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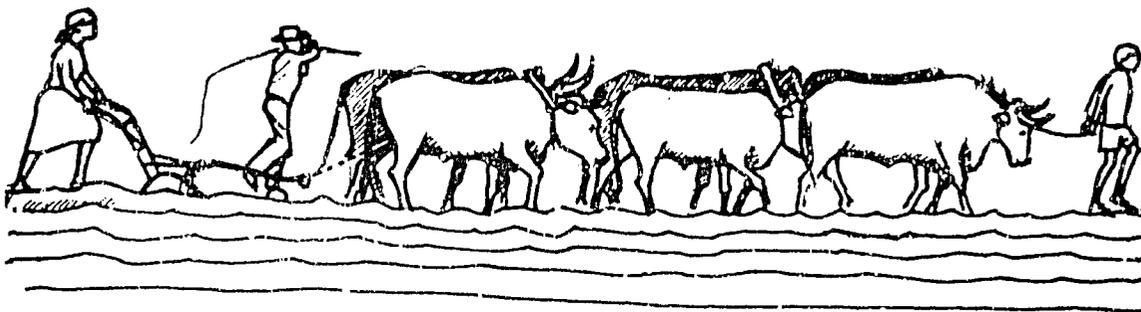
AGRICULTURAL TECHNOLOGY IMPROVEMENT PROJECT (ATIP)

TRACTION USE IN SHOSHONG AND MAKWATE

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BY

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PREFACE

ATIP working papers consist of methodological and empirical material which has been reviewed internally by ATIP. Working papers are prepared and circulated to make ATIP research findings available to GOB personnel and researchers interested in Botswana farming systems. Any interpretations, or conclusions presented do not necessarily reflect the views of the Department of Agricultural Research, USAID or MIAC.

This paper gives an overview of traction use in Shoshong and Makwate villages. The paper covers the frequency of various traction activities, differences in traction use patterns by village and household circumstances (gender of household head and cattle wealth), and the hours spent on different activities. Findings also are presented on draught access, the number of animals used, number of people, and gathering hours. For carts and tractors, information is presented on acquisition, use patterns and costs. The final chapter summarizes key findings and discusses implications for draught power policy.

The paper shows that the traditional image of traction use in Botswana -- that of a farmer using 8-10 household oxen to plough a field -- is outdated. Instead, it is shown that donkeys provided more traction hours than did cattle, more traction hours were spent on transport than on ploughing, and that traction animals and tractors were an underutilised resource. Moreover, there were substantial differences in traction use by village, month of the year and household type (as distinguished by cattle wealth, draught access, and gender of household head). The research makes it clear that draught power policy in Botswana must be reoriented to give greater emphasis to transport, carts, donkeys and tractors. Increased draught access and traction utilization rates are identified as policy priorities.

ACKNOWLEDGEMENTS

The analysis in Sections 2 through 6 is based on a series of surveys carried out between 1983 and 1986. During the 1983-84 season, animal traction use was monitored through twice-weekly visits to 27 households. During the following season, traction use patterns by a larger sample of 50 households were monitored on a monthly basis. In the same season, twice-weekly monitoring was carried out on a small sample of draught-controlling households. During the 1985-86 season, single-visit surveys were administered on cart acquisition and use and tractor acquisition and use.

David Norman gave helpful comments on the design of most of the surveys and helped supervise data processing. Jay Siebert, Fred Worman and Wayne Miller gave comments relating to the design of some of the surveys. Chada Tibone shared responsibility for supervising the 1983-84 MVRU Survey and the 1984-85 Activity Survey. Catherine Jonas helped supervise the 1986 Tractor Survey and the 1986 Cart Survey.

The following people were enumerators for the various surveys:

- (a).1983-84 MVRU Survey - C. Mahilo, K. Okaile, B. Motlhokodise
- (b).1984-85 MVRU Survey - C. Mahilo, K. Okaile
- (c).1984-85 Activity Survey - C. Tibone, R. Serumula
- (d).1985 Tractor Survey - C. Jonas
- (e).1986 Cart Survey - M. Letlola, C. Mathumo, C. Mahilo, D. Dira

Section 7 integrates findings from three additional surveys: the 1983 Crop Management Survey, the 1983 Draught Arrangements Survey, and the 1987 ARAP/Draught Relief Assessment Survey. C. Jonas and A. Caplan supervised the 1987 ARAP/DR Survey in the Mahalapye area. E. Worman and S. Bock were responsible for the ARAP/DR Survey in Tutume District. The following people were enumerators:

- (a).Crop Management Survey - M. Tjirongo, E. Modiakgotla, D. Dira, W. Keipeile
- (b).Draught Arrangement Survey - J. Lesotlho
- (c).ARAP/DR Survey (Mahalapye area) - C. Mahilo, K. Okaile, M. Letlola, I. Bane

P. Monyane and K. Seleka were responsible for data entry.

As with all farm-level research, survey respondents made the paper possible through their time and cooperation.

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1. INTRODUCTION

One of the distinctive features of Botswana farming systems, relative to most Africa farming systems, is the extensive use of animal and tractor traction. Animal traction was introduced more than 80 years ago and, except in a few areas, essentially all farming households rely on animal or, more recently, tractor traction for ploughing. Traction also is used for transport and various gathering activities. Historically, the main source of animal traction has been cattle but donkeys have been used in many villages during the last two to three decades.

In a farming systems context, animal and tractor traction can have a major impact on system productivity because of the possibility of substituting animal labour or tractor power for human labour. This is most obvious in the case of ploughing. Because most Botswana plough their fields, the average field size is larger than in most other African countries. This creates the possibility of meeting household food requirements even when yields are as low as they are in Botswana. Animal labour and tractor power also can be substituted for human labour in various household maintenance activities, most notably for firewood gathering and fetching water. Traction, of course, can also be used to pull carts and sledges, facilitating the transport of goods and people.

Despite the importance of animal and tractor traction, data are not commonly available on traction use in a whole-household context. Thus, for example, little -- if anything -- is known about relative frequencies of traction use for different activities. Nor are data available on hours animals and tractors are used for traction activities. These data, however, are useful for diagnosing farming systems problems and opportunities for improving farmer welfare. In addition, data on current traction use patterns are needed when attempting to place a value on the use of animals or tractors for additional traction activities.

In order to generate a profile of traction use patterns, the Mahalapye farming system team began monitoring draught access and traction use during the 1982-83 season. This research was in part motivated by a belief that there is a strong relationship between draught control, traction use and arable farming productivity. This relationship had been noted on several occasions in the Botswana literature (eg., FAO [1974; Oland, Alverson, Cummings [1980]; Livingstone and Srivastava [1980]; Vierich and Sheppard [1980]).

During the 1982-83 season, information on traction use patterns was generated through the 1983 Crop Management Survey. Draught access arrangements were examined through the 1983 Draught Arrangements Survey. Together, the surveys showed that tractors and donkeys were more commonly used in Shoshong and Makwate than in many other parts of the country. Both surveys also confirmed that draught control was associated with several measures of farming systems performance. Preliminary findings from those surveys were presented in ATIP Research Report Number One [ATIP, 1986]. More complete findings were given in Working Papers 16 [Baker, 1988c] and 17 [Baker, 1988d].

During the 1983-84 season, the focus of traction research was on the use of household traction animals. Twenty-seven households were monitored twice-weekly but only 13 draught-controlling households used traction on a regular basis. Therefore, during the 1984-85 season, traction use patterns were monitored twice-weekly only for a small sample of draught-controlling households. To generate a representative profile of traction use, however,

traction use frequencies and the types of traction used were monitored monthly for a larger sample of 50 households. During the 1985-86 season, traction use patterns were no longer monitored but single-visit surveys were administered on cart and tractor ownership.

Taken together, the above research has provided valuable baseline information on traction use in Shoshong and Makwate villages. This information should be of use in both technology development research and agricultural policy planning.

1.1 OBJECTIVES

The purpose of this paper is present the results of traction use research carried out during the 1983-84, 1984-85 and 1985-86 seasons. The specific objectives are as follows:

- (a).To characterize the frequencies of traction activities and the hours spent on each major activity using various types of traction.
- (b).To examine differences in traction use patterns by village location, period of the year, and household type.
- (c).To identify coefficients for budget analyses, including the typical number of people, animals, equipment and hours for various traction activities.
- (d).To identify and assess draught power policy options.

Section 2 describes the use of household traction animals during the 1983-84 season. The analysis covers the frequency of different traction activities, differences in traction use patterns by village and household circumstances (gender of head and cattle wealth), the hours spent on various activities, number of animals used and number of people.

Section 3 gives an overview of traction use during the 1984-85 season by a representative set of Shoshong and Makwate households. The analysis addresses differences by village location, period and household circumstances. Because of the survey procedures, a limited range of data were collected. Nevertheless, Section 3 complements the Section 2 in two specific areas: information is given on tractor use and uses of non-owned traction.

Section 4 presents findings on traction use during the 1984-85 season by a small sample of draught-controlling households. As in Section 2, the analysis covers the frequency of various traction activities, the hours spent on each activity, the number of animals used, and the number of people. The small, unrepresentative sample has not allowed an analysis of differences by wealth or gender of household head. Section 4 does, however, include data on animal traction gathering times. In addition, the Multiple-Visit Resource Use (MVRU) Survey data form was modified prior to the 1984-85 seasons in order to ensure more accuracy in distinguishing household from non-household uses of traction.

Sections 5 and 6 cover cart and tractor ownership, respectively. Both sections characterize acquisition methods and costs, condition and use patterns. One of the main issues addressed is the frequency of use for household versus non-household activities. Section 6, on tractors, also covers repairs and maintenance.

Section 7 summarizes some of the main findings from the earlier sections, as well as related ATJP research on traction use -- as those findings relate to draught power policy option. Several policy options are introduced and discussed. The paper ends with a brief set of recommendations on draught power policy.

1.2 METHODS

Issues relating to traction use were investigated within the overall framework of the on-farm research programme of the Mahalapye farming systems team. The Mahalapye team has used a representative village approach. Most diagnostic research has been concentrated in Shoshong and Makwate villages. Shoshong is a large village which was selected to represent the dominant pattern of cattle and tractor-based farming systems in the Central Region. Makwate is a small village with relatively little infrastructural or institutional development. Makwate was selected to represent the minority pattern of donkey-based farming systems.

The analysis in Section 2 is based on Sheet 8 of the 1983-84 ATIP Multiple-Visit Resource Use Survey: "Use of Household Animals." The MVRU Survey was administered twice-weekly from November 1983 until October 1984. On Sheet 8, respondents were asked to recall all traction activities using household animals since the prior interview. For each activity, the following data were recorded: type of animal used, the number of hours spent, number of animals, and number of people. If the traction activity was transport, the origin and destination were recorded. If traction animals were used to assist another household, the reason for the non-household use was recorded.

The analysis in Section 3 is based on Sheet B of the 1984-85 Activity Survey. In the Activity Survey, respondents were asked at the end of each month how often the members of their households used traction for fieldwork and transport. Household uses were separated from non-household uses of traction. Categorical responses were recorded, distinguishing between "not at all during the month," "one to three times during the month," "two to three times a week," "four to five times a week," and "everyday or nearly every day." Data also were collected on the combinations of traction used during the month.

Section 4 is based on Sheet 3 of the 1984-85 MVRU Survey. Sheet 3 covered all traction use, not just use of household animals, but was otherwise similar to Sheet 8 of the 1983-84 MVRU Survey. Data also were collected on animal traction gathering times. As in the previous season, the MVRU Survey was administered twice-weekly.

The samples for Sections 2 to 4 were various subsets of the ATIP cooperators in Shoshong and Makwate villages. The ATIP cooperators were selected using a two step procedure. First, a 16 question census was administered in each village in order to generate a sample frame. The census was administered in late October and early November 1982. Approximately 90 percent of households were contacted in both villages. The ATIP cooperators then were selected using stratified random sampling. Two sub-sets of cooperators were selected, one for trials and one for the MVRU Survey. The strata for the trials sub-set were based on draught access and type of traction. The strata used for the MVRU Survey sample also took into account gender of household head and cattle assets. To the extent possible, the proportion of households selected in each stratum reflected the proportion of households in that stratum in the entire population of Shoshong and Makwate villages. This was done so that weighting would not be required when aggregating

results for each village.

The data in Section 2 were collected only from the 27 households which participated in MVRU Survey. The data in Section 3 were collected from all the ATIP cooperators. The data in Section 4 were collected from a sub-set of 12 MVRU Survey households. This sample included six of seven Makwate households which had used animal traction during the 1983-84 season and five out of six Shoshong households which had regularly used animal traction during the 1983-84 season. The excluded Shoshong household was unable to arrange for draught access during the 1984-85 season. The sixth household in Shoshong was included because the household head owned a tractor.

Sections 5 and 6 are based on quota sub-samples of Shoshong and Makwate cart and tractor owners, respectively. For both surveys, sample frames of owners were compiled by ATIP village staff. The lists were randomly ordered. Owners were then contacted and interviewed until a target number of survey forms had been completed.

In the data analysis for Sections 2 and 3, households were stratified on the basis of village location, gender of household head, and cattle assets. Household head was defined on the basis of the resident head. If a recognized head was absent for the entire season, the resident head was not the same as the recognized head. Cattle assets were determined on the basis of the 1983 Crop Management Survey and verified for the MVRU sample during a Livestock Inventory Survey Administered in 1984.

2. ANIMAL TRACTION USE: 1983-84

This section presents findings on traction animal use in Shoshong and Makwate during the 1983-84 season. Section 2.2 gives an overview of the frequencies of various traction animal activities. Differences by village, type of animals, and household circumstances are discussed. Section 2.3 shows the amount of time spent on different activities: in total during the year, by month, and on average per time animals were used. Section 2.4 covers the number of animals used and the number of people who managed the traction teams.

