On-farm participatory research on ox-powered weeding technology in Sukumaland, Tanzania

by

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Abstract

Sukumaland in north-west Tanzania makes an important contribution to the national production of cotton and maize. The use of animal traction for plowing is common. Inadequate weeding is considered the major factor limiting crop production. Ox-drawn weeder (inter-row cultivators) could do much to alleviate the problem. Following the farming systems diagnostic survey, ox-drawn weeder were tested in different villages. Three models of weeder (Cossul, Agro-Alfa and Mkombozi) were tested by farmers in different types of soils.

Farmers emphasised the importance of early weeding. On average ox-weeded maize yielded 4782 kg/ha and hand-weeded plots only 2649 kg/ha. Ox-weeded cotton fields yielded an average of 575 kg seed cotton/ha compared to 475 kg seed cotton/ha for hand-weeded plots. Economic analysis showed that ox weeding took less than one-quarter of the time of hand weeding (39 and 173 working hours/ha, respectively). The quality of the equipment differed, but the choice of which model to buy depended on the price and soil type.

Introduction

Sukumaland, comprising Mwanza and Shinyanga Regions, has a cattle population of about 3 million, or one quarter of the national livestock herd. Some 15–30% of the cattle are oxen and these are used to plow more than 50% of the land (Wella, Babu and Roeleveld, 1993; Ngendello, 1995). Animal traction was introduced to Sukumaland as early as 1923 (Oloufa, 1982), but it was used mainly for primary tillage and transport. Starkey (1985, 1988) found that although animal-drawn weeder are available in most African countries, only 5% of those farmers using animal traction for plowing practise animal-powered weeding.

Diagnostic surveys in Mwanza and Shinyanga Regions confirmed that weeding was a major limiting factor in crop production in ox-cultivated areas (Bantje, 1989; Wella, Babu and Roeleveld, 1993; Bunyecha et al, 1994). Different alternatives to solve the weeding problem were discussed with farmers.

The first attempt to alleviate the problem was made in 1989/90 when different types of herbicides were tested in Maswa and Meatu District, Shinyanga Region. Within one season the technology had failed completely, as it did not fit the existing farming system; a particular problem was access to water supplies.

The second attempt was made in 1991 when ox-drawn inter-row cultivators were tested in two villages. The main objectives were to determine the technical, social and economic aspects of ox weeding compared to hand weeding. Results appeared very promising.

In 1992, the testing was transferred to Kwimba District, Mwanza Region. The research approach also changed from individual contact farmers to the group approach. Farmer Research Groups were formed and proved very valuable (Wella and Roeleveld, 2000). Farmers first tested the Cossul weeder and initial reactions of male and female farmers were very positive (Wella and Roeleveld, 2000).

After three seasons of intensive testing involving three types of ox-drawn weeder, farmers began to buy the weeder of their choice. Some of the farmers involved in the programme have also trained other farmers (even some from outside the district) on animal-powered weeding.

This paper discusses the methodology, success, potentials and problems encountered or likely to be encountered in the introduction and dissemination of ox-weeding technology.
Methodology

The trial was conducted for three years. Three villages were selected (Kishili, Mwakilyambiti and Mwampulu) and in each village three types of ox weeder (Cossul, Agro-Alfa and Mkombozi) were tested.

The number of farmers per village varied between 10 and 20 and on average one ox weeder was available for three households. Most farmers had both an ox-weeded plot and a hand-weeded plot; plot sizes varied, but the minimum plot was 0.5 ha (randomised block design).

In the third year some maize fields were intercropped (randomised complete block design) with cowpeas in both hand-weeded and ox-weeded plots (as requested by female farmers) to observe the effect on ox weeding. Weeding started in November/December and continued until January/February.

Farmers recorded data on time spent, labour distribution per activity and the people involved. Data on yield were collected by researchers in a 4 x 5 m area. Technical data were analysed and followed by a farmer assessment.

Results and discussion

Crop yields

Shetto (1988) reported that relieving labour constraints without increasing yields would justify only a low level of adoption of animal weeding technology. This was not the case in Kwimba District, as labour productivity became the main criterion for acceptability and adoption of ox-powered weeding technology.

General analysis of yield data for maize showed a significant difference between ox-weeded and hand-weeded plots (t-test at 5% significance). Analysis per village showed significant differences in only villages. For cotton, no significant differences were observed. Results are summarised in Tables 1 and 2.

Table 1: Mean yields of maize and cotton from ox-weeded and hand-weeded plots

<table>
<thead>
<tr>
<th>Crop</th>
<th>Mean yield (kg/ha)</th>
<th>t-value</th>
<th>Probability</th>
<th>Number of plots</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ox-weeded</td>
<td>Hand-weeded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>4782</td>
<td>2649</td>
<td>2.138</td>
<td>0.040</td>
</tr>
<tr>
<td>Cotton</td>
<td>575</td>
<td>475</td>
<td>1.854</td>
<td>0.106</td>
</tr>
</tbody>
</table>

Table 2: Comparison of mean yields of maize and cotton from ox-weeded and hand-weeded plots, by village

