

An assessment of some aspects of work oxen use in Sierra Leone

by

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Abstract

The paper is based on a study of the viability of the Work Oxen Project made by A. A. Metianu and D. Vose in January 1986.

The use of ox power in Sierra Leone decreased from the 1950s to the 1970s. Some of the circumstances contributing to this decline have changed in recent years. The Work Oxen Project, based originally at Njala University College, has successfully identified and alleviated some of the constraints to ox use, notably by the provision of satisfactory implements and by training and extension activities.

Inland valley swamps are potentially the best areas in which crop production may be increased and it appears that replacement of hand work by ox draft for primary cultivation typically doubles the area cropped. Although such a change may increase the hired labour requirement on the extra land there is a net cash benefit. A significant part of the income is due to the appreciation in the value of the oxen over their working lives. Additional benefits could be derived by the use of ox power for other farm operations or for transport. The cost of the implements could be reduced by changes in manufacture or procurement or by the introduction of alternative equipment.

There is potential to increase rice production by expansion of the use of ox power but its realization depends on technical and social changes for which a major programme of trials, development and extension is needed.

Introduction

Ox plowing was introduced in Sierra Leone in the 1920s. During the 1950s to 1970s the use of

work oxen decreased until only in Koinadugu District and the Mabole Valley were oxen still worked. The reasons for this decline are not fully known but contributory factors may have been:

- Low profitability of arable crops.
- Availability of tractor hire at subsidized rates.
- Unsuitability of ox plowing for poorly stumped land (slash and burn shifting cultivation is the dominant upland system).
- Cultural factors - most of the oxen are owned by pastoralist Fulah who have little activity in crop production.
- The high value of cattle relative to arable production.
- Non-availability of plows for animal traction.
- Exchange rates and controls which depressed commodity prices and limited imports of equipment and spares.

In the late 1970s Sierra Leone was not self-sufficient in rice (the principal cereal), the public sector tractor hire scheme was inadequate and uneconomic, production on the 350,000 small farms was limited mainly by labour availability and there was no large landless labour force available. Land appeared to be in surplus with only 10% of potential arable land under cultivation. The national herd of approximately 330,000 cattle was almost entirely of the trypanotolerant N'Dama breed, well-suited to plowing and light cultivation (Kanu, 1984).

The Work Oxen Project

From the foregoing it appeared that conditions were favourable for much wider use of animal draft but constraints included:

- availability and cost of oxen in areas where required;
- availability and cost of implements;
- need for training of oxen and operators.

The Work Oxen Project (WOP) was established at Njala University College in 1979 to investigate these problems and to promote the use of work oxen by dissemination of technical information and by collaboration with existing organizations and departments. A research, development and equipment evaluation programme was initiated in 1979, and crop production trials using work oxen began in 1980 (Starkey, 1981).

In 1980 the Koinadugu Integrated Agricultural Development Project (KIADP) implemented a work oxen component providing ox-training at Musaia and, subsequently, a credit facility. It is anticipated that soon four of the six current IADPs will have work oxen components.

In 1982 the Rolako equipment centre was set up to manufacture and service plows and other equipment, and to develop equipment suited to local needs. The Work Oxen Project grew from an informal initiative and marshalled substantial support from a number of aid agencies. By January 1986 about 350 plows had been produced at Rolako using components supplied under aid programmes.

In January 1986 there were approximately 200 pairs of working oxen in Koinadugu District and 70 pairs in the Mabolé Valley. An additional 30 pairs were in use, mainly by projects in other areas. The number of oxen pairs in Koinadugu District appears to have increased substantially over recent years (KIADP, 1985).

Initially the Work Oxen Project (WOP) concentrated on identification and selection of suitable equipment, supply of equipment and investigation of the technical aspects of the use

of work oxen. Later, WOP demonstrated that by using oxen, farmers who had previously relied on manual cultivation with machete and hoe could substantially increase the area cropped. In Koinadugu they appear to have doubled the area of swamp and boliland cultivated per family. The project is now in an extension phase.

