

Environmental impact of animal traction in Rukwa Region, Tanzania

by

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Abstract

There is a relatively high level of adoption of animal traction in Rukwa Region, western Tanzania. This has brought benefits in terms of reduced drudgery, increased labour productivity and expansion of area cultivated. However, the technology has some negative effects, especially increased soil erosion due to farmers plowing along slopes and the widespread use of sledges.

It is important to see these negative impacts in relation to the positive benefits of the technology. Animal traction is an appropriate technology for the region and its potential contribution to agricultural development cannot be overemphasised. Lack of credit for purchase of oxen and implements is a major constraint to further expansion of the technology.

Introduction

Rukwa Region lies in the extreme west of Tanzania, bordering Zambia and Zaire. It occupies a total area of 70,000 km². The region has a population of about 900,000 people with an annual growth rate of 4.3% (figures based on 1988 census). More than 90% of the people in Rukwa Region live in rural areas with agriculture, livestock keeping and fisheries being their main occupations. About 70% of the total area is arable land, of which 3% is utilised for agriculture. This means that the enormous agricultural potential of the region is yet to be exploited. Nonetheless, the region is famous for its maize production and the use of oxen for plowing crop fields.

Mechanisation in Rukwa

Whether in human, animal or mechanical form, power is an essential component of all production processes in agriculture. Mechanisation plays a large role in ensuring land and labour productivity. Mechanisation increases yield by expanding the area under cultivation and, if treated in isolation from other production techniques such as

fertilising, could well increase yield per unit area by improving the quality of tillage.

In Tanzania in general, and Rukwa Region in particular, humans still provide most of the power needed for farming activities. The introduction and use of draft animal power occurred about 50 years ago (BRALUP, 1977). However, it has never replaced human power per se. In contrast, it has contributed a substantial workload to most farmers in carrying out post-tillage operations as the oxen are often used only for primary tillage (Kilemwa, 1993). It is estimated that 80% of the 300,000 ha cultivated are plowed by oxen.

Surveys showed that of the total of about 130,000 households in the region 58% own oxen and 6% own donkeys (Kilemwa, 1993). Households that possess animals have between one and 20 oxen and one and six donkeys. All ox-owners also own a mouldboard plow (known as the UFI plow) and a wooden sledge (see Table 1).

Mechanisation trends

With a good agricultural production environment, rising living standards and a high rate of population increase, Rukwa farmers have been compelled for the past two decades to increase food crop production to feed the population and produce a surplus for sale to earn income. This has involved the use of animal power in agriculture. The number of oxen has risen by almost 400% over the last 20 years. For example, in 1975 there were an estimated 19,000 oxen in the region compared to 106,000 in 1995 (see Table 1).

Three factors are associated with the increased adoption rate of animal traction by farmers:

in the 1970s, there were projects which advocated the use of oxen in farming activities, such as the National Maize Project, the Small Industries Development Organisation's common facility workshops

Table 1: Numbers of draft animals and animal-drawn implements in Rukwa Region

	1990/91	1991/92	1992/93	1993/94	1994/95
Oxen	27,750	36,000	58,870	76,300	106,000
Donkeys	3,800	4,200	4,800	5,000	5,400
Mouldboard plows	18,800	28,000	36,000	42,000	48,000
Harrows	220	340	720	560	520
Cultivators	102	213	250	230	220
Ridgers	100	450	460	390	350
Planters	6	10	12	8	8
Ox carts	120	250	230	250	260
Donkey carts	-	-	3	3	5

Source: Regional agricultural office

and Zana za Kilimo Mbeya, an agricultural implement factory in the Southern Highlands. These projects stimulated the use of animals as animal-drawn implements were readily available in the area

the continuous influx of Wasukuma pastoralists from neighbouring Tabora and Shinyanga regions to Rukwa in search of pasture and water for their cattle. These people introduced and developed a substantial level of animal traction technology to the indigenous people, in particular in the Mpanda lowland and Rukwa valley

the third factor was the villagisation programme which was carried out in 1974/75 by the Government with the intention of keeping scattered rural families in settlements to provide social services such as dispensaries, primary schools, roads and other collective infrastructures. Villagisation created a scarcity of suitable cultivable land near farmers' homesteads. Farming intensification then became a priority for most farmers which consequently called for the use of animal traction technology.

