

# The Impact of Ox-weeding on the livelihoods of poor smallholder farmers in the Teso Farming System

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## Abstract

Weeder evaluation (4 designs) by farmers on their own farms took place during 2000 and 2001 in sorghum and groundnut crops. For sorghum DAP weeding made little impact on yield but reduced the time needed for hand weeding from 157 hours to 34 hours per hectare. Hand weeding costs were reduced from 47,000 Ush to 10,000 Ush per hectare. For groundnuts DAP weeding gave higher yields (not statistically significant) and reduced the time needed for hand weeding from 73 hours to 31 hours per hectare. Hand weeding costs were reduced from 30,700 Ush to 13,700 Ush per hectare. This research demonstrated that SAARI, AEATRI, SG2000 weeders and a plough (minus its mouldboard) are all technically efficient in terms of reducing the labour required for weeding. Participatory assessments of the technology identified the most appropriate tool for local conditions and confirmed the impact on gross margins for different crops.

Use of oxen in weeding has a big role to play in reducing drudgery, making farming attractive and improving the income of resource poor-farmers in North Eastern Uganda (Teso Farming System). Weeding using oxen can improve crop production and alleviate the labour shortages experienced during weeding in the Teso Farming System.

## INTRODUCTION

Weed management is one of the most expensive farming activities faced by farmers in north-eastern Uganda. It is labour demanding in terms of human labour or cash and if is not properly done, or on time it can lead crop yield losses of up to 100% (Akwang et.al. 1998). Continuous cropping of land due to labour shortages, which has prevented the opening of new land led to the collapse of the traditional soil productivity management practice of crop rotation, which in turn caused declining soil fertility and increased weed pressure.

It has been reported that weeding using oxen can play a very important role in improving agricultural productivity and alleviating the labour shortages experienced during weeding operations (Lekezime 1988). Weeding with oxen is a much faster and less tiring operation compared with hand weeding. This can allow timely weeding which in turn can subsequently lead to better yields per hectare. Benefits of using draught animals power however, will not be fully realised until animals are used for tasks other than ploughing (particularly weeding). This was established during a "Needs Assessment for Agricultural Research in Teso undertaken during 1998 (Akwang et al, 1998) where farmers identified weeding labour constraints as having a major impact on area cultivated and yields. Therefore this study was

designed to assess various weeder designs and assess the impact of ox-weeding on the livelihoods of poor smallholder farmers in the Teso Farming System (TFS).

## METHODOLOGY

This study was divided into two phases; on-farm trials and dissemination of the proven technological option.

### *On-farm trials:*

The on-farm trials were carried out in farmers' fields and they were farmer managed. Farmers were trained at the beginning of the study on weeder adjustments and how to use oxen for weeding.

Farmers from nine sites took part in the on-farm trials. Three designs of weeder and a plough with the mouldboard removed (Figure 1) were used by farmers at each site.

*Figure 1: Designs of ox-drawn implements tested.*



The use of the plough without the mouldboard was tested as a possible cheaper solution. Farmers in a site were considered as replications and sorghum and groundnuts were planted at a recommended spacing. Data were collected on weeder performance, farmers' comments on weeders and crop yield. In addition economic analysis was carried out to assess the profitability of weeding groundnuts using oxen.

### ***Assessments of weeders:***

Participatory weeder assessment was conducted to allow farmers to articulate their experience on use of oxen in weeding. The technique used was a Strength, Weakness, Opportunity and Threats (SWOT) approach for data collection and analysis. The farmers were asked to assess the efficiency and effectiveness of weeders against hand weeding (farmer practice). Farmers were facilitated to identify a set of criteria that they deemed relevant for ranking the two weeders that they had used (SAARI and AEATRI). The criteria developed were then scored using a score range of 0 – 5, for worst and best performance, respectively. Prior to scoring, reasons for the choice of particular criteria were examined and the comparative performance of each weeder against the identified criteria evaluated.

### ***Farmer-to-farmer extension***

Following weeder evaluation a farmer-to-farmer extension system was established to promote DAP weeding technology. Links were developed between farmers and manufacturers of agricultural implements (weeders) to ensure that these tools match their requirements and to ensure future sustainable supplies of appropriate equipment. Farmers were then trained on how to train fellow farmers on use of oxen for weeding.

### ***Participatory assessment of impact of technology***

A participatory assessment exercise was undertaken to further explore the impact of DAP weeding. The method used was participatory budgets (see Box 1).

