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Weed management in groundnuts using ox-drawn weeders in northeastern Uganda: Farmers experience in ox-drawn weeders

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Abstract A study was carried out with farmers to assess effectiveness of weed control using ox-drawn weeders and hand weeding. Trials were conducted in farmers' fields during first and second rains of 2000. Two different types of ox-drawn weeders (SAARI weeder and AEATRI weeder) were evaluated and compared with hand weeding. SAARI weeder was very effective in controlling annual weeds, giving the highest weeding efficiency (95%), while the lowest weeding efficiency (65%) was obtained from AEATRI weeder. Hand weeding efficiency gave weeding efficiency of 82%. Highest groundnut yield (1135 kg per acre) was obtained from fields (plots) weeded by SAARI weeder as compared to 691 kg per acre from fields weeded by hand. On returns to labour, ox-drawn weeder produced the highest gross margin (25,000 Ush./ha), while hand weeding gave 770 Ush/ha and subsequently returns per day of family labour were increased with the use of ox-drawn weeder (21,978 Ush for weeder and 3,735 Ush for hand weeding). At the end of the study, farmers concluded that ox-drawn weeders reduced the labour and costs required for weeding groundnuts and improved gross margins. They also found out that ox-drawn weeders are a practical and effective alternative to hand weeding and may improve groundnut yields.

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). In almost in all sub-Sahara countries, weeding has been cited as one of the main constraints in crop production for resource poor farmers and crop losses of 30 – 70% have been recorded because of poor weeding (Croon et.al. 1984). Weeding normally takes up to 50% of the available season time and accounts for 40 – 55% of the total labour input.

Weeds are a major constraint to crop production in the Teso Farming System of Eastern Uganda and weeding labour constraint severely limits the area that a household can sow to arable crops. To increase production, there are two options; namely increase acreage or intensify production by increasing yield/unit area. To succeed with either of these strategies it will be essential to manage weed populations on farmers' fields. 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 inturn can subsequently lead to better yields per hectare (Kwiligwa et.al. 1992).

A needs assessment carried out in 1998 (funded by DFID) indicated that groundnut is a very important crop in north eastern Uganda both as a cash and food crop. However, weed management is one of the most expensive farming activities faced by farmers in groundnut production. It demands a lot of labour and if it is not done well and on time it causes a high crop yield loss. Therefore, this study was designed to test the effectiveness of ox-drawn weeders for controlling weeds and reducing labour bottlenecks.

Methodology

The study was conducted in nine sites (Abalang, Kachede, Kaler, Kibale, Koritok, Obule, Obur, Orungo, and Pingire parishes in Soroti, Kumi, Kaberamaido, Katakwi and Pallisa districts). Trials were carried out in farmers' fields and they were farmer managed.

Two types of weeders (SAARI weeder: with ridged tines attached to the ox-plough beam, and AEATRI weeder: with spring tines attached to its own frame) were compared with farmers' practice of weeding groundnut using hand hoe. The crop was weeded twice, a recommended practice. Farmers were trained at the beginning of the study on weeder adjustments and how to use oxen for weeding. Farmers in a

site were considered as replications and the plots measured 40 x 10 m. Groundnut was planted at a spacing of 45 x 10 cm. No fertilizer and pest control method applied. At maturity all the plants in the plot were harvested and the plot yields were used to calculate yield per hectare. Data was also collected on weeder performance and farmers' comments on weeders. In addition economic analysis was carried out to assess the profitability of weeding groundnuts using oxen. In this analysis, variable costs for each weeder and hand weeding were computed and these deducted from the gross income. Groundnut market price at the time (in 2000) was used in the calculations. The data collected was then subjected to analysis of variance (ANOVA) using Genstat computer package.

