforts have been geared mainly towards tractorization. It is

evident that this has not yielded the expected results, for a number of reasons including:

- lack of skilled operators and maintenance personnel;
- lack of suitable implements and spare parts;
- farm land fragmentation;
- increases in the cost of tractors and implements.

In developing countries, the most viable alternative to the use of mechanical power is animal power. This source of power, supplied by work oxen, donkeys and sometimes horses, has been very important in the northern parts of Nigeria, which is free of tsetse fly and has light soils. Bodet (1987) gave a number of reasons in favour of animals as the best alternative to mechanical power for increasing energy in the agriculture of developing countries. They include the following:

- animal power sources already exist in most developing nations and so need not be acquired at high cost;
- animal power increases the farmers' work-force for cultivation as well as transportation;
- animal traction implements are more affordable than large tractor-drawn implements. They are also more suitable for the small, and often fragmented, farm lands;
- animals can be fed on crop residues, and they can supply other products including meat, milk, manure (for soil fertility and biogas);
- work bulls may be sold after a period of about seven years with a profit.

* Position at the time of the 1988 workshop.

The use of animal draft force was first demonstrated in Nigeria in Daura in 1922 (Alkali, 1969), and serious attempts to introduce "mixed farming" started in northern Nigeria in 1926 (Holmes, 1938). Mixed farming involved both animal and crop production and the animal wastes were used as manure to maintain the fertility of fields. Due to the success of this new method of farming the number of mixed farmers rose steadily from three in 1928 to over a thousand by 1936 and by 1956, the number of mixed farmers in northern Nigeria had risen to over 15,000 (Chambers, 1958). Table 1 shows the progress of mixed farming in northern Nigeria since 1928.

Faulkner and Machie (1936) gave the following as reasons for the success of mixed farming in northern Nigeria.

- A good extension network with demonstration farms was established, reproducing good real working conditions.
- A loan scheme enabled farmers to purchase work bulls and implements. The interest rates and repayment schedules were quite fair to the farmers.
- Veterinary services were established to attend to sick animals and healthy ones were inoculated against diseases.
- Increasing farm revenue attracted more farmers.
- Effective training of farmers was initiated in topics such as animal care and feeding.

Animal power in use in Nigeria

Several types of draft animals are used in Nigeria, the most important being the bull. Because of the tsetse fly threat in the southern regions, the use of draft animals has mainly been limited to the savanna zones of the northern regions. Work bulls are mostly used in pairs, but sometimes singly, to pull tillage implements for plowing, ridging, re-moulding, planting etc. Studies have shown that work bulls develop up to 0.4 kW of power for continuous work, which is about five times the manual work capacity.

Table 1: Progress of mixed farming in northern Nigeria from 1928

Year	No. of mixed farmers
1928	3
1930	17
1934	298
1936	1 054
1940	1 820
1945	2 547
1950	7 052
1956	15 452
1965*	36 000
1980**	100 000

Sources:

*Chambers, 1958; * Alkali, 1969; ** Kalkat, undated*

There have been attempts to introduce donkeys into soil cultivation operations. After training, it was found that the load-carrying capacity of the donkey could be increased by about five times by the use of a cart (Musa, 1978). Further training revealed that donkeys could pull light tillage implements for cultivation, harrowing, ridging, planting and weeding. The average draft the donkey pulled was 450 N at an average walking speed of 2.34 km hr⁻¹, (0.65 m s⁻¹) giving an average power output of about 0.29 kW (Musa, 1978). Horses are also used in Nigeria as draft animals but are limited only to small-scale sugarcane crushing and processing. The output from the horse-powered cane crushers could be as high as 300 kg hr⁻¹ (Kalkat and Kaul, 1983) which is quite good compared to the output of 700 kg hr⁻¹ from a 7.3 kW engine-powered crusher. It is however still not clear why horses are not used for tillage operations.

Present status of animal power

Accurate data on the number of Nigerian mixed farmers were kept between 1928 and 1955 and probably up to 1966. From then onwards, the number of mixed farmers has only been estimated. As shown in Table 1, the

number of mixed farmers in Nigeria may now be estimated to be about 150,000.