Appropriateness of animal traction

The potential contribution of draft animal power to agricultural development in Rukwa cannot be

over-emphasised. Most farmers are now aware of how draft animals can reduce their workload and increase land productivity, whilst raising income, social status and prestige among themselves.

Farming in Rukwa is done using three major systems, the first system, the use of hand tools and manual labour, being the oldest from which the other two have evolved. It is estimated that currently 20% of the farming population in Rukwa, mostly resource-poor families, employ this system. Under this system, the area cultivated per family is usually low due to the difficulty and drudgery involved in performing farming operations.

The second system which is used widely is when farmers employ oxen for primary tillage only. Planting, weeding, harvesting and transportation are carried out by hand. In this system the area cultivated can be expanded and better land preparation is achieved. The bottleneck of this method is that weeding is done by the family, so it is usually done only once because of time limitations. This contributes to low yields.

Plowing, weeding and haulage of produce by oxen is the third system used in Rukwa. About 25% of the farming population use this system. In this system plowing, making furrows for sowing seeds, and weeding are done using ox-drawn mouldboard plows, while produce is transported from field to homestead using sledges or ox carts.

The advantages of this system are that the optimum crop density can be obtained as the seeds are planted in rows and that weeding can be carried out two or three times depending on weed intensity. The bottleneck of this system is during harvesting as it is usually done manually and the area planted is relatively large. However, the magnitude of this operation is reduced by using oxen to transport the crop home.

The use of tractors in Rukwa has not been encouraging. With 67 working tractors out of the 152 available, many farmers have not benefited from their use. Owners of tractors, usually a cooperative society, an institution, a settlement, or even individuals, hire the tractors out on a cash basis. The tractor is used for the first plowing, but planting is done without a second plowing (harrowing) because of inadequate financial resources at the farmer's disposal. Weeding and harvesting are done by hand. The area cultivated is in some cases expanded, though not necessarily so because the area correlates directly with the farmer's financial resources. Yield per unit area is mostly low as plowing is done unsatisfactorily and weed intensity and growth is accelerated on an unharrowed field. Delays in planting normally occur as farmers keep waiting to hire the tractor as the season progresses.

Environmental impact of animal traction

Since animal traction has been appreciated by many farmers to increase labour and land productivity, reduce drudgery and increase efficiency in farming practices, its effect on the environment has not been assessed and analysed critically. As in any situation the use of animals in agriculture also has negative effects. It has been associated with a number of environmental damages: soil degradation, vegetation depletion, water and soil moisture losses and other complementary effects brought by the technology. To most farmers environmental protection has not been their priority, rather their priority has been ways of increasing food production with minimum fatigue and low input use.

Ox plowing and soil structure

Plowing improves soil tilth, providing a good growing medium for crops, by increasing porosity and the water-holding capacity of the soil. However, plowing is damaging to soil as it

involves cutting, loosening and inversion of a soil structure and therefore increased soil erodability. Research is needed to understand these conflicting effects of plowing. Researchers and extension agents have the role of guiding farmers to making decisions on what system of land preparation and cultivation does not cause excessive soil erosion and at the same time provides crops with a well-tilled seedbed.

Cultivation on hillsides

The most damaging impact of oxenisation on the environment is the widespread practice of plowing fields *along* the slope. Due to the undulating topography of Rukwa, farmers who use oxen for plowing demarcate their fields along the slopes in order to make longer runs for plowing. This practice opens up the soil to erosion by run-off. As a result many fields are now becoming difficult to plow as they are full of rills and gullies.

