

# Introduction of ox-drawn weeders in Maswa District, Shinyanga Region, Tanzania

by

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## Abstract

*Until recently, plowing was the only mechanised agricultural operation in the Maswa District of Tanzania. Weeding has been done by hand, mainly by women and children. Although large areas have been planted, many fields have not been adequately weeded, and resulting yields have been low.*

*A survey by the Farming System Research team based at Ukuriguru showed that the single most important constraint to achieving higher crop yields was labour for weeding. The Maswa District Council took steps to alleviate this problem. A farm mechanisation expert made an extensive tour throughout Tanzania to assess problems with the use of ox-drawn implements. Consequently five types of weeders were purchased. Farmers made a selection after testing these weeders and named the weeder they considered most suitable for their area the Masanja weeder.*

*Following the introduction of the weeder farmers had to change from broadcast sowing to line planting and a longer yoke had to be introduced into the system. To make weeding economically profitable it was integrated into an intensification package. Farmers doubled their maize yield in the first year of trials. Reactions from farmers convinced the Agricultural Department to obtain many more weeders to supply to farmers. Weeders will also be promoted for use with sorghum, millet and cotton crops.*

## Introduction

Maswa is one of the six districts of Shinyanga Region, Tanzania. It covers an area of about 3398 km<sup>2</sup> of which 2375 km<sup>2</sup> is arable land, 177 km<sup>2</sup> is forest, and the rest is mountainous and covered with stunted shrubs and bush.

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Maswa District lies between latitudes 2.45° and 3.15° south and longitudes 33.0° and 34.7° east. Altitude is about 1200–1300 m and rainfall between 600 and 1000 mm per year.

Deforestation accompanied by soil erosion is causing environmental degradation problems.

The district is divided into three administrative divisions with 18 wards and 77 villages. The 1988 census registered 221 194 people and a growth rate of 2.3% per year. The estimated population in 1993 was about 247 200 people with approximately 80 000 farm households. Most of the people belong to the Sukuma tribe.

Agriculture and livestock keeping are the main occupations. The main food crops are sorghum, maize, rice, sweet potatoes and groundnuts, with smaller amounts of millet, cowpeas and cassava. Cotton and rice are the major cash crops. The total bovine population is about 300 000 Livestock Units with a growth rate of 2.5%. The capital reserve of the rural population is in general stored as cattle.

## Problem identification by Farming System Research–Ukuriguru

An informal survey was carried out in 1989 by Farming System Research (FSR) based in Ukuriguru, Mwanza District, to identify key issues and trends in agriculture in Maswa and Meatu Districts (FSR, 1991). The survey highlighted weeding as one of the major constraints to agricultural production; other constraints included scarcities of water, firewood and transport. FSR carried out a follow-up diagnostic survey in Maswa and Meatu Districts in 1990.

## Crop budget and farm management studies

Crop budget and farm management studies were undertaken to learn how households in the target area managed the problem of labour shortages during the growing season. Maize and rice were chosen as test crops in the appropriate zones. As well as quantifying input

requirements, emphasis was placed on net returns and resource productivity. During the first year (1990) crop budgets showed higher net returns for the rice production system than for maize.

It was felt that ox-drawn weeders offered a means of solving the problem of labour shortage for weeding. Management of oxen in the area was therefore studied, with a view to assessing the potential for weeder introduction.

### Mechanisation in Sukumaland

Ox plows were introduced in Maswa District in the 1960s, to combat drudgery and to boost crop production. Farmers could easily afford to buy plows. Ubungo Farm Implements (UFI), a State owned enterprise, was producing and/or assembling ox plows for the whole of Tanzania. The price was low and it was almost impossible for other enterprises to compete with them. The price has subsequently risen steadily.

No further action was taken in Shinyanga Region to mechanise other cultivation activities. This partial mechanisation enabled farmers to expand their fields considerably over time. During the 1980s, more than 10 000 plows were sold in Maswa District, doubling the number in the area.

Weeding was not mechanised, and was often left to the women and children. Manual weeding was the most time-consuming activity for the Sukuma farm family. Because of the large areas plowed, many fields have been planted but not weeded. Weeds dramatically reduced yields, especially of cotton (see Table 1).