2.2 TRACTION USE ACTIVITIES

Out of 27 households monitored during the 1983-84 season, only 17 used household traction animals at any time. Sixteen of the 17 households ploughed at least once using traction animals, and four households did not use traction animals for any activity except ploughing. Only two households used traction animals for any fieldwork activity besides ploughing.

The most common activities, in addition to ploughing, were transporting people and household goods, gathering firewood and fetching water. Twelve households regularly used traction animals for transporting people and household goods, 11 used traction animals for gathering firewood and ten used traction animals for fetching water. Traction animals were used by only five households for collecting thatch.

Table 2.1 shows the number of households which used traction animals for the various activities by village, and for different categories of households as distinguished by gender of household head and cattle assets. A somewhat higher percentage of Makwate households used traction animals for nearly all activities than did Shoshong households. This is because many households in Shoshong commonly used tractors for ploughing and transport. Also, cattle -- the main type of animal used by many Shoshong households -- tend to be used less often for activities such as gathering firewood or water.

TABLE 2.1: NUMBER OF HOUSEHOLDS DOING EACH ACTIVITY
BY VILLAGE, GENDER OF HEAD AND CATTLE ASSETS

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATH. WOOD	COLLECT THATCH	ALL
VILLAGE:								
Shoshong (17)/a	9	1	1	5	4	5	3	10
Makwate (10)	7	1	0	7	6	6	2	7
GENDER OF HEAD:								
Male (17)	13	2	1	10	8	9	4	14
Female (10)	3	0	0	2	2	2	1	3
CATTLE ASSETS:								
0-15 (10)	4	1	0	5	4	5	2	5
16-35 (5)	4	0	1	3	2	2	2	4
36-70 (5)	3	1	0	2	2	2	0	3
71+ (6)	5	0	0	2	2	2	1	5
ALL (27)	16	2	1	12	10	11	5	17

a. Total number of households per category are in parentheses.

There were substantial differences in the proportions of households using traction animals for the various activities between male-headed and female-headed households and by cattle wealth household categories. Over 80 percent of male-headed households used traction animals compared to 30 percent of female-headed households. Similarly, 75 percent of households owning more than 15 cattle used traction animals compared to 50 percent of those owning 15 or fewer cattle.

The number of times traction animals were used during the period monitored ranged from once for households which used animals at any time, up to 119 times. The average was 25 times per household for all 27 households, or 40 times each for the 17 households which ever used animals. Sixteen households -- or nearly 60 percent -- used animals less than 20 times during the year monitored. Only four households used animals an average of more than five times a month.

Data on the number of times animals were used per activity are summarized in Tables 2.2 and 2.3. Table 2.2 shows the total number of times for the entire sample. Table 2.3 gives the average number of times animals were used for each activity by households which used animals for that activity at any time. Both tables present sub-divisions by village, gender of household head and cattle wealth.

TABLE 2.2: TOTAL NUMBER OF TIMES ANIMALS WERE USED PER ACTIVITY BY VILLAGE, GENDER OF HEAD AND CATTLE ASSETS

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
VILLAGE:/a							
Shoshong	37	3	1	167	54	35	4
Makwate	95	1	0	123	60	89	3
GENDER OF HEAD:							
Male	113	4	1	210	59	105	5
Female	19	0	0	80	55	19	2
CATTLE ASSETS:							
0-15	50	1	0	106	27	78	79
16-35	24	0	1	27	10	2	2
36-70	24	3	0	78	28	36	0
71+	34	0	0	79	37	11	2
ALL	132	4	1	290	114	124	7

a. See Table 2.1 for number of households per category.

Tables 2.2 and 2.3 make it clear that transport and gathering activities accounted for most of the times that animal traction was used. Eighty percent of the times animals were used, they were used for transporting people, household goods, firewood, water or thatch. Transport of goods and people was the single most frequent activity, accounting for 43 percent of the total times animals were used. Ploughing accounted for 20 percent of the times used, closely followed in frequency by fetching water and gathering firewood. Animals were used only seven times for collecting thatch, four times for row planting, and once for harrowing.

The relative frequencies of use for various activities were significantly different by village. In Shoshong, ploughing accounted for only 12 percent of the times animals were used while 55 percent of the time animals were used for transport. In contrast in Makwate, 26 percent of the time animals were used for ploughing and only 33 percent of the time for transport. Also, animals in Makwate were used twice as often per household for gathering firewood as they were in Shoshong.

The few female-headed households that used animal traction at any time, generally used their animals more frequently than did the male-headed households. There were small differences for ploughing, gathering wood and collecting thatch, but female-headed households used animals for transport nearly twice as often as did male-headed households. Also, among households using animal traction, animals were used by female-headed households nearly four times more often for fetching water than they were by male-headed households.

TABLE 2.3: AVERAGE NUMBER OF TIMES USED PER HOUSEHOLD BY ACTIVITY, VILLAGE, GENDER OF HEAD AND CATTLE ASSETS

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
VILLAGE:/a							
Shoshong	4.1	3.0	1.0	33.4	13.5	7.0	1.3
Makwate	13.6	1.0	---	17.6	10.0	14.8	1.5
GENDER OF HEAD:							
Male	3.7	2.0	1.0	21.0	7.4	11.7	1.3
Female	6.3	---	---	40.0	27.5	9.5	2.0
CATTLE ASSETS:							
0-15	12.4	0.4	---	21.2	8.5	15.0	0.6
16-35	6.0	---	1.0	9.0	5.0	1.0	1.0
36-70	8.0	3.0	---	39.0	14.0	18.0	---
71+	6.8	---	---	15.8	18.5	5.5	2.0
ALL:							
Average	8.3	2.0	1.0	24.2	11.4	7.1	1.4
Range:							
Minimum	1	1	1	1	1	1	1
Maximum	20	3	1	72	36	25	2

a. Average number of times per household which did each activity at any time during the season. See Table 2.1 for number of households per category.

Table 2.3 shows that in Shoshong and Makwate it was the households which had the least number of cattle which ploughed most often with traction animals. This resulted from the common use of donkeys by cattle-poor households in Makwate. There were no other significant relationships between cattle wealth and the frequencies of doing various activities. However, the data in Table 2.3 suggest that households which had less than 35 cattle and did not have donkeys were the least frequent users of animal traction -- compared to either poor households which owned donkeys or to richer households.

Tables 2.4 and 2.5 summarize data on the use of traction animals by month. Table 2.4 shows the total number of times animals were used for the various activities. Table 2.5 shows the average number of times animals were used for each activity per month by households which used animals at least once for that activity during the month.

TABLE 2.4: TOTAL NUMBER OF TIMES ANIMALS WERE USED PER ACTIVITY BY MONTH

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATH. WOOD	COLLECT THATCH	ALL
November	36	1	0	6	0	4	3	50
December	46	2	0	1	0	2	0	51
January	50	1	1	11	0	0	1	64
February	0	0	0	25	16	15	0	56
March	0	0	0	40	11	14	0	65
April	0	0	0	22	15	11	3	51
May	0	0	0	46	13	17	0	76
June	0	0	0	47	21	14	0	82
July	0	0	0	37	10	21	0	68
August	0	0	0	33	22	14	0	69
September	0	0	0	7	3	10	0	20
October	0	0	0	15	3	2	0	20

TABLE 2.5: AVERAGE NUMBER OF TIMES USED PER HOUSEHOLD BY ACTIVITY AND MONTH

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
November	5.1/a	1.0	---	1.5	---	1.3	1.5
December	4.2	2.0	---	1.0	---	1.0	0.0
January	3.6	1.0	1.0	1.6	---	---	1.0
February	---	---	---	3.6	5.3	2.1	---
March	---	---	---	5.0	2.8	2.0	---
April	---	---	---	2.8	3.0	1.6	1.5
May	---	---	---	4.6	3.3	2.1	---
June	---	---	---	5.2	3.5	2.3	---
July	---	---	---	4.6	2.0	2.6	---
August	---	---	---	6.6	4.4	2.3	---
September	---	---	---	2.3	3.0	1.7	---
October	---	---	---	7.5	1.5	2.0	---

a. Average number of times for households which used at least once during the month. See Table 2.A1 for the number of households which did each activity by month.

Except for September and October, there was relatively little difference in the number of times animal traction was used each month. The mean for the other ten months was 63 times, with a coefficient of variation (CV) of only 17.5 percent. The total number of traction animals activities in September and October, however, was only 20 times per month, so the monthly average

including all months was 56 times with a CV of 34.5 percent.

All animal traction ploughing was done in November, December and January during the 1983-84 season (by the monitored households). During these three months, the households which ploughed, ploughed an average of 3.6 times in January up to 5.1 times in December. Relatively few other animal traction activities were done during the heavy ploughing period. Following January, the main use of traction animals each month was for transport and gathering activities.

Aside from the decreased use of animals traction for activities besides ploughing during the November to January period, there were no discernible seasonal patterns in the frequency of traction use activities. In general, during most of the year, animals were used for transport slightly more often than once a week, for water two to three times a month, and for firewood once or twice a month.

Table 2.6 gives follow-up information on the reasons why traction animals were used for the various activities. More than 91 percent of the time, traction animals were used in order to benefit the household. This might somewhat understate the use of animals for other households since some respondents may have failed to specify the reason for a non-household use (and therefore there was no way of determining that it was in fact a non-household use). Nevertheless, it is quite certain that traction animals were not used as a "community-wide" resource. For example, hiring out accounted for only 2.2 percent of the times that traction animals were used, and helping relatives accounted for only 2.5 percent of the times animals were used.

The only substantial non-household use of traction animals was for ploughing; accounting for just over 23 percent of the times animals were used for ploughing. The most common reason for ploughing on a non-household field was because a cooperative arrangement. In these cases, traction animals generally were used on non-household fields in order to gain access to additional labour.

TABLE 2.6: REASONS ANIMALS WERE USED BY ACTIVITY

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATH. WOOD	COLLECT THATCH	ALL
	(Number of Times Used)							
Help Household	101	4	1	269	112	120	7	614
Help Relative	6	0	0	8	2	1	0	17
Help Non-Relative	0	0	0	1	0	0	0	1
Hire Out	4	0	0	10	0	1	0	15
Coop Arrangement	21	0	0	2	0	2	0	25

Table 2.7 shows the origination and destination when the traction activity was transport of goods and people. The transport patterns differed between the villages. In Shoshong, most transport took place between the village and the lands area, or within the lands area. Transport was necessary for most households since most fields are more than 10 kilometres from the village. The cattle posts generally are even more distant from the village, but most trips to the cattle post started from the lands area.

In Makwate, most trips started from or ended-up in the village. There was

about an even split between trips to or from cattle posts versus trips to or from the lands. The lands are much closer in Makwate than in Shoshong, making it possible to commute to fields on a daily basis -- thereby reducing the need for transporting supplies to the field. Transport to another village was done only by Makwate households. These trips generally were to Machaneng, for shopping purposes.

TABLE 2.7: WHERE TRANSPORT GOODS AND PEOPLE

	---SHOSHONG---		----MAKWATE----		-----BOTH-----	
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
To/From Village	104/a	31	105	43	209	36
To/From Cattle Post	29	9	66	27	95	16
To/From Other Village	0	0	23	9	23	4
To/From/Within Lands	201	60	52	21	253	44

a. The number of times each location was either the origin or destination.

2.2 HOURS USED

This section shifts from the frequency of use for various activities to the actual number of hours spent on each activity. Tables 2.8 to 2.10 summarize data on animal traction hours by village and type of traction animal. Table 2.8 gives the total number of hours spent on each activity. Table 2.9 presents the percent of time spent on each activity for each village and animal type category. Table 2.10 shows the average hours spent on each activity. The number of observations for Tables 2.8 to 2.10 are given in Table 2.A2.

TABLE 2.8: TOTAL NUMBER OF HOURS PER ACTIVITY
BY VILLAGE AND ANIMAL TYPE

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
Shoshong:							
Cattle	163/a	0	2	60	18	2	14
Donkeys	2	5	0	372	115	84	0
Makwate							
Cattle	182	0	0	31	7	8	0
Donkeys	341	2	0	245	119	219	10
Both Villages:							
Cattle	346/b	0	2	91	26	10	14
Donkeys	342	6	0	617	234	303	10

a. See Table 2.A2 for the number of observations.

b. Totals in this and other tables might not add due to rounding.

The greatest number of hours was spent on transport, a total of 708 hours in the two villages. This was closely followed by ploughing, accounting for 688 hours. Combining transport and gathering activities, non-fieldwork uses

of traction animals accounted for 65 percent of traction hours. By traction type, non-fieldwork accounted for 29 percent of cattle traction hours and 77 percent of donkey traction hours.

Table 2.8 shows that donkeys accounted for 76 percent of all animal traction hours. Cattle and donkeys were used for almost the same number of hours for ploughing. Donkeys though provided nearly all the draught for the transport and gathering activities: 87 percent of traction hours for transport, 90 percent for fetching water, and 97 percent for gathering wood.

The percent of hours spent on the various activities was quite different between the villages for cattle versus donkeys. In Shoshong, donkeys were used exclusively for transport and gathering activities. The main use of cattle was for ploughing but 23 percent of cattle traction hours also were used for transport. In Makwate, ploughing accounted for nearly 80 percent of cattle traction hours and transport for only 14 percent. A smaller proportion of donkey hours was used for transport and gathering activities in Makwate than in Shoshong but this is because donkeys were also used for ploughing in Makwate.

TABLE 2.9: PERCENT OF HOURS PER ACTIVITY
BY VILLAGE AND ANIMAL TYPE

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
Shoshong:							
Cattle	63.0/a	0.0	0.8	23.0	7.0	0.8	5.2
Donkeys	0.3	0.7	0.0	64.0	19.9	14.5	0.0
Makwate							
Cattle	79.7	0.0	0.0	13.6	3.3	3.5	0.0
Donkeys	36.4	0.2	0.0	26.2	12.8	23.5	1.1
Both Villages:							
Cattle	71.0	0.0	0.4	18.6	5.2	2.0	2.8
Donkeys	22.6	0.4	0.0	40.8	15.5	20.1	0.7

a. See Table 2.A2 for the number of observations.

