Animal power for weed control: experiences in Zambia

by

Emmanuel Mwenya

National Draft Animal Power Coordinator, Agricultural Engineering Section
Department of Agriculture, PO Box 50291, Lusaka, Zambia

Abstract

In all farming systems agricultural mechanisation is one of the important production inputs that will directly or indirectly enhance agricultural production. Mechanisation of farm operations saves labour and time, particularly during the critical periods of land preparation and weeding. As farmers cultivate more land with the assistance of improved technologies such as tractors and draft animals, family labour becomes insufficient and normally not all fields are weeded. Notwithstanding the importance of other weeding methods, this paper identifies animal power as an important method for weed control. It reviews some experiences of farmers and researchers in the use of animal power for weed control, and looks at its opportunities in Zambian agriculture. Shortage of labour coupled with the low work rates in hand-tool technology seem to justify the need to use animal power for weed control.

Introduction

Agriculture in Zambia is dominated by smallholder farmers who produce more than 60% of the total marketed maize. With rural populations decreasing because of high rural–urban migration, Zambia needs to sustain its food supplies. It is estimated that in the year 2010, only 30% of Zambians will live in the rural areas (Silumesii and Musonda, 1991). This will mean much more reliance on mechanised agriculture.

As in other African countries, up to 90% of the farming systems in Zambia are based on hand-tool technology. With this type of technology a major constraint is a critical shortage of labour during land preparation and weeding. The average size of a rural Zambian family in the subsistence and emergent farmer categories is 4–6 and 6–12, respectively (de Toro, 1985). Only 50% of this labour force is economically active. Work rates for hand weeding are low, so family labour is not adequate to complete weeding the crop in time on larger fields. Animal-powered weeding is relatively faster, but a key question remains: are the benefits to farmers of using animal power more than the costs?

Present status of animal traction for weeding

Animal traction use in Zambia varies greatly from one region to another. The plow appears to be the most popular implement in areas where animal traction is used; nearly all farmers who own oxen have at least one plow (Starkey, Dibbits and Mwenya, 1991).

In many parts of the country a plow is the first and only implement introduced with the technology. Other implements, such as cultivators and ridgers, come later. In the meantime, the farmers get used to the plow and cultivate larger areas, thus increasing the labour requirements at weeding. With most smallholder farmers the practice of applying a basal fertiliser dressing at first weeding increases the labour requirement during this period even more. In areas where animal traction has been in use for a long time, some farmers use plows to remove weeds between rows, while others have used ox cultivators or ridgers.

In all farming systems 70% of weeding is done by hand. In Southern Province, an animal traction area, only about 22% of weeding is done using draft animals (DoA, 1993), while in some parts of the same province about 90% of smallholder farmers use a plow to cultivate their fields (Starkey, Dibbits and Mwenya, 1991). Surveys of Lusaka and Central Provinces revealed 16 and 3%, respectively, of weeding is done using animals (DoA, 1993). Comparing the use of animal traction for weed control to plowing in subsistence and emergent farming, oxen plow about 54 and 55% of cropped areas in Lusaka and Central Provinces,

This paper is published in: Starkey P and Simalenga T (eds), 2000. *Animal power for weed control.* A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA). Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands. ISBN 92-9081-136-6. For details of ATNESA and its resource publications see **http://www.atnesa.org**

respectively (Dibbits and Mwenya, 1993). It is therefore clear that the use of animals for weeding is very low, compared to their use for plowing.

The limited use of animal power for weeding can probably be explained by the farming systems of smallholder farmers. Many farmers practise intercropping which makes it difficult to mechanise operations such as weeding. On average, over 60% of farmers interviewed believe that intercropping is better than sole cropping (DoA, 1993). The advantages of intercropping may include increased productivity per unit area, as different crops would need different nutrients from the same area. Weeding trials also show that some intercropping systems–for example, climbing beans and pumpkins through maize–provide more shade and competition against weeds than sole cropping (Waterworth, 1991).

In order to increase the use of animal traction for weed control, the farmers have to be convinced that sole cropping, and particularly planting in rows, is better than intercropping.

Why mechanise weeding?

The main purpose of mechanisation is to increase labour productivity. Mechanisation is taken to mean the provision and use of all forms of power sources and mechanical assistance, from simple hand tools to animal power or mechanical power. Mechanisation also contributes indirectly to higher yields, by facilitating the application of yield-increasing inputs such as fertilisers. Perhaps one of the important arguments in favour of mechanisation is that, in situations where labour is unreliable or difficult to manage, farmers may prefer mechanisation, even if it costs more to use the implements. Shortage of labour is the major limiting factor in increasing agricultural production. It is because of this problem in getting sufficient labour that farmers are encouraged to mechanise their farm operations such as weeding.

Demand for more labour during weeding will always be high in areas where tractors or animals have been used to plow large areas. Several studies have shown that an adult male, using hand labour alone, can work only about 0.5 ha of land per year: this includes plowing, planting, weeding, etc. This implies that a family with four economically active members can work only 2 ha (Crossley and Kilgour, 1983). By adopting animal traction, the same family could cultivate 4 ha or more.

Assuming that only manual labour is used for weed control, family labour would not be enough to cope with weeding in the peak periods of December and January. In many areas, farmers ignore part of the cropped area and weed only where the crop looks better. Mwenya (1993) demonstrated that a farmer using work animals has no labour shortage when weeding a 4 ha farm. Based on work rates of 0.1–0.25 ha/day for a human and 0.8 ha/day for a pair of oxen (Waterworth, 1991), it will take approximately 3 days for a family of four people to weed one hectare; a team of two oxen and two people would take 1.25 days. In trials in Eastern Province of Zambia, Waterworth (1991) confirmed that it takes a person three times as long to weed one hectare as it does an ox team.

