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Introducing animal-drawn cultivators in north Namibia: preliminary results and reasons for hope

by

Imalwa Veikko[1] and Carole Pitois[2]

1) Chief Agricultural Extension Officer, Department of Agriculture and Rural Development P/Bag 5556, Oshakati, Namibia

2) Agronomist, North Namibia Rural Development Project (NNRDP), PO Box 498, Oshakati, Namibia

Abstract

The North Namibia Rural Development Project carried out on-farm tests of imported 'BS41' animal-drawn cultivators in northern Namibia with the aim of showing farmers that the cultivators could reduce the time required for soil preparation and weeding of plots of pearl millet. Four groups of farmers in each of two locations tested the cultivator for weeding and/or soil preparation compared to hand weeding and hand or no soil preparation. Using cultivators pulled by donkeys or oxen markedly reduced the time taken for weeding and soil preparation compared to performing these operations by hand or with a plow. On good soils yields were higher when a cultivator was used for weeding and/or land preparation. On poor soils the cultivator had no negative effect on yield. In general farmers were enthusiastic about the technology and when the cultivators were offered at a subsidised price all the farmers involved bought them. A few technical problems with the cultivators were noted. Other constraints included poorly trained animals and poor condition of the animals at the start of the rainy season. The paper gives a short description of proposed follow-up initiatives.

Introduction

This paper describes the animal traction extension work carried out by the North Namibia Rural Development Project (NNRDP) in collaboration with the extension services in two communities of North Namibia. The NNRDP is a "research-action" project funded by the French government whose role is to improve farming systems and to support extension services and local initiatives. It has worked in North Namibia for one and a half years. This paper is the result of pilot demonstrations run with Namibian extension officers and farmers in two communities (McKee and Pitois,1995).

Half the Namibian population, 800,000 people, live in scattered homesteads in the North-Central region of Namibia (Tötemeyer, Tonchi and du Pisani, 1993). Annual rainfall averages 200–400 mm but is highly variable. Northern Namibia is predominantly agricultural, but many farms depend on relatives working outside the villages (Durrand, 1994). The soils are mostly sandy and the main crop is pearl millet (known locally as *mahangu*). Livestock keeping is also important. There are no cash crops. Approximately 50% of the farmers own draft donkeys or oxen. These animals are used for plowing and in some cases for pulling carts. Currently, the only draft tillage implement used is the single-furrow mouldboard plow. A few farmers use either government or privately hired tractors for plowing. Durrand (1994), found three main classes of farmers:

> farmers who own no cattle, only a few goats (<20) and poultry. They usually have no off-farm income. As a consequence, they do not use animal traction and are not in a position to hire animals. They have little agricultural equipment and cannot afford a fence for their field
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> farmers who own animals, with up to 20 cattle. They often have access to off-farm income which allows them to invest in fences for their fields. They use animal traction, but due to people working in towns, they have to hire workers, especially for weeding
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> farmers with many animals, often over 40 cattle and 20 goats. They receive off-farm income, have fences around thier fields and have access to a cattle-post (veterinary services). They use animal traction and hire mechanised plowing services and workers for weeding.

Methodology

Diagnosis

An informal general survey of the area was carried out resulting in a better understanding of the agricultural systems and in the establishment of a typology of the farms. The typology (production system analysis) was based on how the farmers use their means (labour, land etc). Secondly, a series of informal interviews about the cropping systems was carried out with individuals from the chosen communities.

General meetings with the farmers gave extension officers and the project team the opportunity to carry the diagnosis a step further by discussing with them at length the external diagnosis and proposals aimed at alleviating the identified constraints. This stage was participatory: farmers were free to make proposals and to reject or to approve the findings presented by the extensionists.

The results of the surveys highlighted three main constraints:

- late plowing, due to a lack of draft power, leads to ripening problems and low yields of pearl millet
- only small areas of millet can be sown without prior soil preparation because of the time taken to weed the plots
- weeding is probably the most significant and arduous workload in the crop cycle.

The farmers confirmed this diagnosis.