Table 2.10 shows that the average amount of time spent on ploughing was just over twice the amount of time spent on each of the various transport and gathering activities: just over 5 hours compared to around 2.5 hours. Taken activity by activity, the amount of time spent on each activity did not differ significantly for donkeys versus cattle. Since cattle were used primarily for ploughing, however, the average traction hours per use for all activities combined was 4.1 hours for cattle compared to 2.7 hours for donkeys.

TABLE 2.10: AVERAGE HOURS PER USE BY ACTIVITY, VILLAGE AND ANIMAL

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATH. WOOD	COLLECT THATCH	ALL
Shoshong:								
Cattle	4.5	---	2.0	3.0	4.5	2.0	3.4	3.9
Donkeys	2.0	1.5	---	2.5	2.3	2.5	---	2.5
Makwate:								
Cattle	6.3	---	---	2.2	1.1	2.0	---	4.2
Donkeys	5.2	1.8	---	2.3	2.3	2.6	3.3	3.0
Both Villages:								
Cattle	5.3	---	2.0	2.7	2.3	2.0	3.4	4.1
Donkeys	5.1	1.6	---	2.4	2.3	2.6	3.3	2.7

a. See Table 2.A2 for the number of observations.

Tables 2.11 to 2.13 summarize findings on traction hours by month. Table 2.11 shows the total number of hours spent on each activity by month and Table 2.12 gives the percentage of hours spent on each activity. Table 2.13 shows the average number of traction hours per household spent on the various activities, for households which did an activity in any given month.

November through January were the months with the greatest number of traction hours, strictly as a result of the time spent ploughing. There was a slight secondary peak in May and June, mainly stemming from extra transport hours. This was when several Shoshong households moved back from the lands to the village. The months with the least amount of traction hours were by far September and October. This was the slow period when all lands-related activities were completed for the 1983-84 season, and had not yet started for the 1984-85 season.

Traction hours for the transport and gathering activities were concentrated in mid-summer through mid-winter, as was noted above when discussing the frequency of traction use. During this period, there was somewhat greater monthly variation in transport traction hours than there were in the hours used for gathering firewood or fetching water.

TABLE 2.11: TOTAL NUMBER OF HOURS PER ACTIVITY BY MONTH

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATH. WOOD	COLLECT THATCH	ALL
November	215	2	0	22	0	11	8	257
December	226	3	0	4	0	5	0	238
January	248	2	2	24	0	0	1	276
February	0	0	0	60	40	37	0	136
March	0	0	0	101	30	41	0	172
April	0	0	0	74	20	29	15	137
May	0	0	0	114	34	46	0	193
June	0	0	0	116	42	33	0	191
July	0	0	0	76	40	46	0	162
August	0	0	0	77	44	31	0	152
September	0	0	0	17	6	32	0	55
October	0	0	0	25	6	3	0	35

Table 2.12 shows that ploughing accounted for around 85 to 95 percent of traction hours in November through January. In the remaining months, transport generally accounted for just over half the traction hours and gathering for the remaining hours. Except for September and October, when there were few traction hours, the percentages of traction hours spent on transport, gathering firewood and fetching water were quite similar from month to month.

TABLE 2.12: PERCENT OF HOURS SPENT ON EACH ACTIVITY BY MONTH

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
November	83.3	0.8	0.0	8.5	0.0	4.3	3.1
December	95.0	1.3	0.0	1.7	0.0	2.1	0.0
January	89.5	0.7	0.7	8.7	0.0	0.0	0.4
February	0.0	0.0	0.0	43.8	29.2	27.0	0.0
March	0.0	0.0	0.0	58.7	17.4	23.8	0.0
April	0.0	0.0	0.0	53.6	14.5	21.0	10.9
May	0.0	0.0	0.0	58.8	17.5	23.7	0.0
June	0.0	0.0	0.0	60.7	22.0	17.2	0.0
July	0.0	0.0	0.0	46.9	24.7	28.4	0.0
August	0.0	0.0	0.0	50.7	28.9	20.4	0.0
September	0.0	0.0	0.0	30.9	10.9	58.2	0.0
October	0.0	0.0	0.0	73.5	17.6	8.8	0.0

TABLE 2.13: AVERAGE HOURS USED PER HOUSEHOLD BY ACTIVITY AND MONTH

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
November	30.7	2.0	---	5.4	---	3.7	3.8
December	20.6	1.3	---	4.0	---	2.5	---
January	17.7	1.8	2.0	3.4	---	---	1.0
February	---	---	---	8.5	13.3	5.2	---
March	---	---	---	12.7	7.4	5.9	---
April	---	---	---	9.2	4.0	4.1	7.5
May	---	---	---	11.4	8.4	5.8	---
June	---	---	---	12.9	6.9	5.5	---
July	---	---	---	9.5	7.9	5.7	---
August	---	---	---	15.3	8.8	5.2	---
September	---	---	---	5.7	5.5	5.3	---
October	---	---	---	12.5	3.1	3.3	---

a. Average hours for households which used at least once during the month. See Table 2.A2 for the number of households which did each activity by month.

Table 2.13 shows that the largest number of traction hours per household on any activity were for ploughing during the months of November, December and

January. Households using traction animals to plough, ploughed an average of over 30 hours each in November and 20.6 hours in December. The greatest number of hours spent on any other activity was for transport in August, an average of 15.3 hours per household. In most months, however, transport only required nine to 12 traction hours. The smallest variation in the average number of traction hours was for gathering wood.

2.3 NUMBER OF ANIMALS AND PEOPLE

This section summarizes data on the number of animals and people used when doing the various traction activities. One objective in analysing the numbers of animals and people used is to determine appropriate numbers to use when preparing enterprise or partial budgets.

For most activities, fewer donkeys were used in a traction team than were cattle, as can be seen in Table 2.14. For example, six cattle were most frequently used for ploughing, compared to four donkeys. Either two or four donkeys were used for the various transport and gathering activities, while four or six cattle generally were used. For both cattle and donkeys, more animals usually were used when ploughing than for the other activities.

Any analysis of the number of animals by village did not reveal any significant differences. For all activities combined, Shoshong households used an average of 5.6 cattle compared to 6.5 by Makwate households. When using donkeys, Shoshong households used an average of 4.3 animals compared to 3.1 by Makwate households. There was, however, much variation and no consistent patterns from activity to activity.

TABLE 2.14: NUMBER OF TIMES DIFFERENT NUMBERS OF HOUSEHOLD ANIMALS WERE USED BY ACTIVITY AND TYPE OF ANIMAL

	PLOUGH	PLANT	HARROW	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
Cattle:							
1	3/a	--	0	0	0	0	0
3	2	--	0	0	0	0	0
4	4	--	1	16	6	3	2
6	35	--	0	15	2	2	2
8	13	--	0	3	3	0	0
10	1	--	0	0	0	0	0
12	7/b	--	0	0	0	0	0
Average	6.7	--	4.0	5.2	5.5	4.8	5.0
Donkeys:							
2	0	4	--	98	21	65	0
3	0	0	--	3	1	0	0
4	49	0	--	104	68	39	3
5	0	0	--	32	13	10	0
6	0	0	--	19	0	3	0
8	18	0	--	0	0	2	0
Average	5.1	2.0	--	3.5	3.7	3.1	4.0

a. In cases where small, odd numbers of animals were reported, household animals generally were combined with non-household animals to form a single larger team of 6 or 8 animals.

b. Two teams of six animals were used at the same time.

For purposes of enterprise analysis, it would be most appropriate to assume the use of six cattle and four donkeys, regardless of activity. The second best assumption would be eight cattle for ploughing and four cattle for transport. There is no reasonable alternative to four donkeys for ploughing, but two donkeys could reasonably be used for transport.

Table 2.15 shows the number of household members and non-members who worked with traction animals when cattle were used. The number of household members ranged from zero up to five for ploughing. For the remaining activities, at least one household member was always involved. Non-household members were involved more than half of the time traction was used for ploughing, but rarely for the other activities.

Overall, more people were involved when ploughing than for the various transport and gathering activities; just over three for ploughing compared to two to two and one-half for the other activities. It appears that the best assumption for enterprise analysis would be three people for ploughing and two people for the other activities. Although greater numbers of people were sometimes involved, this is because people tended to trade off, resting in between being actively involved.

TABLE 2.15: NUMBER OF TIMES DIFFERENT NUMBERS OF PEOPLE MANAGED CATTLE BY ACTIVITY

	PLOUGH	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
Household:					
0	9	0	0	0	0
1	14	7	5	3	0
2	12	17	5	2	2
3	18	7	1	0	2
4-5	12	3	0	0	0
Average	2.2	2.2	1.6	1.4	2.5
Non-Household:					
0	28	24	9	3	4
1	19	6	2	1	0
2	5	2	0	1	0
3	12	0	0	0	0
4-5	1	0	0	0	0
Average	1.1	0.4	0.2	0.6	0.0

Table 2.16 shows the number of people involved when using donkeys. In general, fewer people managed donkey teams than was the case for cattle teams. For example, in many cases only two people were involved with ploughing and one person for the various transport activities. Otherwise, the patterns noted for cattle held for donkey teams as well. Specifically, more people were involved when ploughing compared to other activities, and the proportion of non-household members was greater for ploughing.

The best assumptions for human labour when budgeting donkey traction use are not clear. For ploughing, either two or three people could be reasonably assumed. Based on field observations, however, two people were the most

frequent with perhaps a third person rotating in. For the other activities, one or two people might be assumed. One would perhaps be the best assumption since only one person generally is required to drive a donkey team even if two people are present.

TABLE 2.16: NUMBER OF TIMES DIFFERENT NUMBERS OF PEOPLE MANAGED DONKEYS BY ACTIVITY

	PLOUGH	TRANS- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
Household:					
0	0	5	2	3	0
1	31	202	71	70	2
2	12	42	27	35	0
3	8	4	3	10	1
4-5	16	3	0	1	0
Average	2.2	1.2	1.3	1.5	1.7
Non-Household:					
0	28	213	90	91	2
1	23	37	13	25	0
2	16	5	0	3	1
3	0	1	0	0	0
4-5	0	0	0	0	0
Average	0.8	0.2	0.1	0.3	0.7

2.4 SYNTHESIS

Only two-thirds of the 27 households monitored used traction animals during the 1983-84 season. Higher proportions of male-headed and richer households used traction animals than did female-headed and cattle-poor household respectively.

Ploughing was done by the greatest number of households but the most frequently done traction activity was transport of people and goods. Transport and gathering of firewood and water were done regularly throughout the year while ploughing was concentrated in just three months. As a result, non-fieldwork uses of traction animals accounted for nearly two-thirds of the traction hours.

Cattle and donkeys provided almost the same amount of traction hours for ploughing, but donkeys were used most of the time for transport and gathering activities. Consequently, donkeys accounted for 65 percent of the overall traction hours. The relative importance of cattle versus donkeys differed by villages.

Both cattle and donkey traction animals were underutilised throughout the year -- as indicated by the small number of hours used -- and were infrequently used to help other households. The prospects for greater utilization are greater for donkeys since they can more easily be used for non-fieldwork activities.

From a policy perspective, the main implications of the findings are that relatively more emphasis should be given to transport relative to ploughing, and to donkeys relative to cattle than is currently the case.

TABLE 2.A1: NUMBER OF HOUSEHOLDS DOING ACTIVITIES BY MONTH

	PLOUGH	PLANT	HARROW	TRANS-- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
November	7	1	0	4	0	3	2
December	11	1	0	1	0	2	0
January	14	1	1	7	0	0	1
February	0	0	0	7	3	7	0
March	0	0	0	8	4	7	0
April	0	0	0	8	5	7	2
May	0	0	0	10	4	8	0
June	0	0	0	9	6	6	0
July	0	0	0	8	5	8	0
August	0	0	0	5	5	6	0
September	0	0	0	3	1	6	0
October	0	0	0	2	2	1	0

TABLE 2.A2: NUMBER OF TIMES ACTIVITIES WERE DONE
BY VILLAGE AND TYPE OF ANIMAL

	PLOUGH	PLANT	HARROW	TRANS-- PORT	FETCH WATER	GATHER WOOD	COLLECT THATCH
Shoshong:							
Cattle	36	0	1	20	4	1	4
Donkeys	1	3	0	147	50	34	0
Makwate:							
Cattle:	29	0	0	14	7	4	0
Donkeys	66	1	0	109	53	85	3
Both:							
Cattle	65	0	1	34	11	5	4
Donkeys	67	4	0	256	103	119	3

3. TRACTION USE PATTERNS: 1984-85

When animal traction use was monitored during the 1983-84 season, only 17 of 27 households used animal traction at any time. Only 11 used traction animals on more than 20 occasions during the entire year. Because so few households regularly used animal traction, the format for monitoring traction use was changed for the 1984-85 season. Two monitoring surveys were administered. In the Activity Survey, the frequency of traction use was monitored monthly for a relatively large, representative sample of 50 households. More detailed data on traction use by 12 draught-controlling households were generated through a slightly revised MVRU Survey.

This section summarizes findings from the Activity Survey. Section 3.1 covers the frequencies of traction use for various activities. Section 3.2 shows the frequencies of use for the various types of traction used. The profile of traction use patterns should be representative of the farming population in Shoshong and Makwate.

3.1 FREQUENCIES OF USE

Frequencies of traction use by period for October 1984 to September 1985 are summarized in Table 3.1. The figures in the table refer to household-months. There were a total of 553 observations, an average of 46 per month.