#### ***Box 1. Participatory Budget (PB )Methodology***

- Timeframes were established (e.g. a season) and the size of the enterprise clarified, i.e area of the garden.*
- A large grid on the ground was drawn with the number of columns representing the number of months.*
- Farmers were asked to symbolize the different months in the top row of the grid and to indicate the different activities involved in the enterprise in each month by placing symbols in the second row on the grid.*
- Discussions were held with the farmers about which resources they considered important to be included in the budget.*
- Different counters were identified to represent each of the resources.*
- Farmers identified units to measure each resource (e.g. labour by number of people and days).*
- Farmers indicated the quantity of each resource in each month.*
- Outputs and income that the farmer received from the enterprise were indicated.*
- Farmers were asked to work out the end balance by comparing resources used and products*

## RESULTS AND DISCUSSIONS

### *On-farm trial results*

#### *2000 season 2 (sorghum)*

The differences in yields between DAP and hand-weeding treatments were not large or statistically significant. Given the variation between sites and plots in planting dates, rainfall (which was not recorded) and other factors such as soils, cultural practices etc. it is not possible to attribute yield effects from this data to a particular weeding technique. The use of ox-drawn weeders reduced the hand labour required for weeding from 157 hours/ha to 34 hr/ha. Hand weeding costs (at the prevailing market rate) are significantly reduced to around Ush 10,000/ha compared with Ush 47,000/ha for farmer practice.

**Table 1. Labour use and costs on-farm, season 2, 2000**

	DAP weeding	Farmer practice (hand hoe)	Statistics <sup>1</sup>
Yield (kg/ha <sup>-1</sup> )	894.1	833.7	Ns
Hand weeding (hr/ha <sup>-1</sup> )	34.7	157.8	<0.001
Cost of hand weeding (Ush/ha <sup>-1</sup> )	10,401	47,343	<0.001
Returns to hand weeding (Ush/day)	19,388	3,735	<0.001
Hand weeding costs as % of total	13.2	51.3	<0.001

Hand weeding costs as a percentage of total costs are reduced from more than 50% to 13%. Returns per day of hand weeding labour are significantly increased with the use of ox-drawn weeders.

**Table 2. Labour use, costs and margins on-farm, season 1, 2001 (Groundnuts) (DAP weeding versus farmer practice)**

	DAP Weeding	Farmer practice (hand hoe)	Statistics <sup>4</sup>
Yield (t/ha <sup>-1</sup> )	1,823	1,397	ns
Hand Weeding (hr/ha-1)	31.8	73.2	P<0.001
Cost of hand weeding (Ush/ha <sup>-1</sup> )	13,717	30,727	P<0.001
Return/day of hand weeding labour (Ush)	230,835	31,315	P<0.001
Hand weeding as % of total costs/ha <sup>-1</sup>	7.7	21.5	P<0.001

<sup>1</sup> Direct variance ratio test F probability

The use of ox-drawn weeders reduced the hand labour required for weeding from 73hr/ha to 32hr/ha. The difference is statistically significant demonstrating that weeding using draught animal power (DAP) provides important benefits in terms of reducing the time and drudgery associated with hand weeding a groundnut crop.

Hand weeding costs (at the prevailing market rate) are reduced by at least 50% (from Ush 25,290 to 11,580 per hectare) when DAP weeders are used. The difference is statistically significant providing strong evidence of the cost savings associated with the adoption of DAP weeding. Returns per day of hand weeding labour are increased with the use of ox-drawn weeders. The difference was statistically significant.

The comparative performance of the four ox-drawn weeders is shown in Table 3. Although some differences can be discerned from the data none of these were significant statistically reflecting again the high degree of variance between farms.

**Table 3. Comparative performance of 4 weeders (groundnuts, season 1 2001)**

Implement	SAARI (1)	AEATRI (2)	SG2000 (3)	PLOUGH (4)
Yield (t/ha)	2,162	1,897	1,457	1,577
Hand Weeding hr/ha	28.7	22.0	45.2	25.6
Cost of intra-row hand weeding (Ush/ha)	12,050	9,250	19,000	10,750
Gross Margin (Ush/ha)	1,348,926	1,173,561	844,691	953,910

The SAARI weeder gave significantly higher yields ( $p < 0.01$ ) than other implements (Table 3). This can be attributed to the action of the SAARI weeder, which digs deeper than other designs, burying weeds and allowing greater infiltration of rainwater. It may also have a ridging effect, which may provide positive benefits for a groundnut crop. Highest gross margin was recorded from use of SAARI weeder, followed by AEATRI weeder.

