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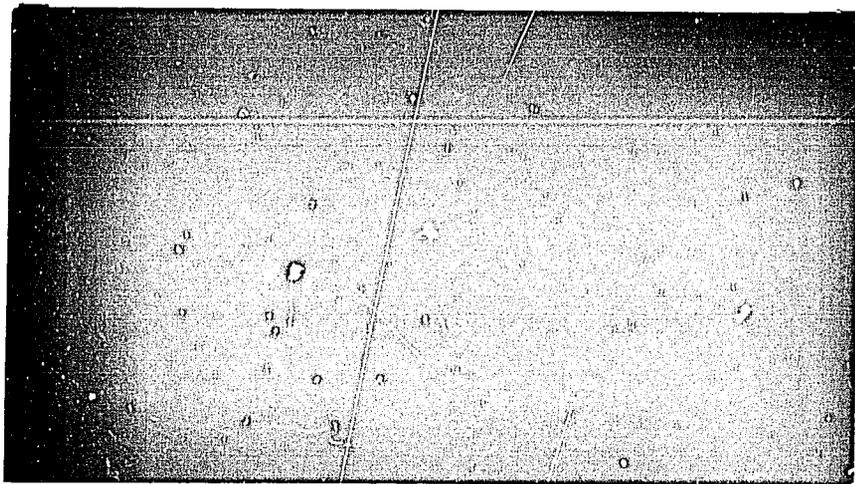
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Botswana
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PLANNING FOR AGRICULTURE IN BOTSWANA
A REPORT ON THE
ARABLE LANDS SURVEY

BY
MARCIA ODELL

RESEARCH PAPER NO.7
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TABLE OF CONTENTS

	<u>Page</u>
Foreword	i
ALS Map	iii
<u>SECTION</u>	
I Household Profile	1
II Implements and Inputs	8
III Farming Practices	19
IV Draft Power	26
V Extension	36
VI Labor	43
VII Land	53
VIII Soil and Land Improvement, Water Resources ..	62
IX Yields	68
<u>APPENDIX</u>	
I Mokatako (Rolong)	A-1
II Pelotshetlha (Ngwaketse)	A-5
III Mathothwana and Mokgosi	A-11
IV Dikwididi	A-23
V Moiyabana and Tlhabala.. .. .	A-27
VI Sechele.. .. .	A-35
VII Kalkfontein	A-38
VIII Kang.. .. .	A-46
IX Ngamiland	A-54
X Methodological Note.. .. .	A-75
XI Lands Area Agricultural Survey Questionnaire.	A-78
SELECTED BIBLIOGRAPHY.. .. .	A-87

LIST OF TABLES

<u>TABLE</u>		<u>Page</u>
1	Cattle Distribution, Comparative Data	2
2	Arable Lands Survey: Household Profile	4
3	Implements Owned or Used in Arable Agriculture by Farming Households	9
4	Implement Securement Arrangements	10
5	Incidence of Plowing; Households Using Own Implements, and Cattle Ownership	10
6	Area Plowed	11
7	Households Using Improved Seed and Fertilizers	12
8	Arable Lands Survey: Implements and Inputs	15
9	Improved Agricultural Practices Regularly Used by Households	20
10	Arable Lands Survey: Farming Practices	23
11	Distribution of Households by Type of Draft Power Used	27
12	Distribution of Households Using Different Types of Plowing Arrangements with Draft Cattle	28
13	Plowing Dates Using Different Types of Plowing Arrangements with Draft Cattle	30
14	Average Acreage Plowed by Plowing Arrangements	30
15	Arable Lands Survey: Draft Power	32
16	Farm Families and Personal Contact with Extension Agents	37
17	Arable Lands Survey: Extension	41
18	Average Per Hectare Labor Utilization (Man/Days) for the Production of Selected Crops by Agricultural Activity, 1977/78	43
19	Arable Lands Survey: Labour	46
20	Consideration of Land Sufficiency	53
21	Distribution of Agricultural Holders by Hectarage Planted	54
22	Distribution of Agricultural Holders by Hectarage Planted and Herd Size	55
23	Reported Pressure on Land, by District	56
24	Constraints to Production	57
25	Arable Lands Survey: Land	59
26	Arable Lands Survey: Soil and Land Improvement, Water	65
27	Annual Variations in Hectarage Planted of Major Crops, 1967/68 - 1971/72	68
28	Arable Lands Survey: Yields/Productivity	71

F O R E W O R D

Arable Lands Survey

The IDM has seen the role of policy research as an important if not crucial function in the overall promotion of development management. Policy research has an action orientation; it attempts to find answers to practical questions that concern decision makers in policy formulation and in program execution.

Several years ago the IDM had discussions with key individuals in the Botswana Government about ways in which we could contribute, by means of practical research, towards the development of policies in the priority area of rural development. These discussions were extremely beneficial in helping to identify specific questions and issues affecting rural development in Botswana. From these discussions we decided to undertake a research study of the factors affecting arable agriculture in Botswana.

