

Weeding technologies and possibilities for improving animal-powered weeding in Swaziland

by

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Abstract

About 65% of rural households in Swaziland keep cattle and the total cattle population is almost equal to that of the human population. Cattle provide about 5% of the total cash income of rural homesteads, and about 26% of homestead income when the value of herd off-take is included. The commercial off-take of cattle is very low as cattle have a high cultural value. Oxen are the main draft animals. They form about 23% of the total cattle herd and are owned by about 55% of homesteads. Despite the use of oxen for plowing, weeding using draft animals is rare.

Several on-station experiments indicated that weeding was a critical factor in production, especially of maize, the staple food for Swazis. Weeding is currently carried out mostly by women and is a significant burden to them. Access to animal-drawn implements for weeding would alleviate drudgery for women at an affordable cost. Since animal power is already used widely in Swaziland, introduction of animal-powered weeding would not be difficult. A systematic analysis should be carried out to assess the resources necessary to introduce and sustain animal-powered weeding in Swaziland.

Introduction

Swaziland, which lies between the Republic of South Africa and Mozambique, has an area of 1736 square kilometres. One of the most striking features of Swaziland's agricultural sector is its two forms of land tenure arrangement:

- the traditional land tenure system practised on Swazi National Land (SNL) which comprises 58% of Swaziland's total land

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area and is where 82% of the country's population live

- the freehold tenure system operating on what is called Individual Tenure Farms (ITF), which comprise 42% of the total land area and are mainly foreign-owned and managed.

ITFs are predominantly capital intensive and account for about 65% of the sector value added and almost 70% of the export earnings. Production on SNL is geared mainly towards subsistence and is widely based on traditional practices. Only 14.8% of SNL is cultivated or fallow, the rest is being used for grazing (de Vletter, 1983). Communal grazing land comprises about 85% of SNL.

The roles of cattle

Livestock have traditionally been an important component of the agricultural industry in Swaziland. According to Chambers et al (1983) about 65% of rural homesteads keep cattle. The cattle population (636 036) almost equals the total human population (712 131) of Swaziland (DPU, 1983). Cattle on SNL are used mainly for plowing and planting, as draft animals and for providing meat and milk for family consumption. According to de Vletter (1983), cattle are also the traditional store of wealth and have an important role in cultural and social customs. Thus the rate of commercial off-take of cattle on SNL is extremely low, ranging from 2.8 to 3.2%. This is in direct contrast to the commercial off-take on ITFs (which ranges from 14 to 18%). Because the off-take on SNL is so low, Swaziland has to rely on imports of beef animals from South Africa to satisfy her domestic and export markets.

A study by Russel and Ntshingila (1984) reported that livestock contribute 5% of the average homestead income from all sources including absentees wages and non-agricultural

enterprises. De Vletter (1983) reported that livestock sales comprise 6% of the annual homestead cash income. When consumption and herd growth were included, livestock contributed 26% of the total homestead income.

Several factors have been identified that contribute to the low animal (particularly cattle) off-take rate from Swazi homesteads. Among them were cultural factors such as:

- keeping cattle for security and wealth
- prestige
- lobola (bride price)
- inherent desire to own livestock
- they are a common homestead resource with no effective control of use
- security for loans
- high return on investment
- no incentive for commercialisation
- inadequate competition in the market.

Draft animal use

No systematic approaches to draft animal husbandry have been developed in Swaziland to date. The information in this paper therefore focuses on indications of the situation as derived from agricultural surveys, livestock statistics and observations. Most of the data quoted result from research by either the Farming Systems Research Programme or the Rural Development Area Programme and individual researchers.

Oxen are the main work animals in Swaziland. A few donkeys and mules (<1%) also serve as draft animals. There are about 95 750 oxen on SNL, about 23% of the total cattle population (DPU, 1983). About 55% of homesteads stock oxen (RDAP, 1981a,b), and sharing of oxen between homesteads is widespread.

The percentage of total SNL maize and cotton fields plowed by draft animal power has been decreasing over the years. For example, in 1982/83 the figures were 66 and 49%, respectively (Watson, Mamba and Mamba, 1983), but in 1990/91 the figures had declined to 51 and 45%, respectively. There has been a gradual movement on SNL towards mechanical power as an alternative draft source. This process has for a long time been facilitated by the Government of Swaziland by the establishment of tractor pool services which can be hired by farmers at a relatively low hourly rate. This measure was designed to 'alleviate' problems associated with dependency on ox-draft power in crop production.

With the government encouraging mechanical and chemical technologies, animal traction has not been considered seriously as an alternative means of weeding in Swaziland.

The primary problems of animal power in cropping operations were identified by Watson, Mamba and Mamba (1983) as centring around four interacting factors:

- condition of animals at the beginning of the crop season
- late planting
- poor soil preparation
- poor crop yields.

Oxen are known to be in poor physical condition at the start of the cropping season; this follows a cool dry winter during which the animals receive poor quality feed on the veld or crop residues. As a result farmers are late in plowing and planting their fields. These operations are also delayed by late termination of animal grazing on communal crop land.

