Der Tropenlandwirt, Zeitschrift für die Landwirtschaft in den Tropen und Subtropen
92. Jahrgang. April 1991, S. 29 – 40

Interrelationship Between Male Labour Shortage and Use of Animal Draft Power: A Case Study from Botswana[1]

Zusammenhang zwischen Mangel an männlichen Arbeitskräften und Nutzung tierischer Zugkraft: ein Fallbeispiel aus Botswana

by Wolfgang Kunze[2] and Heinz Loos[3]

1 Introduction

1.1 Background

Results presented in this paper are based on experiences gained during six years of technical assistance provided to small-scale farmers in Ngamiland East/North-Eastern Botswana. In 1983, the Molapo Development Project was started as a technical assistance project which was attached to the Department of Agricultural Field Services of the Ministry of Agriculture/Republic of Botswana. Financial and technical assistance was provided by the German Agency for Technical Cooperation (GTZ)/Federal Republic of Germany. The Project originally aimed at improving the level of production in the floodable areas near Shorobe, 40 km north of Maun and therefore concentrated on the flood control infrastructure and agronomic research and extension. However, since the Project was established, parts of the Molapo areas were flooded only twice in 1984 and 1989.

The overall goal of the Molapo Development Project is to contribute to the food self-sufficiency in Ngamiland District, while the immediate objective of the Project is to develop and test the technical, organizational and administrative base for improved flood recession farming.

---

[1] Paper presented at the Colloquium on Donkeys, Mules and Horses on September 4 – 6, 1990 at the Centre for Tropical Veterinary Medicine of the University of Edinburgh

[2] Dr. W. Kunze, Sozioökonom, Mögersbrunn Nr. 8, 8805 Feuchtwangen

[3] Dr. H. Loos, Agronom, GTZ Abt. 105, Postfach 5180, 6236 Eschborn 1

1.2 Geography

The Project Area is situated in Northern Botswana on the South-Eastern fringes of the Okavango Delta (20.00 S, 23.25 E, and 935 m above sea level). The soils consist of superficial deposits of considerable thickness of windblown sands and alluvial sediments. Between the sandy islands with tree vegetation, the alluvial sediments are concentrated in melapo (plural of molapo) which are wide, bowl-shaped flood plains, covered by sedge and grass. The arable melapo often have a sandy topsoil over deep alluvial deposits, varying from sandy loams to clays. In depressions, the sandy topsoils may be shallow or missing at all, making their utilization for arable agriculture difficult.

1.3 Climate

The Project Area lies in a semi-arid climate zone which is characterised by distinct hot summers and mild, dry winters. The length of the calculated growing season is some 90 days, usually from January to March. The rainfall pattern is marked by one rainy season between October and April. The mean annual precipitation amounts to 460 mm, but rainfall may be highly variable from year to year with values ranging between 200 and 1 200 mm. Dry spells between heavy showers can cause yield reductions or even crop failures and make agriculture a risky undertaking.

Mean temperatures vary from 16°C in July to 27°C in November; the seasonal mean amounts to 22°C. However, absolute maxima can be well over 40°C during ploughing season. During winter, frost may occur. Mean annual evaporation (Penman) is 1910 mm with maximums up to 210 mm during October.

2 Human resources

2.1 Household structure and population characteristics

All in all approximately 350 households live in the Project Area with an average size of 4.1 household members. The age group of persons below 15 years, i.e. the age group where population growth can be most prominently observed, is presented by 1.6 persons per household on the average. This rather low number can be mainly explained by the overall age structure of the target population (see chap. 2.2).

