

# Transfer of animal traction technologies in Zambia through on-farm programmes

by

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## Abstract

*This paper describes the approaches that the Animal Draft Power Research and Development Programme follows in its on-farm programmes, which aim at promoting the diversification of animal draft power techniques as well as formulating alternative animal draft power based tillage systems. The topics of these programmes are highlighted, and some related activities—establishment of sales agents, training of extension staff and regional cooperation—are discussed. Institutions based in other countries and involved in the introduction, diversification or intensification of the use of animal power could benefit from this particular Zambian experience.*

## Introduction

The Animal Draft Power Research and Development Programme (ADPRDP) has been operating since mid-1987 (initially it was called a project but since 1991 it has been referred to as a programme). Its general objective is to increase and secure agricultural production in Zambia through further development and introduction of animal draft technologies.

To achieve this objective, the ADPRDP has been focusing on the following activities:

- testing and development of animal-drawn implements
- applied research on animal draft power based soil tillage and cropping systems
- on-farm testing and farming systems research programmes
- establishing close cooperation with other national and regional institutions working on animal draft power.

Because very little information that could readily be translated into extension messages was available at the start of the ADPRDP, the emphasis of the work programmes in the first two years was on testing and development work and applied tillage research. The results obtained from these programmes have led to a continuously increasing shift from

information gathering to information dissemination through extension programmes.

The distinct variation in the status of animal traction use in different areas of Zambia, and the fact that constraints on its implementation differ from area to area, demand a flexible, non-uniform approach by ADPRDP's programmes.

The areas where animal traction has been in use for the longest time are Southern and Western Provinces, traditional cattle-keeping areas. In Southern Province in particular, farmers often possess a wide range of animal draft power implements, such as several plows, harrows and cultivators, a planter and an ox cart. In Central, Lusaka and Eastern Provinces the situation is more mixed: in some areas the use of animal traction has been well established for many years, while in others the technology has only recently been introduced. In the Copperbelt, North Western, Luapula and Northern Provinces animal traction is generally a new technology, whose use is steadily increasing (Starkey, Dibbitts and Mwenya, 1991). In those areas where animal traction is a new concept, plowing and, to a lesser extent, transport are its main applications. For many farmers, animal-drawn cultivators, ridgers and planters are novel implements; planting is generally done by hand, and most farmers use either hoes or their plow for weeding.

## Applied research highlights

The major constraints that Zambian farmers face in using animal draft power for soil tillage are (ADPRDP, 1991):

- time and energy bottlenecks at the beginning of the rainy season (seedbed preparation) and during the crop growing season (weeding)
- poor availability of properly designed and constructed tools for plowing, seedbed preparation, weeding and planting.

On-station and on-farm research programmes on tillage systems using animal draft power have so far focused on alternative primary tillage systems

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(direct ridging, tie-ridging and ripping) and weeding techniques (using ridgers and cultivators). The major conclusions from this research (ADPRDP, 1991) can be summarised as follows:

- under specific regional and management conditions, certain primary tillage systems (such as direct ridging and ripping) can be alternatives to plowing, but further adaptive research at the farm level is needed to formulate feasible and acceptable systems
- animal draft power based weeding techniques, especially ridging and re-ridging, are very effective under diverse conditions. However, these methods are scarcely used at present in large parts of the country, so awareness should be created and farmers' acceptance monitored. Moreover, few appropriate weeding implements were available in the past and so their manufacture and distribution should be encouraged.

### **On-farm demonstration programmes**

As a logical follow-up to the soil tillage research programmes, an increasing number of regional activities are being carried out by the ADPRDP at farm level. Demonstrations play a major role in these activities, the objectives being to:

- encourage the diversification of animal draft power techniques through promoting proven animal draft power technologies
- formulate alternative animal draft power based tillage systems through on-farm adaptive research
- train extension staff and actively involve them in animal draft power extension and development programmes.

