

Animal power for weed control: experiences in Zimbabwe

by

Irvine Chatizwa and Raymond M Nazare

Institute of Agricultural Engineering (IAE), PO Box BW 330, Borrowdale, Harare, Zimbabwe

Abstract

Weed control is a major problem contributing to low agricultural yields in Zimbabwe. Weeding takes up to 50% of available agricultural time. The degree of the problem varies from the communal areas to the large-scale commercial farms.

Cattle and donkeys are the main source of animal power in Zimbabwe. The distribution of animals varies from one province to another, with donkeys concentrated in the drier regions because they are more tolerant of harsh conditions. The use of animal power for weed control is mainly confined to communal, resettlement and small-scale commercial farms. On large-scale commercial farms, tractors are used to operate cultivators and sprayers for weed control. Hand weeding is practised in all the subsectors.

This paper describes the different types of weeding systems and the related implements in Zimbabwe, their availability, supporting infrastructure, constraints to adoption and possible ways to promote draft power for weed control. The capability of the agricultural machinery manufacturing sector is also discussed.

Introduction

In most developing countries, the bulk of the staple food is produced by small-scale farmers whose farms range in size from 1 to 100 ha of arable land. Many farming inputs, including mechanisation, improved seed and agrochemicals, are either too expensive or not available for many small-scale farmers.

One of the major problems facing Zimbabwe is to generate a substantially greater output from the smallholder farming community (communal, resettlement and small-scale commercial) in order to meet direct household consumption needs and to provide a surplus to generate greater net farm cash incomes (Kangai, 1993). It is also the aim of the government to increase the smallholder

farmers' contribution to the Gross Domestic Product (Chidzero, 1989). To achieve this, more research on sustainable agriculture is recommended for all the marginal rainfall areas (agro-ecological zones 3, 4 and 5), which are mostly occupied by the smallholder farmers (Figure 1).

Agriculture in Zimbabwe is broadly divided between two major farming sectors: smallholders, and state and commercial enterprises. There are numerous differences within the farming sectors, but the two main characteristics are land tenure system and size of landholding. In the small- and large-scale commercial farming system, land is owned by

Figure 1: Agro-ecological zones of Zimbabwe
Source: Surveyor General, 1985



Zone	Mean annual rainfall (mm)
1	over 1000
2a	750–1000
2b	750–1000
3	650–800
4	450–650
5	450 or less

Table 1: Land distribution and characteristics of the farming subsectors of Zimbabwe

	<i>Large-scale commercial</i>	<i>Small-scale commercial</i>	<i>Communal</i>	<i>Resettlement areas</i>	<i>National parks</i>
Total area (000 ha)	12 000	1 420	16 350	3 000	5 620
Total area (%)	31	4	42	9	14
% of area in regions 1–3	51	56	26	51	15
Number of farms	4 500	8 500	850 000	50 000	–
Average farm size (ha)	2 666	167	1–5 ¹	5 ²	–
Permanent labour force	30	–	2–4	–	–

1) 1–5 ha arable land plus about 14 ha grazing land per household

2) 5 ha arable plus communal grazing area

Source: Moyo and Nazare, 1993

the farmers: in the communal and resettlement areas, land is owned by the community (State) and arable land is allocated to families.

The main sources of draft power in the large- and small-scale commercial farming sectors are motorised systems (tractors, etc). Animal draft power is used mainly by farmers in the communal and resettlement areas. Small-scale commercial farmers use both tractors and animals. However, tractors and related equipment are used to a smaller extent by some of the farmers in the resettlement and communal areas.

Many farmers lost their cattle in the 1991–92 drought, worsening the shortage of draft power for all agricultural operations. In the past, farmers who used donkeys were accorded a lower social status by the community and this has resulted in lower acceptance of donkeys for draft power. One effect of the depleted cattle herd following the 1991–92 drought was to force farmers to use donkeys on a large scale for draft purposes. Donkeys have historically been used with carts for transport, and their use for field operations has been limited nationwide. Since the drought, donkeys have

been seen to offer an available and relatively cheap form of draft power.

Weeding is a very important operation which has to be carried out by farmers if substantial yields are to be obtained. This paper reviews the current practices, supporting infrastructure, constraints to adoption and activities underway to promote animal draft power for weed control in Zimbabwe.

Weeding practices in Zimbabwe

All farmers in Zimbabwe use hand weeding and herbicides to some extent. Communal and small-scale commercial farmers also use animal-powered weeding, and small- and large-scale commercial enterprises also use tractor power.

Animal-drawn weeders

About 863 500 farmers use animals for draft purposes on about 1 770 000 ha of arable land (Tables 1 and 2).

Small-scale farmers in Zimbabwe use purpose-made weeders in the form of cultivators, and adapted implements such as plows, ridgers and harrows.