Two settlement patterns can be found in the area: villages along the main Maun-Shorobe road and small settlements scattered around the melapo. The majority of the population lives in the villages, but also those scattered usually have a second home in one of the major villages. More important, however, is the fact that an estimated 50 percent of the farmers have their "real" homes in Maun. Their homes on the lands are seasonal and more perceived as "cultivation posts" rather than permanent residences (DORLOECHTER, 1989). But even for those who still have their permanent residence in the Project Area, it seems to be a matter of highest priority to establish a home in Maun in the near future. Comparing the 1981 census figures with the actual (estimated) number of people living in the Project Area, an out-migra-

tion can be observed which appr. makes up for the natural population growth of about 3 percent. The strong links to semi-urban Maun can be expected to cause considerable changes in consumption patterns and lifestyle, which may have wide effects on farmers' priorities and strategies to make a living. Furthermore, it may more and more lead to considering arable farming as a part-time business aiming solely at securing (staple) food subsistence for the family in town.

2.2 Age structure and labour force

In general, the Project population is superannuated, whereby the extent of deviations from the normal age distribution varies between genders. Significantly more men (male heads of household) belong to the elder groups than women (their wives or female heads of household). Only 30 percent of the men are under 50 years, 25 percent are between 50 and 60 and 45 percent are over 60. The respective figures for women are 60 percent under 50 (with more than half of them being between 40 and 50), 25 percent between 50 and 60, and 15 percent over 60. For interpretation purposes it should be kept in mind that life expectancy at birth in rural Botswana is 55 years for men and 61 years for women.

3 Socio-Economy

3.1 Farming system

The farming system prevalent in the Project area comprises more than just agriculture, although arable and livestock farming are still the centre of economic activities. Due to the harsh and extremely changing environmental conditions, farmers developed a very flexible set of strategies to make a living including both subsistence and market oriented activities. Apart from reproduction work including housebuilding, fishing, hunting and gathering of wild fruits and vegetables are solely subsistence oriented, while arable farming and small livestock production serve both subsistence and income generating purposes. The same applies for cutting reed and grass, while wickerwork, production of alcoholic drinks (beer and palm wine), cattle production and wage-work are directed towards cash income generation or, in the case of cattle, also serve as economic security and status symbol (see DORLOECHTER, 1989)

In addition to these economic activities, a common feature of the Project's farming system needs to be mentioned, that is a reciprocal relationship between members of the farm household and their relatives in town. To put it in a nutshell, in years of favourable conditions, farmers send some of their produce to their relatives in town, while in unfavourable years they receive remittances from them.

3.2 Government subsidy schemes

An economic assessment of the existing farming system cannot neglect the influence of the Government subsidy schemes presently in force. The two main schemes predominantly designed to boost arable farming are the Accelerated Rainfed Arable Programme (ARAP) and the Arable Lands Development Programme (ALDEP). ARAP was mainly initiated by the

prevailing drought conditions of the mid eighties and subsidizes farm operations like ploughing and rowplanting, but also includes free seed supply and destumping subsidies. It is meant as a temporary support programme, while ALDEP has more a long-term feature. ALDEP has been designed to assist specifically small scale farmers by providing essential inputs that will enable them to improve their production level. Among the offered on-farm investment packages, in the context of this Project, two are of major interest, that is the animal drawn implements and the animal draft power subsidy. Qualifying farmers, and most of the Project farmers do qualify, can get an 85 percent grant against a self-contribution of 15 percent for the purchase of donkeys and all major animal drawn implements like plough, harrow, planter and cultivator. The whole package of these four implements which is required to comprehensively apply the improved cultivation methods as recommended by the Project's extension service costs appr. P 650.– of which the farmer has to pay P 98.– or an equivalent of about 4 bags of maize. A span of 6 donkeys can be purchased for appr. P 360.– or P 50.– downpayment (self-contribution) by the farmer which corresponds to roughly 2 bags of produce. In other words, under the present conditions the farmer can get a complete set of farm implements including the necessary draft power for an equivalent of 6 to 7 bags of produce or appr. 30 percent of one hectare's production under reasonable growing conditions. Both, ARAP and ALDEP, serve as means of reducing production costs rather than increasing production returns, whereby ARAP is operation oriented, while ALDEP aims at improving the general level of production technology. Considering the rather low investment costs, the low take up rate of the ALDEP packages is quite astonishing. About 45 percent of the farmers in the Project area do still not have their own draft power and the same percentage does also not have a plough, only 15 percent own a planter, and all other implements are negligible with regard to their spreading.