### Sukuma women in agriculture

There is a diverse and complex relationship among household members in the Sukuma tribe (FSR, 1991). In Maswa District many tasks are divided according to gender: women have more duties in agricultural production than men.

**Table 1: Average and potential yields of major crops in Maswa District**

	<i>Average yields (kg/ha)</i>	<i>Potential yields (kg/ha)</i>
Cotton	300	1600
Rice	1000	3500–4000
Maize	800	2400–6000
Sorghum	700	2300
Millet	700	1400–1700

Food crops are mainly the responsibility of the women and most of the cash crop area in the district is weeded by women using hand hoes. Men are, in general, responsible for plowing (especially of cash-crops).

Studies on the role of women in agriculture are important because gender must be considered when introducing mechanisation. The weeding problem was accentuated after the mechanisation of plowing, thus creating a bigger workload for women. If men can take up the task of weeding with oxen this will considerably reduce the burden on women.

### The plow team

The power sources available to farmers determine the area of land that can be plowed, planted and weeded. In Maswa, mechanised plowing with oxen is already well adopted.

The survey revealed that a normal plow team consists of two people and two oxen. One person walks in front beside the oxen and guides them with a stick, while the other person walks behind and controls the plow.

The plowing season runs from mid-November until February, so oxen are worked for three to four months. It is estimated that one ox team can plow between 0.2 and 0.25 ha per day. Furrows are about 22 cm wide, and between 20 and 25 cm deep. There are normally two plowings in rainfed agriculture: the first is to plow the weeds under and the second is meant to prepare the seedbed. Broadcast seeding is generally practised in Sukumaland and takes place before the second plowing.

After the FSR–Ukuriguru’s diagnostic survey (FSR, 1991), solving the weed problem was given top priority by the Agriculture and Livestock Department of Maswa District. A weed control programme was initiated in 1992. This was expected to change the traditional hand weeding system, create a more even distribution of responsibilities between the sexes and achieve a better use of resources.

### Introduction of ox weeders

At the start of the weed control programme, Maswa agricultural staff visited several oxenisation programmes in Tanzania involved in mechanised weeding, after which the following implements were purchased:

- 15 Cossul type weeders
- 10 *Mkombozi* weeders

- 2 *Houe Sine* type frames with weeding equipment – rigid support (Rumptstad production)
- 5 *Houe Sine* type frames with weeding equipment – spring support (Camartec production)
- 5 Agro-Alpha weeders.

The introduction and testing of the Cossul, *Mkombozi* and *Houe Sine* (Rumptstad) weeders was carried out with selected farmers in the district in conjunction with the Sasakawa Global 2000 project. By combining optimal agronomic practices with a variety of weeders, it was hoped to achieve the most cost-effective way of paying for any weeder that might be selected for introduction.

The *Houe Sine* (Camartec) and the Agro-Alpha arrived late. These were introduced to the farmers only during a workshop at the end of the agricultural season. The weeding workshop was designed to allow all the farmers to share their individual experiences. The aim was to evaluate the results and select one weeder which the District Agricultural Department could introduce on a larger scale.

The weeder introduction and all actions taken during the season were carried out according to the 'farmer first' principles described by Chambers, Pacey and Thrupp (1991) combined with the Participatory Rural Appraisal guidelines (Anon, 1992).

## Yokes

The only type of yoke found in the area was the withers yoke. This is considered appropriate for the two types of Tanzanian short-horn zebu (*Bos indicus*) oxen used in Maswa. However, withers yokes are also used for donkeys. Breast band harnesses better suited to donkeys were not seen in Sukumaland. No nose-rings were seen on oxen in Sukumaland: the cattle, particularly the oxen, found in Maswa District are extremely docile compared to those found in South and West Africa. Nevertheless guidance of the animals still poses a problem, because the farmers have no direct method of correcting their direction.

For weeding purposes a larger yoke had to be introduced into the farming system. The yoke used for plowing is 80 cm long and the choice was made to have an inter-row spacing of 80 cm resulting in a weeding yoke of 160 cm (centre to centre). This distance allows the oxen to walk in the two outer lines while the inner

line is weeded. It was proposed that the weeding should be carried out by one pair of oxen and this was accepted by the farmers. Convincing the farmers that this type of weeding was possible without the oxen eating the major part of the crop was very difficult.