TABLE 3.1: FREQUENCIES OF TRACTION USE:
OCTOBER 1984 TO SEPTEMBER 1985

	NOT AT ALL	ONCE/WEEK OR LESS	MORE THAN ONCE/WEEK
	(Pct. Household-Months)		
<u>HOUSEHOLD TRACTION</u>			
FIELDWORK:			
January to March	66	19	15
April to June	92	7	1
July to September	99	1	0
October to December	77	16	7
TRANSPORT:			
January to March	61	29	10
April to June	58	21	21
July to September	70	18	12
October to December	67	20	13
<u>NON-HOUSEHOLD TRACTION</u>			
FIELDWORK:			
January to March	87	14	0
April to June	99	1	0
July to September	100	0	0
October to December	93	5	2
TRANSPORT:			
January to March	93	7	0
April to June	88	7	5
July to September	100	0	0
October to December	86	13	1

The most common traction activity was use of household traction on transport. Some use of household traction on transport was recorded in more than 30 percent of the household-months. Few households used non-household traction for transport. The most frequent use of non-household traction for transport came in the October to December period, when several households hired transport in order to make their seasonal migration to the lands area.

Household traction was used more frequently for fieldwork than was non-household traction. Regardless of source, fieldwork uses of traction were concentrated in the early part of the cropping season. This is because traction is used almost exclusively for ploughing.

Perhaps most notable about Table 3.1 is how infrequently traction was used. Aside from household transport and a brief peak of traction use related to plowing, traction was used only irregularly. This confirms the pattern identified for the MVRU Survey sample during the 1983-84 season. In addition, no use of non-household traction was reported in more than 90 percent of the household-months. Even for household traction on transport, there were no periods of the year in which traction was used in more than a third of the household-months.

An assessment of traction use by village and household types is presented in Table 3.2. The table only distinguishes between use and non-use since few households used traction regularly.

TABLE 3.2: USED TRACTION AT LEAST ONCE DURING THE MONTH BY VILLAGE AND HOUSEHOLD TYPE

	--FIELDWORK--		--TRANSPORT--	
	HH/a	NON-HH	HH	NON-HH
	(Pct. of Household-Months)			
VILLAGE:				
Shoshong	13/b	7	27/b	10
Makwate	23	3	51	6
GENDER OF HEAD:				
Male	21/b	5	44/b	9
Female	7	6	18	7
CATTLE ASSETS:				
0-35	17	6	35	9
> 35	16	5	38	7
ALL HOUSEHOLDS	17	5	36	8

a. HH = household owned traction; NON-HH = non-household traction.

b. Proportions household-months in which traction was used are significantly different between sub-groups at >.99 confidence level.

No significant differences were found with reference to the use of non-household traction, either for fieldwork or transport. Control of cattle assets was not associated with any type of traction use. There were, however, significant differences by village and gender of household head in the use of household traction. Makwate and male-headed households used their traction more frequently than did Shoshong and female-headed

households, respectively, for both transport and fieldwork. In Makwate, household traction was used for transport in more than half of the household-months.

3.2 TYPES OF TRACTION USED

An overview of the types of traction used in 1985 is given in Table 3.3. The percentages of household-months are based only on months when any traction was used.

The most commonly used type of household traction were donkeys, for both fieldwork and transport. Donkeys were used in two-thirds of the household-months in which any household traction was used for fieldwork and were used for transport in more than 75 percent of the household months. Household cattle were used for fieldwork in nearly 30 percent of the household-months but were used little for transport.

TABLE 3.3: TYPES OF TRACTION USED WHEN USED

	-----HOUSEHOLD USE-----			-----NON-HOUSEHOLD USE----		
	DONKEY	CATTLE	TRACTOR	DONKEY	CATTLE	TRACTOR
	(Percent of Household-Months/a)					
<u>FIELDWORK</u>						
ALL	65/b	29	8	25	19	69
VILLAGE:						
Shoshong	51	36	16	19	19	73
Makwate	78	22	0	50	0	50
GENDER OF HEAD:						
Male	62	30	9	19	24	71
Female	83	17	0	36	64	0
CATTLE ASSETS:						
0-35	88	14	0	38	29	52
> 35	26	53	21	0	0	100
<u>TRANSPORT</u>						
ALL	77	14	10	81	2	17
VILLAGE:						
Shoshong	67	14	21	75	3	22
Makwate	86	14	0	100	0	0
GENDER OF HEAD:						
Male	73	15	12	79	3	18
Female	94	6	0	85	0	15
CATTLE ASSETS:						
0-35	92	8	1	84	3	13
> 35	53	23	24	75	0	25

a. Based only on household-months when any traction was used, with each activity and household versus non-household traction treated separately.

b. Proportions sum to more than 100 since some households used more than a single type of traction during any given month.

Tractors were the most frequently used non-household traction for fieldwork. Donkeys were the most common non-household traction used for transport. Household owned tractors were used only in Shoshong and by male headed and richer households, whether for fieldwork or transport. Non-household

tractors were also more commonly used for fieldwork in Shoshong and by male headed and richer households.

3.3 SYNTHESIS

Findings from the 1984-85 season confirmed several patterns identified during the 1983-84 season. For example, the figures on traction use frequencies highlighted the importance of donkey traction for cart use, both household and non-household. Also, there again were substantial differences in the types of traction used associated with village and household types. An important new finding from the 1984-85 survey was the importance of tractor hire for fieldwork.

The patterns of traction use make it clear that traction resources were underutilised. There is a need for research on post-ploughing options for the use of traction in fieldwork. It would also appear that there is less sharing of traction resources among different members of the farming community that has often been thought to be the case in Botswana. Additional information is needed on the various constraints which prevent traction owners from using their animals or tractors to help (including hiring out to other households).

4. DRAUGHT CONTROLLING HOUSEHOLDS: 1984-85

This section presents findings on traction use during the 1984-85 season by the 12 draught-controlling households. In ATIP terminology, "draught control" means that a household not only has access to draught but that it has control over decisions as to how and when draught resources are used. The 1983 Draught Arrangements Survey showed that households which use owned or managed traction have draught control [Baker, 1988c]. The same survey, as well as the 1983 Crop Management Survey [Baker, 1988d], showed, however, that draught control is not a simple issue. Several draught-controlling households, for example, use multiple traction types in any given season -- some of which might not be controlled. Also, many draught-controlling households face partial constraints on their control because they plough for relatives and neighbours.

The analysis in this section covers the frequencies of various traction activities, hours spent on different activities, number of animals used, and number of people. Because of modifications made in the survey form used for the 1984-85 season, more comprehensive data are presented on household versus non-household uses of traction, and draught access patterns (compared to Section 2). Data also are presented on animal traction gathering times.

4.1 HOW USED TRACTION

All 12 households used traction animals or tractors for household fieldwork, transport of goods and people, and gathering of water and firewood. Seven households did fieldwork for other households, five in Makwate but only two in Shoshong. Four households did transport for other households, three in Shoshong.

Traction was used more than twice as often by the Makwate households, as is shown in Table 4.1. Each Makwate household used traction an average of 123 times during the year, compared to only 52 times by Shoshong households.

TABLE 4.1: FREQUENCY OF USE FOR EACH ACTIVITY

	--FIELDWORK--		HH TRANS.	WATER & WOOD	NON-HH TRANS.	ALL
	HH	NON-HH				
TOTAL TIMES:						
Shoshong	76	17	68	119	30	310
Makwate	169	61	192	309	9	740
Both	245	78	260	428	39	1050
PERCENT OF TIMES:						
Shoshong	25	5	22	38	10	
Makwate	23	8	26	42	1	
Both	23	7	25	41	4	
TIMES PER HH:/a						
Shoshong	12.7	8.5	11.3	19.8	10.0	51.7
Makwate	28.2	12.2	32.0	51.5	9.0	123.3
Both	20.4	11.1	21.7	35.7	9.8	87.5

a. Average number of times per household which did each activity, except for "all" column which is based on all households.

Despite the difference in traction hours, the patterns of traction use by activity were quite similar in the two villages. In both villages, the most common use of traction was for gathering water and firewood. Transport and gathering activities accounted for 70 percent of the times that traction was used. Fieldwork work accounted for 30 percent, compared to only 20 percent during the 1983-84 season. Only a small part of the difference is attributable to the fact that tractor uses were monitored during the 1984-85 season as well as animal traction. The main part of the difference stems from a greater amount of post-planting rain during the 1984-85 season.

Table 4.1 clearly shows that most of the time traction animals and tractors were used, it was for the benefit of the monitored households. Nevertheless, traction was used for other households just over 20 percent of the time. This is substantially higher than the nine percent found for 1983-84 season. The higher figure for the 1984-85 season mainly is due to the sample compositions. Draught-controlling households obviously are in a better position to do traction activities for other households than are draught-dependent households.

Table 4.2 summarizes data on traction hours. Even though fewer households were monitored during the 1984-85 season, the number of traction hours reported was substantially greater than during the 1983-84 season. Somewhat more hours were spent on gathering while about the same number of hours were spent on transport. The main difference between seasons was in the hours reported for fieldwork. Nearly 1100 hours were spent on fieldwork during the 1984-85 season, or 91 hours per household. Consequently, fieldwork accounted for 50 percent of all traction hours, 38 percent on household fields and 12 percent on fields belonging to other households. In the 1983-84 season, for contrast, only 35 percent of animal traction hours were spent on fieldwork.

TABLE 4.2: HOURS SPENT ON EACH ACTIVITY

	--FIELDWORK--		HH TRANS.	WATER & WOOD	NON-HH TRANS.	ALL
	HH	NON-HH				
TOTAL HOURS:						
Shoshong	290	76	160	218	84	828
Makwate	805	271	365	598	32	2071
Both	1095	347	525	816	116	2899
PERCENT OF HOURS:						
Shoshong	35	9	19	26	10	
Makwate	39	13	18	29	2	
Both	38	12	18	28	4	
HOURS PER USE:						
Shoshong	3.8	4.5	2.4	1.8	2.8	2.7
Makwate	4.8	4.4	1.9	1.9	3.5	2.8
Both	4.5	4.4	2.0	1.9	3.0	2.8
HOURS PER HH:/a						
Shoshong	48.3	38.0	26.7	36.3	28.0	138.0
Makwate	134.2	54.2	60.8	100.0	32.0	345.2
Both	91.3	49.6	43.8	68.0	29.0	241.6

a. Average hours per household which did each activity, except for "all" column which is based on all households.

The hours per use consistently were less during the 1984-85 season. When traction was used for fieldwork, the average was 4.5 hours per use. This compares to 5.2 hours during the 1983-84 season. The difference in part stems from the inclusion of tractor ploughing during the 1984-85 season. The average time per use for transport and gathering activities was around two hours per use. This compares to about 2.5 hours per use during the previous season.

Makwate households used their traction more hours for every use. In fact, Makwate households spent nearly three times as many hours as did Shoshong households on household fieldwork, transport and gathering. The gap was much smaller for non-household traction uses.

Table 4.3 shows a profile of traction use by month, both frequencies and the number of hours used. In general, the seasonal pattern observed during the 1984-85 season was similar to that which occurred during the 1983-84 season. During November, December and January, the main use of traction was for fieldwork. During these months, the use of traction for transport and gathering activities generally was less than in the remaining months. Following January, the main uses of traction were for transport and gathering. However, unlike the 1983-84 season, traction was used for fieldwork in every month except July.

TABLE 4.3: NUMBER OF TIMES AND HOURS PER ACTIVITY BY MONTH

	--FIELDWORK--		HH	WATER	NON-HH	ALL
	HH	NON-HH	TRANS.	& WOOD	TRANS.	
NUMBER OF TIMES:						
November	46	10	30	11	0	97
December	62	4	7	26	3	102
January	96	28	7	41	0	172
February	7	3	44	26	0	80
March	9	8	35	54	11	117
April	2	4	25	56	4	110
May	15	0	36	56	6	93
June	8	1	19	25	5	58
July	0	0	8	37	1	46
August	0	5	8	28	0	41
September	0	14	16	34	2	66
October	0	1	25	34	7	67
NUMBER OF HOURS:						
November	212	48	44	24	0	328
December	271	26	5	39	3	345
January	498	172	14	71	0	755
February	27	13	86	33	0	159
March	18	45	86	92	49	290
April	4	12	76	119	12	223
May	45	0	76	131	11	263
June	18	3	50	56	15	142
July	0	0	26	76	2	104
August	0	8	20	44	0	72
September	0	18	13	65	5	101
October	0	3	30	67	19	119

There was greater seasonal variation in the 1984-85 season compared to the prior season. In January, for example, traction was used for 755 hours, more than twice as much as any other month. Throughout the year, traction was used an average of 241 hours per month, but was used for less than half that number of hours in July through October. Traction was used least often during summer in the 1984-85 season -- as opposed to spring in the 1983-84 season.

Sixteen percent of traction hours were for non-household fieldwork or transport. The reasons for non-household uses of traction are summarized in Table 4.4. For transport and fieldwork combined, hiring out and cooperative arrangements accounted for the same percentage of non-household uses. In terms of hours, cooperative arrangements were the main reason for non-household traction uses -- as it was during the 1983-84 season. However, the importance of hiring was much greater in the 1984-85 season relative to either cooperative arrangements or helping relatives than it was during the previous season. In fact, more hours were spent on non-household transport due to hiring than due to cooperative arrangements. Overall, one of the most surprising findings was how little time was spent helping relatives, less than four hours per household over the entire year.

TABLE 4.4: REASONS FOR NON-HOUSEHOLD USE

	FIELDWORK	TRANSPORT	BOTH
PERCENT OF TIMES:			
Hired Out	46	46	46
Coop Arrangement	44	49	46
Family Help	10	5	8
PERCENT OF HOURS:			
Hired Out	36	53	41
Coop Arrangement	52	41	49
Family Help	12	5	10

Table 4.5 gives follow-up information on the origin and destination in cases where people or goods were transported, or traction was used to gather water or wood. The most common use for traction was trips to cattle posts, either from the lands or the village. This is a dramatic difference from the pattern found in the 1983-84 season in which either the lands or the village were the origin or destination in most trips. The difference is partially due to the fact that 416 hours, or 51 percent of the total hours spent on non-household transport involved trips to or from cattle posts. Excluding those hours, then trips to, from or within the lands accounted for 44 percent of transport and gathering traction hours -- which is the same percentage as in the 1983-84 season. Nevertheless, transport to cattle posts was relatively more important in the 1984-85 season even when just considering household transport.

