Participatory research on oxen-drawn weeders in Lake Zone, Tanzania

by

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Abstract

The Lake Zone Farming Systems Research Project started livestock research activities in north-west Tanzania in 1992. During a rapid appraisal in Kwimba District (rainfall 800–950 mm), labour shortage during weeding was one of the major constraints identified. The project therefore started trials with ox-drawn weeders, in collaboration with the extension service, in three villages (54 households).

Men and women of cattle-owning and non-cattle-owning households participated and managed the trials. Most fields were located on sandy soils and maize was the major crop sown. Male and female farmers highly appreciated the weeders, because mechanical weeding increased crop yields, reduced labour requirements and lightened the work load.

Maize yields were low, but animal-weeded plots had higher grain yields than hand-weeded plots. Questionnaire results indicated that mechanical weeding required less than half the labour of hand weeding.

Participating farmers in each village formed a Farmer Research Group (FRG), which regularly discussed experiences with the use of the oxen-drawn weeders. FRGs organised field days and participated in an agricultural show and a district workshop. The FRGs have become the discussion forum for farmers, extension workers and researchers.

Introduction

The Lake Zone Farming Systems Research (FSR) Project is one of the seven zonal FSR projects in Tanzania. It is located in the north-west of the country bordering Lake Victoria, and covers two districts (Kwimba and Bukoba) with very distinct agro-ecological conditions. The project started in 1988 and livestock-related research activities started with the second phase of the project in 1992.

After a participatory rapid (livestock) appraisal in Kwimba District (Wella, Roeleveld and Babu, 1994) the testing of ox-drawn weeders started in three villages. This paper reports farmers reactions to the trials with mechanical weeding.

Study area characteristics

Kwimba District (6100 km^2) lies in Mwanza Region, south-east of Lake Victoria, at an altitude of 1150–1350 m. The average annual rainfall ranges from 800 to 950 mm. The wet season is from October until May, with a period of dry spells from January to mid-February. The onset of the rains in late September or October is erratic.

Seven soil types can be found, but three of them cover more than 90% of the land: sandy soil ('*luseni*'), loamy-clay, hardpan soil (*'itogolo'*) and black cotton soil (*'mbuga'*). The location of each of them on the toposequence, and the major characteristics for agricultural land use, are summarised in Figure 1.

Three toposequences are found in the district varying mainly in the steepness of the hillsides and the relative importance of each of the dominant soil types (Bunyecha et al, 1994).

The fertility of the sandy soils is very low due to over-exploitation. After the introduction of the plow in the 1950s the fertile *'itogolo'* and *'mbuga'* have been taken into production.

The farming system in the area is a mixed crop/livestock system in which crop production forms the most important activity. Cotton and rice are the most important cash crops, and maize, sorghum, rice, cassava and sweet potatoes are the main food crops. Legumes (green gram, cowpeas, groundnuts) are

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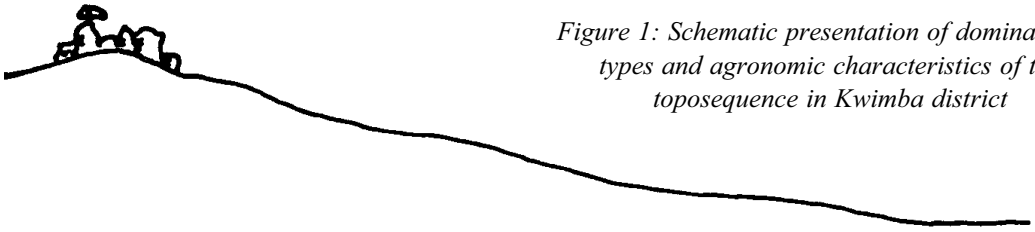

Figure 1: Schematic presentation of dominant soil types and agronomic characteristics of the toposequence in Kwimba district

intercropped, mainly with maize. Crop yields on the *'luseni'* soils are very low (eg, maize, 500–750 kg/ha), but rice yields on *'itogolo'* are high (2000–3000 kg/ha).

Inorganic fertilisers are seldom applied because they are in short supply. Cattle manure is used, although not as intensively as one would expect given that cattle are the most important livestock. Although only a minority (30–45%) of the households in the villages own cattle, most households have access to oxen for plowing their land.

