ASSESSING THE PROFITABILITY OF USING ANIMAL TRACTION UNDER SMALLHOLDER FARMING CONDITIONS

T.E. Simalenga[1], A. Belete[2], N.A. Mseleni[2] & L.L. Jongisa[2]

ABSTRACT

A study was carried out to assess the profitability of using draft animal power under smallholder farming conditions. The study, which was carried out in the central region of the Eastern Cape Province, revealed that most smallholder farmers in the study area use draft animals as the main source of farm power. To carry out the cost benefit analysis, six scenarios were considered. These were: The use of oxen for ploughing only; use of oxen for ploughing and carting; use of donkeys for ploughing; use of donkeys for ploughing and carting; use of horses for ploughing and the use of horses for ploughing and carting. For all scenarios, the benefit exceeds the cost and the net farm income is positive and significant.

The study has confirmed that draft animal power is still a realistic and cost-effective option for improving smallholder-farming systems. Since draft animal power is an alternative, complementary technology, the necessary support is required in terms of scientific research, education, training and to provide improved agricultural support services for rural communities in South Africa.

1. INTRODUCTION

Agriculture in South Africa is characterised by its dualistic structure. On one side there is the highly developed commercial farming sector, effectively supported by agricultural education/training as well as research and development; while on the other hand there is the smallholder farming sector which was in the past (and mostly, still is) neglected as far as effective support services, education and research are concerned. One way of improving agriculture in rural areas in South Africa is to provide farmers with the opportunity of using improved technologies.

In the past, the Government has tried to promote the use of motorised power for use in crop production and transport in communal areas through tractor

[1] *Department of Agriculture and Rural Engineering, University of Venda for Science and Technology.*

[2] *Department of Agriculture Economics, Extension and Rural Development, University of Fort Hare.*

hire schemes, which have not yielded positive sustainable results (Dibbits & Wanders, 1998). Similar failure results from the use of tractor hire schemes owned by the government or co-operative farms have been reported in many Sub-Saharan African countries as well (Panin & Ellis-Jones, 1994 and Ellis-Jones *et al*., 1997). The use of tractor power in agriculture by smallholder farmers has remained unaffordable and uneconomical for many of them. The main option for these farmers is the use of animal draft power which is an environmentally friendly and appropriate farm mechanisation option under smallholder farming systems in most agro-ecological zones.

Despite the poor image of draft animal power and the neglected support services, it has survived and is still widely used by smallholder farmers in the rural areas/communities of South Africa. During the national survey carried out in 1994, it was found that on average 60 per cent of all farmers and rural communities visited were using animal draft power for transport and crop production. The survey also estimated that at least 400,000 smallholder farmers still rely heavily on draft animals as a source of power on the farm (Starkey, 1995). Despite the important role which tractors have, and will continue to play in South African agriculture, it has been clearly shown that draft animal power will continue to play an important role in the development of sustainable smallholder agricultural systems throughout the country for the foreseeable future (Simalenga & Joubert, 1997(a) and Simalenga & Joubert, 1997(b)).

So far very little has been done to understand the dynamics of the practices and promotion of the use of animal draft power in South Africa. Recently, several research and studies have been initiated at the Animal Traction Centre of Fort Hare University and the ARC-Institute of Agricultural Engineering at Silverton, which include conducting field performance trials for improved animal drawn equipment and the establishment of supplementary feeding standards for working animals.

This paper discusses the results of a study to assess the extent of use and profitability of animal draft power at farm level. The study, which was conducted in 1998, had three main objectives:

- To determine the utilisation levels of draft animal power under smallholder conditions;

- To carry out cost benefit analysis; and

- To assess farmers' constraints and opportunities of using draft animal power at farm level.

2. MATERIALS AND METHODS

A survey was undertaken in 1996 to determine the extent of use and management of draft animals in the Eastern Cape province. A total of 94 rural households were interviewed and it was found that 80 per cent of the respondent use animal traction (O'Neill *et al.*, 1999). As a follow up to the 1996 survey, it was found necessary to conduct an in depth study to assess the profitability of using animal traction under smallholder conditions. Thirteen representative farmers from the communal areas of the former Ciskei region, namely, Middledrift, Tyume, Amatola basin, Mdantsane, Zwelitsha and Cathcart were therefore selected for this in-depth cost-benefit study.

Detailed information on: Socio-economic issues, animal health and nutrition, implement costs and crop yields were recorded using a structured questionnaire, which was designed for this purpose. Research questions included:

- Total area and time of ploughing per season
- Crop yields and selling price
- Investment costs of the animals and implements
- Maintenance and running costs
- Health and supplementary feeding of the animals

The data was then collated on a spreadsheet and analysed using descriptive qualitative methods. Tables were used to present the data.

3. RESEARCH RESULTS

3.1 Crop area and utilisation of draft animals

In all the surveyed areas, the land which the farmers (i.e. small scale emerging farmers) use, is under communal land tenure, that means farmers have access to a small piece of land for crop production and the grazing land is communally owned and utilised. The farm sizes ranged from 0,6 ha to 4,9 ha with an average farm size of 2,5 ha. Since most farmers own a small piece of land, it limits their farming activities, which ultimately reduces their profit. Studies elsewhere have indicated that farmers need to farm a minimum of

2 ha in order for them to realise a good profit margin (Mwinjilo, 1994 and Van Averbeck *et al.*, 1998).