With the present economic situation, prices of tractors and their implements have increased beyond the reach of most farmers. This has forced attention to turn towards animal power mechanization. In fact some Agricultural Development Projects (ADPs) now purchase and stock animal-drawn implements and spare parts which are then sold to farmers at subsidized rates. Others encourage animal power mechanization by giving loans to farmers to purchase their work bulls and implements.

A detailed survey of the savanna zones of Nigeria where animal tractive power is mostly used has been initiated by the National Animal Production Research Institute (NAPRI, Shika - Zaria) and the Institute for Agricultural Research (IAR). This aims to collect information on the types and numbers of implements in use, numbers of mixed farmers and the difficulties faced by these farmers. It should yield concise, first-hand and up-to-date information on animal power usage in Nigeria will be available.

Animal-drawn implements

With the introduction of draft animals and mixed farming in Nigeria came animal-drawn implements. The first animal-drawn implement introduced in Nigeria was a wooden plow. As from 1934, these were replaced by steel ridging plows (Ransome "Emcot" ridgers) because of their durability (Holmes, 1938). This ridger was used for almost all tillage operations from ridge splitting, ridging, remoulding, weed control to groundnut lifting (Alkali, 1969).

It was thought that Nigerian mixed farming required a multipurpose toolbar which would offer as many attachments as possible for different tillage operations and could be drawn by the local work bulls. Sporadic efforts were made towards importation and local development of animal toolbars in Samaru and Daudawa but the results were unsatisfactory. The

Emcot ridger manufactured by the John Holt Agricultural Engineering Company in Zaria was introduced in the mid 1960s and the Ariana and Unibar toolbars were imported in the late 1960s (Alkali, 1969). Other toolbars such as Arara, Occidentale and Kazaure were later introduced to the Nigerian farmers. Some of these toolbars (Arara, Ariana, John Holt Strad, Emcot, Unibar, Occidentale and Kazaure) were available for technical evaluation at the Institute for Agricultural Research (IAR).

Performance of toolbars

The following are salient points noted during the technical evaluation of the toolbars (Kalkat, undated):

- It was observed that none of the toolbars had a complete package of attachments for crop production under local farming conditions. All toolbars lacked planting attachments even though it was reported that Ariana had one. With the exception of the John Holt Strad, no other toolbar had an effective weeding attachment.
- The Arara toolbar was found to be light and within the draft potential of local draft animals.
- The Arara and Ariana toolbars were promising for use either on the flat or on ridges, however the Ariana was more expensive.
- It has been reported that efforts have been made to popularise Ariana but this failed perhaps due to poor extension services, lack of training and repair facilities, heavy draft power requirement for plowing, and problems of the transporting the implements.
- Economic analyses showed that the use of Emcot and Kazaure can be economically justified over an area of one hectare; while the Arara, Strad and Ariana toolbar systems are economically justified on farm areas of at least two, four and five hectares respectively.

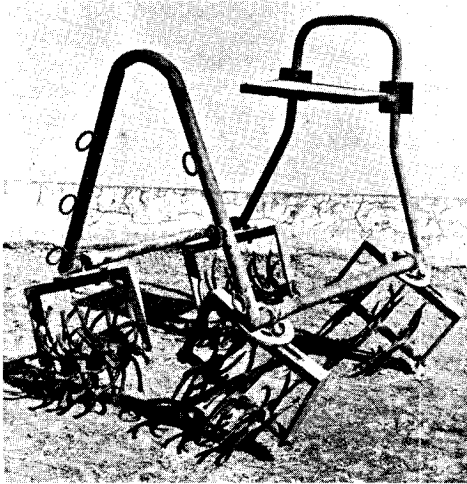


Fig. 1: Prototype IAR straddle-row weeder.

Of the total number of available implements, only the Emcot ridger and John Holt Strad are manufactured locally by John Holt Agricultural Engineering of Zaria. All others are imported. It is known that some progressive blacksmiths have now learnt how to manufacture the Emcot and its spare parts, supplementing the production of John Holt.

Implement development

The Institute for Agricultural Research (IAR) is working towards the improvement of existing toolbars to suit the local needs, and is

Fig. 3: Prototype Emcot rotary weeding attachment.

