Animal-powered weeding: experience in western Kenya

by

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Abstract

Animal traction is used in western Kenya for primary tillage and for transport. However, it is not widely used for weeding, even though many farmers do not have enough labour available for hand weeding. Non- governmental organisations and donors have made concerted efforts to develop animal traction for weeding in the region. Various implements have been tested for their suitability as animal-powered weeders under the conditions prevailing in the region. Also, new implements (for example, a ridger, a lightweight plow and a cultivator) have been designed and developed. The major constraints to animal traction development in the region are lack of funds and shortages of trained personnel, equipment and transport. Widespread adoption of the advances made will only be achieved where policy makers create an environment for economically sound agricultural development.

Background

The economy of western Kenya depends heavily on agriculture, which employs 85% of the economically active population. Sugar cane is the main cash crop in the region, and maize the staple food crop. The climate is tropical, with mean annual rainfall of 1000–2000 mm. Average day temperatures range from 24 to 35°C.

Weeding is one of the most important operations for agricultural crops, absorbing a major proportion of labour input, most of it manual. Animal traction is used in the region for primary tillage and transport, but rarely for weeding. Farmers who use animal power will plow and plant more land than can be weeded by hand, so any technology that would reduce the labour needs for weeding would benefit these farmers.

Considerable progress has been made in the field of draft animal power technology as a result of government and donor efforts. However, financing has fallen short of the target of providing appropriate animal-powered weeding equipment to the more than 400 000 households that use the technology.

This paper reviews the major lessons and achievements of the development of animal draft power technology for weeding in rural western Kenya, and also seeks to identify the range of options available, and areas for further development.

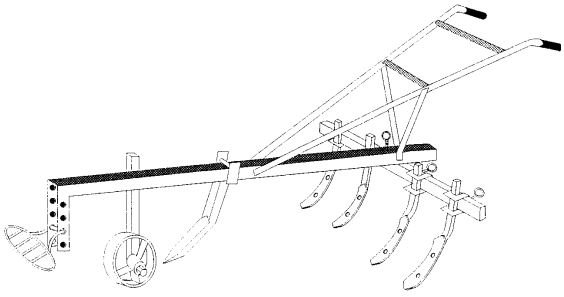
Trials with weeders

Two cultivators were tested at the Kabete Campus of the University of Nairobi to determine their suitability as weeding implements under the prevailing conditions. The implements tested were the Bukura Mark II cultivator and a long-established design of cultivator from Zimbabwean.

The Bukura Mark II cultivator (Figure 1) has a set of four chisel tines mounted on a horizontal beam perpendicular to the mainframe of the implement. A fifth tine is mounted on the mainframe before the cross beam. All the four tines on the cross beam are adjustable for a range of inter-row spacings and depths. The implement weighs 35 kg.

The main advantage of the Bukura cultivator and other attachments is that it is community maintainable, and could be manufactured in rural areas with limited resources. The cultivator and other attachments have evolved from prototypes developed at Bukura.

Figure 1: The Bukura Mark II cultivator



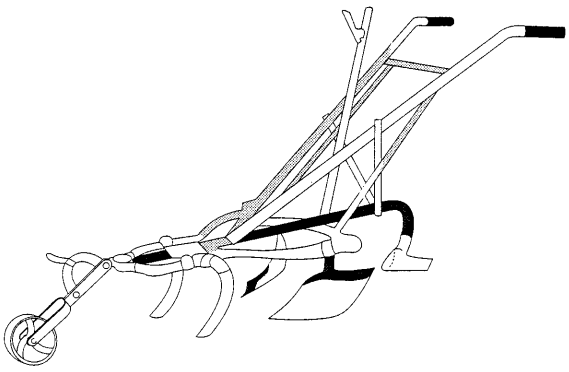


Figure 2: The Zimbabwe cultivator

Following field trials in many parts of the country, extensive modifications were made by the Agricultural Engineering Department of the University of Nairobi. The implement is now in production by Ekima and Guy Engineering, two private concerns, manufacturing ox-drawn equipment.

The cultivator incorporates many of the concepts that are important for community management:

- moderate purchase price
- inexpensive wearing parts
- main frame of rectangular hollow section, which is light, yet strong
- repairable by community members
- can be manufactured locally, except for the mouldboard, at competitive prices
- design is in the public domain.

The other implement tested was from Zimbabwe and has two chisel tines at the front (one on each side), and two hillers and a central duckfoot at the rear (Figure 2). The implement weighs 42 kg.

Trial results

Field performance of the two implements, each pulled by a single donkey, was tested in a maize crop with a row spacing of 85 cm. The Bukura Mark II cultivator required more draft than the Zimbabwe implement.

When the soils were dry, the Bukura cultivator disturbed soil between the rows fairly well, although some weeds were left standing. Destroyed weeds were scattered evenly in the inter-row space, but few were covered by soil. The range of width adjustment for the Bukura implement was 35–64 cm.

The Zimbabwean cultivator was easier to handle than the other implement. The two chisel tines at the front loosened the soil and destroyed the weeds. The weeds were then swept and buried by the hiller blades, which swept the loose soil aside onto the crop rows on either side of the implement. The implement left a clean inter-row with hardly any weeds standing. Most of the destroyed weeds were buried and some soil was banked to the crop row to support the plants. The range of width adjustment was 60–87 cm.