It is well known that weeds reduce crop yields. From trials conducted on groundnuts fields at five sites in Zambia, Smart (1961) found that yields from unweeded fields were only about 65% of those from weeded fields; weeding the fields twice more than doubled the yields compared with unweeded fields.

Waterworth (1991) reported that hybrid maize yields decline if weeding is delayed beyond 10 days after crop emergence, falling from 7.1 to 6.6 tonnes when not weeded for 20 days. Other recent literature reviewed also indicates that if the crop is not weeded, yield losses would range between 30 and 90% (Shetto, 1992).

It is because of some of these experimental results and experiences that improved mechanisation such as animal traction for weeding is justified.

Farmer adoption of animal traction

Some authors have observed that smallholder farmer adoption of a mechanisation system will depend on the degree to which the system reduces the unit cost of inputs used in the production process. Other writers, however, have indicated that whether or not an individual smallholder decides to use a particular method is not purely a business decision; reduction in drudgery and saving on labour for other important activities are some of the factors considered (Crossley and Kilgour, 1983; Panin and Ellis-Jones, 1994).

Unlike other agricultural inputs, such as fertilisers and hybrid seed, it is usually difficult to assess the financial benefits associated directly with a particular implement. Looking at the arguments presented above it may be difficult for the farmer to realise a reduction in costs if, say, a cultivator is employed for weeding, because the initial cost of the implement is far more than the substituted labour.

Some farmers opt to use implements already available, such as plows. Plows have been used in Zambia by some farmers to remove weeds in between rows, but experience has shown that the time needed for weeding using a plow is almost double that using a ridger, particularly on groundnut fields. Here a field demonstration might be appropriate, to show farmers the importance of using the correct weeding implement. However, some farmers have argued that the use of a plow is still cheaper, as a ridger costs more than a plow. Other farmers, however, are convinced that weeding implements such as cultivators and ridgers are faster.

Conclusions

The role of animal power for weed control will always be important as long as farmers continue expanding their fields using improved technologies such as animal power and tractors. With decreasing rural population, more fields will not be weeded on time. This will make farmers continue to look for technology with a higher work rate to cover the fields in time. In such circumstances animal power would be the most appropriate method for weed control.

References

Crossley P and Kilgour J, 1983. *Small farm mechanisation for developing countries*. John Wiley, Chichester, UK.

Dibbits H J and Mwenya E, 1993. *Animal traction survey in Zambia*. Ministry of Agriculture, Food and Fisheries, Lusaka, Zambia in association with the Institute of Agricultural and Environmental Engineering (IMAG-DLO), Wageningen, The Netherlands. 119p.

DoA, 1993. *Knowledge, attitude and practice; base line surveys on crop and livestock production.* Reports of suerveys carried out in 1992 in Mkushi and Serenje Districts, Southern Province; Kafue and Lusaka Rural Districts, Lusaka Province; Mpika and Chinsali Districts, Northern Province. Department of Agriculture, Ministry of Agriculture, Lusaka, Zambia.

de Toro A, 1985. *Evaluation of the mechanization systems of different groups of farmers in the Eastern Province of Zambia.* International Rural Development Centre, Swedish University of Agricultural Sciences, Uppsala, Sweden.

Mwenya E, 1993. *Smallholder mechanisation systems: a comparison of hand powered, animal powered and tractor hire mechanisation systems in Zambia*. MSc Thesis, Silsoe College, Bedford, UK.

Panin A and Ellis-Jones J, 1994. Increasing the profitability of draft animal power. pp. 94–103 in: Starkey P, Mwenya E and Stares J (eds), *Improving animal traction technology*. Proceedings of the first workshop of the Animal Traction Network for Eastern and Southern Africa (ATNESA) held 18–23 January 1992, Lusaka, Zambia. Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands. 490p.

Shetto R, 1992. *Field operations and implements for production on small scale farms*. UNDP/OPs, Agrotec, Harare, Zimbabwe.

Silumesii G M and Musonda N G, 1991. An overview of agricultural mechanization strategies in Zambia. pp. 160–176 in: Mrema G C (ed), *Agricultural mechanisation policies and strategies in Africa: case studies from Commonwealth African countries*. Proceedings of the workshop held at the Institute of Agricultural Research, Ahmadu Bello University, 13–17 August 1990, Zaria, Nigeria. Food Production and Rural Development Division, Commonwealth Secretariat, London, UK. 313p.

Smart J, 1961. Weed competition in leguminous grain crops in Northern Rhodesia. *Rhodesia Agriculture* 58:(4).

Starkey P H, Dibbits H J and Mwenya E, 1991. *Animal traction in Zambia: status, progress and trends*. Ministry of Agriculture, Lusaka, Zambia, in association with IMAG–DLO, Wageningen, The Netherlands. 105p.

Waterworth V J, 1991. *A handbook for agricultural extension workers*. Ministry of Agriculture, Lusaka, Zambia.

This paper is published in: Starkey P and Simalenga T (eds), 2000. *Animal power for weed control.* A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA). Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands. ISBN 92-9081-136-6. For details of ATNESA and its resource publications see **http://www.atnesa.org**