

Animal power for weed control in Kaoma District, Zambia

by

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Abstract

Kaoma District, Zambia, has a high agricultural potential. However, this is not being exploited fully, particularly due to a shortage of labour for weeding. The Western Province Animal Draught Power Programme has been supporting the spread of animal-powered weeding in the district through training of extension staff and farmers, organising demonstrations of weeding technology and by stimulating trade in implements.

After field tests/demonstrations and farmer acceptance tests the ridger was selected as a potential weeder in preference to a cultivator. This was because a ridger can be used both on flat and ridged land. A ridger is able to cover weeds and top-dress fertiliser immediately after its application, is robust and requires only minor adjustment whilst in operation and can also be used as a primary tillage implement.

The use of weeders doubled to over 100 farmers in less than two years. These new adopters favoured weeding using animals for reasons other than the reduction in cost of weeding. During demonstrations farmers stressed the advantage of 'speed', and the ability of the weeder to combine weed control with fertiliser coverage.

Weeding is a major constraint to the expansion of the cultivated area by farmers. However, access to draft animal power has not increased the area cultivated due to external economic constraints which have had a negative effect on crop production.

Background

Kaoma District, in the eastern part of Western Province of Zambia, is an area of 23 315 square kilometres between longitudes 24° and 26° east and between latitudes 14° and 16° south. It is situated 400 km west of Lusaka on the all weather road to the provincial capital, Mongu. About 60% of Kaoma District is arable land.

The district is the most fertile area in the province, and accounts for 90% of the marketable surplus production of maize and groundnuts. It experiences a very distinct agricultural season which coincides with the 800–1000 mm annual rainfall distributed between November and April. Temperatures can be as high as 34°C in the driest period of October–November and during the cool period of June–July can fall as low as 5°C.

Kaoma soils are predominantly a well drained sandy loam (65%) with varying topsoil depth of 100–150 mm in the relatively flat uplands (Muma, 1994). There are areas of sandy clay loam in the lower parts of the district.

In 1990, Kaoma District had a population of well over 113 000 people of which 85% were supported directly by agriculture. The average household size was 4.1.

The principal crop is maize contributing about 65% of arable crops, grown chiefly for home consumption rather than for commercial purposes. Other crops in decreasing order include cassava, millet, sorghum, groundnuts, cotton, mixed beans, tobacco, soya bean, sunflower and rice. The existing land tenure system is a mixture of share cropping and communal ownership.

Agriculture in Kaoma farming systems is mainly semi-subsistence rainfed cropping comprising 25% of traditional, 65% small-scale commercial and 10% medium-scale commercial farmers. The average size of household arable land is estimated at 2.5 ha. It is estimated that there are about 21 837 rural households in the district of which 30% are female-headed (Kakwaba, 1995).

There are basic institutions and infrastructures in Kaoma which provide services ranging from farmers' extension to agricultural credit in order to promote and encourage the adoption of improved agricultural technologies. In keeping with the liberalised market economy, there are scattered marketing channels which supply agricultural inputs as well as purchases of farm

produce. Furthermore, the communications and road network are better developed here compared with other districts.

Human labour is the traditional method of tillage. However, the use of animal power is increasing. There are about 5000 work oxen out of 23 000 cattle representing 4.2% of the provincial cattle population. Although only 25% of farmers own oxen, 65% of cultivable land is prepared by oxen through hiring and borrowing, often practised when the ox owners have completed their critical tasks.

The main uses of animal draft power are for land preparation and transportation of agricultural produce and inputs. Transport is mostly on sledges, although the number of ox carts is increasing. Primary cultivation is mostly accomplished by use of a mouldboard ox-drawn plow. There are over 1500 in use (WP-ADPP, 1994). Other soil engaging implements in use are ridgers, multi-tine cultivators and spiked harrows. The ridger is assuming greater importance due to its dual purpose as a primary tillage implement and also as a potential weeder. Seeding, harvesting and threshing operations are all carried out manually.

The high agricultural potential in the district is not utilised fully due to various constraints, such as shortages of energy sources and time at peak periods during the growing season, and more especially, during the weeding period (Meijer, 1992).

Draft animal power in Kaoma District

It is reported that draft animal power technology was introduced into Kaoma District between the late 1960s to mid 1970s by immigrant farmers from the south of the country, probably from what is now Zimbabwe. These farmers brought in oxen and plows since the indigenous population were not traditional cattle keepers. Since then the technology has been transferred from farmer to farmer, mainly by themselves (Starkey et al, 1991).