3.3 Social organisation of ploughing

According to the sexual division of labour in arable farming, ploughing is the task of men. Every man who is able to plough and has the necessary means for it (plough and draft power), is obliged to plough for female family members, following a socially accepted priority list.

Despite the ongoing outmigration, especially among young adult men, the traditional system of ploughing still remains. The result is, that those mainly old men, who remain in the village and still comply their duty, have to meet an increasing demand, which gets more and more difficult.

This development has basically two major consequences. First of all, it minimizes the interest of the remaining men in arable farming, because the social obligations make it impossible for them to plough just for their own interest and business. Secondly, the extent to which the social obligation is met, is naturally very low, thus also those women being served are only able to meet their subsistence level (see DORLOECHTER, 1989, p.20).

3.4 Labour shortage

A good number of farmers, especially the resource poor farmers who are predominantly women, seem to be kept in a "vicious circle of labour shortage". As they do not have sufficient labour to look after animals, it is pointless to keep any, since they will stray and some may even disappear in the bush. Without animals implements are useless and thus, no mechanization of farm operations will be adopted. This keeps the overall production and consequently the income from the arable sector low. Low income means low attractiveness and thus people, especially young ones, will continue looking for greener pastures. Consequently, the labour shortage will remain or even worsen, and the vicious circle starts again.

Any strategy aiming at the improvement of arable production, has to take this into account and must try to break this vicious circle. The social organisation of ploughing however also has to be considered. If men plough for a number of women, they should not complete the job one by one, but should plough only strips of each woman's field, following the traditional hierarchy. Usually, an area of about 1500 m2 is ploughed in a one-day's-job.

After having completed the first sequence, another strip on each field can be ploughed. This system gives every woman the advantage of different planting dates and avoids labour bottlenecks with post-planting operations.

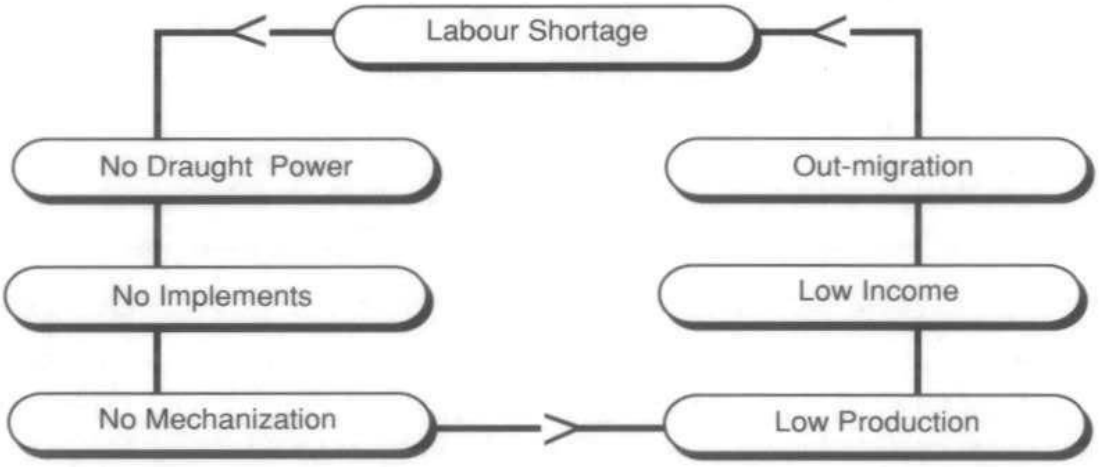

Figure 1: Vicious circle of labour shortage

4 Agriculture

4.1 Cultivation practices

The traditional cultivation system is based on flood recession and rainfed farming. The melapo (depressions) are prone to flooding from the Boro River during the period from July/August to September/October after which the floods recede. Crops are grown on the residual moisture on the fringes of the melapo and mature during the rainy season, which covers the months from December to April. Low inputs, shallow bunds, no water intake

structures, and bush fences allow farmers to be flexible and move their fields according to flooding patterns. This means, a certain area is intensively cultivated under favourable conditions, followed by periods of inundation or just fallow when the field is abandoned. Labour bottle necks do occur with ploughing and weeding operations. Apart from crop failures due to uncontrolled late floods, this system is quite appropriate, but only suitable for subsistence production.