This practice not only subjects good soils to erosion but wastes farmers' resources as fertiliser is easily washed off the soil. This practice needs an urgent intervention by agriculturalists and leaders of Rukwa in educating farmers on either better ways of cultivating on slopes, or making topography a determining factor in the selection of farm equipment.

Use of sledges

A survey of animal traction in Rukwa Region revealed that most ox owners own sledges (Kilemwa, 1993). The sledges are simply V- or Y-shaped tree branches, and do not have a proper floor. They are used for transporting plows to and from fields, for hauling crops and, to a lesser extent, for domestic chores. The efficiency of sledges is hindered by their low carrying capacity and substantial grain losses due to the lack of a floor. They also cause environmental problems as they have a high frictional resistance which damages roads and footpaths and causes extensive soil erosion, especially on sandy and loose soils.

Cutting trees to make sledges is also a problem. Most farmers think cutting trees for sledges has a minimal effect on the environment, but experience has shown that farmers rarely plant new seedlings for the future.

Ox plowing and spread of weeds

In the villages there is a feeling that ox-plowed fields usually have many weeds and weeding is

required regularly and earlier than on hand-tilled plots. This could be true, for two reasons. First, the finely tilled land that ox plowing produces encourages early and fast weed generation. Second, ox plows spread weed seeds during plowing, especially of vegetative weeds such as couch grass (*Digitaria* sp) and nut grass (*Cyperus* sp). It may be beneficial to advise farmers to clean their plows at every turn to reduce spread of weeds, or to perform two plowing operations before sowing, which has been found to check weed germination.

Sustainability of animal traction

One study in Rukwa showed that many farmers who do not own oxen would prefer to own oxen as they believe their neighbours' who own oxen and plow usually harvest more and have a higher standard of living (Kilemwa, 1993). From this observation it is safe to assume that the process of adoption of animal traction has been "farmers' personal involvement" after first being induced by extension agents and projects. Most farmers are aware that the overall increase in crop production depends greatly on bringing more land under cultivation, which is only possible through the improvement of labour efficiencies.

Farmers being aware of the benefits of animal traction as a source of farm power is a prerequisite for extension agents, researchers, manufacturers and distributors of agricultural equipment promoting sustainable use of animals in agricultural production. What is required is provision of all necessary technical know-how for ox and donkey training followed by ensuring the availability of all related implements, tools and other farm machinery for the smallholder farming sector. There is also a need to find ways to alleviate short-term constraints which slow the rate of adoption of animal traction in Rukwa.

Blacksmith training and development

This is an important component of animal traction since the use of animal-drawn equipment creates a demand for maintenance and spare parts. For sustainable use of animal traction there is a need to have locally-based production, distribution and sale of the parts needed. With training, this

could be done by village blacksmiths.

Centrally-located production centres, mostly in urban areas, have proved inadequate, as they force farmers to travel long distances in search of spares. This is a costly and inconvenient exercise, especially during the farming season.

Training programmes for farmers

On-site training programmes have proved to be better in terms of attendance and low cost. They also have the advantage of giving better understanding to farmers as they use similar conditions to the farmers' local environment.

Provision of credit

Draft animal power involves both large expenditures and high risk which could not be met by many subsistence farmers who want to introduce animal traction in their farming systems. No clear credit policy has been formulated by the few existing credit institutions and not enough credit channels have been established by the government to enable subsistence farmers to obtain credit for animal traction. The problem of securing credit is responsible for the slow adoption of animal draft power for farming.

Conclusion

Labour saving and area expansion are the main motivating forces in the adoption of animal traction in Rukwa. Indeed, an increase in agricultural production is a direct result of expanding area cultivated and reducing the drudgery involved. Oxenisation has been a key factor influencing crop production in the region despite some negative environmental impacts it created. These negative effects can be minimised by choosing appropriate equipment and by application of better farming techniques. However, it is important to keep environmental concerns in perspective by relating environmental damage costs to crop production benefits.

References

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