On sandy *'luseni'* soils cultivation is often on hand-made ridges. Grazing land is scarce due to high pressure on the land (human population density ranges from 40 to 130 persons/km^2), and the high proportion of arable land.

Main agricultural constraints identified in the survey were: low fertility of *'luseni'*, high labour requirements for weeding on all soil types, shortage of forage for cattle, high incidence of livestock diseases, especially tick-borne diseases, poor supply of agricultural inputs and insufficient agricultural extension.

During survey debriefing meetings in the villages, constraints and possible solutions were discussed. It was decided that the first experimental activity would be to test whether ox-drawn weeders could solve labour constraints during weeding.

Testing an ox-drawn weeder

The tests were carried out in three villages in Kwimba district: Kishili, Mwampulu and Ng'wakilyambiti. These villages were selected because of their involvement in the livestock appraisal and the fact that their farmers had shown a keen interest in testing the implements during the survey debriefing meetings.

In each village 18 households participated. In the selection of interested farmers care was taken to include non-cattle-owning households (who hire oxen for plowing) and female-headed households. The number of participating households had been determined by the number of available weeders, assuming that each weeder could be used by three households.

The tests were carried out with the Indian-made *Cossul* weeder, which was the only model immediately available. The *Cossul* is a moderately heavy, five-tine inter-row cultivator. One of the tines can be replaced by a rear double-faced shovel. The tines are reversible. Six weeders were placed in each village.

Farmers were free to choose the soil type and crop on which to test the weeder. The only condition set was that each household should have a minimum of 0.2 ha to be weeded mechanically, and that a control (hand-weeded) plot of similar size should be available. All management decisions regarding the crop (date of sowing, fertiliser application, date of weeding, etc) were made by the farmers.

Farmers were trained in row planting by village extension workers. Plant spacing was according to one of the following extension service recommendations:

70 x 30 cm, 1 seed/hole = 44 000 seeds/ha
90 x 45 cm, 2 seeds/hole = 49 000 seeds/ha.

After sowing the experimental fields, extension workers, a livestock research officer and a livestock subject matter specialist of the District Agricultural Office attended a three-day workshop on weeding technology at the Mbeya Oxenization Project (MOP) in southern Tanzania, to get acquainted with the 'new' technology. At the start of the weeding season an instructor from MOP taught participating farmers and village extension workers how to

use the weeders, during a training session in Kwimba.

All participating farmers (men and women) were asked to meet every 2–4 weeks to exchange experiences among themselves and with the extension workers and researchers. These groups of participating farmers are henceforth referred to as Farmer Research Groups (FRGs).

At the start of the tests an inventory was made on the characteristics of the participating households and on the experimental fields (soil type, recent land use, etc).

During the weeding season the village extension worker, with support of the livestock researchers, collected data on the dates of the various field activities (plowing, sowing, weeding, harvesting), manure application, time and the number of oxen used for plowing and weeding, and labour used for plowing, sowing and weeding. Labour data included age and gender information. Crop yields were measured at harvesting.

Researchers and extension workers discussed experiences with mechanical weeding during FRG meetings (every 1–4 weeks). In each village a field day was organised for extension staff and farmers from nearby villages. After harvest farmer assessment meetings were organised to obtain the farmers' observations on the use of the ox-drawn weeder. These meetings were held separately for participating men and women farmers.

Apart from lending the ox-drawn weeders and providing technical advice, no financial or material incentives were provided by the project to participating farmers or FRGs.

Results

Households using the weeder

Most of the participating households were cattle owners. Few women registered for the tests. It should, however, be noted that women were always closely involved in weeding (hand and mechanical). Despite the high number of farmers who wished to participate, only one-third actually used the weeder. During the farmer assessment and FRG meetings, farmers said that the main reason for not using the implement was doubt (not previously expressed) about the work of the ox-drawn weeder: many farmers apparently could not believe that mechanical weeding was possible.

Farmer implementation

The making of yokes and muzzles, and the training of oxen, did not meet with major problems. Oxen, which were used to plowing, performed quite well after a short training period (ranging from a few hours to one day). The quality of the row planting varied considerably, mainly because of inexperience with this technique.

The plot size varied from 0.2 to 0.4 ha per household for both mechanical and hand weeding. However, not all farmers established a control plot. In some control plots the maize was planted on rows, but in most of the fields it was broadcast.