<table>
<thead>
<tr>
<th>Village</th>
<th>Mean yield (kg/ha)</th>
<th>t-value</th>
<th>Probability</th>
<th>N^a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ox-weeded</td>
<td>Hand-weeded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kishili</td>
<td>5225</td>
<td>4606</td>
<td>0.880</td>
<td>0.412</td>
</tr>
<tr>
<td>Mwakilyambiti</td>
<td>5421</td>
<td>2143</td>
<td>2.357</td>
<td>0.023</td>
</tr>
<tr>
<td>Mwampulu</td>
<td>3700</td>
<td>1200</td>
<td>4.192</td>
<td>0.032</td>
</tr>
<tr>
<td>Cotton</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kishili</td>
<td>700</td>
<td>600</td>
<td>1.750</td>
<td>0.140</td>
</tr>
<tr>
<td>Mwakilyambiti</td>
<td>450</td>
<td>350</td>
<td>1.000</td>
<td>0.055</td>
</tr>
</tbody>
</table>

^a Data for one farmer for maize are omitted because of dubious quality
An economic analysis of hand and ox weeding, presented in Table 4, shows that ox weeding is highly profitable. Therefore, ox-weeding technology is both technically and economically superior to hand weeding.

Women and young children did most of the interplant weeding. In circumstances where only a husband and his wife are in the field, women tend to lead the ox team.

**Technical assessment of the ox weeder**

Farmers used different models of ox weeders in different types of soils. The technical assessment of each type in relation to soil was quite clear. They all agreed that all types are appropriate depending on the type of soil intended for use. The Agro-Alfa and Mkombozi were ranked higher than Cossul in terms of strength and durability of parts, and hence were considered suitable for heavy soils (‘Mbuga’). However, the Cossul model was mostly liked by farmers due to its lightness (suitable in light soils like ‘Luseni’ and ‘Itogolo’), price and good handling qualities. It was noted that the efficiency in weeding for all models depended on the soil type on one hand and experience of both oxen and the user on the other hand. The proportion of different soil types varied markedly between villages.

**Equipment quality**

The inter-row cultivators tested performed well provided that the fields were well prepared, and that weeding was done at the optimum time. Using the Cossul on stony or stumpy land can lead to breakage of cast iron parts and bending of soft steel components (Loewen-Rudgers et al, 1990; 2000), but these problems did not occur in Kwimba District, and only a few implements suffered damage in three years of use. The majority of farmers bought a cheap Cossul cultivator for the 1995 season.

**Efficiency in eradicating weeds**

Some weeds caused major problems, especially when weeding was delayed or seedbed preparation had been poor. There is positive correlation between weed type and soil; plant species with a stronger deep root system and quick vegetative growth (such as ‘migundululu’) are common in heavy soils. In light soils the most troublesome weed is ‘tiza’ (Commelina spp), which tends to collect along the duckfeet of the weeder, lifting the tines and leaving unweeded patches.

In general it was noted that ox weeding was more effective than hand weeding in eradicating weeds because of deeper penetration which destroys the rooting system. In addition, ox weeding clears weeds off the field, so there is no chance of regrowth.

**Farmer assessment**

Many farmers still weeded late and few farmers (about 20%) did a second ox weeding (recommended weeding time is two weeks after sowing). Only 10% of farmers did ox weeding within two weeks after planting, 67% between two to four weeks and 23% after four weeks. Reasons for late weeding included the shortage

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**Table 3: Performance of maize cropping in ox-weeded and hand-weeded plots, Kwimba District, 1994/95**

<table>
<thead>
<tr>
<th>Village</th>
<th>Weeding time (h/ha)</th>
<th>Yield (kg/ha)</th>
<th>Output (kg/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ox-weeded</td>
<td>Hand-weeded</td>
<td>Ox-weeded</td>
</tr>
<tr>
<td>Kishili</td>
<td>40</td>
<td>178</td>
<td>5425</td>
</tr>
<tr>
<td>Mwakilyambiti</td>
<td>38</td>
<td>169</td>
<td>5421</td>
</tr>
</tbody>
</table>

**Table 4: Economic analysis of hand and ox weeding, Kwimba District, 1994/95**

<table>
<thead>
<tr>
<th></th>
<th>Cost of hiring labour (Tsh/ha)</th>
<th>Average weeding time (h/ha)</th>
<th>Cost of weeding (Tsh/ha)</th>
<th>Value of output (Tsh/h)</th>
<th>Benefit:cost ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand weeding</td>
<td>7000</td>
<td>173.5</td>
<td>40</td>
<td>887</td>
<td>22.0</td>
</tr>
<tr>
<td>Ox weeding</td>
<td>3500</td>
<td>39.0</td>
<td>90</td>
<td>6401</td>
<td>71.3</td>
</tr>
</tbody>
</table>

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Note: This version of the paper has been specially prepared for the ATNESAs website. It may not be identical to the paper appearing in the resource book.
of weeder when the trial was carried out, flooded fields and unexpected family problems. Discussion with farmers in Kwimba showed that ox weeder would not remove weeds that were about 30 cm high. It was also noted that earlier weeding can facilitate good eradication of weeds between plants, as soils can easily be thrown on top of small weeds, and subsequent hand hoe weeding is not necessary. Farmers noted that if ox-weeding technology was introduced to farmers without emphasising the importance of early weeding, the technology would be rejected in the long run.

In the cowpea intercropped trial, farmers indicated clearly that the spreading variety of cowpea can impair a second ox weeding.

References