Little was known about actual conditions affecting arable development in Botswana particularly for the range of situations presented by a large country of such varied geographical conditions. The last major study of an arable area in Botswana was in 1974 for the Pelotshetlha area. It was decided in consultation with the Ministry of Agriculture and various districts, to survey some nine areas with arable potential for intensive field research. This approach was taken in order to develop a more comprehensive picture of the arable lands situation of Botswana, particularly from a socio-economic perspective.

The earlier Pelotshetlha field survey questionnaire was the basic instrument used in this survey: firstly, because it dealt with arable agriculture and was well designed and field tested; secondly, because it would permit the inclusion and comparison of the Pelotshetlha data with that of other districts throughout the country. In addition the Ngamiland District was undertaking its own survey and incorporated parts of the Arable Lands Survey questionnaire. In total, field data on 1650 rural households are analyzed in this study, 1271 households surveyed in September to December, 1978, plus 379 households surveyed in 1974.

The survey data were first presented to district personnel at the National District Development Committee meetings in Gaborone in December 1979 in the form of computer printout data on the lands areas surveyed in each district. The districts had the opportunity to analyze the data and to submit their comments and observations on the validity and reliability of the data at a national workshop on the Arable Lands Survey which was held in Molepolole in February of this year. The Districts' comments and observations are extremely helpful in this written presentation of the analysis. The Districts' comments are also reproduced as Appendices I-IX of this report.

The study's methodology is discussed in Appendix X but a few observations should be made at this point. The nine arable lands areas surveyed were fully enumerated in this study. The areas surveyed were identified on the basis that they typified arable areas in the various districts. The sampling frame was not intended to be a national sample based on random selection of households in each of the districts. We feel the results give a good comparative analysis of conditions affecting representative lands areas throughout the country. An additional advantage of selecting specific areas for full enumeration is that it establishes base line references which can later be checked to see how programs have affected arable farming practices.

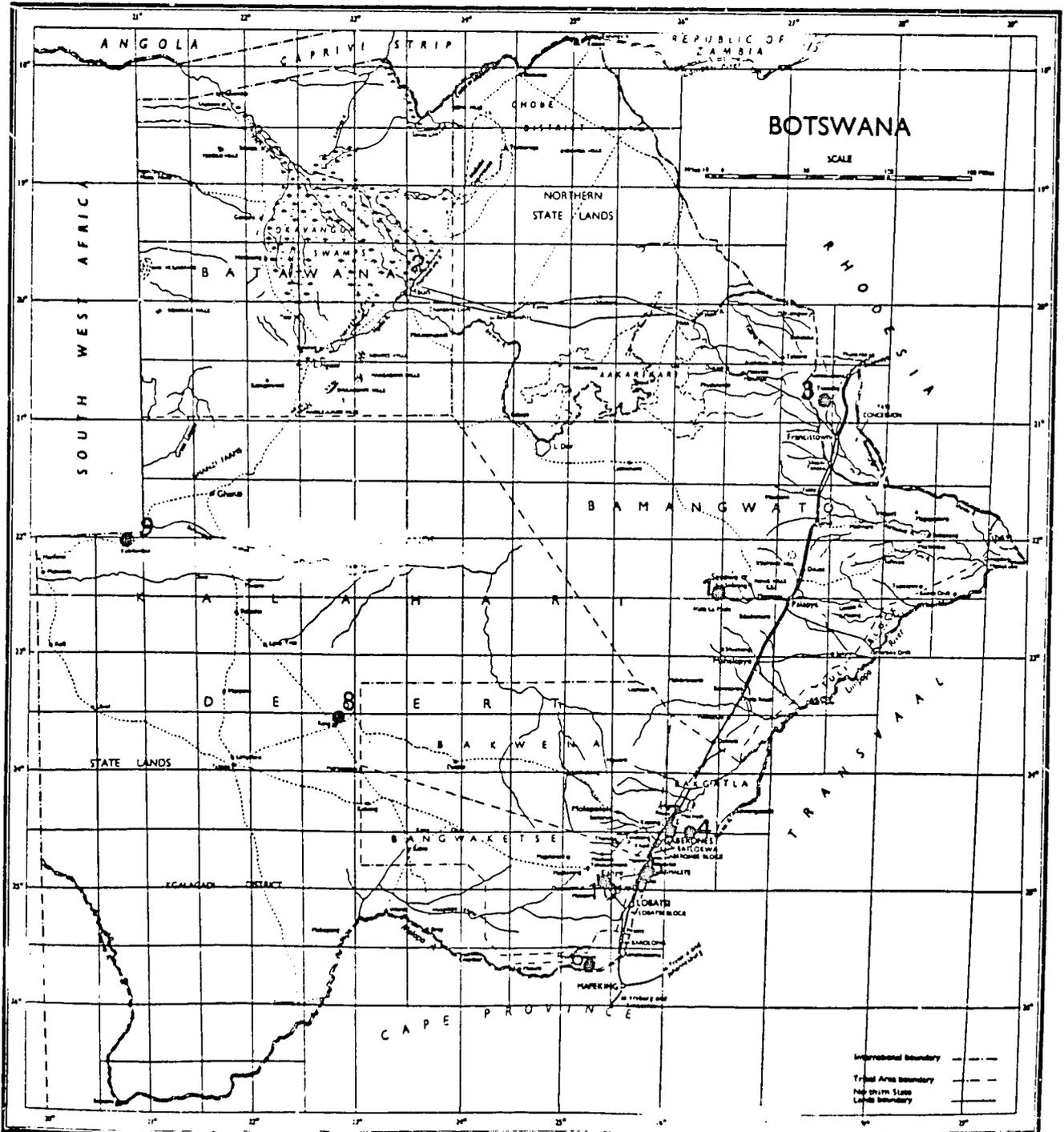
This study has received financial support from the International Development Research Centre and USAID. We have greatly benefited by the close collaboration and support provided by several Government Ministries, in particular the Ministry of Agriculture, both in planning the study and in the actual conduct of the field research. People in the Districts have also greatly assisted our efforts and they in turn are one of the principal client groups of the findings of this research. The list of people who have made valuable contributions to this work is very long but a few names should be noted: Peter Molosi, B.K. Temane, James Leach, George Haythorne, Jim Katarobo, Hoyt Alverson, Ray Purcell, Mac Odell, Clive Lightfoot, Bonnake Tsimako and Fred Schindeler.