Weed data were collected from each plot on weeds using a quadrant measuring 33 x 33 cm (0.11 m^2). The quadrant was randomly thrown ten times in each plot and the weeds inside the quadrant were counted. Weeds were categorized as perennial grasses, annual grasses, sedges and broad-leafed annuals. Data on weeds were collected before (a) first weeding, (b) second weeding, and (c) at maturity (i.e. at harvest time). Efficiencies of the different methods of weeding were calculated using the formula:

$$\text{Weeding efficiency (\%)} = 100 - \{[(W_0 - W_1)/W_0] \times 100\}$$

Where W_0 = weed density immediately before weeding and W_1 = weed density immediately after weeding

Assessments of weeders. Two assessments were conducted to allow farmers to articulate their experience on use of oxen in weeding. The assessment was carried out in all nine sites by the farmers. 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.

Results and discussions

Effect of weeder and hand weeding on weed densities at farmers' fields. Throughout the nine sites, the highest population of weeds was the broad-leafed annual category (Figure 1), possibly due to their high seed rate, viability and easy dispersal. These data indicate the commonest categories of weeds in the north eastern Uganda (Teso Farming System) but not necessarily the most important. The SAARI weeder was very effective in controlling annual weeds, possibly because they were completely buried by the deep digging and burying action of this weeder. By contrast, the farmers' practice of hand-weeding was better for controlling perennial grasses and sedges because of the reproductive parts were pulled out of the soil by hand. The preliminary results from this study indicate that continuous use of a SAARI weeder could lead to the build up of a population of sedges and other perennial grass weeds as the population of annual weeds is reduced.

Weeding efficiencies (%) against annual and perennial weeds. The SAARI weeder gave the highest weeding efficiency (95%) for annual weeds, while hand-weeding resulted in the highest weeding efficiency (82%) for perennial weeds (Fig. 2). The AEATRI weeder had low weeding efficiencies, possibly due to their narrower working parts, which reduced weed-cutting effects. In addition, the AEATRI weeder had weak tines that did not penetrate very well when the soil was dry, reducing its effect on controlling weeds.

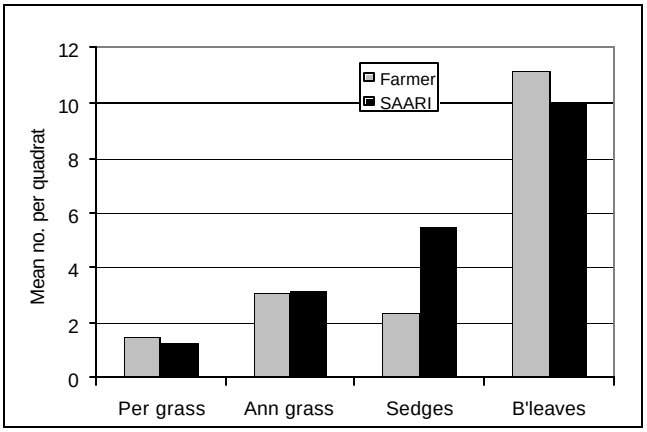


Fig 1. Weed densities (no. per 0.11 m^2 quadrat) on farms at 2nd weeding

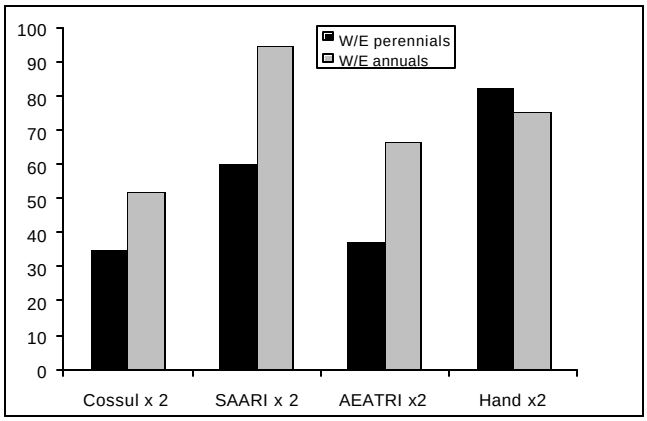


Fig. 2. Weeding efficiencies of DAP weeders and hand weeding against annual and perennial weeds at 2nd weeding of 2nd rainy season, 2000