After flood recession the land will be ploughed soon after it becomes firm enough for access. Depending on height and duration of the floods, ploughing can start at the beginning of October, but may be delayed until January or may be even not possible at all without flood protection measures. Since 1986 an area of approx. 1400 ha has been protected from uncontrolled flooding of which about 1000 ha are suitable for arable farming. Within this area most fields are protected against straying animals either by group or individual fences.

On dry melapo, ploughing will only start after sufficient rainfall, usually not before December. On average about 3 ha of molapo land are cultivated per farming household. According to the sexual division of labour in arable farming, fencing, bund construction and ploughing (planting) is the task of men, while women are responsible for all post-planting operations. Due to shortage of male labour and shortage of draft power, favourable planting conditions are often missed. Draft animals are used in a very inefficient way (6 – 8 animals per span), and access to draft power is not equitable, since only 50% of the farm households own sufficient draft animals.

The common method of planting is to broadcast a mixture of seeds before ploughing. Under pre-flooded conditions farmers usually mix maize, pumpkin, watermelon, grain and sugar sorghum. Under pure rainfed conditions a similar mixture is sown but with a greater sorghum component. Cowpeas are interplanted to a little extent under both pre-flooded and rainfed conditions. Groundnuts and millet are grown on small separate plots usually next to the islands.

Due to the planting method applied population density varies a lot and over-populated patches alternate with excessive spacing. Thinning of the crop is not practised. On a broadcasted field weeding can only be done by hand and thus is a labour bottle-neck limiting the cropped area. Especially under pre-flooded conditions farmers' yields are far from potential because of insufficient weeding. This applies particularly when large portions are ploughed and planted at the same time.

Under dry conditions (non-flooded, low rainfall), when planting is delayed and crop development is slow, plants are attacked by a great number of pests (rodents, stalkborers, cutworms, leaf-eating and sucking insects, termites and birds). After harvest, another portion of the produce is lost due to poor storage facilities.

Using traditional cultivation methods average grain yields of about 1 t/ha are obtained under favourable natural conditions. With improved cultivation methods (splitting of planting dates, row planting, control of plant population, interrow cultivation) the risk of crop failures is

reduced and average yields of about 2.5 t/ha can be achieved. Improved cultivation methods have been introduced since 1984 and have been partly adopted by 10% of the farmers so far in the Project area.

4.2 Livestock sector and draft power situation

Although the baYei (the dominant tribe) are originally not typical cattle farmers, they are increasingly involved in livestock enterprises. Cattle rearing is exclusively the task of men. About 45% of the households own cattle and about 40% do own donkeys, but there is a great overlap between cattle and donkey owners. Getting considerably exact figures on the number of cattle farmers own is always somehow a matter of "guesstimations". On the basis of data collected during a baseline survey and cross-checks with figures from vaccination campaigns, the average herd size per household over all households is appr. 9 head of cattle. As only 45 percent of all households do own cattle, the actual herd size is 20 head on average.

Cattle are used for draft power (ploughing and transportation), milk and as a source of income and security. Management is poor and no supplementary feeding is practised. During the drought years (1981–1987) the cattle population were considerably reduced and donkeys were increasingly used as draft power. The number of donkeys in the area is not known.

In order to identify problems related to animal draft power and to develop recommendations for its more efficient use, studies and field tests were conducted. The important findings are presented here, while for more detailed information the reader may be referred to the studies carried out by NÜSING (1989) and SMOTZOK (1988).