Draft animals can perform several operations on the farm such as: ploughing, harrowing, planting, weeding and transport. Table 1 shows summary of the estimated purchase price, working life, utilisation and work output for different working animals.

Table 1: Draft animal power vs. other sources of farm power: working rates and output for ploughing operation

	Donkeys	Oxen	Horses	Human power	Tractor 50kW
Purchase price R	50-300	1000-2000	800-5000	N/a	120 000
Working life (Years)	12-25	6-10	15-20	N/a	15-20
Daily work* output (ha) ploughing operation	0.25	0.5	0.5	0.1	5
Daily working* time (hours)	4	6	5	6	10 or more

Source: *1998 field survey; Simalenga and Joubert 1997(a)*

* *Daily work output and working time has been estimated for spanning 6 donkeys, 4 oxen and 2 horses.*

3.2 Source of income and investment costs of draft animals

The study results showed that thirty eight (38) per cent of all farmers interviewed, depended on farm income only to purchase all equipment and for survival. Fifty four (54) per cent of farmers interviewed were pensioners, which means that they have an additional income that can be used for on-farm investments. Eight (8) per cent of those interviewed were full time workers in towns and cities and were supplementing their farm income with monthly salaries. None of the farmers interviewed had received any financial assistance from the government or financial institutions.

The main source for buying draft animals was from auctions or from each other. The cost of buying oxen ranged between R1 000 - R2 000, donkeys between R50 – R300 while horses ranged between R800 - R5 000 (Table 1).

The study found that on average a household owns 6 oxen, 6 donkeys and 2 horses.

3.3 Health and management costs of draft animals

Animal nutrition, good health and management are key factors for maximum performance of working animal on the farm. During the study, it was found that almost all smallholder farmers maintain their livestock on communal grazing land but supplement their feed as required when working. This means they do not pay for maintenance feeding (i.e. natural grazing), they only pay for supplementary feeds, the cost of which ranges between R 60 - R150 per household per year. Ninety (90) per cent of farmers, however, grow their own supplementary feeds.

Vaccination, treatment of wounds and tick control are required to keep the animals in good health. Dipping facilities are available in all the surveyed areas. The dipping facilities controlled by government are free of charge while those owned by farmers' co-operatives do charge a small fee for using the facilities. For management purposes, most of farmers do keep their animals in kraals or simple constructed shelters, which are built using family labour costing between R 100 and R 300.

3.4 Implement and maintenance costs

Most of the farmers interviewed could not remember the price of implements or the time when they were bought (most of them had implements which were 5 – 10 years old) and some had inherited them from their relatives. A survey was therefore conducted among different local dealers to establish the current prices. Using a straight line depreciation method, an annual depreciation value for the expected life of each implement was determined as shown in Table 2. Most farmers service their equipment by buying spares parts from local suppliers and the maintenance cost was estimated to be 10% of purchase price per year.

3.5 Labour and operators' costs

Most of the farmers interviewed do not employ permanent labourers and hence they use their family members to assist in farm operations. Casual labourers are only employed during peak seasons for activities such as harvesting and weeding. The survey showed that the number of casual labourers employed range from 2 to 10 people and cost between R5 and R10 per day.

Table 2: Purchase price, maintenance and depreciation of Animal drawn equipment

Equipment	Purchase Price (R)	Maintenance cost (R)	Working life estimated (years)	Depreciation annual (R)
Plough	515.40	51.54	20	23.19
Harrow	446.30	44.63	20	20.08
Cultivator	568.84	56.88	15	34.13
Planter	1659.00	165.90	12	124.43
Trek gear*	300.00	30.00	20	13.50
Cart	4400.00	350.00	10	396.00
Donkey harness (webbing type)	1000.00	50.00	10	90.00
Horse harness	2000.00	70.00	10	180.00

Source: *1998 field survey*
** Trek gear includes: yokes, skei, strops and chain*

3.6 Crop yields and gross margin analysis

The major crops, which farmers cultivate using draft animal power include: Maize, potatoes and beans. On average, it was found out that farmers cultivate a total of 2.5 hectares, which were planted with maize (1 ha), potatoes (0.5 ha) and 1.0 hectares with beans. The average yields and production costs are shown in Table 3. Most farmers were using kraal manure to improve soil fertility on their farms hence saving the cost of buying commercial fertilisers.

Table 3 also shows a summary of gross margins for planting maize, beans and potatoes using 2.5 hectares as the average farm size. As Table 3 shows, farmers do indeed get a positive gross margin when using the draft animal power.

A farm income analyses was done to determine the profitability of using draft animal power. This involved subtracting the overhead costs from the total gross margin. The overhead costs consist of all non-directly allocateable variable costs (such as maintenance and spare part costs of implements; depreciation, labour and veterinary costs). The net farm income for each category is summarised in Table 4.