Economic and technical assessment

As the Work Oxen Project entered a new phase in 1986, an assessment of the economic and technical potential of using work oxen was made by Metianu and Vose (1986). Their major conclusions were:

Potential in upland farming systems

Approximately 80% of the potentially arable land is upland of relatively low fertility currently cultivated under a slash and burn shifting cultivation system. The land is not clean stumped and so is better suited to manual cultivation than to ox cultivation. Although only 10% is cultivated at any time, reduction of the fallow period could lead to a reduction of soil fertility.

Potential in inland valley swamps

The inland valley swamps are relatively fertile but are less attractive to the traditional farmer because of the problems of initial clearance of swamp vegetation and because of unhealthy working conditions. The present land tenure system grants rights to the use of land but does not provide security of tenure. These swamps offer the greatest potential for increase of crop production by use of draft animals but there is need for land development and water control also. However these developments are unlikely to be made without security of tenure to farmers.

Potential in bolilands

Bolilands are poorly drained areas, generally of low fertility. They appear physically suited to mechanized or animal draft cultivation but a financial and economic analysis indicates that

Table 1. Simplified economic analysis of swamp and boliland rice production with or without oxen

	Swamp Le/ha	Boliland Le/ha
<i>Without oxen</i>		
Gross output	7499	3659
Seeds	272	272
Labour	3705	3705
Gross margin	3522	(-318)
<i>With oxen</i>		
Gross output	7499	3659
Seeds	272	272
Labour	2717	2717
Oxen	84	207
Gross margin	4303	440

Notes:

Major assumptions: Yields: swamp 1850 kg ha⁻¹; boli 900 kg ha⁻¹. Prices: Le2.55 kg⁻¹ husked rice at farm gate. Farm sizes: without-oxen farm is 2.8 ha, with 1.4 ha upland rice, 0.7 ha swamp and 0.3 ha boli; with-oxen farm is 3.8 ha, with 1.4 ha upland rice, 1.4 ha swamp and 0.6 ha boli. Fuller details of economic analysis can be found in the report of Metianu and Vose (1986).

The local currency, the Leone, has changed greatly in value in recent years, so that international comparisons are difficult. At the time of the report of Metianu and Vose, Le1 = US\$0.17. At the time of the Net-

at prices prevailing in January 1986 the farmer had no financial incentive to cultivate more rice in the bolilands.

Technical performance

Monitoring of farms suggests that farmers using oxen are likely to grow double the area of lowland rice (both swamp rice and bolilands) compared to farmers relying on hoe cultivation (Allagnat and Koroma, 1984). Typically household labour provides up to 75% of total labour on manually cultivated farms. Although ox plowing can reduce labour demand for cultivation, the additional area of rice will require more labour for other operations unless these too are modified to facilitate the use of oxen for planting, weeding and at harvest.

Table 2. Annual cost of oxen and implements

	Le
a) Oxen	
Purchase cost of pair (160kg, Le6.50/kg)	2100
Sale price after 5 years (340kg, Le6.50/kg)	4500
Capital gain over 5 years	2400
Capital gain per year	480
Ownership costs (per year)	
Risk of loss, 2% of average value	70
Repayment of loan and interest	580
Salt and medicines; housing	40
Total annual costs	690
Net annual cost	210
b) Implement and Harness	
Cost of Pecotool	1100
(imported cost Le 7.8 = UK £1)	
Annual depreciation (over 10 years)	110
Interest @ 15% of 1/2 cost	82
Ropes and yoke	58
Total annual cost	250
c) Total Annual Cost of Oxen and Implements:	460

Economic performance

By increasing the area cultivated the farmer increases his gross return and gross margin on the inland valley swamp. However, on the boliland where yields are low it appears that extra production on an area beyond that for which household labour is available is not financially attractive. Nevertheless it must be noted that in economic terms even the bolilands show a positive gross margin (Table 1). (Note: the local currency, the Leone, has changed greatly in value in recent years, so that international comparisons are difficult. At the time of the report of Metianu and Vose, Le1 = US\$0.17. At the time of the Networkshop for which this paper has been prepared, Le1 = US\$0.05.)

Cost of ox plowing

Major components of the cost of ox plowing are the costs of owning and maintaining animals and equipment (Tables 2 and 3).