Table 2: Distribution of farming sectors among agro-ecological zones in Zimbabwe

<i>Agro-ecological zone</i>	<i>Communal</i>		<i>Small-scale commercial</i>		<i>Large-scale commercial</i>		<i>Total</i>	
	<i>(000 ha)</i>	<i>(%)</i>	<i>(000 ha)</i>	<i>(%)</i>	<i>(000 ha)</i>	<i>(%)</i>	<i>(000 ha)</i>	<i>(%)</i>
1	140	24	10	2	430	74	560	1.7
2	1 270	22	250	4	4 430	74	5 860	17.5
3	2 820	43	540	8	3 240	49	6 600	19.7
4	7 340	62	520	4	4 020	34	11 880	35.5
5	4 780	56	100	1	3 650	43	8 530	25.6
All zones	16 350	49	1 420	4	15 770	47	33 430	100

Source: CSO, 1987

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>

Table 3: Ownership pattern for various farming implements surveyed in six districts

District	Percentage of households owning			
	Plow	Harrow	Cultivator	Hoe
Buhera	82	17	7	95
Chirau	82	24	50	96
Chirumanzu	87	26	28	100
Chiweshe	59	2	33	93
Nyajena	70	7	5	97
Zvishavani	79	11	20	96
All areas	76	14	23	96

Source: Lands (1990)

Practices with animal-drawn weeders.

In general, normal practice is to weed the crop two to three weeks after germination and then once or twice during the growing season depending on the rainfall pattern for the region and level of weed infestation.

All animal-drawn weeders are for row-crop work and are mainly used for inter-row cultivation. For within-row weeding the most common exercise is to hand weed using hoes and various other forms of hand weeders. About 70% of hoeing is done by women. Animals are mainly used by men. Animal-drawn weeders provide a faster method of controlling weeds during the growing season. A combination of hand and animal-drawn weeders can reduce weeding work hours by up to 50%.

Where animal power is not used, weeding can take up to 175 h/ha: this is almost half of the total time required for all the field operations put together.

Implement types

A survey conducted in six districts in Zimbabwe showed that, on average, 96% of households owned hoes; 76% owned at least one plow; about 23% owned a cultivator; and about 14% owned a harrow (Table 3).

The animal-drawn weeders used in Zimbabwe require very little draft force, except when tools like ridgers and plows are being used for weed control. The cultivator is a purpose-designed implement for weeding which, when equipped with duckfoot shares, is suitable for cutting weeds with a slight additional effect of pulling out or covering the weeds. The cultivator can be equipped with reversible point shares and it then becomes suitable for pulling out or covering weeds.

The ridger is designed for primary ridge construction, re-ridging and weeding. The working depth is normally set to move 1–2 cm of soil on the sides of the ridge, which is sufficient to kill annual weeds when they are still small. In some cases, where crops are grown on ridges, a re-ridging operation can be carried out as a weed control measure.

A variety of tines (sweep, duckfoot and ripper) can be attached to a standard plow beam and used for inter-row cultivation. The exercise of using tines for weeding may require several runs in the row, depending on the inter-row spacing. The wider the inter-row spacing, the more runs are required to destroy the weeds effectively.

The use of the plow without a mouldboard for weeding is an exercise which is currently being introduced to farmers. It is equally effective, cheaper and requires about two runs per row to destroy weeds effectively.

Supporting infrastructure for weeders

Manufacturing industry

The manufacturing industry for animal-drawn weeders in Zimbabwe comprises the formal (Bulawayo Steel Products and Zimplot) and the informal (blacksmiths) subsectors. Formal industry produces almost all animal-drawn implements which meet the requirements for the smallholder farming community: the informal subsector supports the community with mainly hand implements, often made from scrap metal.

Implements are available from retailers countrywide in the form of complete equipment and spare parts. The distribution chains are shown in Figure 2.



Three-tine weeder made by Bulawayo Steel in use in Zimbabwe

Blacksmiths only produce implements through placed orders unless a high demand is anticipated.

Most farmers service their own implements. Spare parts are readily available, but sometimes the cost of replacement parts can be high, compared to a farmer's income. Rural blacksmiths thus become very important, because they can repair or replace worn-out parts at reasonable cost; they may also offer terms for repayment, or accept barter terms (eg, payment in grain).

Repair and maintenance

The Institute of Agricultural Engineering (IAE), under the Department of Agricultural, Technical and Extension Services (Agritex), has an on-going programme to provide training for rural blacksmiths, who are taught to produce

basic tools which will enable them to perform minor repairs and fabricate most of the small agricultural implements, such as sweep tines and duckfoot weeders.

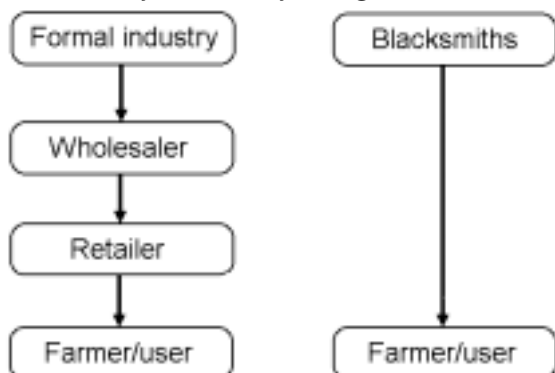
Training

Farmers are trained by agricultural extension staff – agricultural mechanisation specialists, extension officers and workers advising on all aspects of the proper use of implements and cropping. All these extension staff are trained at the IAE, and also at day centres where they can meet farmers on a daily basis for instruction. The IAE also trains farmers in the use of various implements for weed control directly through demonstrations and field days.