Since 1989 draft animal power has been promoted actively by a donor-assisted project, the Western Province Animal Draught Power Programme (WP-ADPP). WP-ADPP is a programme of the Ministry of Agriculture, Food and Fisheries (MAFF) but funded directly by The Netherlands through RDP Livestock services, a Dutch technical assistance company.

Phase I of the project commenced in 1989 and ended in 1992. Phase II ran from 1993 to 1995.

One of the main objectives of the programme's first phase was the promotion of timely supply and distribution of appropriate implements and spares through public institutions as well as through private traders. Special emphasis was placed on secondary tillage implements (Kamphuis and Muma, 1991). The main emphasis of Phase II was the consolidation of the successful and proven experiences of the former. The overall objective was of contributing to the development of sustainable farming practices by increasing, intensifying and diversifying the use of draft animals by communities in priority areas of the district.

Weed control

The importance of weed control is well documented: lack of it will deprive any crop of the nutrients, water and sunlight. Weeds are also a source of pests and disease which independently or collectively account for lower yields in Kaoma. Thus it is a very important operation which farmers have to perform if substantial yields are to be realised. However, the weeding operation takes about 50% of the total labour required for crop production per hectare (Chatizwa and Nazare, 2000—in this resource book). Weeding in Kaoma is carried out predominantly by hand and mainly by children and women. Hiring of external labour is frequent; payment is made per row weeded (Siyambano and van Leewen, 2000—in this resource book). A very small percentage of farmers practise a combination of hand- and ox-weeding.

Animal drawn weeders

In Kaoma district about 8650 households have access to oxen through owning, borrowing and hiring. Of these only about 40 used animal drawn weeders at the start of 1994 (Siyambano and van Leewen, 2000). Ox-owners use multi-tine cultivators, ridgers and a limited number of mouldboard plows to control weeds in such crops as maize, groundnuts and cotton.

Costs and benefits

A survey conducted in 1994 among 50% of farmers owning draft animal weeding equipment indicated that Kaoma farmers use both hand weeding and animal-powered weeding in combination. A comparison of hand- and ox-weeding shows that animal-powered weeding results in an almost tenfold labour saving compared to weeding by hand (Table 1). This labour-saving advantage of animal power for weeding would particularly

Table 1: A comparison of time, labour costs and investment for hand- and ox-weeding

	<i>Hand weeding</i>	<i>Ox weeding</i>
Labour (person-days/ha)	30–45	3–5
Labour cost (ZK*/ha)	15 000	5 000
Investment (ZK*)	–	28 000

Source: WP-ADPP, 1994

* US\$1 ≈ ZK650 in 1994

benefit women who currently do most of the weeding. It would also allow farmers to spend more time on other worthwhile activities. The capital investment for ox-weeding is high but the labour costs per unit area are 60% less than for hand weeding. This being the case it becomes apparent that investment in draft animal equipment is considered feasible.

Promotion of animal-powered weeding in Kaoma

Introduction and promotion of a technology entails the simultaneous provision of both 'software' and 'hardware' requisites (Starkey and Grimm, 1994). In the recent past the WP-ADPP has attempted through the Department of Agriculture to increase awareness of animal-powered weeding. Thus, a number of strategies have been initiated and implemented.

Training of farmers

As well as ox handling, farmers received training in sowing crops in rows, yoke and muzzle making and implement setting. Work oxen were trained by farmers to walk between the rows and obey new orders whilst being harnessed with a cultivating yoke and accepting a muzzle. Training ranged from a one-day weeding demonstration/field-day to two-week mobile courses. The training covered 200 farmers, of which 30% were women. More than 10 pairs of oxen were trained for weeding.

Extension and demonstrations

Initially the programme concentrated on demonstrations to show farmers various possibilities of weeding with animals. Two pairs of trained cows were taken on a demonstration weeding tour in Kaoma (Akombelwa, 1992). An average of five field-days were conducted each year attracting 40–50 farmers each time. Six comparative tests

on a wide range of weeders were carried out to ascertain their suitability and farmers' acceptance (Siyambano and van Leewen, 2000).

The farmers participating in these activities clearly favoured the ridger as the most suitable implement for weeding. As a result of this feedback a programme of large-scale distribution of ridgers was launched through trial groups. Trial groups of five or six farmers were encouraged to offer as many farmers as possible the opportunity to work with the weeder.

Almost 100 implement trial groups were formed. The groups allowed over 450 farmers to gain practical experience of the equipment. The groups organised a total of 36 demonstrations showing over 650 farmers (37% female) their skills. In addition, extension leaflets with technical details on prices of labour and weeding were disseminated to participating agricultural staff and interested farmers.