Almost all the fields were on *'luseni'* soil and planted with maize. Few fields were manured, and inorganic fertilisers were not available. Plant densities were low, ranging from 22 000 to 28 000 plants/ha, indicating that almost half of the plants did not develop. Most farmers weeded twice, starting rather late (plant height 20–30 cm) because of the late start of the test.

Farmers stated during evaluation and FRG meetings that the weeder was not difficult to use. However, during the field days it was observed that there was ample scope for improvement, especially with respect to the adjustment of the weeder (height of the wheel, length of the chain). During field days it was also noted that women seemed to have less difficulty in steering the weeder, because they tended to use less force in guiding it.

Labour and yield data

Questionnaire results indicated that mechanical weeding (including inter-row hand weeding) required less than half of the labour requirements for hand weeding.

Yields were very low, but mechanically-weeded plots yielded considerably more than hand-weeded plots (Table 1).

Table 1: Maize yields on hand-weeded and mechanically-weeded fields in two villages[1] in Kwimba District

	Yield (kg/ha)	
Type of weeding	*Kishili (n=11)*	*Mwampulu (n=7)*
Hand	242	261
Mechanical	460	662

[1] *Ng'wakilyambiti village not included because of limited number of valid comparisons*

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As already noted, crop productivity on the depleted, sandy soils was very low. Furthermore, rainfall in 1993 was below average (811 mm at Ukiriguru Agricultural Research Institute in Kwimba District compared with the average of 906 mm: rainfall was very low at the start of the long rains in March).

Farmer assessment

Farmer assessment centred on the advantages and disadvantages of mechanical weeding in comparison with hand weeding. Table 2 shows the results of this assessment at Kisgili. All participating farmers were invited to participate, whether or not they actually used the weeder.

Both male and female farmers appreciated the ox-drawn weeder most of all because of the decreased time spent on weeding and the ease of mechanical weeding. Mechanical weeding had, according to the farmers, some agronomic advantages as well, but they were considered of less importance.

When asked about the disadvantages of mechanical weeding women referred to the restrictions in its use. Men first spoke of the problems that would be caused by expected yield increases. They then emphasised the problems of additional time required for row planting and the loss of land needed to turn the oxen. Women had a long discussion on intercropping. A majority thought that intercropping in rows will result in reduced yields of the grain legumes because of increased shading by maize plants. Many farmers were of the opinion that the recommended plant densities were too low.

Farmers did not consider the cost of a weeder a problem. Farmers observed that the adjustable, cast-iron joints of the *Cossul* weeder broke easily if not tight.

The assessment with male farmers in Mwampulu gave almost the same picture. When asked about the implications of large-scale introduction of oxen-drawn weeders, men in Kishili and Mwampulu said that they expect land scarcity to increase: whenever possible people will expand their land under cultivation and no fields will remain uncultivated because weeding will no longer form a labour constraint. As a result more people will have to migrate to less densely populated areas and livestock numbers will have to be reduced. The continuous cultivation is expected to result in a quicker depletion of soil fertility, particularly of *'luseni'* soil.

Table 2: Advantages and disadvantages of mechanical weeding in comparison with hand weeding indicated at a farmer assessment meeting at Kisgili

	Ranked by	
	Males	*Females*
Advantages		
Fewer people involved	1	2
Larger area weeded	2	–
Less tiresome work	3	–
More timely weeding	4	–
Less expensive	5	–
Increased yields	6	6
Soil is looser	7	3
Helps to cover fertiliser	8	–
Less time needed for weeding	–	1
Weeder easy to handle	–	4
Fields weed-free for longer	–	5
Disadvantages		
Increased labour for harvesting	1	–
Increased storage costs	2	–
Increased labour for sowing	3	–
Inter-row weeding by hand	4	3
Loss of land for turning oxen	5	–
Not effective if soil not well-prepared	–	1
Only good for dry light soil	–	2
Intercropping more difficult	–	4

18 men and 16 women participated
The aspects are ranked in order of importance
1 = most important; – = point not mentioned

Women in Mwampulu also mentioned the increased intensity of land use. In both villages women emphasised the fact that the time saved by mechanical weeding would be invested in spending more time on crops grown on ridges, particularly sweet potatoes.