Oxen costs (figures in Leones at 1986 values)

Oxen for plowing are purchased at about 160 kg and if used for 5 years should attain a weight of about 340 kg. At a price of Le6.50

Table 3.
Cost of oxen and implement per work day

Days worked per year	10	20	30	40	50
Annual cost	460	460	460	460	460
Variable cost	70	140	210	280	350
Cost per day	52	30	22	18	12

Notes:

Variable costs per day:

Ox handler Le 6.50, salt Le 0.50, Total Le 7.00.

Typically oxen work 20-40 days per year.

Typically oxen are hired out to other farms for about 10 work days, at a rate of about Le 30 per day.

See note on Table 1 concerning the value of the Leone.

per kg a pair of oxen is purchased at Le 2100 and sold at Le 4500, an annual increase of Le 480. There is some risk of loss by accident or theft, and if purchased on credit at 15% interest, the net annual appreciation of the oxen pair will be about Le 210.

For maintenance and security the oxen will need salt, medicines and simple housing, resulting in annual costs of about Le 40. The animals must also be herded. In this paper it is as-

sumed that this is by unpaid family labour. When working, extra salt and labour for driving oxen add a cost per work day of Le7. Typically oxen are used for 30-40 days per year of which 20-30 are in hire service to other farmers. Hire rates are Le 20-40 per day. The risk of loss or death of oxen has been assumed to be 10% over 5 years or 2% of average value per year but there is little firm data concerning the health and weight gain of work oxen away from the main pastoral areas.

Implement costs

The Pecotool was selected early as technically the most appropriate tool for Sierra Leone. It is a versatile toolbar which can be fitted with 6" or 9" plow or tools for inter-row cultivation. It is made of good quality steel; it is light and easy to handle. It is however expensive, costing Le 1100 as an imported item assembled at Rolako. If supplied as a plow only, the cost could be reduced to Le 850. Local manufacture using imported material and local labour has so far

proved more expensive but a simplified version might cost only Le 642. Alternative simpler plows, or plows of lower quality are available at prices of Le440 - Le820 landed in Freetown (Metianu and Vose, 1986). It appears preferable therefore to use the resources of Rolako for service and repair of plows, for extension, and for the development of ox equipment. The annual cost of the Pecotool plow (depreciated over 10 years and with interest at 15%) is Le 200.

Table 4. Change in cash flow due to use of oxen

	Yrs 1-4	Yr 5	Yrs 6-9	Yr 10
Extra crop income with oxen (Table 1)	4190			
Extra income by hiring out oxen	300			
Extra costs of seed and labour	-2670			
Extra gross margin due to oxen	1820			
Extra costs of working oxen (excluding herding cost)	-320			
Net extra income	1500	1500	1500	1500
Capital				
Repayment on ox loan (2100/5)	-420	-420		
Repayment on implement (1200/5)	-240	-240		
Interest on ox loan	-160	-160		
Interest on implement loan	-80	-80		
Sale of 2 oxen @ 340 kg	4500	4500		
Purchase of 2 oxen @ 160kg	-2100		-2100	
Purchase of new implement				-1200
Capital income (+) or payments (-)	-900	+1500		+1200
NET cash flow due to oxen per year	600	3000	1500	2700

Average extra income: Le 980 during first 5 years, Le 1410 during first 10 years

Notes:

See note on Table 1 concerning the value of the Leone.

Assumes typical farm in Northern Region.

If risk of loss or death of oxen is 2% per annum this represents an annual cost of Le 70.

Conclusions

By using oxen the farmer may increase the area his family cultivates and so increase his net income. However, the capital investment is more than his total present annual gross margin. If credit is available at 15% then by using oxen he may double his area of swamp rice and increase his gross margin by 15%. At present hire rates for oxen, it is also financially attractive for the farmer who does not own work oxen to hire them when required (Table 4).

Widespread use of ox plowing could result in an increase of rice production sufficient for national needs. Such an increase is however unlikely unless credit is available for purchase of oxen and plows and unless farmers have security of tenure so that they can develop their land and introduce more continuous cropping. A major programme of evaluation and development and of extension to introduce ox power for all farm operations is necessary before such social changes occur. The cash flow benefit from owning oxen is low for the first 4-5 years and is sensitive to crop yield on

the additional area cultivated. Major cash benefits depend on sale of oxen at the end of their working lives and this is very sensitive to any failure to gain weight at the predicted rate. It is likely that some form of staged replacement would provide a satisfactory return in practice.

References

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