ADPRDP's demonstration programmes focus on:

- systems and implements which are already known in some areas, but need to be further extended in other regions: an example is the use of ridgers and cultivators for weeding
- alternative systems (and related implements) that need further adaptive research and development in the regions before they can be extended on a wider scale. Major attention is given to direct ridging, and location-specific attention to direct planting, tie-ridging and ripping, as alternatives to plowing for reduced time and energy requirements, improved timeliness of operations and better soil and water management.

### **Weeding systems demonstrations**

Competition by weeds is still one of the major yield-limiting factors in small- and medium-scale farming in Zambia.

As a follow-up to previous research into weeding methods and tests of weeding equipment, pilot demonstrations of weeding methods aiming at effective weed control and reduced work times were held in the 1990/91 season at seven locations in Southern and Western Provinces; various ridgers and cultivators were compared, as weeding implements, to a standard mouldboard plow. The demonstrations, in which more than 350 farmers participated, were greatly appreciated by farmers and cooperating extension officers. In view of this success, the ADPRDP decided to conduct demonstrations on a larger scale during the 1991/92 season: 10 areas were selected in seven provinces. By the end of the 1991/92 season weeding demonstrations had been conducted at approximately 30 locations.

#### ***Approach***

Locations for the demonstrations are selected in conjunction with local organisations, mainly regional agricultural development programmes. The pilot demonstrations indicated that these organisations can have an impact in virtually all areas where animal traction is being used. However, in order to make most efficient use of its limited resources, the ADPRDP presently restricts the demonstration programmes to areas where effective local cooperation has been established.

The demonstrations are carried out in close cooperation with such "local counterparts". Extension personnel are responsible for selecting farms on which to hold the demonstrations, arranging dates for the demonstrations, and taking care of all practical arrangements, such as inviting farmers, providing refreshments, etc.

The implements demonstrated comprise five makes of ridger (two locally manufactured and three imported) and two makes of cultivator—all animal-drawn weeding implements that are (or at least were, when the demonstrations were planned) sold commercially in Zambia. The demonstrations thus not only introduce new concepts to farmers who are not (yet) using such equipment for weeding, but also allow comparisons to be made between the two weeding methods (cultivating and ridging) and between the different makes of equipment.

#### ***Execution***

Each demonstration starts with an explanation of its objectives, followed by an introduction to the

different implements (names of parts, adjustments, etc) and related tillage practices.

An extension worker then demonstrates the use of each implement in a field with a crop that needs weeding, after which the farmers are encouraged to try out each implement themselves. After the actual demonstrations, the implements' quality and performance, as well as the farmers' preferences, are discussed extensively, and a classification of the implements (best to worst) is determined by vote. Participating farmers are also asked to comment on the organisation, execution and content of the demonstration.

An immediate demand is often created for certain implements, and as they are not readily obtainable in most areas, these are made available to participating farmers after the demonstration; to date a total of 450 cultivators and ridgers have been distributed in this way. Farmers are given two options for obtaining an implement of their choice: they can either buy it outright, by paying the ex-factory (or ex-importer) cash price immediately; or they can pay a deposit (10–20%) and enter into a contract to settle the full amount (ex-factory price at the moment payment is completed) before a specified date.

Feedback of results and follow-up are an important aspect of the demonstrations. ADPRDP staff make regular visits to all regions, and extension personnel are issued with special forms on which record farmers' demand for all demonstrated equipment. At the end of the season the information gathered is made available to implement manufacturers and importers.

A workshop is held for all extension staff directly involved in the season's demonstration programmes. The purpose is to review the achievements of the past season, and to formulate recommendations for the demonstration programme for the following season.

## **On-farm adaptive research**

### *Initial approach*

In the past, the ADPRDP selected farmers for its on-farm research activities through local extension personnel who had been briefed on the planned programmes. At the beginning of the season, ADPRDP staff would then give explanations and, if necessary, brief demonstrations to each selected farmer. This procedure had its drawbacks: because of this complete involvement of ADPRDP staff, the number of participating farmers and the number of selected regions had to remain relatively small;

furthermore this method of selection often led to disappointing levels of farmer enthusiasm and participation.