Even after animals are removed from arable areas, farmers sometimes leave their oxen to graze for a further period on the veld before they use them, in the hope that they might benefit from the fresh grass following spring rains. Despite these efforts most farmers plow with oxen that are too weak to perform soil penetration at the recommended depth of 30 cm. The situation is worse in dry years, such as 1990-92. Crop residues from previous seasons tend to make soil penetration more difficult. Such conditions lead to roughly or shallowly prepared seedbeds, and planting under such conditions results in poor germination and increased weed numbers.

A high percentage of such plantings fail to take place within a time frame suitable for optimum crop production in Swaziland. The worst affected homesteads, according to Watson, Mamba and Mamba (1983), are those which do not own oxen, cannot hire tractors and/or depend upon hired or borrowed oxen for plowing and/or planting. In some locations, up to 37% of homesteads fit this description (SCSRETP, 1983).

Draft animal practices in Swaziland

In a study conducted by King and Corbett (1984), it was shown that in Swaziland, the predominant team used for plowing consists of six animals, usually oxen. Where not enough oxen are available to fill a complete team, cows are used frequently and sometimes bulls.

Sometimes the farmer rented a tractor for initial plowing and then plowed a second time with cattle just prior to planting. In addition to plowing and planting, farmers used their teams to perform other jobs such as hauling building materials, water, fuelwood and crops. Rarely, if at all, do farmers use draft animals for weeding.

Research on weeding technologies

The Farming Systems Research Project in Swaziland, implemented by the Malkerns Research Station of the Ministry of Agriculture, carried out research in weed management between 1982 and 1988. The research programme included formal and informal diagnostic surveys to define farmers' problems, on-station and on-farm trials to test new weed management technologies, and socioeconomic evaluations of these technologies.

Conclusions from on-station trails

Several on-station experiments indicated that weeding was a critical factor in production, especially of maize, the staple food for Swazis. The general recommendations on weed management methods emerging from the research programme were summarised into guidelines for farmers (REDSO/ESA, 1986):

Weed management methods

- *Prevention.* Clean soil from machinery to prevent entry of weeds and use clean seed. Prevent weeds from seeding by removing weeds from non-cropped areas, eg, border areas of research plots or unplanted fields.
- *Land preparation methods.* Crop and weed trash should be minimised to ensure thorough seedbed preparation. Growing weeds should be completely eliminated. A relatively smooth seedbed will make subsequent planting and cultivation operations more effective.
- *Manual and mechanical cultivations.* Mechanical cultivation (tractor or oxen) is recommended to help alleviate labour bottlenecks presently inherent with using only hand weeding. Manual hoeing should be done early and not too deeply.
- *Cutting or mowing.*
- *Burning.* A method not particularly applicable to Malkerns and most areas.
- *Cover cropping.* Use particularly on fallow areas to prevent weeds and help even out panel variations.

- *Crop rotation.* The research farms should design a rotation plan with weed management as one of the criteria. Noxious weeds should be mapped.
- *Competitive cropping and good crop husbandry.* Choose an accurate planting method, proper spacing and population density. Practise disease and insect control. Use viable, vigorous seed. Use adequate fertiliser. Areas outside plots should be planted and receive similar treatment to plot areas.
- *Herbicides.* Guidelines are presented for maize, cotton and perennial and parasitic weed control.
- *Roguing.* Removal of *Striga* plants after crop establishment.

Late-season weed control in the winter season

Late-season weeds may not reduce yields but may interfere with harvest operations, and will also provide a seed source for weed infestation next season. The additional trash left by these weeds or those growing during fallow periods will add to the cost of, and/or may hinder, land preparation processes. Therefore, late-season weed control is recommended.

Noxious weeds

Certain noxious weeds such as perennial grasses, sedges or parasitic weeds (*Striga* spp) should be kept out of cropped areas at all times. If stringent control practices are not used, these species will become dominant and make weed management expensive and labour consuming. Therefore, it is best to maintain a strict control programme where noxious weeds are concerned.

Diversity of crops and methods

Any single method of weed control or the continuous use of the same chemicals can lead to the build-up of weeds resistant or tolerant to that control method. Rotations with other crops, and/or other control methods will reduce the chance of new or unique weed infestations.

Herbicides

Herbicides are recommended to help alleviate the labour bottlenecks inherent when using manual means only for controlling weeds on larger areas. Due to the large areas and importance in maintenance timing for research plots, herbicide use on farm crops in particular will ensure timely weed control and assist in controlling perennial and parasitic weeds, the most noxious weed problems at present.

Selection, rate, time and method of application should be carried out using the guidelines along with local pricing information, bearing in mind potential crop injury problems due to inaccurate application, soil residues or drift potential. The lowest rate possible which will adequately control the weeds should be chosen. A flat fan nozzle is recommended for herbicide application. The most important thing is to get an even, uniform coverage of herbicide.