The main constraints have been identified as follows:
-lack of male labour, -lack of work oxen, -poor management of draft animals, -poor animal husbandry, -no supplementary feeding, -poor health and hygiene control, -poor training of draft animals and farmers, -inadequate equipment (harnesses, yokes), -inefficient use of available draft power (number of animals per span)

For this purpose an animal draft power training centre will be established in order to:
-train farmers on the efficient use of their animals, -train draft animals, -initiate animal draft power use, especially donkeys by women, -train farmers to make appropriate harnesses, yokes, etc. and to repair and maintain their implements.

4.3 Technical features of draft power utilization

The results of some previous tests and observations on the use of animal draft power are summarized below.

Number and type of animals per span:
The habit of using up to 8 animals per span for ploughing with a single mouldboard plough is very inefficient. No rational or technical reason could be found to justify such big spans.

Neither are the soils extremely heavy, nor are climatic conditions too harsh. This habit is based in the socio-cultural field, where tradition and status symbol play a role.

Tests have shown that a span of 4 oxen is sufficient to even pull a two-furrow plough (see fig. 3). Using a 1-furrow VS 12 plough, time consumption was most efficient with 4 oxen and increased with the number of animals (see fig. 3). This can be explained by the fact, that the draught power requirement is easily fulfilled by the span with 4 animals, hence the pulling speed is at least the same as with the bigger spans. However, those need more time for the turnings at the ends of the field. Furthermore, the relatively small standard deviation of time consumption indicates, that there is only little room for improvement. If labour was not a limiting factor, one could recommend using two ploughs and two spans with 4 animals each instead of one span consisting of 8 animals. But since traditions are more difficult to change than to introduce new technologies, we recommended the use of a 2-furrow plough to be pulled by six oxen.

In the case of donkeys, no significant difference in time could be observed with 4 and 6 animals per span respectively (see fig. 2). This can be explained by the different pulling speed of the various spans. Since 4 donkeys can just manage to pull the plough, they go slower than the span of six donkeys. However, they need less time at the turning points, which compensates for their lower speed. Very interesting is the high standard deviation of time consumption. While some spans needed only 14 hours to plough one hectare, others needed more than 30 hours. This can be caused by differences in field size and shape, soil conditions, plough condition, animal condition etc., but the same implies for the use of oxen and no such time differences could be observed. The answer can be found looking at the status of training including spanning techniques. While some farmers used proper harnesses, others used wooden yokes or just ropes around the neck of the animals. This shows, that in this region training of farmers on the use of proper spanning techniques would be most efficient, when donkeys are used.

Conclusively it can be said that a span of 4 oxen is more efficient than a span of 4, 6 or 8 donkeys. However, shortage of male labour is a problem in the area and the handling of oxen is a domain of men. Donkeys are easier to keep and to handle and may be more suitable to be used by women. So training efforts focus on the use of donkeys by women.

Type of implement:

A VS-10 two-furrow plough (approx. 50 cm working width) can be pulled by 4 strong oxen, but time saving was not as much as expected, when comparing it with a VS-12 single furrow plough (approx. 30 cm working width), see fig. 3. Working depth was approx. 15 cm with both implements. However, with the two-furrow plough the ploughing quality was much better and handling by the operator much easier, since the implement guides itself if properly adjusted. For optimal draft power utilization, a VS-10 two-furrow plough or a VS-12 single furrow plough should be used with oxen, while the smaller VS-10 single furrow plough should be used with donkeys only.