A young blacksmith produced five yokes according to instructions given by the Agriculture Department. The yokes were then taken to the target villages and distributed as examples for further production.

## Proposed intensification package

Agricultural practices have changed little in Sukumaland since 1960, despite a growing demand for food crops and the introduction of cotton as a cash crop.

An intensification package was proposed to increase the productivity of the farming system with the objective of securing food production and improving the welfare of the farming family through use of certified seed and fertilisers combined with the ox-drawn weeder. Maize was chosen as the test crop for the first season, because of its popularity with farmers.

The intensification package offered to the farmers consisted of:

- fertiliser 115 kg N and 57.5 kg P<sub>2</sub>O<sub>5</sub>/ha (30 kg urea and 125 kg triple superphosphate per ha at sowing and 175 kg urea per ha topdressed at the knee-high stage)
- certified seed: 25 kg of Tanseed or Cargill seed per ha, planted in rows 80 cm apart at an intra-row spacing of 50 cm (two plants per hole) to achieve a population of 50 000 plants/ha
- pesticide: Marshall ST pesticide (active ingredient carbosulfan) applied as a seed dressing at 450 g per ha
- ox-drawn weeders were provided to the farmers for testing.

The price of the proposed package was TSh 27 500 (then about US\$ 80) per ha exclusive of the weeder. Following the farmers' suggestion it was agreed that half the amount was to be paid before the harvest, and the remainder after. The Agriculture Department financed the action through the Revolving Fund and the District Rural Development Programme.

The weeders were introduced and distributed. Farmers were trained and guided during the

weeding season, but the weeders remained the property of the Agricultural Department. The farmers selected all had plows and oxen.

Mechanisation of weeding cannot be practised by itself and the agricultural staff of Maswa District took steps through active collaboration with Sasakawa Global 2000 to integrate it in a more intense crop production programme. The aim was to intensify crop production, producing more on a smaller area, thereby offering the possibility of introducing a crop-rotation scheme with a fallow period for part of the arable land. It was thought that this farm practice might reduce some pressure on the environment. Further information on appropriate crop rotations was to be obtained from the various agricultural research institutions.

### A farmer workshop

Most of the farmers involved in the introduction of the weeder came from the neighbourhood of Ipililo village. Therefore, Ipililo was chosen to host a three-day workshop, in 1993, with the theme: 'Farmers' participation in selecting an animal-drawn weeder'.

Most of the 43 participants were farmers who had participated in the weeder testing programme. Extension staff, researchers from FSR-Ukuriguru, farmers from Kwimba District, and livestock and agricultural staff from Maswa and Meatu Districts also participated in the workshop.

The objectives set for this workshop were to:

- determine, together with the end users (the farmers), the most appropriate animal-drawn weeder for the region
- exchange experience and views on the previous mechanisation programme
- decide on actions for the coming agricultural season.

Yields obtained from traditional fields and from using the proposed package were announced and discussed with the farmers (see Table 2). In both cases the fields were plowed to a depth of 25 cm. The traditional fields had broadcast seeding and hand-hoe weeding. Crop density was approximately 30 000 plants per ha. Time taken to weed the fields was 20 hours/ha using the new technology and about 200 hours/ha in the traditional fields. This is in line with experience from other African countries (Mungroop, 1991).

The weeders were compared and discussed by the whole group. The discussion was led by a farmer and other farmers were asked to relate their experiences.

### Farmers' comments on the weeders

#### *Cossul weeder*

- a problem was breakage of the rear heel part and the moving part in the centre where the lever is situated
- it weeds very well when the soil is moderately moist. However, when the soil is too wet the front sweeps clog with mud and other waste matter
- it needs greasing occasionally to work smoothly; storing grease specifically for this purpose might be a problem
- it is easily adjusted during weeding to suit the row width.

#### *Mkombozi weeder*

- it seems too heavy to be pulled by two oxen; the weight should be reduced
- it does not penetrate well into soil which is too wet or when weeds are abundant.

#### *Houe Sine (Rumptstad)*

- it does not earth-up the crops
- the area which the duckfeet cover is very small and sometimes parts are left unweeded
- it needs experienced operators because it is not stable in the soil.

On the second day of the workshop the farmers' wives and children took part in testing the weeders. At the end of the day the overall first choice was the *Houe Sine* (Rumptstad type combined with wider duckfeet found on the Camartec model).

