Surveying animal traction use in Zambia

by

Henk J Dibbits

Institute of Agricultural and Environmental Engineering (IMAG-DLO)
PO Box 43, 6700 AA Wageningen, The Netherlands

Abstract

Results of a national animal traction survey in Zambia showed that small-scale and medium-scale farmers prepare about 54% of their cultivated area with oxen. In 1990 the total number of trained oxen was 266,000. There were 132,000 working plows. The national average plowed area per pair of trained oxen was 3.5 ha. Generally there were not enough weeding implements which restricted the utilisation of trained oxen. Rural transport is not well developed, particularly in the non-traditional cattle-keeping areas where there are few sledges and ox carts per 1000 farming households. About 25% of the plows and ox carts are broken down and need to be repaired. It is assumed that the other implements have the same percentage of breakdowns. Veterinary and extension services leave much to be desired. Although credit has had little influence on the development of animal traction in the past, farmers still complained about lack of loan facilities for buying oxen and implements. The survey confirmed the poor distribution of implements and spares and the need for more repair workshops. The survey results are intended to support animal traction programmes by providing information for policy development, research and extension activities, (rural) development programmes and manufacturers and distributors of animal-drawn implements. The survey is an example for other areas where more in-depth information is needed to promote animal traction development.

Introduction

The development of animal traction can be hampered by lack of information about both its current and potential contribution to agricultural production. Without reliable data it will be hard to convince a Government and/or donor agencies of the need for support. Importantly, when reasons for successes and failures are not well known it will be difficult to analyse the situation and formulate policies to stimulate progress. In Zambia, substantial experience in the promotion of animal traction had been accumulated in different parts of the country. However, the evolution of project design and implementation had occurred without proper central direction and without a formal mechanisation policy structure. The signals of the several animal traction projects and the necessity to promote a mechanisation system for small-scale farmers without requiring large sums of foreign exchange (tractorisation for small-scale farmers had failed), made the Ministry of Agriculture and Water Development decide to investigate the status of animal traction. In 1985, a team travelled to all provinces of Zambia to describe the situation, and collect statistical data on the numbers of trained oxen and implements The latter were difficult to obtain and many assumptions had to be made. Nevertheless the study resulted in a good overview of the status of animal traction at that time, and this was incorporated in an Animal Traction Investment Plan.

Many donor agencies were willing to support a part of the Investment Plan and although not all proposed projects were funded (particularly some provincial animal traction programmes), many animal traction programmes were launched. In 1990, the National Animal Draft Power Coordination Programme initiated a review of the animal traction development since the start of the Investment Plan. By that time little new statistical information was available in some provinces, but it was considered that a national animal traction survey could provide more detailed information to be included in the review. Some analyses of initial responses to the questionnaires of the survey were made and included in the report (Starkey, Dibbits and Mwenya, 1991). However, some obstacles in carrying out the national survey caused a delay in data collection and therefore an in-depth analysis had to be done later. The results are stated in a separate report (Dibbits and Mwenya, 1993).

This paper describes the main results of a national animal traction survey in Zambia.

Information is also given about the methodology that was used and constraints encountered. The support of this survey to further animal traction development in Zambia is explained. The survey could be repeated (adapted to the local needs) elsewhere if more in-depth information is needed to promote animal traction development.

Objectives

The objectives of the survey were:

- to collect numerical data on animal traction from all agricultural camps in Zambia.
- to provide statistics to review the importance and potential of animal traction in all districts in Zambia as a whole based on:
  - households owing oxen
  - (trained) oxen
  - area cultivated with trained oxen
  - implements in use and repair needs
  - ox carts in use and repair needs
  - animal means of transport
  - blacksmiths.

The results of this survey were intended to assist in the development of animal traction policy. Other important beneficiaries include: district and provincial rural development programmes; manufacturers, importers and distributors of animal-drawn implements and spare parts; and researchers and extension staff involved in the development and promotion of animal traction.

Methodology

To obtain the information required for this exercise, questionnaires were distributed to all agricultural camps in Zambia (the political organisation of Zambia is based on a hierarchy of provinces, districts and camps). The survey tried to get details of farming households with and without oxen, area cultivated and common animal-drawn implements in use by farmers. This was the first time that such a specific survey had been carried out by Camp Officers. The method of data collection employed included farmer interviews and observations. The first version of the questionnaire was tested in five agricultural camps in Lusaka Province. An explanatory note was added to clarify certain questions, to prevent the Camp Officers from making mistakes and to enable them to cross-check some data. The questionnaire had provision for numerical data and comments from Camp Officers concerning changes, constraints and suggestions for improving animal traction in their camps.

The farmers surveyed were mainly small- and medium-scale farmers who normally use hand tools and animal traction. These two categories and the large-scale farmers are classified according to the Ministry of Agriculture Food and Fisheries as follows:

- **small-scale farmers:** farmers who normally plant at least 0.5 ha but less than 5 ha.
- **medium-scale farmers:** farmers who normally plant at least 5 ha but less than 20 ha.
- **large-scale farmers:** farmers who normally plant more than 20 ha.