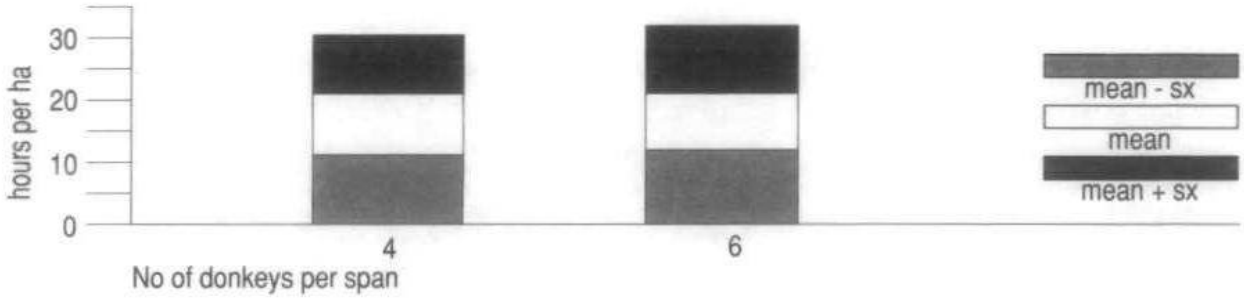

Figure 2: Time required to plough 1 ha with various spans of donkeys using a 1-furrow VS-10 plough (25 cm working width)

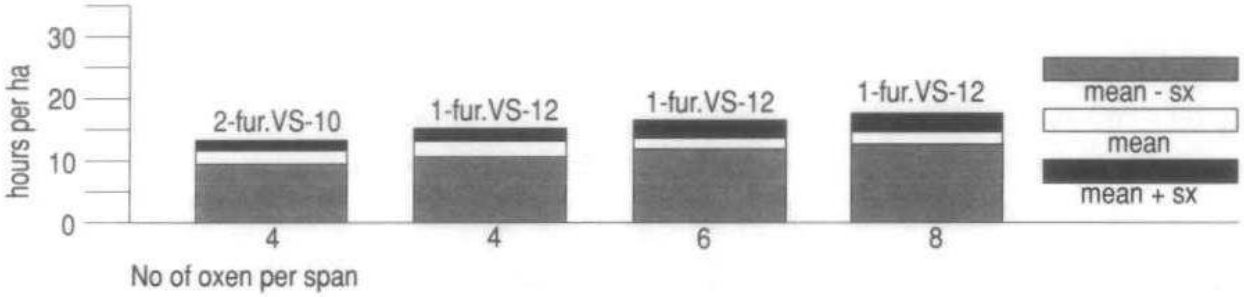

Figure 3: Time required to plough 1 ha with various spans of oxen using a 2-furrow VS-10 plough (50 cm) and a 1-furrow VS-12 (30 cm working width)

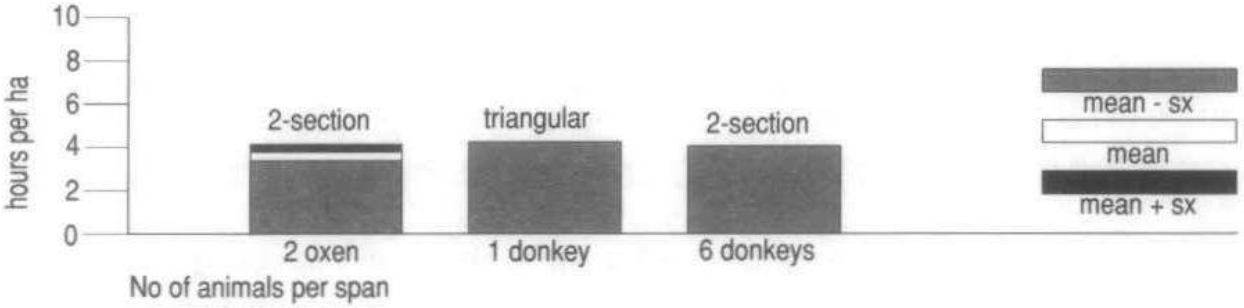

Figure 4: Time required to harrow 1 ha with various spans of animals using a 2-section (160 cm) and a triangular (140 cm) harrow