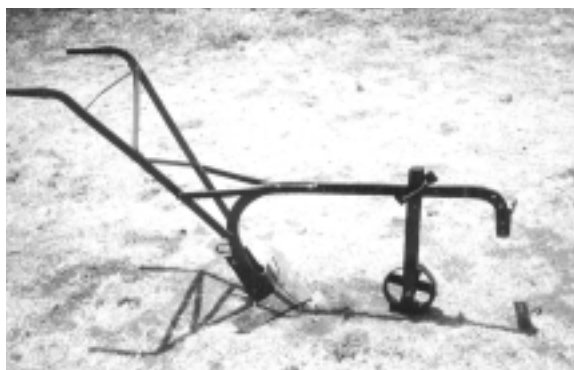
Credit

Credit is available to farmers through the Agricultural Finance Cooperation (AFC). Most

Figure 2: Distribution chains for formal and informal manufacturing sectors



Weeder manufactured by a blacksmith, Zimbabwe



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>



*Single duckfoot tine
mounted on a plow beam for weeding*

of the loans to the smallholder farmers are to purchase new implements and draft animals. There is also some vetting as to who should be given the loan by Lending Groups, AFC and the Agritex staff. The loans are medium-term, and the repayment period is within 3–5 years.

Steel supplies

Zimbabwe has its own natural deposits of iron ore, and a well-established steel manufacturing industry. The country is thus in a strong position to satisfy almost all the requirements of the smallholder farming community, with surplus for export. The steel is not high quality, but it satisfies the requirements for the manufacture of animal-drawn implements.

Constraints to adoption of animal-drawn weeders

A survey conducted in six districts, covering 737 farmers using animal power, showed that 328 used animal draft for planting, 179 for weeding, 142 for winter plowing and 88 for manuring. Some 11% of the farmers hired draft for all operations: of these, 5% hired draft for weeding operations.

Most farmers in the communal areas do not use animal-drawn weeders on all the planted areas, the major reasons for this being:

- the high price of cultivators relative to farm incomes

- lack of knowledge about alternative animal weeders
- inadequate human resources
- poor dissemination of the weeding technology
- inadequate access to draft animals and weeding tools
- failing to plant in rows, eg, broadcasting.

The availability and use of animal power for weed control determines the extent to which the smallholder farmers can increase their crop production. Inadequate knowledge of the use of animal power for weeding is associated with poor timing of weeding operations, resulting in heavy losses in yield.

Activities to promote animal draft weeding in Zimbabwe

Various organisations are promoting programmes to improve adoption of animal-drawn weeders. These include:

Programmes addressing the draft shortage

- use of donkeys
- development of a donkey harness
- development of a single ox harness
- development of light equipment for single or small animals.

Programmes to address the high cost of weeding implements

- promotion of competition (training of blacksmiths)
- use of existing toolbars (eg, plow beams) with new cultivator tines to reduce the overall cost
- encouragement of sharing of implements (problems with timeliness of weeding operations)
- promotion of blacksmiths who offer credit or better terms for their products and services
- exposure to the credit terms.

Programmes to improve information dissemination on weeder technology

- incorporation of new technologies into the training curriculum of field extension staff, eg, weeder attachments, harrowing, etc
- attendance at field days
- assisting with rural competitions for blacksmiths
- deployment of new technologies for field tests in fairly high numbers

- exposure of blacksmiths to new tools so that they can be included in the range of products they manufacture
- collaborating with non-governmental organisations (NGOs) promoting animal draft power programmes.

Research programmes to optimise performance and manufacture of weeders

- research into alternative weeding technologies.
- research into manufacturing methods for the rural blacksmiths.

Conclusion

Weeding is seen as a severe bottleneck for small-scale farms in Zimbabwe. Resolution of the problem requires a systems approach to effectively promote the various technology options available. Zimbabwe as a country, through various organisations, is addressing some of the constraints highlighted in this

paper, but much more effort needs to be directed towards weed control among small-scale farmers.

References

- CSO, 1987 *Agricultural and livestock survey for 1985–86 season*. Permanent Sample Unit, Central Statistical Office (CSO), Zimbabwe.
- Chidzero B, 1989. The Zimbabwe Economy. *Financial Gazette* 10 February.
- Kangai K, 1993. Zimbabwe's proposed agricultural policy. *Farming World* (9):16–17.
- Lands, 1990. *The second Annual Report of farm management data for Communal Area farm units, 1989/90 farming season*. Farm Management Research Section, Economics and Markets Branch, Ministry of Lands, Agriculture and Rural Resettlement. Government Printers, Harare, Zimbabwe. p62.
- Moyo N and Nazare R, 1993. The current status and trends in agricultural mechanisation in Zimbabwe. Regional Workshop on National Agricultural Mechanisation Strategy Formulation. *Country Papers* (2): 2. Nairobi, Kenya.
- Surveyor General, 1985. *Agro-ecological zones of Zimbabwe*. Surveyor-General's Department. Government Printers, Harare, Zimbabwe.