The 1989/90 Crop Forecast classified farmers as small-scale, emergent and commercial, with similar definitions.

All the questionnaires were checked by the provincial staff and the National Animal Draft Power Coordination Programme. Where data seemed to be incomplete or doubtful, questionnaires were sent back for verification. Several provinces were also revisited to consult on the data submitted.

As not all camps submitted questionnaires, district totals had to be adjusted, based on the number of missing camps and other sources of information such as cattle censuses and crop forecasting.

Limitations and constraints

Data collected on number of farming households and area under crops did not appear to be a problem for Camp Officers as they were familiar with the data required. Most of the data submitted on farming households and area under crops coincided fairly well with that of the crop forecasting estimates. However, the area cultivated with hoes plus the area plowed by oxen is not always equal to the total area under crops. This is because in some areas tractors are used for plowing and because 'permanent' crops such as cassava are grown.

The estimates of number of oxen and number of trained oxen in a camp were sometimes the same. This is feasible in areas of introduction where oxen are brought in for traction but is less likely in traditional cattle-keeping areas. The survey did not

include donkeys and work cows; however, the use of donkeys and work cows was reported by a number of Camp Officers.

The numbers of mouldboard plows and ox carts not in use were included to find out the need for spare parts and repair facilities. It was expected that the situation for the other implements in the survey would be similar.

For the implement repair and maintenance, only the number of blacksmiths or blacksmith-farmers was recorded. No information was gathered about their capabilities and work. However, the number of blacksmiths in the area is a good indication of the potential for establishing rural repair facilities.

The National Animal Draft Power Coordinating Office encountered some obstacles in carrying out the national survey. Communication with Camp Officers, particularly the ones in the very remote areas appeared to be difficult. Distribution and collection of questionnaires was sometimes delayed. Furthermore, many Camp Officers had to collect the data on foot. Despite many follow-ups to provinces and districts as well as financial support for fuel, in a number of districts the handing in of questionnaires was slow. The programme had underestimated the time and manpower required to carry out such a national survey and the difficulties that might arise.

Abbreviations

In the graphs and charts in this paper the following abbreviations are used:

NP	Northern Province
LUP	Luapula Province
COP	Copperbelt Province
NWP	North Western Province
WP	Western Province
SP	Southern Province
CP	Central Province
EP	Eastern Province
LUS	Lusaka Province

Results of the survey

Area cultivated with human and animal power

Small-scale and medium-scale farmers in Zambia prepare about 46% of their cultivated area with hand hoes and 54% with oxen. A small unknown percentage, which has not been accounted for in these figures is plowed with tractors. There are big variations in percentages between the provinces (Figure 1), and also between the districts within provinces, because areas with few trained oxen will automatically have a low percentage of ox plowing. On average, a pair of oxen in Zambia plow 3.5 ha per growing season.

In Zambia the total area plowed with trained oxen, 468,000 ha, is about five times bigger than the planted area of all the large-scale farmers (close to 90,000 ha; 1989/90 final crop forecasting).

Number of trained oxen

The total estimated number of trained oxen in 1990 was 266,000 (Table 1). Compared with the estimates in the 1985 Investment Plan, there has been an increase of about 48%, while during the same period the cattle population in the traditional sector increased with only 7%. This implies that the percentage of the cattle population used as draft oxen has been increasing rapidly. Unfortunately, after the 1990 survey many cattle/oxen have died due to outbreaks of disease in some districts.

Number and balance of implements

Finding similar numbers of several different types of animal-drawn implements means that there is a well-balanced package of equipment available, so that oxen can be used for many agricultural operations. An even balance also implies the potential for a reduction of human power use, for example with a complete set of implements human power might be used only for in-row weeding. In practice, farmers tend to buy plows first. The purchase of other equipment, particularly weeding implements, depends very much on profitability in ox farming and availability. In some cases the balance has been influenced by project interventions, as in North Western Province where for a number of years, a district development programme has promoted plows and not weeders. In Eastern Province farmers appreciate the ridger for tillage operations and weeding.

The nationwide estimates of numbers of ox-drawn implements (Figure 2) hide the differences between provinces. However, the data collected on the numbers of available ridgers, harrows, planters and cultivators per 100 ha plowed with work oxen by province (Figures 3, 4, 5 and 6) show the variations clearly.