Participants were asked to propose a name for the weeder. By majority vote the name *Masanja* weeder was adopted (in Sukuma language *Masanja* means combination).

**Table 2: Maize intensification in Ipililo village: average yields on 'proposal' and traditional fields in 1992-93 season**

	Average yield (kg)	Bags/ha
Proposed plan + ox weeder	3417	5.7
Traditional cultivation and hand weeding	1574	2.4

## Farmer workshop resolutions

At the end of the farmers' workshop the following five resolutions were adopted by the participants:

- The District Council, in cooperation with FSR–Ukuriguru and the Maswa District Rural Development Programme, should ensure that the selected *Masanja* weeder will be manufactured in large quantities and made available in the District
- the use of ox weeders should be accompanied by other farm techniques, such as better seeds, use of fertilisers and insecticides, planting in line, and timely execution of cultivation practices
- farmers must be prepared financially in order to afford to buy the weeder and other inputs
- one acre (0.4 ha) of land must be the minimum area to be cultivated using the new techniques by farmers participating in the programme in the coming season
- the Maswa Agricultural Department should prepare a manual about the new weeder to facilitate its operation and service.

The Maswa Agricultural Department agreed to help implement the resolutions and arranged with a local workshop for an initial production run of 200 *Masanja* weeders. Discussions have been held on possible credit packages.

## Profitability of weeder adoption

It appears that the use of weeders by Sukuma farmers will be profitable, due to increased production (higher yield), fewer labour constraints during weeding and improved timeliness. Considerable yield improvements in maize have been seen. It was also observed that farmers who assessed the package of inputs worked more intensively on their field than previously. They had a better standing crop and were proud of this achievement. The oxen which were usually left idle after the plowing season were used more intensively.

The introduced technology does not appear to have displaced labour but has increased the productivity per person working on the farm. Drudgery has been much reduced, and women are spared long hours weeding the fields manually. Some economic data are presented in Table 3.

## Conclusion

Farmers were sceptical about the transition from manual weeding to weeding with the help of draft animals. They were completely involved in all steps of the introduction through the 'farmer first' methodology and participatory rural appraisal techniques. Prejudice that the animals used for weeding would eat a lot of the crop has been overcome. Guidance of the

**Table 3: Some relative economic data from a maize trial carried out in Maswa**

<i>Operation</i>	<i>Cost of traditional method (Tsh)</i>	<i>Cost of proposed package (Tsh)</i>
Plowing	10 000	10 000
Planting	4 000	4 000
1st weeding	7 500	4 920
2nd weeding	7 500	4 920
1st fertiliser application	-	1 200
2nd fertiliser application	-	1 200
Insecticide application	-	1 500
Harvest	2 700	3 300
Shelling	1 200	2 100
<b>Total labour costs</b>	<b>32 900</b>	<b>33 140</b>
<i>Inputs</i>		
Seed	2 000	12 000
Fertiliser	-	23 250
Insecticide	-	12 750
<b>Total input costs</b>	<b>2 000</b>	<b>48 000</b>
<i>Output</i>		
Yield (kg/ha)	1 574	3 417
Bags	16	34
Sale value in July (Tsh 3000/bag)	48 000	102 000
Sale value in September (Tsh 6000/bag)	96 000	204 000
<b>Total expenditure</b>	<b>34 900</b>	<b>81 140</b>
<b>Net margin (July)</b>	<b>13 100</b>	<b>20 860</b>
<b>Net margin (September)</b>	<b>61 100</b>	<b>122 800</b>

*Notes: Based on data from 1992–93 trials. Crop residues were not included as income. US\$1=Tsh 400 (approx) in 1993*

animals during weeding is still a problem because farmers have no direct method of correcting their direction. It was a great advantage that the Sukuma farmers have already worked with animals for decades.

Yield and productivity increased on all farms included in the programme. All the farmers involved in the programme volunteered to continue the trials and were ready to assist in helping other farmers with the new technology. The price of the preferred weeder was perceived to be high. Credit facilities were under discussion with the farmers.

It is expected to take several years before it will be possible to quantify adoption and economic benefits of weeding with oxen. However, the trials and farmer workshop have already

demonstrated that the use of weeders in Sukuma farming is feasible and could lead to a revolution in cultivation practices.

## References

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