### *New approach starting with the 1991/92 season*

Problem identification and planning of the research programme are, as before, based on region-specific demands and results obtained so far. The programmes focus on tillage practices (direct ridging, ripping, direct planting, split-ridging, tied ridging) and related implements as alternatives to conventional plowing, the aims being to reduce time and energy requirements, to improve timeliness of tillage and planting operations, and to achieve better soil and water management in regions prone to erosion, in low-rainfall areas, or in areas where waterlogging occurs.

Selection of locations is generally determined by region-specific constraints and subsequent requests, which generally originate from the extension service or agricultural development programmes.

Participating farmers are selected through small-scale on-farm field days during which the techniques are demonstrated. The approach to implementing and executing these demonstrations is identical to that of the weeding demonstrations.

The application of these techniques and implements by participating farmers is encouraged by offering them the use of the implement(s) of their choice for the duration of the season. At the end of the season, farmers can either buy the implement at the prevailing factory price, or they can return the implement to the ADPRDP.

Monitoring and evaluation of these applications, using record sheets and questionnaires, is carried out in close cooperation with extension staff and regional development programmes.

Feedback of results translated into clear-cut recommendations adapted to the requirements of the different target groups is an essential goal of the research effort.

At the conclusion of the 1991/92 season, a workshop was held for all extension staff directly involved in the season's programmes.

If after one or more seasons the investigated techniques prove to be successfully accepted by farmers, that particular adaptive research activity will evolve into a more widely spread demonstration programme.

## **Programme topics**

### *Direct ridging*

The direct ridging programme is a follow-up to several research programmes the ADPRDP has executed on ridging as a primary tillage practice. This research indicated that direct ridging (ridging without plowing) can be a viable alternative to plowing: a considerable reduction in work times for primary tillage allows earlier planting, and weeds can be controlled effectively by re-ridging (Meijer, 1992). However, its suitability in various regions (and thus under different agroclimatic conditions) and its practical value to farmers need to be further investigated through on-farm programmes.

This was the largest primary tillage programme in the 1991/92 season, with 14 demonstrations in five provinces and a total of 124 ridgers handed out to farmers.

### *Tie-ridging and ripping*

The tie-ridging and ripping programme originates from the soil and water conservation tillage trials conducted in Lusitu (Southern Province) for the past three years. They are an addition to the direct ridging programme in three out of six locations, and thus the three alternatives investigated are direct ridging, tie-ridging and ripping.

Tie-ridging shows definite advantages over plowing. Run-off is reduced, and so water conservation is improved and there is less erosion. Land preparation takes less time, thus allowing earlier planting. Weed control (by re-ridging) is very effective. Ripping has potential as a "last resort option" when rains start late: land preparation takes very little time and can be done before the rains, allowing a farmer to dry-plant. However, weed growth on a ripped field will be abundant, and run-off and erosion are potential hazards (Meijer and Chelemu, 1990). As with the direct ridging programme, the practical applicability of tie-ridging and ripping in various regions, and farmers' acceptance of these techniques, are further investigated through this on-farm programme, which involves nine demonstrations in three provinces, using 60 ridge-tiers (two ADPRDP prototypes) and more than 70 rippers (two commercial makes).

In addition to the above two main programmes, small-scale region-specific demonstrations are carried out in certain areas.

## **Sales agent programme**

During the pilot demonstrations held in the 1990/91 season, it was found that the awareness created

among farmers through these demonstrations often led to an acute demand for one or more of the demonstrated implements. Although, of the equipment demonstrated, the tie-ridgers and all but one model ripper are manufactured, or at least marketed, in Zambia, only a few, if any, implements are available in sufficient numbers in rural areas.

Several factors contribute to this poor availability:

- logistic problems of manufacturers/importers (eg, acquisition of foreign exchange, procurement of raw materials, sub-capacity production levels)
- the tendency to manufacture on order only, without the establishment of a network of sales points
- malfunctioning of marketing channels.

The second and third factors, especially, are responsible for the present situation whereby, if a demand exists in a particular area, little response can be observed from the manufacturer/importer. Retailers (sporadic in most rural areas) have to recognise such a demand and place a firm order before most manufacturers/importers will take any action.