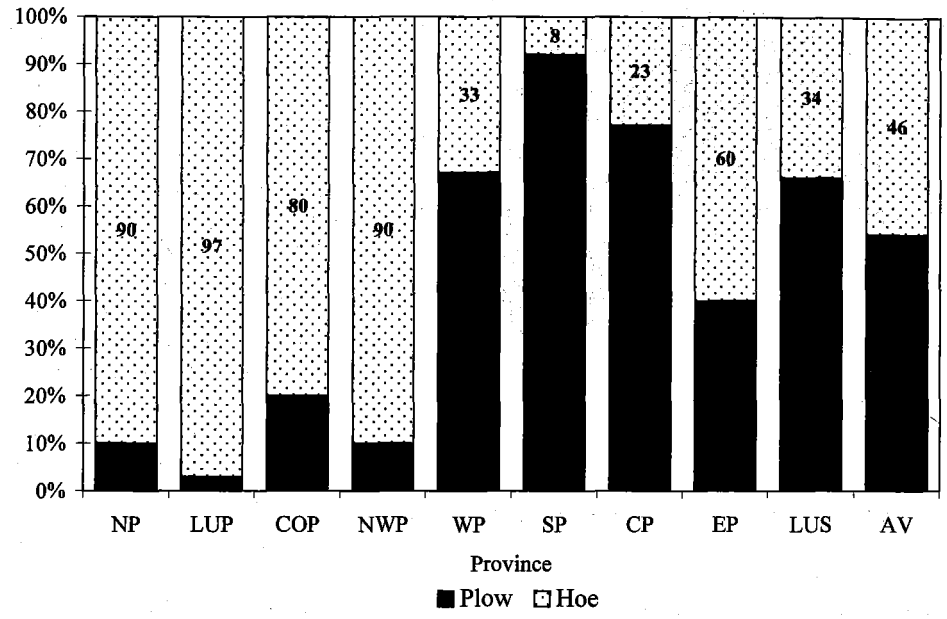


Figure 1: Percentage of area cultivated with hoes and ox plows by province and the national average

Table 1: Estimates of numbers of trained oxen and total number of cattle in Zambia in 1985 and 1990

Province	*1985*[1]	*1990*[2]	*% change*
Northern	4,200	4,620	10
Luapula	500	487	-3
Copperbelt	1,300	2,329	80
North Western	300	2,375	790
Western	10,000	31,700	317
Southern	96,000	126,400	32
Eastern	38,000	47,9600	26
Central + Lusaka	29,000	50,055	73
Total	**179,000**	**266,000**	**48**
Cattle (traditional sector)[3]	2,077,000	2,216,125	7

1) Estimates from 1985 Animal Draft Power Investment Plan
2) Estimates from 1990 animal traction survey
3) Livestock census figures from the Department of Veterinary and Tse tse control services

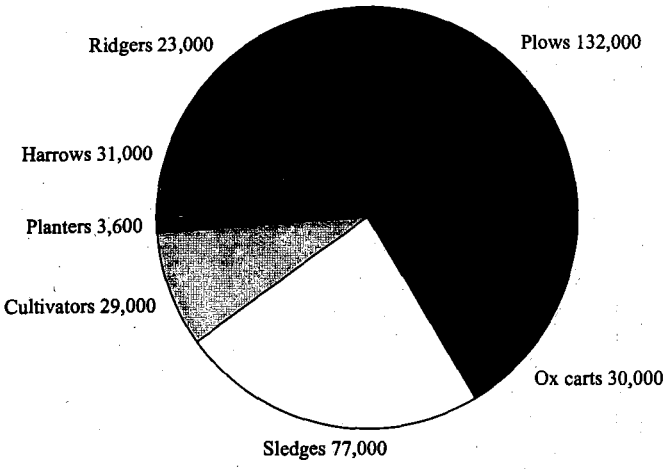


Figure 2: Estimated numbers of ox-drawn implements in Zambia

For example the imbalance of implements in Western Province manifests itself in the low number of cultivators and weeders per 100 ha plowed with animal power. Eastern Province is also a typical example. It has many ridgers but few cultivators and harrows. There ridgers are also used for primary tillage, particularly in groundnut production, hence the high number. In Lundazi District there are even more ridgers than plows.

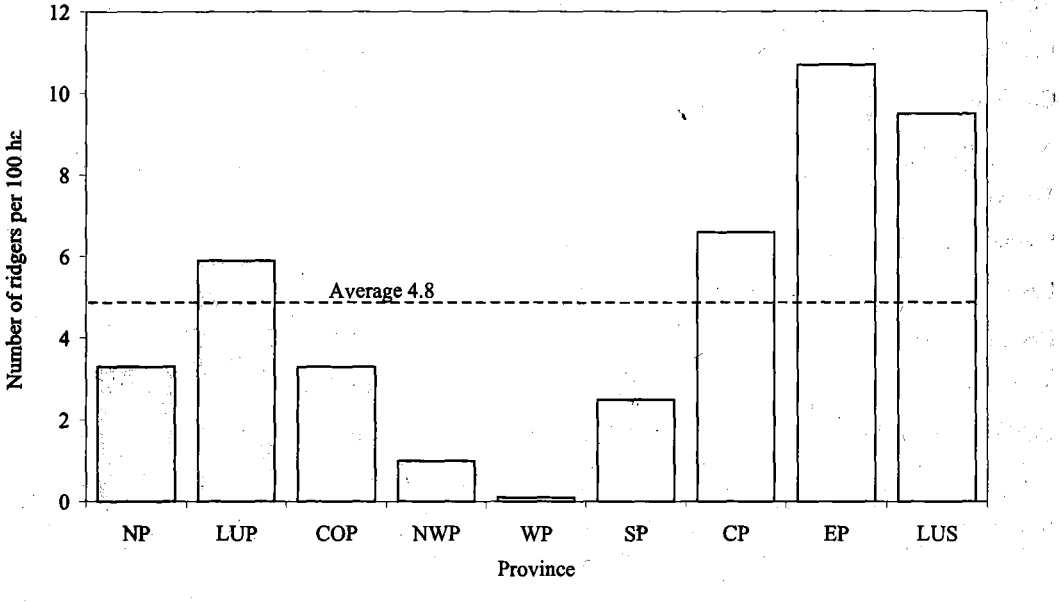
The optimum number of cultivators, harrows and ridgers seems to be about 8 to 10 per 100 ha of ox-plowed land, bearing in mind that cultivators and ridgers are interchangeable in weeding operations. From this assumption and the total area plowed with trained oxen, one can calculate the theoretically required increase in number of implements per province and per district. However, one also has to take into account local farming practices and the profitability of ox farming, as in Western and Eastern Provinces.