As can be seen from Table 4, the surplus which was generated by using oxen for ploughing alone or ploughing with carting, is more than when using

Table 3: Average yields, production costs and gross margins analysis for dryland farming

Crop	Yield/ha (Kg)	Value /ha (R)	Variable cost/ha (R)	Gross margin/ha (R)
Maize (N = 12)	142	669.62	179.23	490.39
Potatoes (N = 7)	352	2288.00	376.00	2100.00
Beans (N = 10)	850	2125.00	265.00	1860.00

NB: *Variable costs include: seeds, fertiliser, labour and packages*

Table 4: Net farm incomes for using draft animals*

	Oxen (N = 7) Plough [Plough + Cart]**	Donkeys (N = 4) Plough [Plough + Cart]	Horses (N = 2) Plough [Plough + Cart]
Total Gross*** Margin (R)	4450.39	4450.39	4450.39
Depreciation (R) (plough + yoke/harness)	36.69 [432.69]	113.19 [509.19]	203.19 [599.19]
Maintenance & repair cost (R)	81.54 [431.54]	101.54 [451.54]	120.54 [470.54]
Veterinary cost (R)	115.00	n/a	115.00
Net Farm Income (R)	4 217.16 [3 471.19]	4 235.66 [3 489.66]	4 011.66 [3265.66]

* *The net farm income for the different scenarios is calculated on the basis of the average farm size of 3 hectares.*

** *Figures in parenthesis indicates costs when using a combination of a plough with a cart.*

*** *The total gross margin represents a gross income of planting maize (1ha), potatoes (1 ha) and beans (1 ha) per farm as calculated in Table 3.*

donkeys or horses. In summary, all the six options bring a substantial amount of net farm income to the smallholder farmers.

4. DISCUSSION AND CONCLUSION

This study has attempted to assess the profitability of using draft animal power under smallholder farming conditions in the Ciskei region. The study has revealed a number of issues. Firstly, smallholder farmers in the study area

use animals for draft power extensively. A similar survey conducted by O'Neill *et al.* (1999) indicated that about 80% of farmers in the area are currently using draft animals. Secondly, draft animal power is assessed to be profitable as the net farm income when using the working animals for different agricultural purposes is positive. Thirdly, working animals in rural areas, has both agricultural and non-agricultural benefits. Some of the agricultural benefits include: reduction in drudgery during tillage and weeding operations, while for non-agricultural purposes activities such as the transportation of water, firewood and farm inputs as well as farm products to market is important. Moreover, animals such as cattle can be used for meat, for paying dowry (lobola) and for other cultural practices.

The study has revealed that the limiting factors in the development of draft animal power in South Africa are the lack of scientific research, education and training. Also, there is a lack of awareness amongst decision-makers on the importance of draft animal power and the role it plays in smallholder agriculture. Furthermore, most of these farmers lack credit facilities and other agricultural support services as well as good land to expand their farms.

The gross margin analysis has shown that the use of draft animal power for enterprises such as maize, potatoes and beans has positive results. This confirms that animal traction under smallholder conditions is not only technically feasible but also economically viable. It is therefore important that government, private organisations, training institutions and researchers work together to promote and popularise draft animal power in the rural communities of South Africa.

REFERENCES

DIBBITS H.J. & WANDERS, A.A., 1998. *Small scale mechanisation development opportunities in South Africa*. Report submitted to IMAG-DLO and ARC-Institute of Agricultural Engineering, Silverton, Pretoria.

ELLIS-JONES J., 1997. A farming systems approach to increasing the productivity of draught animals. In Ellis-Jones *et al*. (eds*). Improving the productivity of draught animals in Sub-Saharan Africa technical workshop proceedings.*

MWINJILO M.L., 1994. Animal traction technology in Malawi: Potential and constraints. In Starkey P. Mwenya E and Stares J (ed.). *Improving animal traction technology. CTA*, Netherlands. Page 456-459.

O'NEILL D.H.O, SYNED, J., MZILENI, N.T., MAPEYI, L., NJEKWA, M. & ISRAEL, S., 1999. The use and management of draught animals by smallholder farmers in the former Ciskei and Transkei. *Development Southern Africa Journal,* 16(2):319–333.

PANIN A. & ELLIS-JONES, J., 1994. Increasing profitability on animal draft power. In Starkey P. Mwenya E and Stares J (ed.). *Improving animal traction technology*. CTA, Netherlands. Page 94–103.

SIMALENGA T.E. & JOUBERT, A.B.D., 1997a. *Developing agriculture with animal traction.* University of Fort Hare, Alice. 19p.

SIMALENGA T.E. & JOUBERT, A.B.D. (eds.), 1997b. *Animal traction in South Africa: Today and tomorrow*. Proceedings of the SANAT workshop. 80p.

STARKEY P. (ed.), 1995. *Animal traction in South Africa: Empowering rural communities*. Development Bank of Southern Africa. 160p.

VAN AVERBECK, W., M'MARETE, C.K., IGODAN, C.O. & BELETE, A., 1998. *An investigation into food plot production at irrigation schemes in central Eastern Cape.* University of Fort Hare.