Selection of weed control method

It is clear from the foregoing that animal-powered weeding is not yet recognised as an important technology for weed control in Swaziland. Also, the summary of weed management guidelines demonstrates a bias towards use of herbicides compared with other weed control methods. The objective in herbicide promotion is to reduce the amount of time farmers spend weeding, the most labour intensive activity in crop production.

Even though most homesteads have some off-farm income, and thus the ability to purchase herbicides, a study by Guma and Neocosmos (1985) revealed that the predominant form of weed control is hoeing: this is used by 65% of homesteads in general and 78% of the poor homesteads specifically, and use of alternative methods is rare.

This study also found that 24% of ordinary homesteads studied used herbicides, but only 18% of poor homesteads did so. Furthermore, among the homesteads which used herbicides the propensity to rely exclusively on these chemicals for weed control was lower among the poorest homesteads at only 14% compared with more than 20% for other homesteads. Expense was the major constraint to their use for most homesteads.

In the opinion of the author these are the homesteads that would benefit from well-designed, efficient, but cheap animal-powered weeding schemes if they were to be introduced in Swaziland.

Gender roles

In Swaziland women do the majority of agricultural work including planting, thinning, weeding and harvesting, primarily because there are more women than men in the rural areas. Men are more likely to migrate to urban centres and out of the country where there are better employment opportunities. Women are

generally not in control of their agricultural endeavours (de Vletter, 1983), because traditionally men make decisions about agriculture on the homestead, control distribution of land and have greater access to resources such as credit, technology and information from extension officers.

Guma and Neocosmos (1985), among others, showed that, while the head of a homestead in Swaziland is likely to be a man *de jure*, it is sometimes the case that this role is performed by a woman *de facto*. According to UNICEF (1990), about 18% of homesteads are headed by women: this figure rises to 22% among poor homesteads. The proportion of female-headed homesteads may be understated because women tend not to be accepted as heads of homesteads. Thus, even when the male head of the homestead dies, it is sometimes the case that he remains the head of the homestead, his widow serving in the capacity without being recognised as the real head of the homestead. Even in the case of migrant husbands, the male head of the homestead still remains in control of family economic decisions.

In spite of the changing role of women, surprisingly little has been done by development planners, policy makers and decision makers to help them cope with new demands. Attention must be paid to new and existing technologies and farming methods to ensure that they are both sensitive and appropriate to women's needs. Since time immemorial, new agricultural methods and implements have been made for, and are available mainly to, men. Either they apply to male tasks only, or are physically inconvenient for women to handle or too expensive for them to buy. This is certainly the case in Swaziland.

Women and animal-drawn weeding

There have been no studies on women's access to technology in Swaziland, although other studies indicate that time constraints are a serious obstacle to women's participation in agriculture and other economic activities. Among tasks which are time consuming are gathering of wood, collection of water, grinding of maize, thinning, weeding and food processing.

Access to appropriate technology could help alleviate these constraints. Access to animal-drawn implements for weeding would alleviate drudgery for women at an affordable cost.

Requirement for animal-powered weeding initiatives in Swaziland

In Swaziland opportunities for improving animal-powered weeding exist. Since animal power is already used widely in Swaziland, introduction of animal-powered weeding would not be difficult. Empirically the plow has been the most useful draft cultivation implement in smallholder agriculture in Swaziland: two out of three SNL farmers (men and women) use draft animals to till the soil and a large number of these use them for planting (King and Corbett, 1984).

It is therefore reasonable to recommend that draft animals should continue to be the most economical way for many Swazi farmers not only to plow and plant but also to weed, lift root crops and perform other agricultural tasks. When labour is in short supply, as is usually the case at weeding time, and considering the time constraints discussed above, hand weeding becomes an inefficient and inappropriate way to control weeds. Animal-powered weeding would ensure early weed control which, if done before the weeds are too high, would keep fields weed-free for long periods of time. It would also ensure timeliness of weeding operations, thus increasing crop yields.

Research proposals

It is proposed that, for the benefit of all farmers who cannot easily afford mechanical (tractor) and chemical weeding, the alternative of animal-powered weeding be explored further, to assess the means necessary to introduce appropriate animal-powered weeding techniques and technology at the grassroots level where it is needed most. In other words, further study should be undertaken to examine animal-powered weeding closely on a national scale. The premise is that so far considerable research has gone into ox plowing, but little, if any, systematic analysis has been carried out to assess the resources necessary to introduce and sustain animal-powered weeding in Swaziland.

The research should assess the financial means or resources to carry out the strategies. In this light the study should look at the following variables:

- field efficiency and performance of animal-powered weeding

- time requirement for animal-powered weeding compared with alternative methods of weeding
- determination of cost of owning and operating draft animals for weeding
- appropriateness and adaptability of animal-drawn weeding implements.

The study should cover the whole of Swaziland (the three different ecological zones). The research station in Malkerns, which has already carried out a number of studies with draft animals, and which has regional facilities, could be instrumental in carrying out such a study.

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