Transport

Rural transport with trained oxen is not very well developed in Zambia. Although there are many sledges, 29 per 100 trained oxen, they are mainly used for on-farm transport and short distances. Ox carts are more suitable for rural transport but there are only 11 usable ox carts per 100 trained oxen (Figure 7).

The number of sledges and usable ox-carts per 1,000 farming households reveals that the rural transport situation is very bad in Northern,

Figure 3: Number of ridgers per 100 ha plowed with trained oxen



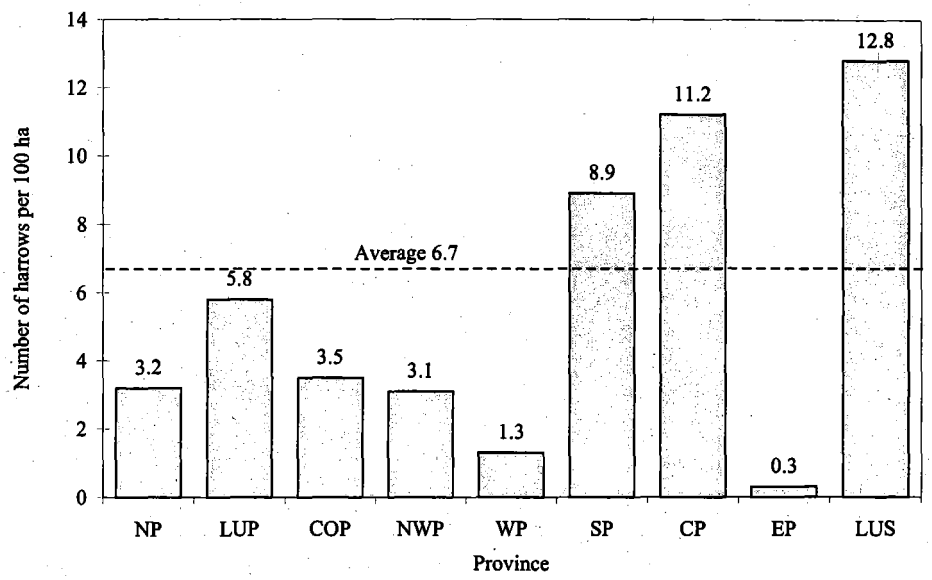


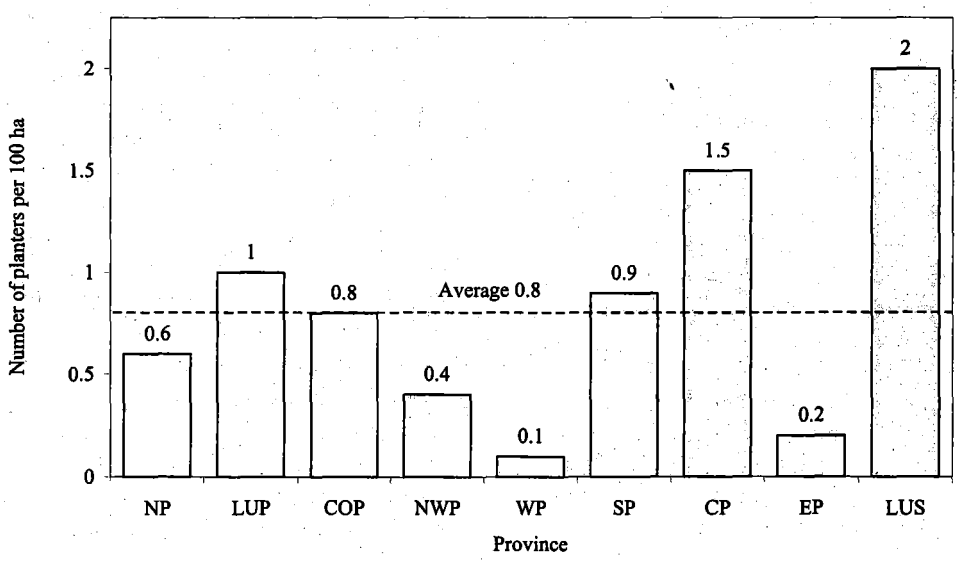
Figure 4: Number of harrows per 100 ha plowed with trained oxen

Luapula, Copperbelt and North Western Provinces. The most developed areas in terms of animal-drawn rural transport are Southern Province and Central Province. The latter has 122 ox carts per 1,000 farming households (Figure 8), the highest density in Zambia.