The average hours per use were the least for trips within the village and within the lands, as would be expected. Trips from villages to the lands took an average of two hours. Trips to the cattle post only took slightly longer, an average of 2.2 hours. The average time required to go to the cattle post was only as low as it was because the Makwate cattle posts are quite near the village. Most of the trips to other villages were made by Makwate households to Machaneng for shopping purposes.

TABLE 4.5: WHERE TRANSPORT GOODS, PEOPLE, WATER AND WOOD

	HH TRANS.	WATER & WOOD	NON-HH TRANS.	ALL
PERCENT OF HOURS:				
Between lands and village	42	22	30	30
To/from cattle post	48	51	30	48
To/from other village	4	4	8	4
Within lands	5	18	32	14
Within village	<1	5	0	3
HOURS PER USE:				
Between lands and village	1.9	1.9	3.2	2.0
To/from cattle post	2.1	2.1	3.6	2.2
To/from other village	3.0	3.4	9.0	3.6
Within lands	1.9	1.5	1.9	1.6
Within village	0.7	1.2	0.0	1.2

4.2 HOW GAINED ACCESS

This section turns to the issue of draught access. Table 4.6 shows just how complicated the determination of draught control can be. Of the 12 households defined to have draught control, only nine used owned traction at any time during the season and only three households just used owned traction. Three used managed traction, borrowed for the entire season. One household reported access by family help. In that case, the son of the female household head used his donkeys to help his mother throughout the season. Although he lived at a separate compound with his own family, he operated as a member of his mother's household for fieldwork and transport. Five households supplemented their traction by hiring, three obtained traction through cooperative arrangements and six entered arrangements in which they combined owned animals with animals belonging to other households in order to form a single traction team.

TABLE 4.6: NUMBER OF HOUSEHOLDS USING EACH WAY OF ACCESS:

	OWN	HIRE	COOP	FAMILY		MANAGE
			ARRANG.	COMBINE/a	HELP	
Shoshong (6)/b	4	3	1	4	1	2
Makwate (6)	5	0	2	2	0	1
Both (12)	9	3	3	6	1	3

a. Combine owned and non-owned traction to form one team.

b. Number of household monitored.

Table 4.7 shows the frequencies and hours for each way of access. Owned traction was used only 58 percent of the time. The two main alternatives to using owned traction were: (a) combining owned traction animals with those.

owned by another household to form a single team, and (b), using managed traction. In both situations, draught control generally was maintained. The was also true for the one household which frequently said access was due to family help. Five percent of the time there clearly was not draught control because of hiring or, in just a few cases, gaining access through a cooperative arrangement.

TABLE 4.7: FREQUENCIES AND HOURS FOR EACH WAY OF ACCESS

	OWN	HIRE	COOP ARRANG.	COMBINE	FAMILY HELP	MANAGE
PERCENT OF TIMES:						
Shoshong	12	2	1	26	24	36
Makwate	78	0	1	11	0	10
Both	58	1	1	16	7	18
TIMES PER HOUSEHOLD:/a						
Shoshong	9	2	4	20	75	56
Makwate	115	0	2	42	0	75
Both	68	2	3	27	75	62
PERCENT OF HOURS:						
Shoshong	10	3	2	34	21	29
Makwate	79	0	1	8	0	13
Both	59	1	1	16	6	17
HOURS PER HOUSEHOLD:/a						
Shoshong	20	8	18	72	176	123
Makwate	325	0	7	86	0	257
Both	190	8	11	77	176	157

a. Average for households which gained access in each way.

The patterns for draught access were quite different between Shoshong and Makwate. Owned traction accounted for only 10 percent of traction hours by Shoshong households, compared to 76 percent of the traction hours in Makwate. In Shoshong, combining teams, family help and managing each accounted for more than twice as many hours as using owned traction. The pattern of draught access in Shoshong was mainly attributable to three households, one male-headed and two female-headed, which worked out various arrangements with close relatives in order to establish draught control. The multiplicity of arrangements was motivated by the weakened state of cattle and a desire to gain access to donkeys for transport. The poor condition of cattle also was the reason why three Shoshong households hired tractors for ploughing.

Relationships between traction activities and draught access are summarized in Table 4.8. For all household traction activities, owned traction was the the primary mean of access. The three households which used managed traction accounted for a large share of the traction work for other households, both for fieldwork and transport. This was because these households occasionally did fieldwork or transport for the households which had loaned them the traction animals. The only hiring of traction was for fieldwork, as a supplement to use of owned traction.

TABLE 4.8: SOURCE OF TRACTION FOR EACH ACTIVITY

	OWN	HIRE	COOP		FAMILY	
			ARRANG.	COMBINE	HELP	MANAGE
	(Percent of Hours)					
HH Fieldwork	69	5	1	13	2	7
Non-HH Fieldwork	41	0	1	19	0	40
HH Transport	57	0	1	18	15	9
Water & Wood	58	0	1	18	9	13
Non-HH Transport	28	0	0	7	3	62

4.3 TRACTION TYPES

This section summarizes findings on the types of traction used. Both cattle and donkeys were used by seven households, while tractors were used by five households. Makwate households only used donkeys or cattle; three used only donkeys, one only used cattle, and one used both. The pattern was more complicated in Shoshong. One household only used donkeys, two only used tractors, and one only used cattle. One used both cattle and a tractor and one used all three types of traction. Details by household are shown in Table 4.A2.

Although several households used each type of traction, there was no comparison in the relative importance of the various types of traction. As shown in Table 4.9, donkeys were used 80 percent of the time, and accounted for 72 percent of traction hours. Donkeys were relatively more important in Makwate than in Shoshong, but even in Shoshong donkeys were the most important traction source. Cattle only were used 17 percent of the time and tractors three percent of the time. These figures both are lower than those for the larger, representative sample reported in Section 3.

TABLE 4.9: FREQUENCIES AND HOURS FOR EACH TYPE OF TRACTION

	DONKEYS	OXEN	MIXED CATTLE	TRACTORS
PERCENT OF TIMES:				
Shoshong	61	29	0	10
Makwate	88	8	4	0
Both	80	14	3	3
TIMES PER HOUSEHOLD:/a				
Shoshong	95	30	0	6
Makwate	131	28	16	0
Both	120	29	16	6
PERCENT OF HOURS:				
Shoshong	48	39	0	12
Makwate	82	11	6	0
Both	72	19	4	4
HOURS PER HOUSEHOLD:/a				
Shoshong	200	109	0	20
Makwate	342	118	64	0
Both	301	113	64	21

a. Households which used each traction type.

An attempt was made during the 1984-85 seasons, to determine how often cows were included in cattle traction team. Table 4.9 shows that in most cases when cattle were used, the teams were comprised only of oxen. Only two households, both in Makwate, sometimes included cows in their traction teams.

Table 4.10 shows which types of traction were used in relation to the means of draught access. Donkeys accounted for most of the traction hours whenever owned, managed, or family help draught was used. In the few cases when these draught-controlling households hired traction, they hired tractors. Tractors also accounted for 56 percent of the small number of traction hours in which a cooperative arrangement was the means of access. These hours were due to one household which gained access to a tractor because one of the household members was a tractor driver. The only access arrangement for which cattle were the most important traction type was combining teams.

TABLE 4.10: TYPES OF TRACTION USED THROUGH VARIOUS ACCESS ARRANGEMENTS

	DONKEYS	MIXED		TRACTORS
		OXEN	CATTLE	
	(Percent of Hours)			
Own	77	13	6	3
Hire	0	0	0	100
Coop Arrangement	34	9	0	56
Combine Teams	37	62	0	2
Family Help	100	0	0	0
Managed	86	10	4	0

Relationships between traction types and activities are summarized in Table 4.11. Donkeys were used for more than 90 percent of the traction hours spent on transport and gathering activities. Donkeys also accounted for 57 percent of traction hours spent on household fieldwork and 45 percent of hours spent on non-household fieldwork. Overall, the role of donkeys relative to cattle was even greater during the 1984-85 season than it was during the 1983-84 season.

TABLE 4.11: TYPES OF TRACTION USED FOR THE VARIOUS ACTIVITIES

	DONKEYS	MIXED		TRACTORS
		OXEN	CATTLE	
	(Percent of Hours)			
HH Fieldwork	57	31	5	7
Non-HH Fieldwork	45	35	20	0
HH Transport	91	8	0	1
Water & Wood	92	6	<1	1
Non-HH Transport	93	7	0	0

4.4 NUMBERS OF PEOPLE AND ANIMALS

This section gives an overview of the number of people and animals used when doing various traction activities. Data on the number of people are shown in Table 4.12. Table 4.13 covers the number of animals used. Both tables distinguish between cattle and donkeys.

TABLE 4.12: NUMBER OF PEOPLE BY ACTIVITY

	--FIELDWORK--		HH TRANS.	WATER & WOOD	NON-HH TRANS.	ALL
	HH	NON-HH				
DONKEYS:						
Times Use:						
1	12	8	97	120	32	269
2	55	7	52	90	4	208
3	51	13	34	96	0	194
4 or More	20	0	57	91	2	170
Average:	2.6	2.2	2.4	2.5	1.3	2.4
CATTLE:						
Times Use:						
1	10	4	3	2	0	19
2	35	17	7	18	1	78
3	30	23	3	2	0	58
4 or More	12	6	3	2	0	23
Average	2.6	2.6	2.5	2.2	2.0	2.5

During the 1984-85 season, there was little difference in the number of people whether using donkeys or cattle. Regardless of traction types or activity, approximately 2.5 people were involved when using traction animals. This average number generally includes all individuals who participated in the various activities, not just individuals who were directly involved in driving the animal traction team. In comparison to results from the 1983-84 season, slightly more people were used on average for transport and gathering activities while slightly fewer were used for fieldwork.

Fewer animals were used when using donkeys than when using cattle, regardless of the traction activity. Four donkeys generally were used for, compared to six cattle. The gap was even larger for the various transport and gathering activities. Only two donkeys were used most of the time for transport and gathering, while six cattle were used for these same activities.

Based on Tables 4.12 and 4.13, it would appear that two or three people could be used for purposes of budget analyses. Three people might be most appropriate for fieldwork and two people for the other activities. Regardless of activity, six cattle would appear to be appropriate. For donkeys, two animals should be used for gathering and transport activities, and four animals for fieldwork.

TABLE 4.13: NUMBER OF ANIMALS BY ACTIVITY

	--FIELDWORK--		HH	WATER	NON-HH	ALL
	HH	NON-HH	TRANS.	& WOOD	TRANS.	
DONKEYS:						
Times Use:						
2	14	1	177	274	7	473
3	0	0	1	12	0	13
4	102	27	54	85	14	282
5	7	0	6	18	11	42
6	0	0	2	8	6	16
8	15	0	0	0	0	15
Average	4.3	3.9	2.6	2.7	4.2	2.4
CATTLE:						
Times Use:						
4	23	24	1	2	0	50
6	64	26	13	21	0	124
8	0	0	1	1	1	3
Average	5.5	5.0	6.0	5.9	8.0	5.5

4.5 GATHERING HOURS

Few households regularly kraal their traction animals. As a result, it often is necessary to spend some time finding and collecting traction animals before they can be used. One of the objectives of the 1984-85 season was to find out how much time is spent gathering traction animals whenever they are used. Findings are summarized in Table 4.14.

TABLE 4.14: HOURS SPENT GATHERING ANIMALS BY ACTIVITY

	--FIELDWORK--		HH	WATER	NON-HH	ALL
	HH	NON-HH	TRANS.	& WOOD	TRANS.	
DONKEYS:						
Per Time Used	.73	.81	.64	.61	.45	.64
Per Animal	.17	.20	.25	.23	.11	.21
Per Hour Used	.16	.15	.33	.32	.16	.26
CATTLE:						
Per Time Used	.81	.70	1.00	.88	1.00	.80
Per Animal	.15	.14	.17	.15	.13	.15
Per Hour Used	.18	.18	.34	.38	.13	.20

Each time that animals were used an average of 40-50 minutes were spent gathering the animals. Gathering took slightly longer for cattle than for donkeys, but this was due mainly to the fact that more cattle had to be collected on most occasions. Gathering times were about half as long when animals were used for fieldwork, as compared to when they were used for transport and gathering activities. There were two reasons for the difference. First, several households did kraal their traction animals when the animals were kept in the lands area for ploughing. Second, gathering

times generally were longer during winter, when transport was the primary use of traction animals.

Table 4.14 shows that for each hour donkeys were used, 15 minutes were spent gathering them. For cattle, approximately 12 minutes were spent gathering for each hour the animals were used. The ratio for gathering hours to use hours was greater for donkeys than for cattle. Donkeys generally were used for shorter periods than were cattle. The ratios shown in Table 4.14 suggest that the amount of traction hours used in crop enterprise budgets should be increased above actual work hours by 20 to 25 percent in order to take into account gathering time.

4.6 SYNTHESIS

Findings from the 1984-85 MVRU Survey revealed similar patterns in traction use to those described in Sections 2 and 3. Transport and gathering activities were as important as fieldwork. Donkeys were a more important source of draught than either cattle or tractors. Most of the time traction was used, it was used for the benefit of the household. Significant differences were again found between Shoshong and Makwate with reference to the number of traction hours, the relative importance of various traction activities and types of traction, and the means of traction access.

Within the above pattern, there were some small differences in traction use between seasons. For example, more time was spent on non-household uses during the 1984-85 season than during the 1983-84 season. Also, fieldwork was relatively more important in the 1984-85 season, as were trips to cattle posts. Seasonal variation in traction hours was greater in the 1984-85 season than during the 1983-84 season.

The 1984-85 survey showed that even draught-controlling households can have complex draught access patterns, involving managed and combined traction teams as well as owned traction. In addition, some draught-controlling households supplemented owned traction by hiring or entering a cooperative arrangement.

Gathering time was found to be substantial, and should not be ignored when preparing crop enterprise or partial budget.