In view of the above, it was decided to combine the demonstration programmes with the establishment of equipment sales points and agents in most locations. Manufacturers were approached to supply such agents (any private entrepreneur can qualify) with their equipment and spares on a "pay when sold" basis. One local manufacturer, Lusaka Engineering Company, agreed to supply 300 implements (with a value of close to 2 million Kwacha, approximately US\$ 20,000) on such conditions, and also supplied 30 implements free of charge for use in demonstrations. The Lusaka-based African Farmers' Enterprises is supplying 100 implements on a "pay when sold" basis. In addition, the ADPRDP and the counterpart organisations are supplying quantities of all other demonstrated implements and their spares on the same basis. It is hoped that, after this initial support, these local agents can continue to operate on a sound economic basis and thus alleviate the present shortage of animal draft power implements and spares, while simultaneously providing a market outlet to manufacturers/importers.

## **Provincial cooperation and training**

When one considers the scope of the on-farm programmes the ADPRDP is presently carrying out, it is obvious that these can only be executed successfully if the extension services and provincial

and district agricultural development programmes are closely involved with their implementation.

In the first half of 1991, discussions were held with these local counterparts with a view to formulating the outlines of the on-farm programme and to selecting participating staff. An important criterion in this selection was previous participation in the regular training course of the Palabana Animal Draft Power Training Project.

In September 1991, the ADPRDP organised a specific follow-up training course for all regional staff (40 in total) involved in the programme. Each area was represented by a supervisor (often a district agricultural engineer) and one extension worker from each location where demonstrations were to be held. The course aimed at providing the participants with all necessary knowledge and skills to carry out the demonstrations programme in their areas without major involvement from the ADPRDP. Course subjects included lectures on primary tillage and weeding practices, a lecture on the planning and execution of on-farm demonstrations and an extensive explanation of the demonstrations and sales agents programme. Through field practicals, participants were made familiar with all the animal draft power equipment involved. Towards the end of the course, the participants had to organise and execute a field demonstration for invited farmers. Finally, individual discussions on logistic matters were held with each group representing an area. Apart from ample background information, the course syllabus contains practical guidelines and checklists for the organisation and execution of the field demonstrations.

In five out of the 10 areas, regional development programmes are either partly or completely funding their part of the demonstrations programme and providing logistic support. In the other areas, the ADPRDP supplies the implements and provides the supervising extension staff with a budget for expenses for such things as fuel and spares, bicycles and allowances.

## Conclusions

The generally high attendance of farmers, and their active participation during the demonstrations (both primary tillage and weeding), indicate that the demonstrations are an answer to a widely existing need. Not only do the demonstrations offer the farmer the opportunity to view new techniques and

compare different implements, they also offer a platform for discussions (among themselves and with extension and project staff) on a wide range of subjects related to animal draft power.

The active and enthusiastic cooperation from extension staff demonstrates that their close involvement in such programmes can strengthen their motivation and performance. It is felt that the combination of training on animal traction subjects, as provided by the Palabana Animal Draft Power Training Project and the follow-up on-farm programmes described above, can act as a catalyst to boost the introduction, intensification and diversification of the use of animal traction.

The keen interest of regional development programmes and their subsequent commitments for support (financial, logistic and personnel) indicate that within these programmes a distinct need exists for the type of expertise provided by the ADPRDP.

The establishment of sales agents is not an easy matter; selection has to be done carefully and constant monitoring is necessary. Good planning is required to get equipment and parts to the right place at the right time and procurement is hampered by irregular stocks and ever-increasing prices.

The keen interest of farmers in obtaining demonstrated equipment, their readiness to pay deposits and the number of farmers that buy implements on the spot, prove that a great demand for such equipment exists. It also indicates, however, that farmers desperately need access to credit facilities. Although confident in their ability to complete payment, many farmers have stressed that late payments of crop proceeds by the cooperatives (frequently six months or more after delivery of the crop) could make payment before the set deadline very difficult.

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