## *Participatory assessments of technology*

The results from the 9 sites have been summarised in Table 5.

**Table 4. Scores and ranks for each weeder**

Criteria	SAARI		SG 2000		AEATRI		OX-PLOUGH	
	SCORE	RANK	SCORE	RANK	SCORE	RANK	SCORE	RANK
Removal of grass weeds	69	1	65	2	40	4	50	3
Removal of broad leaved	63	2	69	1	41	4	55	3
Comfort in using	62	3	65	1	63	2	61	4
Damage to the plants	56	1	42	3	22	4	46	2
Speed of work	69	1	65	2	42	4	53	3
Ease of cleaning and maintenance	62	3	63	2	36	4	79	1
Availability of spare parts	71	2	41	3	22	4	89	1
Ease of adjustments	55	3	72	1	47	4	60	2
Ease of transport	58	2	57	3	31	4	78	1
Durability and strength	73	2	69	3	34	4	78	1
<b>Totals</b>		<b>20</b>		<b>21</b>		<b>38</b>		<b>21</b>

The results of this assessment are summarised as follows; SAARI, SG2000 and the ox-plough are the best weeders while AEATRI was ranked last in all the sites, SAARI and SG2000 are the best at removing grasses and broad-leaved weeds, SG2000 is the most comfortable tool to work with and the easiest to adjust, AEATRI does the most damage to crop plants and has the slowest work rate, SAARI and SG2000 have the fastest work rates. The plough is the easiest to clean and maintain and the most durable implement, spare parts are available for the ox-plough and to a lesser extent the SAARI weeder but are scarce for the SG2000 and AEATRI weeders

### *Farmer-to-farmer extension*

Following weeder evaluation a farmer-to-farmer extension system was established to promote DAP weeding technology and more than 2500 farmers and 100 extension workers have been trained in this way. Links were developed between farmers and manufacturers of agricultural implements (weeders) to ensure that these tools match their requirements and to ensure future sustainable supplies of appropriate equipment. Training was not restricted to weeding only, but farmers were also trained on potato ridging (using a plough), planting (marking lined with a weeder) and groundnut lifting using a plough (minus mouldboard) as an important part of the labour reducing DAP package. Ridging of sweet potatoes and groundnut lifting has been particularly well received by farmers and widely adopted in those communities receiving training. The mechanisation of potato ridging reduces labour costs from 123,000/- to

24,000/- per hectare (and drudgery) of this operation. In some communities this has allowed area expansion (as labour availability and costs formerly restricted the area cultivated), improved food security and incomes.

### ***Impact on livelihoods***

Results from focused group discussions indicated that the introduction of DAP weeding has made women feel less oppressed and men have become involved in this task as it is mechanised and a great reduction in drudgery is reported along with improved food security and higher incomes due to increased crop production and reduced labour costs. Women are now able to pursue more rewarding activities and are experiencing a better quality of life. Children are no longer withdrawn from school during the weeding seasons (April-May and October-November). It is anticipated that in the longer-term even the poorest of economically active households will benefit from mechanisation as hire markets develop for DAP services (weeding, groundnut lifting and potato ridging) – they already exist for ploughing and to a limited extent weeding and potato ridging.

## **LESSONS LEARNT AND CONCLUSIONS**

This research and extension project confirmed that hand weeding of annual crops in the Teso Farming System is a major constraint to agricultural production. Moreover this task is associated with drudgery (particularly for women), withdrawal of children from school during the weeding seasons, high costs if labour is hired to undertake the task, reduced yields (in poorly weeded fields) and poor returns (gross margins).

Use of oxen in weeding has a big role to play in reducing drudgery, making farming attractive and improving the income of resource poor-farmers in North Eastern Uganda (Teso Farming System). Weeding using oxen can improve crop production and alleviate the labour shortages experienced during weeding in the Teso Farming System. Significant differences in performance between the use of oxen-drawn weeders and the traditional practice of hand weeding were found for certain relatively simple parameters (e.g. time taken to weed experimental plot). The main advantages associated with the use of oxen-drawn weeders in Teso Farming System were; higher yields, greater returns, improved household food availability and reduced drudgery.

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