4.A1: HOUSEHOLD RESULTS FOR TRACTION ACTIVITIES

	--FIELDWORK--		HH	WATER	NON-HH	ALL
	HH	NON-HH	TRANS.	& WOOD	TRANS.	
TIMES USED:						
Shoshong:						
1	12	0	4	6	0	18
2	5	0	39	44	1	89
3	3	0	1	1	0	5
4	10	5	8	15	1	39
5	14	12	1	4	0	21
6	32	0	15	49	28	124
Makwate:						
1	25	0	77	115	0	217
2	24	3	40	50	9	126
3	43	14	6	4	0	67
4	26	1	59	108	0	194
5	21	37	3	14	0	75
6	30	6	7	18	0	61
HOURS USED:						
Shoshong:						
1	38	0	7	9	0	54
2	27	0	84	81	4	96
3	20	0	1	4	0	25
4	59	33	24	44	8	168
5	55	43	6	5	0	109
6	91	0	38	75	72	276
Makwate:						
1	113	0	153	235	0	501
2	111	13	110	155	32	421
3	228	89	14	3	0	334
4	118	3	60	126	0	307
5	86	127	10	35	0	258
6	140	39	18	44	0	250

TABLE 4.A2: HOUSEHOLD RESULTS FOR DRAUGHT ACCESS

	OWN	HIRE	COOP		FAMILY	
			ARRANG.	COMBINE	HELP	MANAGE
TIMES USED:						
Shoshong:						
1	22	0	0	0	0	0
2	11	1	0	2	75	0
3	0	1	4	0	0	0
4	0	0	0	39	0	0
5	1	0	0	18	0	12
6	2	3	0	21	0	99
Makwate:						
1	136	0	0	81	0	0
2	123	0	3	0	0	0
3	63	0	1	3	0	0
4	194	0	0	0	0	0
5	0	0	0	0	0	75
6	61	0	0	0	0	0

Continued next page

Table 4.A2 (continued)

	OWN	HIRE	COOP		FAMILY	
			ARRANG.	COMBINE	HELP	MANAGE
HOURS USED:						
Shoshong:						
1	55	0	0	0	0	0
2	13	7	0	<1	176	0
3	0	7	18	0	0	0
4	0	0	0	168	0	0
5	6	0	0	63	0	41
6	7	9	0	57	0	204
Makwate:						
1	330	0	0	170	0	0
2	411	0	11	0	0	0
3	328	0	3	3	0	0
4	307	0	0	0	0	0
5	0	0	0	0	0	257
6	250	0	0	0	0	0

TABLE 4.A3: HOUSEHOLD RESULTS FOR TRACTION TYPE

	DONKEYS	OXEN	MIXED	
			CATTLE	TRACTORS
TIMES USED:				
Shoshong:				
1	0	0	0	22
2	88	0	0	1
3	0	0	0	5
4	0	38	0	1
5	0	31	0	0
6	101	21	0	3
Makwate:				
1	217	0	0	0
2	126	0	0	0
3	0	51	16	0
4	194	0	0	0
5	55	5	15	0
6	61	0	0	0
HOURS USED:				
Shoshong:				
1	0	0	0	55
2	189	0	0	0
3	0	0	0	25
4	0	161	0	7
5	0	109	0	0
6	210	57	0	9
Makwate:				
1	500	0	0	0
2	422	0	0	0
3	0	228	106	0
4	307	0	0	0
5	229	8	21	0
6	250	0	0	0

TABLE 4.A4: FREQUENCIES FOR SOURCE OF TRACTION BY ACTIVITY

	OWN	HIRE	COOP ARRANG.	COMBINE	FAMILY HELP	MANAGE
	(Percent of Times)					
HH Fieldwork	66	2	1	16	2	14
Non-HH Fieldwork	29	0	1	17	0	52
HH Transport	63	0	1	16	13	7
Water & Wood	60	0	1	17	9	14
Non-HH Transport	23	0	0	3	3	72

TABLE 4.A5: FREQUENCIES FOR TRACTION TYPES
BY ACCESS ARRANGEMENTS

	DONKEYS	OXEN	MIXED CATTLE	TRACTORS
	(Percent of Times)			
Own	86	8	3	4
Hire	0	0	0	100
Coop Arrangement	43	14	0	57
Combine Teams	51	49	0	1
Family Help	100	0	0	0
Managed	83	9	8	0

TABLE 4.A6: FREQUENCIES FOR TRACTION TYPES
BY ACTIVITY

	DONKEYS	OXEN	MIXED CATTLE	TRACTORS
	(Percent of Times)			
HH Fieldwork	57	32	3	8
Non-HH Fieldwork	36	36	28	0
HH Transport	92	6	0	2
Water & Wood	93	5	<1	2
Non-HH Transport	97	0	0	0

5. CART OWNERSHIP

With the multi-location settlement pattern in Botswana, substantial amounts of time are spent moving between the lands and village areas, and gathering firewood and water. This was shown in Section 2 to 4. Unless carts are used, most of the time collecting firewood and water is done by women, who have substantial alternative time commitments (see ATIP [1986]). In addition, in villages such as Shoshong, lack of transport has been observed to be responsible for delays in planting and for premature abandonment of fields.

In order to assess the potential advantages of including carts in the ALDEP programme, a subject survey on cart ownership was carried out in 1986. The questionnaire covered cart acquisition, repairs and maintenance, and use patterns. Respondents also were asked whether they felt the carts had helped their households and whether they would like to see carts included in ALDEP. Fifty-two cart-owning households were included in the survey.

This section summarizes findings from the Cart Ownership Survey. Section 5.2 is on cart acquisition. Section 5.3 characterizes the condition and current value of carts. Section 5.4 is on use patterns.

5.1 CART ACQUISITION AND VALUE

Findings on cart acquisition are summarized in Table 5.1. The data distinguish between Shoshong and Makwate households and between households having 15 or less cattle versus those with more cattle. Nearly all the households were male headed, so a sexual sub-division has not been included.

TABLE 5.1: CART ACQUISITION

	-----VILLAGE-----		----CATTLE----		ALL
	SHOSHONG	MAKWATE	0-15	16+	
NUMBER OF HOUSEHOLDS	34	18	30	22	52
YEARS SINCE OBTAINED	9	7	10	7	9
HOW OBTAINED (%HH):					
Purchase	100	61	83	91	87
Gift	0	11	3	5	4
Homemade	0	28	13	5	9
FROM WHOM OBTAINED (%HH):					
Trader	71	53	63	68	65
Another Farmer	24	33	30	23	27
Outside Botswana	6	13	7	9	8
IF PURCHASED:					
Price (Pula)	440	288	312	506	400
% Purchased New	76	50	63	73	67
How Get Money (%HH):					
Sell Livestock	53	27	25	71	47
Wage Employment	27	73	50	24	38
Other	20	0	25	5	15

The responding households had obtained their carts an average of nine years prior to the survey. Only two-thirds of the carts were obtained new. Most of the carts were purchased. A few were received as gifts and nine percent were homemade. Carts obtained new usually were purchased from traders or from outside Botswana. More than a quarter of the carts had been purchased used from other farmers.

The average price of carts (at the time of purchase) was P400. Shoshong and cattle-rich households spent more on their carts, reflecting the purchase of new carts and the relatively greater use of four-wheel as opposed to two-wheel carts. When carts were purchased, the money generally came from livestock sales or from wage employment. It would be difficult for households without many cattle or a wage employee to generate the cash necessary to purchase a cart.

5.2 CART CONDITION ASSESSMENT

As part of the survey, cart owners and the ATIP enumerators carried out a joint assessment of cart condition. Findings are summarized in Table 5.2

TABLE 5.2: CONDITION OF CARTS

	-----VILLAGE-----		----CATTLE----		ALL
	SHOSHONG	MAKWATE	0-15	16+	
	(Percent of Carts)				
AGE OF CART:					
< 5 Years	38	39	43	32	38
5-10 Years	38	17	27	36	31
11-20 Years	18	22	17	23	19
> 20 Years	6	22	13	9	12
CONDITION OF WHEELS/a:					
Poor	23	8	29	0	18
Fair	58	59	54	67	57
Good	19	29	18	33	23
BODY CONDITION:					
Poor	15	29	21	20	20
Fair	57	29	46	47	45
Good	27	41	32	33	32
RIGING CONDITION:					
Poor	32	35	41	17	33
Fair	55	47	41	75	50
Good	14	18	18	8	15
OVERALL CONDITION:					
Poor	27	29	36	13	27
Fair	50	53	43	67	50
Good	23	18	21	20	20
CURRENT VALUE (PULA)/b	356	221	249	391	309

a. Joint assessment by ATIP enumerator and the cart owner.

Thirty-one percent of the carts were more than ten years old, and this was reflected in the condition assessments. Seventy-five percent of the carts were judged to be in only poor or fair condition. The condition of the rigging was most often in poor condition. The carts owned by richer households were consistently judged to be in better condition. Except for

the wheels, there were relatively minor differences in the conditions assessments between villages.

The cart owners were asked to estimate the amount they could get for their cart if they were to sell it. The average estimated current value was P309, approximately 75 percent of the average acquisition price. The carts owned by Makwate and cattle-poor households had lower estimated current values, but the gap between the acquisition and current value was also smaller for those households. Four-wheel carts were worth more, particularly four-wheel tractor carts. Tractor carts were worth an average of P728, compared to P306 for four-wheel donkey carts and only P198 for two-wheel donkey carts.

5.3 CART USE

Cart owners were asked whether they have ever used their carts to gather firewood or water, or for transport to and from the lands, cattle posts, traders or other villages. They were also asked to distinguish between household use, use for the purpose of helping relatives or friends, and use on a fee basis. Results are shown in Table 5.3.

TABLE 5.3: CART USE ACTIVITIES

	-----VILLAGE-----		-----CATTLE-----		ALL
	SHOSHONG	MAKWATE	0-15	16+	
(Percent of Households)					
<u>HOUSEHOLD USE</u>					
GATHER:					
Firewood	100	100	100	100	100
Water	85	78	80	86	83
TRANSPORT:					
T/f Lands	97	100	100	96	98
T/f Cattle Post	44	50	27/c	73	46
T/f Traders	71	89	80	73	77
T/f Other Village	32/a	94	60	46	54
<u>HELP FRIENDS/RELATIVES</u>					
GATHER:					
Firewood	41/a	83	53	59	56
Water	35	44	37	41	39
TRANSPORT:					
T/f Lands	44	72	57	50	54
T/f Cattle Post	9	28	10	23	15
T/f Traders	32	33	37	27	33
T/f Other Village	12/a	50	23	27	25
<u>USE ON A FEE BASIS</u>					
GATHER:					
Firewood	65	78	67	73	70
Water	53/a	11	47	27	38
TRANSPORT:					
T/f Lands	53/b	22	47	36	42
T/f Cattle Post	18	17	17	18	17
T/f Traders	53	33	50	41	45
T/f Other Village	11/a	50	23	27	25

- a. Differences between villages significant at .99 level.
 b. Difference between villages significant at .95 level.
 c. Difference between poor and rich significant at .99 level.

The main cart activities were gathering firewood and water for household use, and transporting household members and goods between the village and lands areas. Carts had been used by only half the owners in order to move between the village and cattle post or to go to another village. Less than half the cart owners had ever used their carts on a fee basis for any activity except collecting firewood. Seventy percent had collected firewood on a fee basis. For most activities, even fewer owners had used their carts to help relatives or friends.

More owners in Mawkate had used their carts for nearly all the household and help activities. More Shoshong owners had used their carts on a fee basis. A greater proportion of richer households had used their carts to go to their cattle posts, mainly because poor households often do not have cattle posts. Otherwise there were not significant differences in use patterns associated with household cattle assets.

Information on the frequency of cart use per month, regardless of the reason for use, is presented in Table 5.4. The most frequent use was for transport between the village and lands area. Households in Makwate used their carts an average of 15 times a month to go to the lands. The second most frequent activity was collecting water, followed by gathering firewood. Carts were used more frequently in Makwate than in Shoshong for all activities. Aside from transport to cattle posts, there were not significant differences in the frequency of use associated with cattle assets.

TABLE 5.4: FREQUENCY OF CART USE PER MONTH

	-----VILLAGE-----		----CATTLE----		ALL
	SHOSHONG	MAKWATE	0-15	16+	
	(Times Use Per Month)				
GATHER:					
Firewood	3.1	5.3	3.3	4.0	3.7
Water	4.8	10.0	7.3	5.7	6.7
TRANSPORT:					
T/f Lands	3.6	15.4	7.8	7.6	7.8
T/f Cattle Post	1.4	2.2	0.5	3.3	1.7
T/f Traders	1.2	1.2	1.4	1.0	1.2
T/f Other Vil.	0.4	0.6	0.7	0.1	0.5

5.4 SYNTHESIS

Most carts were old and were not in particularly good condition. Nevertheless, carts were used regularly for collecting firewood and water, and transporting goods and people. As a result, cart ownership assists farmers greatly. This is reflected in farmers' assessments of carts. Of the 52 owners interviewed, every one said that their cart was a major help to the household, and that their neighbours would be better off if they had carts as well. Every respondent also agreed that carts should be included in the ALDEP programme. In fact, nearly all the owners even said that they would buy a newer cart if carts were included in ALDEP. Carts are a good investment for farmers, even without any subsidy, because they can be used for many years and retain a large share of their acquisition price even when quite old.

6. TRACTOR OWNERSHIP

Tractors likely will be the traction of the future in Botswana but, at present, appear to be an underutilised resource. Therefore, research on tractor ownership was carried out in 1986 in order to evaluate how to help tractor owners provide a better service to tractor hirers.

Research on tractors started with a Setswana language record book. Forty-four record books were distributed to 34 tractor owners. The participating owners were selected on a quota basis from a sample frame of owners assembled by ATIP village staff. Mixed results were obtained with the record books. Most owners recorded some information but only a small portion did a complete job recording. Because of the problems with record keeping, a Tractor Owner Survey was administered covering tractor acquisition, maintenance and repairs, and use patterns. The questionnaire was administered to 22 tractor owners.