Repair needs for plows and ox carts

About 25% of the plows and ox carts are broken down and need to be repaired (Figures 9 and 10), ie 38,000 plows and 11,000 ox carts. The percentage of broken plows is almost equal in all provinces, except for Western Province, which also has the highest percentage of broken ox carts. North Western Province, where many ox carts are relatively new, has few broken carts. Many ox carts with standard roller bearings were sold during the last five years and the North Western Integrated Rural Development Project replaced

Figure 5: Number of planters per 100 ha plowed with trained oxen



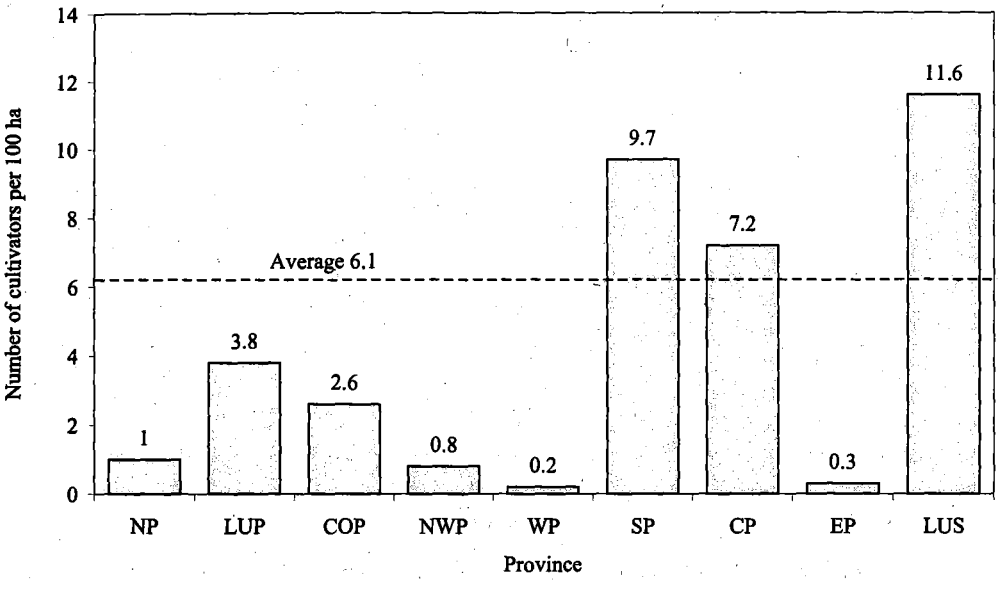


Figure 6: Number of cultivators per 100 ha plowed with trained oxen

failed axles (with bronze, nylon and wooden bearings) by axles with roller bearings.

One can assume that the other implements have the same percentage of breakdowns. In total this means that thousands of different spare parts are needed for the several makes of implements and ox carts.

Draft power utilisation

The importance of animal traction in farming also depends on the rate of utilisation. The survey gives information about the area plowed per pair of trained oxen and the potential for carrying out weeding operations and transport (balance of implements, number per 100 ha plowed with trained oxen or per 100 trained oxen). A high rate of utilisation means that the oxen will be used many days per year, not only for plowing, but also for weeding and transport. Plowing with a team of six oxen where four or two oxen can do, indicates an ineffective use of oxen. Other important aspects in achieving good utilisation of oxen are profitability in farming, rural transport and availability of implements and spares. Figures 3 and 6, indicate that oxen are under-utilised for weeding in Northern, Copperbelt, North Western and Western Provinces.

The rate of utilisation in transport is hard to estimate. At least we know that many oxen are hitched to ox carts and sledges. The average number of ox carts plus sledges in use per 100 trained oxen is 40. It varies from 29 in Western Province to 50 in Lusaka Province (Figure 7).

The average area plowed with a pair of trained oxen is 3.5 ha in Zambia. It is notable that in Northern, Luapula and North Western Provinces, where most of the introduction of animal traction has taken place during the last 10 years, the trained oxen plow more than the national average of 3.5 ha. The reason may be the relatively long rainy season and the fact that farmers plow with one pair of oxen. The Copperbelt Province has the smallest area of plowed land per pair of trained oxen: 2.8 ha. This is because of the very small areas plowed per pair of oxen in the urban districts. In Western Province (where oxen are usually hitched in teams of four or six), the area plowed is 3.1 ha.