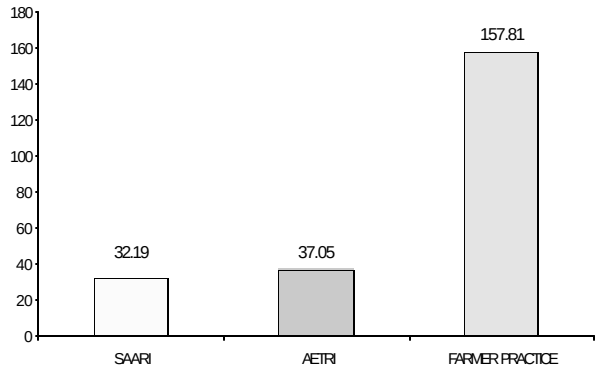


Figure 3. Hand weeding labour (hr/ha) on-farm season 2, 2000

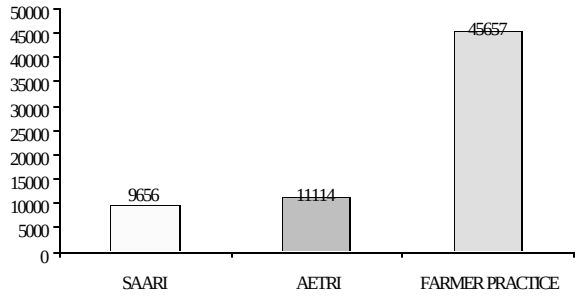


Figure 4.Hand weeding costs (Ush/ha) on-farm Season 1, 2000