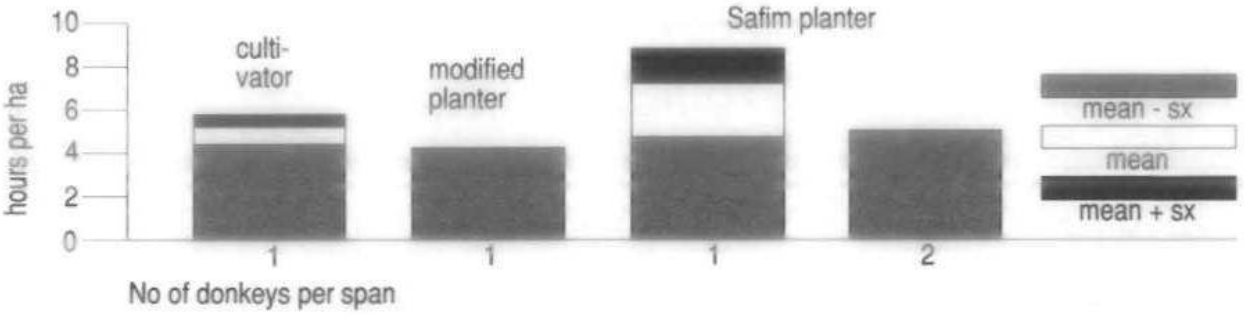

Figure 5: Time required to cultivate or plant 1 ha (80 cm row distance) with various spans of donkeys and different implements

Implements for post-ploughing operations:
The two-section light diamond harrow (160 cm working width) can easily be pulled by two oxen and proved to be sufficiently adequate for molapo soils. This harrow or even the lighter triangular harrow (140 cm) can also be recommended for the use with donkeys (see fig. 4).

The new interrow cultivator (Maun Type, 60 cm working width) has proved its efficiency in weeding for a number of years already and can easily be pulled by one donkey (see fig. 5).

Two types of row-planters are common in the area, the Sebele planter and the Safim planter. The latter is mainly used in the Project and has been equipped with row markers. A directly driven Safim planter, which has been modified by the MDP was tested successfully and can easily be pulled by one donkey. For efficiency comparison see fig. 5.

Harnessing and yoking:
Although it is very common in the area to yoke donkeys, this method is not efficient and can even cause serious injuries on the animals. The Kenya harness is quite suitable but expensive and not readily available. Leather harnesses, which should be used with donkeys, are available in different qualities and prices.

The traditional yokes used with oxen are quite adequate. Minor improvements could be made to improve the fit on the animals neck like shaping or upholstering. Also the length of the trek chains between the animals is sometimes too short.

5 Extension approach and activities

Two main aspects determining an extension approach have been considered important in designing the Project's extension service, i.e. farmers' resource endowment and their level of experience. With regard to the resource limitations, farm households within the Project area were categorised as follows:

-male labour plus own draft animals available, -male labour plus borrowed draft animals or tractor available, -only female labour plus borrowed draft animals (including male driver) or tractor available, -only female labour available without access to any type of draft power.

Since messages cannot be transferred to all farmers in one frontal attack at the same time, they have to be targeted according to the experience of the farmers. Three categories have been defined (ZICHE, 1988):

- "Beginner farmers": These farmers do not yet practise any of the recommended techniques. They are offered a "beginners package" which varies according to the labour and draft power category the farmer belongs to. Farmers will stay in the "beginners" category until they use recommended methods on at least part of their fields during two consecutive years. Then they will be invited to participate in the "advanced package".
- "Advanced farmers": These farmers are trained to adopt additional new techniques recommended in an "advanced package". Farmers will stay in the "advanced" category

until they use improved methods on at least part of their field during two consecutive years. They will then be invited to participate in the "masters package".

- "Master farmers": These farmers are trained to follow recommendations laid out in a "masters package". They are expected to use improved techniques on almost all of their fields.

In order to address farmers and to get the messages across the following extension activities were carried out:
-training courses and group demonstrations according to different farmer categories, -individual farm visits and on-farm demonstrations, -official field days.