Remarks by extension staff

Veterinary and extension services

One can imagine that the farmers experience the services of the Veterinary Assistants and the Camp Officers differently. Loss of an animal is perceived as being far more serious than insufficient

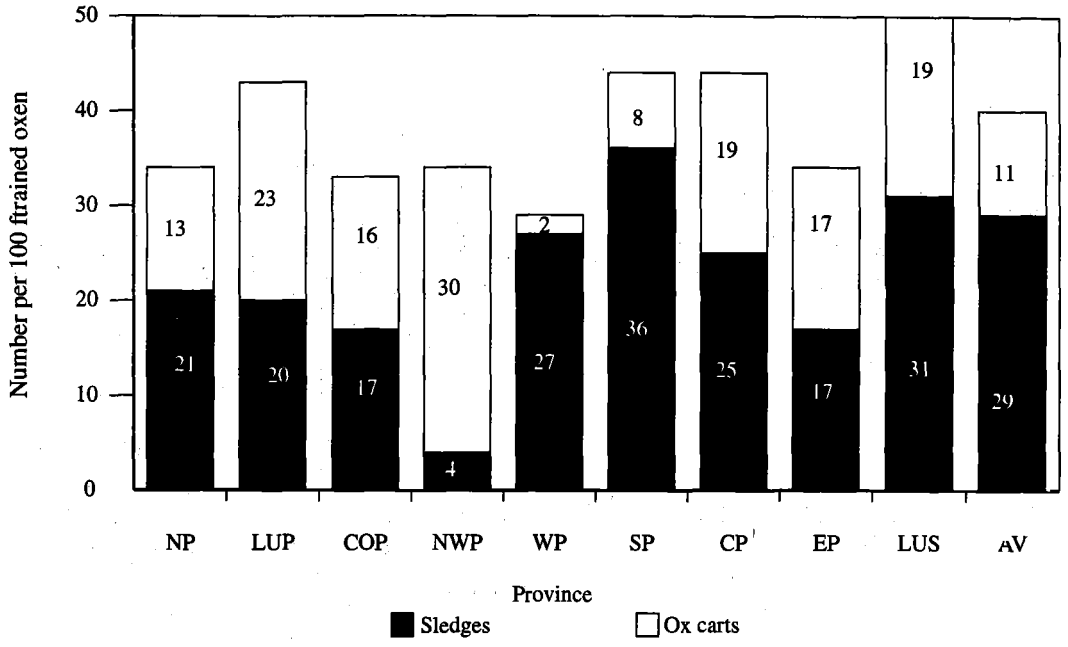


Figure 7: Number of sledges and ox carts per 100 trained oxen by province and national average