This section summarizes findings from the Tractor Owner Survey. Section 6.1 characterizes tractor acquisition patterns. Section 6.2 is on tractor use patterns. Section 6.3 is on tractor repairs and maintenance.

6.1 TRACTOR ACQUISITION

Findings on tractor acquisition are summarized in Table 6.1. The average age of tractors was 13 years. The current owners obtained their tractors an average of eight years prior to the survey. Only one-third of the tractors were obtained new. Nearly all the tractors were purchased and most were purchased from traders in Botswana. One-quarter of the owners had purchased their tractors in South Africa.

TABLE 6.1: TRACTOR ACQUISITION

NUMBER OF HOUSEHOLDS	22		
YEARS SINCE:		IF PURCHASED:	
Obtained	8	Price (Pula)	5397
Manufactured	13	% New	33
HOW OBTAINED (%HH):		How Get Money (%HH):	
Purchase	92	Sell Livestock	82
Inheritance	8	Wage Employment	18
FROM WHOM (%HH):		CURRENT VALUE	6095
Trader	67		
Other Farmer	8		
Outside Botswana	25		

The average purchase price was P5397. Most owners got the money to buy their tractor by selling cattle. The rest saved money from wage employment. The average current value of tractors was estimated to be P6095.

6.2 TRACTOR USE

Findings on tractor use patterns are presented in Table 6.2. The main uses of tractors were for ploughing, transport to the lands and cattle posts, and to gather firewood. Less than half of the tractor owners had ever used their tractors for row planting, harrowing, gathering thatch, picking supplies from traders, or going to other villages.

TABLE 6.2: TRACTOR USE ACTIVITIES

	HH USE	HELP OTHERS	FEE BASIS	TIMES PER MONTH
	(Percent of Owners)			
GATHER:				
Firewood	92	17	33	0.7
Water	63	13	0	3.4
Thatch	29	9	17	<0.1
FIELDWORK:				
Plough	96	13	96	18.9
Plant/Harrow	38	4	17	4.7
Destump/Fence	67	0	29	0.1
TRANSPORT:				
T/f Lands	96	0	29	3.3
T/f Cattle Post	88	0	8	1.1
T/f Traders	4	0	9	0.1
T/f Other Village	38	4	8	0.1

Tractors rarely had been used to help relatives or friends. Less than twenty percent of the owners had ever collected firewood or ploughed to help others, and these were the most common help activities. About the only activity commonly done on a fee basis was ploughing. Most tractor owners had ploughed on a fee basis at some time. However, nearly all the owners said that they do not like to hire out, even for ploughing. Nineteen said they were worried that their tractors would wear out too quickly if they used them on a fee basis.

The fourth column in Table 6.2 shows the estimated frequency of use per month, regardless of reason for use. The most common activity was ploughing during the plough-planting months (October to February). Twenty-one of the owners said that they use their tractors primarily during the cropping season. Throughout the rest of the year, tractors were used most frequently for collecting water and going to the lands. Even these activities, however, were done just over three times a month, on average.

6.3 REPAIRS AND MAINTENANCE

Each owner was asked to describe any major breakdowns or repairs during the time records were kept. In most cases, this was a period of eight months before the survey. Findings are shown in Table 6.3.

Several owners reported that they had experienced one or more major breakdowns. Nearly a third of the tractors had had major engine damage, a third had broken down due to electrical systems problems, and another third

had had problems due to broken fuel or water pumps or leaky gaskets. As a result, 19 of 22 owners reported that their tractors had been unusable at some time. Half of the owners said that their tractors had broken down for more than a month. This was a particular problem because most of the breakdowns came during the ploughing season.

TABLE 6.3: TRACTOR BREAKDOWNS AND MAINTENANCE

	NUMBER		NUMBER
MAIN BREAKDOWNS:/a			
Engine Damage	7	Drive Train	2
Electrical System	7	Hydraulics	2
Pump/Gasket Failure	8		
TIME BROKEN DOWN:			
< 1 Week	3	> 1 to 2 Months	8
1 Week to 1 Month	5	> 2 Months	3
MAIN REPAIRS:			
Engine Overall	7	Gear Box	2
Wheel Bearings	4	Clutch Plate	2
Replace Starter	3	Generator	2
Replace Water Pump	3		
WHO MADE REPAIRS:/b			
Household Members	5	Non-HH Mem.-Free	5
Business	13	Non-HH Mem.-Wage	2

- a. All responses refer to the period during which owners kept records. In most cases, this was a period of eight months before the survey.
- b. Sums to more than 22 since some owners had repairs made by more than one source.

To keep their tractors running, the owners had had to make several major repairs. Nearly a third of the owners said that they had had the engine of their tractor overhauled during the year preceding the survey. In most cases, repairs were made by professional mechanics. To get major repairs done, it generally was necessary to get the tractor into Mahalapye (around 50 kilometres from Shoshong, where most tractors were located).

Because of the severity of maintenance problems, most owners stressed improved service facilities and access to spares when asked about priorities for government assistance. Half the owners said there was a need for well-equipped local garages or, failing that, for mobile mechanics. Half the owners also recommended that the government should either subsidize the cost of spares and repairs or should somehow regulate prices to keep them lower. A third of the owners said that lack of spares, not the price of spares, was their main problem. Finally, a third of the owners recommended that the government consider subsidize the cost of diesel used for tractors.

6.4 SYNTHESIS

Tractors were tremendously underutilised. The main reason is that many of them were in poor condition. Breakdowns occurred frequently. When the tractors were running, owners were too worried about breakdowns to feel free to use their tractors on a fee basis. Fear of breakdowns definitely has

limited the response of tractor owners to the government tractor hire schemes (Drought Relief and ARAP) and has reduced the effectiveness of those programmes. By increasing the effective demand for tractor services but not addressing constraints on the supply of tractor services, the government has created a gap which is either not being filled or is being filled by large scale, commercial farmers from both Botswana and South Africa. This has important equity implications which should be addressed.

7. OBSERVATIONS ON DRAUGHT POWER POLICY

The Ministry of Agriculture currently is trying to establish an appropriate set of policies for draught power. The over-riding draught power policy issue is the incentives structure to be established for different types of traction and means of draught access. This importance of this issue obviously stems from the financial costs of the various subsidies now being provided through several farmer assistance programmes.

This section identifies and comments on draught power policy issues. Section 7.1 characterizes recent trends in draught power use and summarizes findings on the impacts of the ARAP and DR ploughing subsidies. Section 7.2 identifies and discusses various policy options. Section 7.3 gives recommendations on policy priorities.

The observations presented in this section are based on findings from several surveys conducted between 1982 and 1987. The surveys which most directly addressed issues relating to draught power policy were the 1983 Crop Management Survey, the 1983 Draught Arrangements Survey, the 1983-84 and 1984-85 MVRU Survey, the 1985 Management Information for Plough-Planting Survey, the 1986 Tractor Owner Survey, the 1986 Cart Owner Survey, and the 1987 ARAP/DR Assessment Survey.

7.1 DIAGNOSIS OF PATTERNS AND TRENDS

Over the past six years, four subject matter areas have been investigated which directly impact on draught power policy:

- (a). How are household animals used for traction purposes?
- (b). What have been trends in traction use and draught access for ploughing?
- (c). What is the availability of tractors and how much are they being used?
- (d). What has been the effect of the ploughing subsidies under Drought Relief and ARAP?

This section reviews findings presented in the previous sections and in other ATIP reports.

7.1.1 Use of Household Animals

As Section 2 to 4 showed, the main use of traction animals is for transporting people, goods, firewood and water. Section 2, for example, showed that during the 1983-84 season 66 percent of animal traction hours were for transport. Moreover, traction is used for transport throughout the year while ploughing is concentrated in three months. Thus draught power policy should address transport uses, not just ploughing.

There are several constraints on using cattle for traction and, therefore, draught power policy might encourage increased use of donkeys instead of cattle for traction. For example, cattle are not widely used for transport, in part because ox carts have become rare. As a result, traction cattle are not used during most of the year, but maintaining oxen for animals decreases the reproductive capacity of a herd (relative to keeping cows instead). Also, traction cattle are used for only a few years since farmers fear reduced beef sale value if they use their cattle for more than two or three years [Baker, 1988c]. Households using cattle use more animals when ploughing than do donkey-using households, increasing the financial cost per

traction team.

Except in years following drought, farmers express little concern with strength of animals, so subsidies for supplemental feeding would not be a top priority policy issue. There has been more interest feeding during the last few years because of the drought, but this is unlikely to persist [Baker, 1988e].

Little training is done of either cattle or donkeys [Baker, 1988c]. This constrains the possibility of row planting, particularly for cattle traction users. The possibility of row planting is greater when using donkeys.

Nearly half the farming households plough for others, including around 75 percent of those who used owned or borrowed traction. But, according to a 1983 survey, only 15 percent hire out and only 17 percent plough for non-relatives [Baker, 1988d]. The minimal use of traction for non-household uses was confirmed during monitoring in both the 1983-83 and 1984-85 season, as discussed above in Section 2 to 4. Thus, there is a small pool of people who are willing and able to hire out traction animals. Tractor owners also hesitate to hire on a fee basis, as shown in Section 6. This creates major draught access problems. Creating improved draught access should be a focus of draught power policy, as is further explained below.

7.1.2 Traction Use and Draught Access for Ploughing

During drought the use of cattle dropped dramatically while use of tractors increased. For example, agricultural statistics data for the Mahalapye agricultural districts show that cattle use fell from 54 to 16 percent of households between 1980 and 1986; meanwhile tractor use increased from 35 to nearly 70 percent of households [Baker, 1988a]. At least in the Mahalapye area, tractor use took one jump in 83-84 due to Drought Relief and another jump in 85-86 due to ARAP.

The extent of the shift to tractors has differed significantly by agricultural region. For example, the 1987 ARAP/DR Survey showed that 65 percent of households in the Mahalapye area did at least some ploughing with tractors, compared to 46 percent in Tutume District [Baker, Bock, Worman, 1988]. Differences in the types of traction used actually is village related -- not district related. For example, in Shoshong during 1983 only nine percent of households used donkeys, compared to 78 percent in Makwate [Baker, 1988d]. During the same year, 54 percent of Shoshong households used tractors, compared to two percent in Makwate. Thus, the effects of draught power policy, as it relate to the incentives to use different types of traction, will differ significantly across villages, let alone districts.

The recent trends in traction use can be expected to have a significant impact on the productivity and development of the agricultural sector because of the characteristics of different traction types. For example, respondents to the 1983 Draught Arrangements Survey reported that donkeys are easier to use and have more stamina than cattle, but are slow and might not be able to plough heavy soils [Baker, 1988c]. Cattle are seen as being faster than donkeys but are difficult to use for row planting, and are often available for hire only late in season. Farmers like tractors because they can get their ploughing done fast, taking advantage of limited number of days with good soil moisture. The biggest problem with tractors is their expense.

Corresponding to the shift in type of traction used, there has been a decrease in the proportion of households using owned traction. For example,

agricultural statistics data for the Mahalapye districts show that use of owned traction fell from 40 to 26 percent of households between 1980 and 1986, while hiring increased from 37 to 62 percent of households [Baker, 1988a].

The trend away from control of draught resources probably is a more important policy problem than is the shift in the types of traction being used (although the two obviously are interrelated issues). For example, there is substantial evidence that draught-dependent households (regardless of traction type used) tend to plough later and to plough on fewer days each season, both of which increase risk. Regression analysis of data from a 1983 survey showed that use of owned traction has a significant positive effect on both days of ploughing and hectares ploughed (relative to hiring or use of a cooperative arrangement) [Baker, 1988c].

Traction access has a larger significance than just its effect on current productivity. For one reason, lack of traction control is significantly correlated with gender of the household head and cattle wealth. In a 1983 survey, for example, only 20 percent of female-headed households used owned traction, compared to 55 percent of male-headed households [Baker, 1988d]. Similarly, 26 percent of those with less than 16 cattle used owned traction, compared to 57 percent of those with more than 15 cattle. Thus, the equity implications of draught power policies affecting access need to be considered.

The potential impact of access on the incentives to use improved practices also needs to be considered. At least in the Central Region, draught access is significantly related to use of progressive tillage and planting practices, particularly early planting, harrowing and row planting [Baker, 1988d]. In trials, the implementation success rate was much higher for both row planting and double ploughing for draught owners [Baker, 1988b]. Thus, policies which increase control of traction resources should have a positive effect on the probability that farmers will adopt improved practices.

7.1.3 Availability and Use of Tractors

The increasing use of tractors raises the issue of whether existing tractor resources are sufficient. In ATIP villages in the Central Region, only six percent of households had tractors. In most other parts of the country, even smaller percentages of farmers own tractors.

Thus, an important policy issue is whether the limited pool of tractor owners can be expected to meet the demand for custom hire ploughing. Data collected from a small sample of owners in 1986 suggests this is unlikely. As described in Section 6, most of the tractors were old and a majority had been unusable at some time during the season preceding the survey. Consequently, one objectives of draught power policy should be keeping the limited pool of tractors in better working condition.

Even when tractors are working, they are tremendously underutilised. The main use of tractors is for ploughing -- which is of course quite seasonal. The 1986 tractor survey showed that tractors often are used for transport to the lands or to cattle posts, and for gathering firewood. However, tractors are used less frequently for these activities than are donkey carts. Also, most tractor owners expressed concern about hiring out their tractors. While nearly all had ploughed for hire on a fee basis, most owners said they would prefer not to hire out even for ploughing. Since owner demand for tractor services are limited, most tractors are used only a few times a month outside of the ploughing season. Unless tractors can be more fully

utilised, it seem unlikely that support for tractors will be profitable from an economic (domestic resource cost) standpoint.