Finding solutions

As a result of the diagnosis the project team formulated two proposals:

- reduce the time required for soil preparation so as to reduce the delays in sowing.
- reduce the time required for weeding and make it less exhausting.

The project proposed to achieve this by using an animal-drawn cultivator for soil preparation and weeding and a tracer for sowing in rows. The cultivator chosen was the "BS 41" from Zimbabwe (CTA, 1992). This implement was chosen mainly because it was easily available. The farmers involved agreed to test these implements. To maintain its principles of sustainability the project carried out the testing on the following basis:

self organisation: people of the community interested in the trials were asked to organize themselves into four groups with a leading farmer for each group

grouping: the project wanted to work with groups to minimize the workload and to facilitate the spreading of the information

the project provided the material and demonstrated its use

the lead farmer from each group provided a portion of their land and their animal power.

A member of the project team first demonstrated the use of the cultivator and tracer and then asked group members to try it themselves.

Implementation

Two trials comparing yield and time taken for weeding in hand-weeded and animal-power cultivated plots of millet were carried out by four farmers' groups at each of two localities (Eunda and Onamutanda). At the begining of the experiment there was an average of 15 farmers in each group. The average attendance for the different trials was 10 farmers for 6 groups, with a maximum of 20 in one group. The other two groups had poor attendance with only 5 farmers in each.

Trial 1 compared animal-powered cultivating and hand-weeding in plots with no prior preparation of the soil. The aims of this trial were:

- to show that the use of the cultivator for weeding alleviates the major constraint (the weeds) of the farmers on a soil which has not been prepared
- to show that weeding with the cultivator is less tiring and less time consuming
- to show that the cultivator has no negative impact on yields.

Each group prepared two adjacent 10x50m plots of millet according to the following scheme:

- Plot n°1 : no soil preparation, random sowing, hand weeding
- Plot n°2 : no soil preparation, sowing in lines with the tracer, weeding with the cultivator.

Trial 2 compared yields and weeding time in plots of millet with prior soil preparation using hand hoes or a plow and weeded by hand with plots prepared and weeded with the cultivator. The aims of this trial were:

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to show that soil preparation done with the cultivator is faster than with a hoe or a plow

to show that weeding with the cultivator is less tiring and less time consuming than hand-hoe weeding

to show that the cultivator has no negative impact on the yields.

Each group of farmers prepared two adjacent 10x50m plots of millet according to the following scheme:

Plot n°1: soil preparation (either hoe or plow), random sowing and hand weeding

Plot n°2: soil preparation with the cultivator, sowing in lines with the tracer and weeding with the cultivator.

For each plot weeding time was recorded by the team preparing it. The teams also harvested the plots and measured the yields. The main aim of the experiment was as a demonstration to test the acceptance of the cultivator, so the data were not analysed statistically.

Evaluation

The final evaluation meeting gave each farmer the opportunity to make his or her comments on the trials and the motivations. It was also a place for farmers to exchange their feelings about the cultivator with other farmers. The meeting was open to everybody: farmers who participated in the trials and farmers who had not participated.

Results

Time for soil preparation

Table 1 shows the time required for soil preparation by hand, using an animal-drawn plow or cultivator. On average, soil preparation using an animal-drawn cultivator was twice as fast as with a plow and 5 to 10 times faster than when using a hand hoe. These figures are averages of times from a number of locations, which were prepared by different farmers using different animals. In a particular situation the rate of land preparation will vary depending on a number of factors including the level of training of the animals and the animals' condition.

Time for weeding

On average, it took 60 hours for two people to weed a hectare by hand. Using a cultivator pulled by a pair of donkeys the average time was 6 hours and with a pair of oxen four hours. On average weeding with a cultivator was 10 to 20 times faster than hand weeding.

Table 1: Comparison of time taken for soil preparation by hand, using a plow and using a cultivator

	Time required (hours per hectare) with two people		
Tool	***Hand***	***With donkeys***	***With oxen***
Hoe	60		
Plow		20	7–10
Cultivator		13	4–5

Yields

Table 2 shows the yields from the experimental plots. In general, plots in which an animal-drawn cultivator had been used for preparation or weeding had higher yields. This was the case even when there was no prior soil preparation.