Training of field staff

In the first stage the district animal draft power coordinator initiated and implemented demonstrations and training. After this it was felt that field staff should be trained more systematically. Thirty-six field staff of the Department of Agriculture in Kaoma received training on how to carry out trials and demonstrations of ox-drawn weeders. Training at the Palabana Animal Draft Power Development Programme enabled the field staff to organise demonstrations independently.

Stimulation of implement trade

During the first phase of WP-ADPP, participants repeatedly pointed out the lack of availability of implements and spares within the district. The programme therefore made provision to sell weeders immediately after the demonstrations and initiated a programme of timely stocking of implements and spares at 12 rural markets. Other elements of stimulation included the formation of a yoke-making group producing 200 cultivating yokes.

Barter loan package

A loan/barter package was developed to facilitate the acquisition of a ridger (weeder), a plow body, a treckchain and the locally-made cultivating yoke. The barter package cost 21 sacks (each 90 kg) of maize in 1994. This attracted over 40 individuals and groups. A

similar groundnut package is being developed. This package envisages the crop being grown on the ridge, weeded by re-ridging and lifted by a groundnut lifter (Meijer, 1992).

Possible impacts on the farming community

The promotion of animal-powered weeding was based on four main assumptions. The possible impact of the promotion is being evaluated according to these four assumptions, as outlined below.

Area increase?

- A trained labour force and adequate equipment would induce farmers to increase their cultivable area, since the weeding constraint would be reduced.

This assumption has not been proved by the programme. On the contrary, farmers who invested in weeders have in general decreased their area cultivated. Farmers have experienced consecutive droughts and the lending facilities for input supply have shrunk so farmers have cultivated a smaller area, which has reduced weeding requirements.

Ox weeding perceived as cheaper ?

- Farmers trained in the use of animal-drawn weeders would realise that animal power is cheaper than weeding by hand and so would invest in weeders.

This assumption was not confirmed during the promotion of weeders. Although the usage of weeders doubled in two years (to over 100 farmers) these new adopters favoured weeding using animals for reasons other than the reduction in cost of weeding. Time and again during demonstrations farmers stressed the advantage of 'speed', and the ability of the weeder to combine weed control with fertiliser coverage. Moreover some farmers opted to buy a (more expensive) complete ridger and plow separately.

Women released from weeding gain time?

- Women farmers would be released from the back breaking job of hand weeding and will eventually take up other activities.

During demonstrations women commented positively about animal-powered weeding. Still the job of hand weeding remained and the programme did not find out whether more time could be spent on other worthwhile activities.

Poor women may not find weeding work?

- Less well-off women farmers would eventually not find jobs during the weeding period. This could have serious implications for their family.

The programme investigated specifically the opportunities of workers gaining an income from hand weeding in areas where the weeder was adopted. It was found that ridger owners use considerably less hired labour than others. However, it could not be confirmed that less well-off female farmers were losing their part-time work weeding. Owners of weeders do appear to use relatively more of their own family labour in weeding.

Constraints to the adoption of animal-drawn weeders

In promoting animal power for weeding certain constraints originating from these activities are presented here:

- the adoption rate of this technology has been slower than anticipated, thus ample time is required for the practice to be diffused widely
- there is a shortage of labour to clear and stump out fields ready for animal-powered cultivation
- despite implements being readily available, farmers have had insufficient capital to invest in new equipment
- some farmers still plant behind the plow (third-furrow) so efficient animal weeding cannot be performed
- in sandy areas with low soil fertility crops grown on flat land are prone to being covered by a ridger so this technology is not adopted (Koliijn, 1992)
- in some cases human labour seems to be sufficient.

Conclusions and recommendations

Weeding is one of the major constraints Kaoma farmers are facing in their thrust of increasing crop production. Programme intervention in this requires further promotion of alternative technology in the region. After field tests/demonstrations and farmer acceptance tests the ridger was selected as a potential weeder in preference to a cultivator. This was because a ridger can be used both in flat and ridged land, is able to cover weeds and top-dress fertiliser immediately after its application, is robust and requires only minor

adjustment whilst in operation and can also be used as a primary tillage implement. Cultivators may also be useful in certain situations.

The use of draft animal power for weeding should be promoted extensively in areas where scarcity of expensive hired labour is paramount.

Weeding is a major constraint to the expansion of cultivated area by farmers. Access to draft animal power has not increased the area cultivated due to external economic constraints which have had a negative effect on crop production.

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