Discussion, conclusions and follow-up activities

The quantitative results of the initial trials were not very important, particularly as the tests started rather late in the season. More detailed figures, covering the results from several seasons are provided in the subsequent paper

Photo: A C W Roeleveld

On-farm training of women and men farmers in use of ox-drawn weeders
Mwampulu Village, Kwimba District, Tanzania

(Ngendello, Wella and Roeleveld, 2000). The lessons stressed here concern the methodology and farmers' perceptions.

This was the first time that farmers in these villages had participated in on-farm experiments, and useful general lessons were learned. Many farmers followed the performance of the weeders closely and participated in FRG discussions as discussed below. Not only did this provide the researchers with much qualitative information, it also showed the importance attached to the labour constraint during weeding and the wide interest in mechanical weeding.

Low fertility of the sandy soils is one of the major constraints in Kwimba district. According to the farmers this problem may be aggravated by the introduction of the weeder. More attention will therefore have to be paid to soil fertility issues.

FRG meetings decided to continue the testing of the ox-drawn weeder, but some changes were proposed. Farmers previously used the weeder mainly on sandy *'luseni'* soil. In the following season heavy clay soils would be included. Farmers doubted whether mechanical weeding of vertisols is possible with the *Cossul* cultivator. Heavier cultivators (*Agro–Alpha* from Mozambique and *Mkombozi* from Tanzania) would be tested as well. If, as expected, many farmers want to start weeding mechanically the supply of weeders could form a major constraint in the introduction of this technology. In the first season mainly maize was grown in the test fields; in the subsequent seasons farmers also wished to test the weeder on cotton and sorghum. Women wished to test the weeder in intercropped fields.

The results of various follow-up trials that covered some of these issues are summarised in the subsequent paper (Ngendello, Wella and Roeleveld, 2000).

Farmer research group methodology

Many farmers participated in the research programme of the Lake Zone FSR project. In order to improve the efficiency of research activities, and to increase the involvement of farmers in the research programme, FRGs have been established. The FRG approach has been successfully applied in farming systems research in Botswana (Norman et al, 1988). The core of the FRG is formed by the farmers (male and female) of a 'research' village who participate in one or more experiments. However, group activities are open to all interested farmers.

The main activity of the FRGs is the organisation of regular meetings where experiences with on-going experiments are discussed among participating farmers. The village extension worker and researchers attend

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these meetings in order to be informed on the experiments and the farmers' observations. FRG members usually also visit some of the experimental plots.

The first FRGs started in 1993 with the implementation of the weeder test. Members elected a chairperson and a secretary and meet every 1–4 weeks depending on FRG leadership and the season. The weeder tests have been the major discussion topic, but a variety of other topics have also been discussed, including milk marketing, vegetable gardens and the use of cottonseed cake to supplement the feed of oxen.

The number of farmers attending the meetings varied between 15 and 40, many of whom were not directly involved in the weeder experiment but came to the meetings to hear about the new technology and to discuss other topics of interest. The number of farmers has gradually increased, with about half of them women. This is a remarkable fact in view of the assumed difficulties in mobilising women. Apparently women considered the weeder test and the FRG discussion forum important opportunities to search for possibilities to solve perceived constraints such as weeding, production of grain legumes (a 'women's activity'), and water and firewood collection.

FRGs have, apart from the regular discussion meetings, been active in the organisation of field days and in the presentation of the weeder test in a district agricultural show and a district workshop. The organisation of field days to present the weeder test was completely in the hands of the FRGs. The results were very encouraging: several farmers (male and female) explained their experiences, visitors had the opportunity to practise using the weeder, and several fields were visited. The days ended with plenary discussions and a meal (offered by each of the villages). The participation of FRG members in the agricultural show and the district workshop was very convincing and contributed much to their success.

FRG members have, furthermore, made study trips to another district to discuss experiences with various types of ox-drawn weeders with farmers and staff of the Maswa Rural Development Project.

Finally, FRGs comprised the forum of farmers with whom the Livestock Section of the project planned further research activities. These may include ox-drawn weeders, feed supplements for oxen, improvement of reserved grassland, testing of wooden wheelbarrows and experimental village animal health groups. The number of participants of the FRGs may increase and lead to the formation of more than one group per village.

The FRGs have contributed much to successful communication between farmers, researchers and extension workers during the tests with the ox-drawn weeder. The project will continue to work with and try to develop further the FRG approach, which contains many elements which are of interest to the extension service as well.

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