For poor soils (sandy soils, poor fertility, low retention capacity: group n°2 in Eunda and group n°2 in Onamutanda), the cultivator had no negative impact on the yields.

For richer soils (sandy-clayey soils, good fertility, high retention capacity: all the other groups in Eunda and Onamutenda), the cultivator had a positive impact on the yields. In the year of the study the rain pattern (concentration of the rains in February and March) favoured the soils with a high retention capacity.

Some technical problems and solutions

Tracer

The lines produced on the soil by the tracer are faint. A solution could be to adapt coca-cola cans on the teeth of the tracer to widen the traces. However, it is hoped that the use of the tracer will disappear in the medium run since after soil preparation, if the animals are well trained, the furrows should be parallel and a given number of furrows will correspond to a certain width.

Cultivator

The groups found a few technical problems with the cultivator:

the mechanism to adjust the width gets stuck very easily when used in sandy soils

Table 2: Yields of millet from the experimental plots

	Yields (kg/ha)				
Soil preparation:	*None*	*None*	*Plow*	*Hand*	*Cultivator*
Weeding:	*Hand*	*Cultivator*	*Hand*	*Hand*	*Cultivator*
Eunda					
group n°1	240	440	480	x	480
group n°2	–[1]	–[1]	x	160	160
group n°3	560	920	x	600	1080
group n°4	–[2]	–[2]	–[2]	x	–[2]
Onamutanda					
group n°1	–[2]	360	x	360	560
group n°2	80	100	100	x	220
group n°3	360	440	460[4]	x	420[4]
group n°4	–[3]	–[3]	x	–[3]	–[3]

Notes:
X - no trial
– - trials damaged or destroyed: 1) chicken attack, 2) plots flooded, 3) plots flooded and/or attacked by army worms, 4) sticks delimitating the plots were removed so there is uncertainty about the yields.

the bolt to adjust the depth (beside the wheel) does not fit in the last hole on some implements

the BS41 is heavier than a plow and requires a higher draft power so it was difficult for donkeys to use, especially on larger plots

when weeding, the arms supporting the duckfoot tine must be adjusted in such a way that the duckfoot tine move forward in the ground, almost parallel to the surface of the soil. This means the duckfoot tine cuts the roots of the weeds better and less draft power is required.

the goosefeet must be sharpened before use.

Animals

animals are weak at the beginning of the rainy season, the time when their strength is required for soil preparation

in general, donkeys are not well trained (whatever the type of harness used) so several rows of millet are damaged in the process of weeding

oxen are not used to the weeding yoke (not used to walk separated from each other in a straight line). They also require training.

Farmers' response

During the trials, six out of eight groups had a high level of attendance (8 to 10 people in each group). During the final meeting, the farmers expressed their views. In general, they were enthusiastic and recognised the advantages of the cultivators. At the end of the trials, the cultivators that had been used were offered to the farmers at a subsidised price (30% of the initial price). All the farmers who had hosted trials bought cultivators.

Plans for the future

To try to solve the technical problems with the cultivator the project plans to import different and lighter models. These will be tested using the methods described in this paper.

To try to solve the problem of animal nutrition the project will run trials of fodder improvement with urea. Intensive extension sessions on animal training will be organised with the aim of training farmers and extension officers in the use of animal-powered cultivators. After this they should be able to teach other farmers to train draft animals and use cultivators.

Trials will also be run with animals trained at this session to show farmers the difference

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between cultivating with trained and untrained animals. The aim will be to show that the tracer is not needed if the rows are straight.

The BS41 cultivator will be demonstrated to more farmers. BS41 cultivators will be on sale in the agricultural centres.

Pamphlets in local languages and English will be produced describing the cultivators, their use and associated benefits. Meetings with local businessmen and the farmers' cooperative are planned to raise their awareness of the purpose of the technology.

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