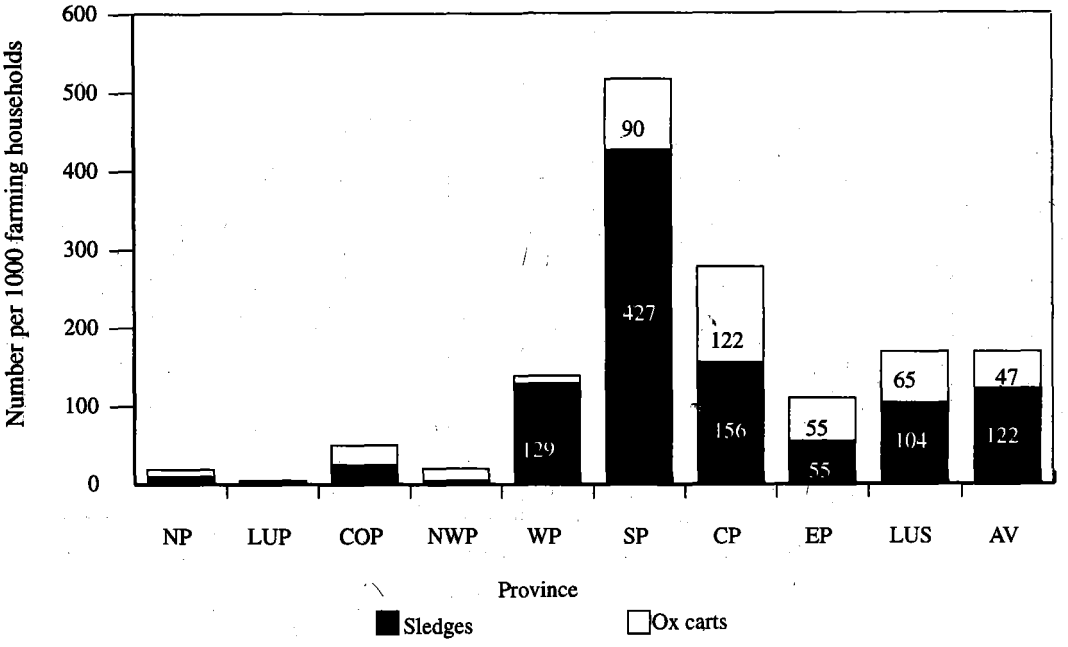


Figure 8: Number of sledges and ox carts per 1,000 farming households

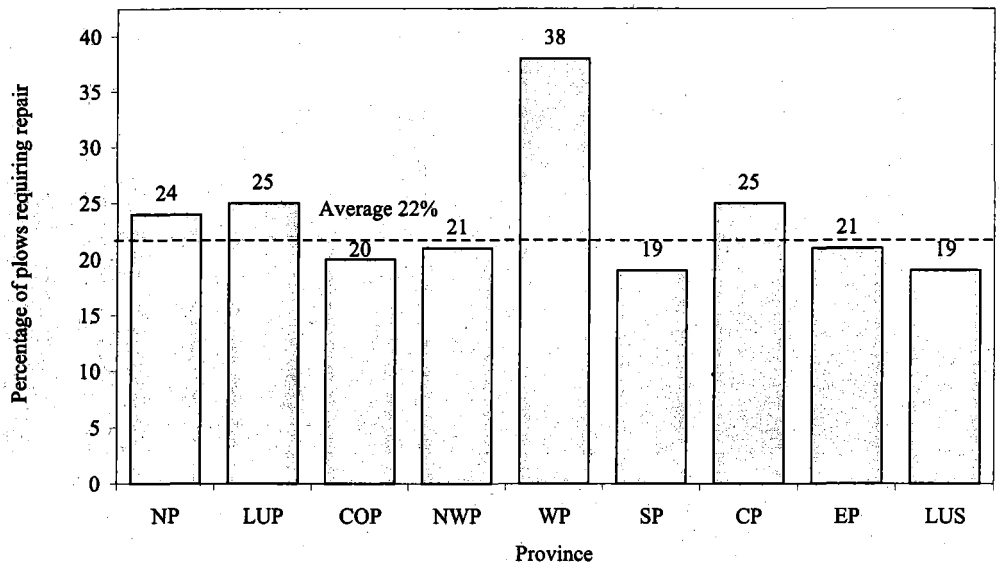


Figure 9: Percentage of plows requiring repair

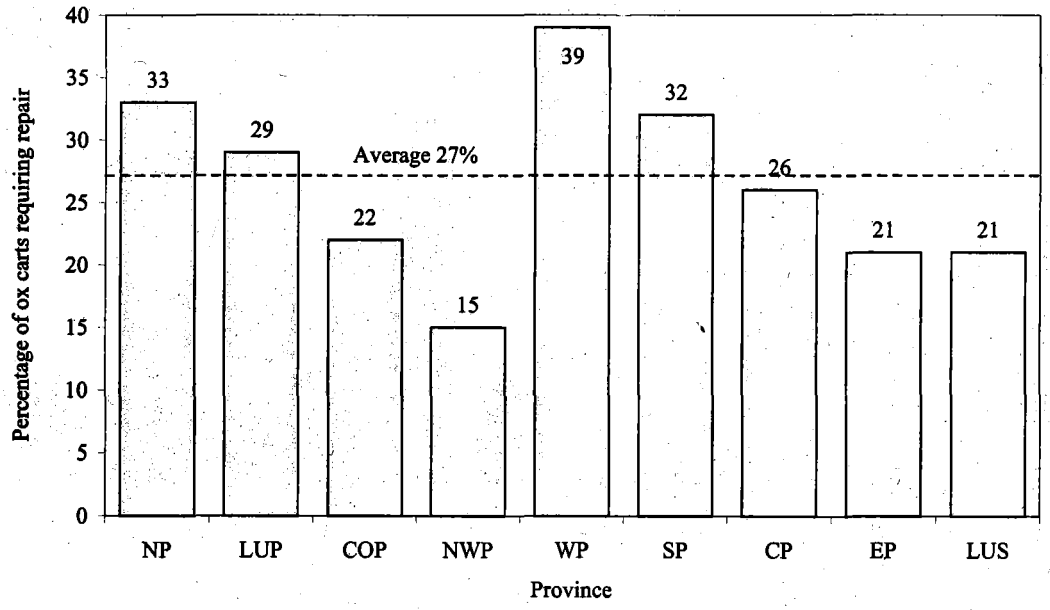


Figure 10: Percentage of ox carts requiring repair

extension services from a Camp Officer. The former has immediate financial consequences for the farmer, whereas the damage of insufficient extension is difficult to estimate. Therefore farmers' complaints about veterinary services and the rise of drug prices (to more realistic prices) are understandable. However, the circumstances under which Veterinary Assistants and Camp Officers have to work leave much to be desired.

The extension staff are hampered in their animal traction extension work by lack of basic needs like transport, protective clothing, and extension/teaching materials. Some have to walk long distances and are unable to visit all farmers. Proper housing and allowances stand much higher on their list of priorities. Camp Officers are critical about their own functioning. It is difficult to transfer knowledge or to convince farmers if you have insufficient knowledge and experience yourself. Camp Officers expressed a desire for extension pamphlets and in-service courses. However, the effect of training will be insignificant if the other problems are not solved. They also feel that farmers need more education and training. Some staff members have communication problems with farmers and others feel left to their own devices. They would like to see more coordination and communication.

Credit

In the past, credit was available and farmers were keen to obtain seasonal and medium-term loans for agricultural inputs and investments in oxen and implements. However, the percentage of farmers that obtained credit has always been low and has had little influence on the development of animal traction. In practice, the credit system was a kind of subsidy, particularly during crop failures, when repayment was poor. Parastatal lending institutions which were running at a loss were subsidised.

With inflation higher than interest rates, credit-giving organisations have seen the value of their capital reduced and have foreseen a cut-back in government support. As a result the credit available has been reduced greatly, both in terms of Kwacha and value.

The farmers' past experience in obtaining credit and the present tight financial situation of the lending institutions explain the many complaints from farmers concerning lack of loans for buying oxen and implements.