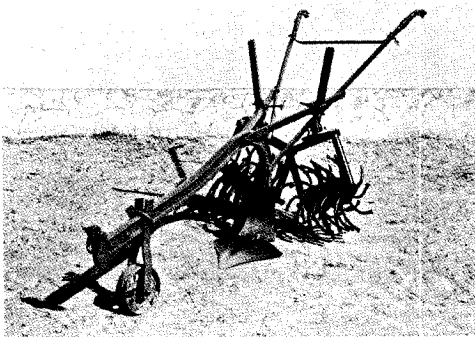


Fig. 2: On-station testing of IAR straddle-row weeder.

developing other animal-powered equipment. Those already developed include:

Straddle row rotary weeder

This weeder uses a set of four gangs of rotary tines which are mounted on a frame which straddles a ridge. The tines rotate on either side of the ridge, digging the soil and removing the weeds. The weeder has a high clearance frame which enables weeding of crops up to one metre high. It is suitable for 76 cm and 90 cm ridges and is pulled by a pair of work bulls. The best output results are obtained when working on weeds at 2-3 leaf stage and soil moisture within the 6-12% range.

Emcot rotary weeding attachment

The Emcot rotary weeding attachment comprises two gangs of rotary tines which are mounted on a commercially available Emcot toolbar. The Emcot ridging share clears the weeds on the furrow bottom while the gangs rotate on both sides of the furrow digging up the soil and removing the weeds as they rotate. The implement is powered by two work bulls and its output ranges from 0.1-0.2 ha per hour on weeds which are at 2-3 leaf stage and with a soil moisture ranging between 6-12%.

Animal-drawn land leveller

This leveller which is still under development comprises an 85 cm blade fixed to a hopper cut away from an ordinary oil barrel. A U-shaped steel rod and a wooden beam are used for hitching. The position of the blade during cutting, haulage and dropping of accumulated soil is controlled by a hand-operated lever. This prototype is currently being tested in the fields.

Conclusion

Animal power usage for cultivation of farms was introduced into Nigeria in the 1920s. The number of mixed farmers rose steadily and by the 1960s, a local manufacturing company had started producing animal-drawn Emcot ridgers. Toolbars such as the Ariana and Unibar were introduced in the late 1960s. From the early 1970s, when sale of petroleum expanded Nigeria's foreign reserves, efforts tended to shift from animal sources to mechanical power sources. This was to the detriment of animal power, so that farmers preferred the socially more prestigious mechanical power sources. However with the present high cost of tractors, the best alternative is animal power. More efforts need to be made by government organizations and research institutes towards the development of other appropriate animal-drawn implements for operations such as harvesting, water lifting and threshing. This will help animal power to make yet more impact on Nigerian agriculture.

Résumé

La réussite de l'agriculture intégrée dans le nord du Nigéria s'explique par la qualité du réseau de vulgarisation et des services vétérinaires; les facilités de crédit pour l'achat des animaux de trait et des équipements; l'augmentation des revenus agricoles; et l'efficacité de la formation.

Au cours d'essais en milieu paysan, le cultivateur Arara s'est révélé léger et adapté à la puissance de trait des animaux locaux. Les cultiva-

teurs Arara et Ariana sont adaptés aux travaux sur sillons à plat et buttés, mais l'Ariana est plus onéreux. Les analyses économiques montrent que les équipements Emcot et Kazoure sont économiques à partir d'un hectare. Les équipements Ariana, Arara et Strad sont économiques sur des superficies de deux, cinq et quatre hectares respectivement.

L'Institut de recherche agricole (IAR) travaille actuellement sur l'adaptation des cultivateurs aux besoins locaux et le développement de nouveaux équipements attelés. L'Institut national de recherche pour la production animale (NAPRI, Shika - Zaria) et l'IAR ont entrepris une enquête sur l'utilisation de la traction animale dans les zones de savane du Nigéria. Cette enquête vise à recenser les types d'équipements utilisés, les difficultés qu'ils rencontrent, etc. Cette enquête permettra d'obtenir une représentation précise et directe de l'utilisation de la traction animale au Nigéria.

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