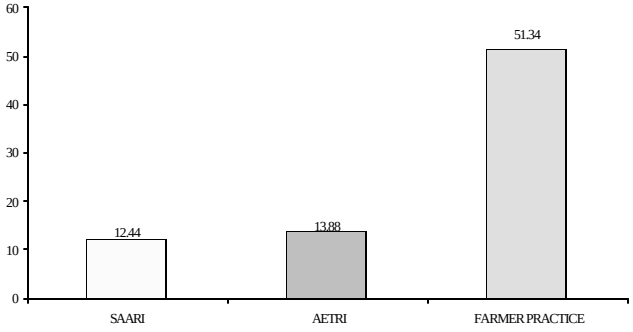


Figure 4b. Hand weeding costs as % of total costs on-farm season 2, 2000

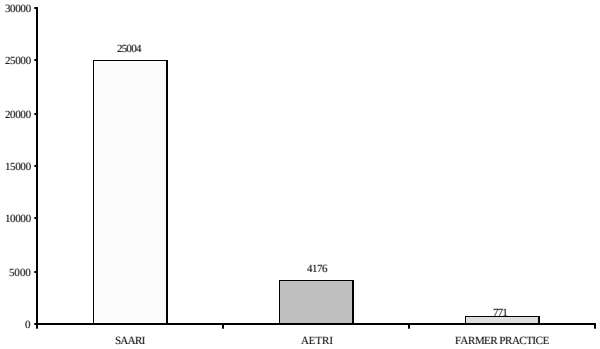
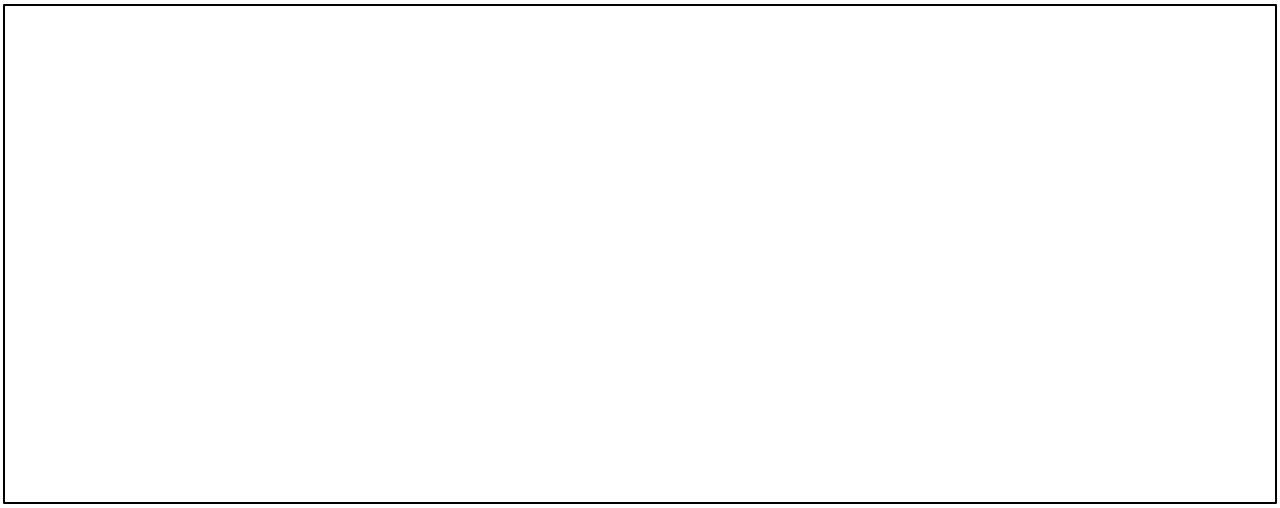
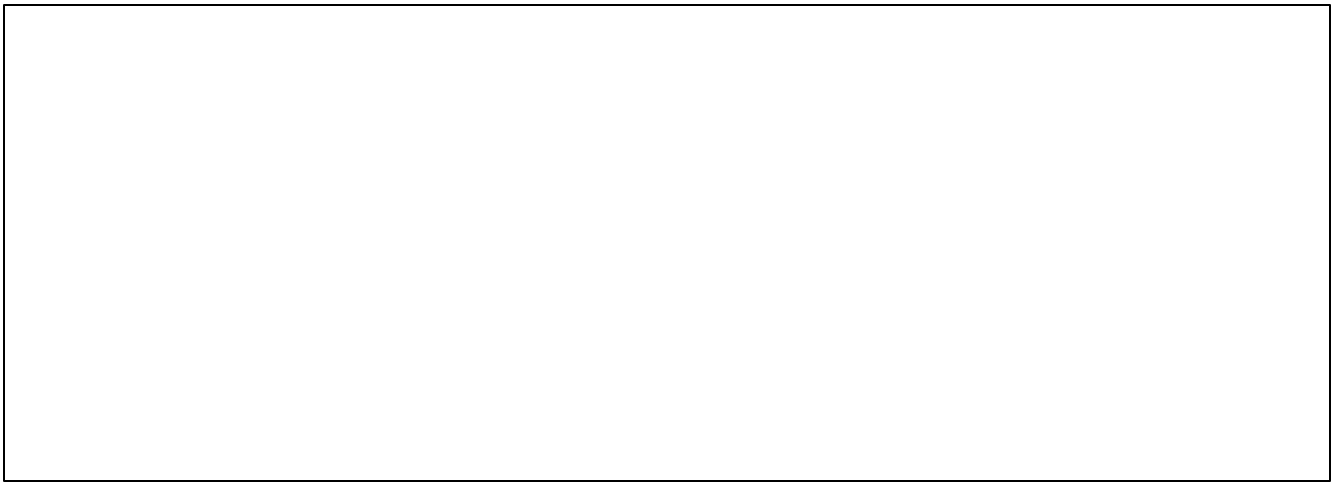