Supply and distribution of implements and spare parts

Complaints about shortages of implements and spares are reported in all districts, even in the districts along the line of rail (railway from Livingstone to Lusaka and the Copperbelt) where they are usually available. Some Camp Officers reported that farmers have to travel long distances in search of implements and spares. Sometimes farmers have to buy a complete new implement due to lack of spares.

Using the survey data, suppliers are now able to make rough estimates of the demand for various types of implements in the districts.

The demand for spares is difficult to estimate. A more detailed survey in a number of camps spread over Zambia is necessary, to map out the different makes and types of implements and ox carts, together with the repairs and spare parts required. Moreover, the distribution network should be improved, to bring the implements and spares closer to the farmers. Ideally, a number of rural blacksmiths or repair workshops should be involved in the distribution.

Blacksmiths

The survey indicates that there are quite a number of blacksmiths in Zambia. The questionnaire does not specify the minimum requirements a person must satisfy to be called a blacksmith and therefore many farmers who occasionally make a hoe may be included. Generally, artisans have no external support and mainly use simple tools and scrap materials. This means that the implement repair and maintenance service to the farmers is limited (Starkey, Dibbits and Mwenya, 1991).

Many Camp Officers recommend further training of blacksmiths and the establishment of more repair workshops. This is in line with the enormous repair needs of implements and ox carts.

Use of cows

An increase in the use of cows for draft was confirmed by a number of Camp Officers, particularly in Western (Sesheke District), Southern and Central Provinces. Loss of trained

oxen has forced farmers to use cows in their teams.

Gender

With reference to a question asking if there had been progress in animal traction in the camp, some Camp Officers reported that an increasing number of women are able to work with draft oxen, particularly in Western province. A considerable number of women use animal traction in Southern Province as well.

Support to animal traction development

The results of the survey are intended to assist in the development of animal traction policy. Other important beneficiaries include district and provincial rural development programmes, manufacturers, importers and distributors of animal-drawn implements and spare parts and researchers and extension staff involved in the development and promotion of animal traction.

Animal traction policy development

Limited financial means force governments to set priorities in their support to the agricultural sector. To be able to set priorities one needs to have at least a number of areas to choose from. To get animal traction on the priority list of the Ministry of Agriculture, one needs to have sufficient information about the role animal traction can play in the agricultural development, its constraints and prospects. A widely distributed animal traction status report and national or regional survey can be of great importance to convince politicians and decision makers of the need for support.

Once animal traction is accepted as a priority area, different policies can be pursued to promote its development. The policies could involve activities of the Ministry of Agriculture (eg further data collection, research, training and extension). Others are measures to make it more attractive for the private sector to be engaged effectively in activities which will stimulate the use of animal traction technologies. One of these measures could be duty-free importation of steel for manufacturing animal-drawn implements or marketing support.

A status report or a survey will also be helpful to differentiate between the different requirements of each region. In areas where there is sufficient experience in animal traction and there are many oxen and implements, the private sector may be able to manage most of the required businesses. In areas with little experience in animal traction the government could facilitate animal traction development in assisting in extra training and extension and also in the supply and distribution of implements.

District and provincial development programmes

Similar to the animal traction policy development, no policy can be developed in districts and provinces and no actions can be taken unless enough information is known about the benefits of animal traction and the constraints to further development.

Manufacturers, importers and distributors of animal-drawn implements and spare parts

It is almost impossible for an individual entrepreneur to gather information about the marketing possibilities for animal-drawn implements and spares. For most entrepreneurs, manufacturing or selling of these items is a minor part of their total business. To play safe, they usually order the same numbers as they did in previous years. Consequently, there are generally few implements and spares available for the small-scale farming community. In addition, implements and spares are usually not well distributed as suppliers are not aware about the demand in certain areas. Statistical data about the number of farmers using draft animals and the available implements can give more information about the potential market.

Research, training and extension

Through detailed information about the constraints in animal traction development the programmes can be adjusted and extra attention can be given to problem solving. Regions with similar problems can be grouped paving the way for more cost-effective tailored approaches in research, training and extension.

Conclusions

The national animal traction survey in Zambia has produced much in-depth information for policy makers, researchers and extension staff, (rural) animal traction development programmes, private enterprises, etc. It has showed clearly the importance of animal traction in agricultural

production and development in Zambia. However, it also confirmed many constraints to the spread of animal traction including:

- poor distribution of implements and spares
- need for more repair facilities
- under-utilisation of trained oxen
- need for better veterinary and extension services.

Last but not least, it may be advisable to carry out such a survey by province. One should not underestimate the finances, supervision, communication and particularly the time required to collect and analyse the data.

References

Dibbits H J and Mwenya E, 1993. *Animal traction survey in Zambia.* Ministry of Agriculture, Food and Fisheries, Lusaka, Zambia in association with the Institute of Agricultural and Environmental Engineering (IMAG-DLO), Wageningen, The Netherlands. 119p.

Starkey P H, Dibbits H J and Mwenya E 1991. *Animal traction in Zambia: status, progress and trends.* Ministry of Agriculture, Lusaka, Zambia in association with the Institute of Agricultural and Environmental Engineering (IMAG-DLO), Wageningen, The Netherlands. 105p.