For the Kabete conditions under which the trials were run (dry loamy soils), the Zimbabwe cultivator was better adapted for weeding maize than the Bukura Mark II cultivator.

Implement development

In western Kenya the institution at the heart of animal draft power technology development has been Action Aid Kenya, a non-governmental organisation (NGO) that has been working in the region for the past 15 years. Action Aid has produced a range of low cost, innovative and appropriate animal draft power implements, such as a plow, a ridger and a cultivator.

Ridger

Action Aid's ridger, designed in 1983, can be attached to the same frame as the mouldboard plow: it looks like a double mouldboard plow. The shares cut the weeds and the mouldboards push the soil to the crop lines, thus helping to conserve moisture and supporting the crop plants. The maintenance cost is low.

After modifications to the original prototype, operational and on-site trials in 1985, and field evaluation in 1987, the ridger is now mass produced by a local medium-sized engineering workshop called Appropriate Implement Project, using production line techniques. Many of the materials used are local and only the steel plate is imported. More than 1000 ridgers have been manufactured, the current rate of production being more than 25 a month. Many have been exported to other regions. Action Aid provides training, a simple tool kit and basic educational materials with the ridger-cum-plow.

Lightweight plows

Lightweight plows were developed by an engineer in response to a need for equipment that could operate in rocky soils. The lightweight feature is the hollow mainframe. The plow has a spring steel reinforced share that can withstand rocky ground. It can work through decomposed rock down to 20 cm.

This paper is published in: Starkey P and Simalenga T (eds), 2000. *Animal power for weed control.* A resource book of the Animal Traction Network for Eastern and Southern Africa (ATNESA). Technical Centre for Agricultural and Rural Cooperation (CTA), Wageningen, The Netherlands. ISBN 92-9081-136-6. For details of ATNESA and its resource publications see **http://www.atnesa.org**

The plow has potential for community use. It is sometimes used by women for primary and secondary tillage. It requires little supervision or prior experience.

Cultivator

Action Aid's cultivator has seven tines, three in front and four behind. The rear tines till the soil left untouched by the front tines. The cultivator is adjustable, and can be used in rows up to 90 cm wide. Each tine is connected to its own standard, and when it wears out it can easily be reversed using simple tools. The multifaceted cross-members are made of high carbon steel and can withstand the roughest conditions. One big advantage with this implement is that the tines can be adjusted to within 3 cm of the standing crop, although it is incapable of pushing the soil against the crop for moisture conservation and smothering of weeds in the intra-rows. This is the current deep level and 'heavy duty' inter-row cultivator of choice in western Kenya for controlling perennial weeds. Its overriding advantage is its durability, and it is one of the most successful and most used weeders in rural Kenya. The current requirement is approximately 100 units per year. It is estimated that there are up to 15 000 cultivators currently in service in the country.

Development experiences

Work on the use of animal power for weeding began in 1983 at Nyabera Draft Animal Power Training Centre in South Nyanza District. At the centre, animals were used to weed all row crops spaced between 60 cm and 90 cm, including sugar cane. A multi-tine cultivator and a regular mouldboard plow were used for weeding. A ridger was used sometimes.

Oxen were used in pairs with a special weeding yoke, two inter-row spaces wide from animal to animal. With a collar harness, just one donkey or ox could be used to weed in light soils under fairly dry conditions. Draft animals were selected from local herds of zebu cattle. Exotic breeds have also been used when they have been properly trained.

Experience has shown that a well-trained pair of oxen can weed one hectare in three hours under favourable soil and weather conditions. When working alone, one donkey or ox can weed one hectare in two to three days, working two hours a day.

In order to realise high crop yields, weeding is carried out several (usually three) times, and it has to be performed at the right time. Under those conditions, animal-powered weeding saves time and labour, and is easier and therefore more appealing than hand weeding. Many farmers have adopted the technology of weeding with a pair of oxen following demonstrations and seminars conducted by the Nyabera Draft Animal Power Centre.

Major constraints to development of draft animal power technology

Despite the marked recognition paid to the importance of draft animal power, its rapid development in western Kenya is still constrained by a myriad of problems. The major constraint is lack of funds, associated with general state of the Kenyan economy. There is a general scarcity of adequately trained people, equipment and transport. National catastrophes such as poor climatic conditions and animal diseases, also affect operations and objectives. In spite of these constraints, the agencies involved in this sector have worked hard towards achieving their objective of providing and promoting draft animal power technology to as many people as possible.

Future of animal-powered weeding

Small-scale farmers contribute a large proportion of the total food production in Kenya, but they also experience acute labour shortages during critical periods of the farming season, especially during planting and weeding.

These shortages can and do gravely affect crop yields when they occur even for as short a period as two weeks. Animal-powered weeding is a viable solution of the problem. The rising cost of hiring labour will push hand weeding out of the reach of most farmers. Farmers in the region depend traditionally on the availability of family labour for farm work. However, as families become smaller, and with children in school, family labour is often not sufficient for the work to be done.

The development of attractive, appropriate and affordable animal-powered weeders is most important for removing a bottleneck in small-scale farming. Widespread adoption of the advances made in recent years will only be achieved where policy makers create an environment for economically sound agricultural development.