7.1.4 Impact of Ploughing Subsidies

Perhaps the dominant draught power policy issue is the impact of the recent ploughing subsidy programmes, and what should be done about them. This policy issue involves several questions:

- (a). Who has been getting the money?
- (b). Has the area ploughed increased?
- (c). Has production increased?
- (d). Has there been a bias in who has benefited?
- (e). Have the subsidies stimulated a shift away from use of owned traction?

Findings from a 1987 survey in the Mahalapye area and Tutume District shed light on these questions [Baker, Bock, Worman, 1988].

Regression analysis was used to address several questions in order to control for location, wealth and season effects. The regression analyses showed that the ploughing subsidy did not have a significant effect on the probability of not using any owned draught. At the same time, the subsidy increased the probability of using a tractor by 38 percent. In other words, farmers who could have ploughed with owned animals most likely still did so. But many supplemented owned traction with tractor hire.

The 1987 survey showed that the area ploughed (by sampled farmers) under ARAP averaged 5.4 hectare in the 1986-87 season and 4 hectares in the 1985-86 season. However, not all of this area was in addition to what the farmers would have ploughed on their own. That is, there was some substitution in which the government paid for ploughing which would have been done anyway in absence of the subsidy. Therefore, the regression analysis (which controlled for season, location and several socio-economic variables) showed that participation in the ploughing programmes increased the area ploughed per farmer by 3.5 hectares.

There was a big difference in the area effect of the subsidies by location. For example, in Tutume District only 15 percent said they would have ploughed less area without the programmes, but in Central Region, 65 percent would have ploughed less. Thus, even if there was a national food security reason for encouraging more area to be ploughed, the effectiveness of subsidies in accomplishing this objective differs by region. In the Tutume District, for example, most farmers use owned cattle and they did not increase the area ploughed hardly at all. In the Central Region, however, where there is a much greater dependence on hiring tractors, the area effect was quite substantial.

Special steps to ensure the area ploughed under a subsidy programme is actually ploughed should not be a major policy issue. The 1987 survey showed that 90 percent of the farmers planted all area ploughed under the ARAP and Drought Relief ploughing programmes. Planting all the area which was ploughed was more of a problem in tractor-dominated areas than in areas dominated by animal traction. For example, in Tutume District, 98 percent of the households planted all the area ploughed under the subsidy programmes, compared to 79 percent in the Mahalapye area.

While it is clear the ploughing programmes led to a substantial areas increase, there was no impact on production, again as determined by a

regression analysis; nor was there any impact on the probability of getting any production. This, of course, only shows that the ploughing subsidy did not pay for itself during the past drought years. More importantly, the subsidy likely would not pay for itself even in good rainfall season. To show this, one can use data from the 1987 survey. Based on that data, the effective price to the government per extra hectare ploughed was around 77 pula (5.4 hectares paid for divided by the net increase of 3.5 hectares, multiple by P50). To recover this amount, average yields would have to be 275 kgs/ha (at 28t/kg for sorghum) -- not counting the domestic resource cost of any equipment used and assuming a zero social opportunity cost for labour and land. Since yields do not average 275 kgs/ha, and there certainly is a non-zero economic cost for land, labour and implements -- the ploughing subsidy would not pay for itself even if average yields expected in better seasons were to be obtained.

Thus, a major political decision which must be made in order to guide draught power policy making is whether the government is willing to pursue an uneconomic programme for the policy objective of increasing the proportion of foodgrain needs which are met from domestic production. It should not be expected that the programme will actually stimulate enough extra production to pay for the social cost of the subsidy.

In addition to the production benefit of the ploughing subsidies, equity effects should be taken into account. The evidence which is available does not suggest there are major problems with the programmes from an equity standpoint. For example, knowledge of the programmes and levels of participation were about the same regardless of wealth or gender of household head. However, richer farmers did tend to plough more area under the programmes, thus receiving a disproportionate share of the subsidy.

A related equity issue is who actually is receiving the money from the subsidies. The 1987 survey showed that 54 percent of households used the subsidy to to hire traction and 54 percent used to plough on their own. (Sums to more than 100 percent because some households used the programmes both to hire and to pay themselves.) In this sense, the ARAP format was much better in spreading benefits than was the Drought Relief format.

There were major differences in who received the money by location. For example, only 29 of households used the subsidies to plough on their own in the Mahalapye area, while 74 percent used the programmes to hire. In Tutume District, 71 percent used the programmes to plough on their own and only 40 percent used the programmes to hire to hire.

Some farmers reported they had problems relying on hired traction, adding an extra equity dimension. In the Mahalapye area, for example, 21 percent of programme participants said they had a hard time finding someone to do the ploughing, 29 percent said that the ploughing was not done when scheduled, and 24 percent said the ploughing was not done when the field moisture was good. Overall, however, most programme participants did not feel there were major problems arranging for ploughing to be done.

In 1987, farmers were asked to assess the value of the various assistance programmes and to make suggestions about possible changes. Discussions of policy options might take advantage of the farmers' viewpoints, since they are ultimately the main client of the programmes. Despite some problems, the ARAP ploughing programme was by far ranked by farmers as being the most valuable farmer assistance programme. The ARAP ploughing programme was also ranked as the top priority for future programme participation (cited at the top priority more than five times more often than any other programme). Thus, as least during drought, farmers believe that the ploughing subsidy is

the most helpful assistance programme. This would caution against too abrupt a withdrawal of the subsidy.

The main recommendation of the farmers was to increase the level of the subsidy payment. Two other common suggestions were to provide government tractor services and to increase the ploughing hectareage limit. Some survey respondents also suggested providing subsidies for buying tractors, and establishing rules for the people who are receiving payments for hiring out.

For ALDEP, the most common farmer recommendation was to end the required deposits. Several respondents also said that more emphasis should be given to making sure the equipment and supplies to be purchased under ALDEP are actually available (and can be transported to the village).

7.2 DRAUGHT POWER POLICY OPTIONS

This section identifies priority issues to be considered when formulating a draught power policy and gives comments on some specific policy options.

7.2.1 Review of Priority Issues

Several issues should be considered when formulating a draught power policy. This section identifies eight main issues.

Perhaps the main challenge facing the Ministry of Agriculture is to help farmers best cope with the rapidly changing patterns of traction use and draught access. This requires sufficient policy analysis to identify which trends should be supported and which should be discouraged. While most people would agree that draught control should be encouraged (as opposed to draught hiring), there probably is less agreement about the relative encouragement to be given to cattle versus tractors versus donkeys.

Many concerns have been raised about the trend toward tractor hire, relating both to the domestic resource cost and the equity effects of having so much government money go to relatively few tractor owners. On the other side of the issue, the trend toward tractor hire provides an opportunity to impact on many farmers by concentrating on developing appropriate implements and practices for a much smaller number of farmers. Moreover, the control, speed and draught power of tractors creates several additional options for field operations such as sub-soiling, stubble sweeping and inter-row cultivating.

Although donkeys are slow and are not that widely used, use of donkeys has several advantages, particularly for the poor. For example, timing of ploughing can be better controlled and more area often can be ploughed than when one hires traction. An entire donkey team costs only the equivalent of one ox or cow. Moreover, donkeys survive better in drought and generally require less management. Row planting can be done with one or two donkeys, while row planting with untrained oxen is impractical. Finally donkeys can be used throughout the year to pull carts, reducing household labour requirements.

A second key issue is how to improve utilisation of available animals and tractors. By increasing the demand for tractor services but not addressing constraints on the supply of tractor service, a gap has been created which is not being adequately filled.

A third draught power policy issue is how to facilitate the recovery of productive assets lost during the drought. This is a priority in order to decrease dependence on the government, as well as to conserve future government resources. This suggests that greater emphasis might be given to the subsidization of draught animals under ALDEP, and to making sure ploughing subsidies are used for own ploughing -- if possible. At the same time, many farmers simply do not have the resources to plough on their own and will need some sort of subsidy if they are ever to begin to build their own productivity capacity.

A fourth key issue is whether it makes sense to have general purpose programmes open to all farmers. The findings summarized above make it clear that the ploughing subsidies have different effects on different farmers and in different locations. Also, as a comparison of Section 3 and 4 make clear, patterns of traction use by draught-controlling households are substantially different from those of draught-dependent households. If it is politically feasible, the programmes could be targeted in order to maximize their benefit relative to the money invested.

A closely related, fifth, issue is what can be done for the intermediate farmers. Intermediate farmers, as identified in the last NDP, are those whose consistently cultivate more than ten hectares, often own or hire tractors, and intentionally try to produce a surplus for sale. The intermediate traditional farmers account for most production from the traditional sector, and are one of the best prospects for achieving a greater degree of food grain self-sufficiency. The government might find that it makes sense to develop a specially targeted programme relating to tractors for the intermediate farmers, while having an animal traction focused policy for the majority of traditional farmers.

A sixth issue stems from the multiplicity of programmes affecting draught access and traction use. There currently are too many packages and subsidies for too many farmers. This leads to a financial drain, and overwhelms ADs. Also, farmers are confused about the different programmes and the requirements for different programmes. Therefore, an attempt should be made to eliminate overlap and to then make well-known the provisions of any policy which is developed.

A seventh issue is how best to increase input access. The various subsidies do not address constraints on input access. This applies to tractors for hire, to the purchase of traction animals, and to the availability of carts and field implements. A draught power policy needs to go beyond the provision of financial subsidies, and address the support systems for input distribution.

An eighth issue is the equity trade-off associated with different levels of subsidies, downpayments and area amounts. In general, rich, draught-controlling households benefit more than do poor households from programmes with large limits, and from programmes having downpayments. At the same time, the rich, draught-controlling households have the greatest potential to contributing to national food production goals. Thus, hard decisions may have to be made about the balance between equity objectives and food self-sufficiency objectives.

7.2.2 Comments on Options

Several specific policy options might be considered as part of an overall draught power policy. This section identifies eight specific options, and gives comments on their relative value.

- (a). Government hire scheme. Government purchase of tractors for the purpose of a government custom hire ploughing service has been suggested by several farmers. Such a scheme was tried in the 1960s drought and then abandoned. The record of these schemes in Africa has not been good and there is no particular reason to believe that such schemes could work well in Botswana.
- (b). Changing the area for ploughing scheme. As discussed above, reducing the area would appear to be a good option to begin reducing the ploughing subsidy. This would ensure all farmers can plough a minimum amount, while reducing unneeded subsidies for larger-scale producers.
- (c). Changing the level of the ploughing payment. This would be a reasonable option, but would most negatively affect the poorest farmers. It might make more sense, as an alternative, to completely eliminate payments for richer farmers while retaining near complete payment levels for poor farmers. In any event, inflation will erode the real value of future payments even if the nominal rate is not reduced.
- (d). Changing the level of the ALDEP downpayments. The donkey downpayment does cause problems and could usefully be reduced. There would not seem to be any great disadvantage since donkeys are used solely for traction purposes. There would appear to be little rationale for reducing the cattle subsidy for traction purposes. It might be useful to reduce cattle subsidies to allow farmers to rebuild their herds -- but this would be to benefit the livestock enterprise not arable farming (and therefore would not really belong in an ALDEP programme).
- (e). Interventions to improve support services. Support services mainly refer to input supply and maintenance. This would seem to be a top priority for taking better advantage of existing draught resources, particularly tractors but also traction animals. Spares for tractors, implements and carts are needed. Availability would seem to be a greater problem than price, so caution would be warranted in immediately turning to a subsidy approach. Perhaps subsidies could be used to encourage distribution through mobile traders.
- (f). Improve programme management and regulation. Reducing the cost to the government of administering the various subsidies should be a top priority. Also, there is a need to minimize overlap and confusion. It might be better to give certain minimal levels of cash based on household circumstances, and allow slippage into other household activities, than to spend so many resources on verification. One option might be to give "script" for a certain number of hectares, and then allow farmers to sell the script if they wish. If the script were not worth anything unless the ploughing was done, the area expansion effect would be there. The production benefit would likely be increased since only the better farmers would consider buying the "script."
- (g). Develop subsidies for tractor owners. The benefits of tractors should not be ignored. A key is to make sure Botswana nationals are the ones who benefit from any programmes. There probably should be some type

of quid pro quo to ensure that better tractor services are provided in exchange for government assistance. It would not make economic sense to subsidize tractor owners if the intent of the owners was to use the tractors primarily for their own farming operation.

7.3 RECOMMENDATIONS ON PRIORITIES

The Ministry should make promotion of donkey traction a top priority. Options to help intermediate farmers (and households lacking labour resources) to best take advantage of the speed and draught of tractors would be another priority. A key is to identify policy options which stimulate increased utilisation of private-sector custom hire services. Support systems for tractor maintenance are perhaps the key. There seems to be little justification for a policy oriented toward improving or maintaining the traditional oxen-based ploughing system.

Because the ploughing subsidy cannot be expected to pay for itself, it should be phased down and eventually eliminated. The equity effects of an abrupt halt would be quite severe, as would the potential loss in national production. In phasing out, one could either reduce the level of the subsidy or the amount of area which could be ploughed under the subsidy. From the ALDEP experience, it is clear that any cash contribution is difficult for poor households to manage. Thus, it would appear best if a certain minimum area could be subsidized, perhaps five or six hectares. This would allow all farmers to get some ploughing done, while the better and richer farmers certainly would not stop at five or six hectares just because that is all the subsidy covered.

To further reduce the cost of the ploughing subsidy, subsidies could be targeted using the same qualifications as the ALDEP programme. This would improve equity effects, but probably would have an insignificant impact on the area ploughed (since richer farmers can afford to hire if necessary).

Given the importance of tractors, and some of the advantages of tractors, it would seem that some programmes should be developed in support of tractor owners. Primary emphasis should be given to increasing utilisation rates from the existing pool of tractors. Training courses for tractor repair should be expanded at the RTCs. A consultancy should be commissioned to analyse the domestic resource cost of using tractors versus animals. In country tractor assembly or government importation and resale might make it possible to increase the supply of tractors without a large, permanent drain on government resources.

Given the value of carts for several household transport and gathering activities, subsidies for cart acquisition certainly would appear to be warranted.

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