6 Conclusions

Of the four classical means of arable production – land, labour, capital and water – labour and capital are of special concern to the people in the Project area. Shortage of labour, especially male labour, is the major problem. The average household size is rather small, the sex structure is unbalanced and the age structure clearly shows a super annuation situation. Capital as means of production occurs in the form of draft power and farm implements, and with regard to arable production both go together as complimentary goods. This fact has been taken care of by the Arable Lands Development Program (ALDEP).

However, despite the heavy subsidies on draft power and farm implements, the take-up rate of the offered support packages is low. Several explanations applicable for different categories of farmers could be given, however, the vicious circle of labour shortage (see chapter 3.4) seems to be the most prominent one.

Therefore, a new section has been established in the Project, to specifically address this issue. Training courses are being developed, which aim at getting women conversant with the use of donkeys not only for arable production, but also to facilitate their daily routine, and at the same time improve the management and efficiency of donkey utilization by removing the technical drawbacks of the presently practised form of draft power use.

Also included in the modified extension messages are recommendations regarding the social organisation of ploughing. Men are being advised not to complete their ploughing job woman by woman, but to start with one strip of each woman's field and then repeat the sequence.

7 Summary

Results presented in this paper are based on experiences gained during six years of technical assistance provided to small-scale farmers in Ngamiland East/North-eastern Botswana. This project, the Molapo Development Project, was launched at the end of 1983 and originally designed to develop technical improvements to traditionally practised "molapo farming", which is flood recession farming. However, over the years it developed more and more a farming systems' oriented approach with a bias towards arable agricultural extension work.

Most of the extension messages, disseminated to the farmers, aim at the improvement of labour efficiency by introducing improved cultivation methods (row planting, mechanized weeding) in combination with animal drawn implements. However, many farmers are not in a position to adopt those methods due to lack of draft animals.

Zusammenfassung

Die hier präsentierten Ergebnisse basieren auf sechsjährigen Erfahrungen mit Kleinbauern in Ngamiland im Nordosten Botswanas. Das hier vorgestellte Projekt, das Molapo Development Projekt, wurde Ende 1983 begonnen, um die traditionelle Anbaumethode, das "molapo farming" = Anbau nach Flutrückgang, technisch zu verbessern. Über die Jahre hat sich mehr und mehr ein Farmingsystems-Ansatz entwickelt mit Schwerpunkt auf agronomische Beratung. Die meisten der Beratungsinhalte, die hier vermittelt wurden, sollen die Arbeitseffizienz steigern durch Anwendung verbesserter Anbaumethoden (Reihenanbau, mechanisierte Unkrautbekämpfung) in Verbindung mit tiergezogenen Geräten. Aufgrund von Engpässen im Bereich der tierischen Anspannung können jedoch viele Bauern die empfohlenen Methoden nicht adoptieren.

References

1. Dorloechter, S., 1989: Women's role in Agriculture. Special Report SE-2, MDP Maun
2. Kunze, W., 1989: Socio-Economic aspects of molapo farming. Technical Notes SE-1, MDP Maun
3. Loos, H., 1990: Modification of animal drawn implements in Northern Botswana. Draught Animal News, No. 12, Centre for Tropical Medicine University of Edinburgh
4. Loos, H., 1989: Agronomy/Extension Section, Annual report. Technical Notes AE-9, MDP Maun
5. Molapo Development Project, 1990: Development Plan Third Phase (1990 – 1993), MDP Maun
6. Nuesing, J., 1989: The use of animal draught power in the Molapo Development Project. Technical Notes AE-8, MDP Maun
7. Smotzok, M., 1988: Improvement of animal draft power in the Molapo Development Project. Special Report, MDP Maun
8. Ziche, J., 1988: Extension work of the Molapo Development Project. Special Report, MDP Maun

(These references may be available from GTZ Head-Office on special request: GTZ, Abt. 105, Postfach 5180, 6236 Eschborn 1)