Figure 5. Gross margins (Ush/ha) on-farm season 2, 2000





Effect of SAARI weeder and farmers' practice on groundnut yields on farmers' fields during first rains 2000. In all the nine sites, the highest yields were recorded in plots where the SAARI weeder had been used (Table 1). The probable explanation is that the SAARI weeder cuts deeper into the soil than the hand hoe, creating ridges beneath the groundnut crop that encourages pegging. The furrow created between rows could collect water when it rained and also prevented water runoff. Stevens, 1994 and Kayumbo, 1994 in their studies reported that weeding using draft animal power gives a better tillage effect with deeper loosening of soil leading to better infiltration of rain water. Variations in yields obtained at different sites could be attributed to differences in soil fertility and rainfall. The abnormally low yields obtained from Pingire and Kaler were due to the prolonged dry spell experienced at these sites. In some instances, no yields were obtained from farmers' fields. Economic profitability of ox-weeding**.** The use of ox-drawn weeders reduced the hand labour required for weeding from 157 hours/ha to approximately 34.5 hr/ha (Figure 2). This is in agreement with what Kwiligwa reported that average time for hand hoe weeding as 230 work hours per hectare as against 50 working hours per hectare when weeding with oxen (Kwiligwa et.al. 1994). This also is almost the same with what Chatizwa and Nazare reported that there was an overall reduction of working hours of 20 – 70% when working weeding with animal power compared to hand weeding (Chatizwa and Nazare, 2000). There were no statistical significant differences in the performance of the two ox-drawn weeders in terms of their impact on the amount of hand labour required for weeding (Fig. 2). Hand weeding costs (at the prevailing market rate) are significantly reduced to around Ush 10,000/ha compared with Ush 45,000/ha for farmer practice (Figure 2). Hand weeding costs as a percentage of total costs are reduced from more than 50% to 13% (Table 2 and Figure 4). Total costs are also reduced but by a much smaller margin. This can be accounted for by increased costs associated with planting in lines 94 hours/ha as opposed to broadcasting and covering seed (30hrs/ha) and the costs associated with using oxen for weeding (hire rates). The SAARI weeder

produced the highest gross margin (Figure 5). However it should be borne in mind that margins are very dependent upon yield. The difference between the margins for the AEATRI weeder and farmer practice may be of greater significance as yields were similar but the use of the AETRI weeder were associated with lower costs. Returns per day of hand weeding labour are increased with the use of ox-drawn weeders (Figure 5).

Farmers' assessment of weeders

The SWOT analysis

Strengths

- Germination rates and vigour in the planted crops were superior to the broadcast ones
- Line planting takes less seed compared to broadcasting
- The incidence and control of insect pests and diseases is easier in row-planted crops. This was particularly the case with groundnut rosette
- Yields were superior in the row-planted plots

Weaknesses

- Labour required for land preparation, marking and planting planted crops is high and may act as an initial deterrent
- It takes time and skill to train both the oxen and the farmers on the basics of ox weeding.

Opportunities

- There is increasing trend towards line planting as opposed to broadcasting crops in the farming community
- Women participated in the study. This has helped demystify the notion that DAP is a preserve for men
- Farmers were increasingly row-planting their own fields (gardens) other than the experimental ones with the aim of ox weeding
- In most of the DAP project sites, input suppliers like AT-Uganda agents are within easy reach
- Some farmers are already taking on the role of farmer trainers
- The beam of the SAARI weeder can be adjusted to accommodate a ploughing function (the blades of the SAARI weeder can easily be fitted on the locally available plough beam)

Threats

- The initial high labour demand for land pre paration, marking and planting might act as a serious draw back, especially because aggregate labour requirements at the onset of the rainy season tend to be high
- A possible conflict of interest between use of oxen for ploughing on one hand and weeding on the other might arise. This has in built gender implications since ploughing is traditionally a male activity and weeding is a female one.
- The cost of the technology may well be beyond the financial ability of most farmers, especially the resource poor ones, who are expected to be the main beneficiaries
- Spares are not readily available
- In some of the sites, oxen have not been nose-punched. This makes harnessing and control more difficult

Weeder Assessment

The comparison between SAARI and AEATRI weeders is given in table 3.

Conclusions

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, and reduced drudgery.

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