The principal researcher, Marcia Odell, deserves special appreciation for her dedication and resourcefulness in carrying out this very demanding research project.

J.G. Campbell,
Assistant Director/ Research
and Consultancy.

ARABLE LANDS SURVEY 1978

1. Moijabana & Tlhabala (Central)
2. Maun (Ngamiland)
3. Sechele (N.E. District)
4. Dikwididi (Kgatleng)
5. Mokgosi (Bamalete)
6. Mokatako (Barolong)
7. Matholwane (Tlokwen)
8. Kang (Kgalagedi)
9. Kalkfontein (Ghanzi)
10. Pelotshetlha (Ngwaketse)



I. HOUSEHOLD PROFILE

Background

Definitions of variables of household structure and characteristics are notoriously varied within the literature on Botswana and thus it is difficult to compare the household attributes of different studies. Nevertheless attention here is drawn to findings of several studies concerning two key variables, sex of the household head and household livestock holdings, in an attempt to provide some context against which the Arable Lands Survey findings can be placed.

The FAO Study of Constraints on Agricultural Production found that 70% of households are headed by a male, 30% by a female (FAO 1974:31). These figures differ substantially from those of the Rural Income Distribution Survey (RIDS) which suggest that more than two-fifths of households (43%) are headed by women (RIDS 1975); in subsequent analysis of the RIDS data, however, Kossoudji and Mueller point out that only 29% of households sampled by RIDS were actually headed by a female with no adult male present in the household. They argue that the presence or absence in a household of a male, rather than household female headedness, per se, may be the crucial factor in defining and examining the female-headed household. (Kossoudji and Mueller 1979)

As for livestock holdings in Botswana, again, there is considerable variation in the findings of different studies. The Ministry of Agriculture's statistics unit found in 1979 that 32% of households held no cattle, while the Agricultural Study of 1971/72 indicated a similar figure of 30%. In contrast, the Rural Income Distribution Survey found that nearly half (45%) of rural households do not own cattle. This difference can in large part be explained by the fact that, once again, definitions between the agricultural studies and RIDS differed. To quote one explanation:

... MOA studies use the same definition (livestock held or managed by the household, and including mafisa cattle on short or long-term loan), while RIDS sought to distinguish actual ownership, which does not include all cattle held under mafisa or other loan arrangements... (RSU 1980: 6)

The distribution of livestock among households with livestock, however, shows more consistency among studies than do figures reflecting no cattle ownership/holdership. Data from two national surveys are presented in the following table.

Table 1

Cattle Distribution

Comparative Data

Herd Size (No. of head)	RIDS 1974/75	Ag Survey 1971/72
0	45%	30%
1- 10	20%	20%
11- 20	15%	17%
21- 40	10%	19%
41- 60	4%	8%
61- 80	2%	4%
81-100	1%	1%
101+	3%	2%

Source: RIDS 1976: 111; Agricultural Survey 1973: 53.

The Arable Lands Survey Results

The following table summarizes findings concerning the households sampled in each study area. Data touch not only upon the sex of household head and cattle holdership, but also upon the place where livestock are held and the general wealth of farming households.

The Arable Lands Survey highlights the diversity of household characteristics in different lands areas across the country. Female-headed households comprise 52% of households in Mokotako (Barolong Farms), for example, but only 10% of households in Pelotshetla (Ngwaketse area). The proportion of residents with no formal education is 58% in Pelotshetla, but only 8% in Sechele (Northeast District). As for livestock, only 7% of households in Pelotshetla own no cattle or smallstock, while that figure jumps to 42% in Kalkfontein (Ghanzi District). Likewise, while all but 13% of Pelotshetla's population keep cattle at the lands -- cattle which can presumably provide draft power for plowing -- nearly three-quarters (71%) of households in Sechele are without any cattle at their lands. Median household wealth varies from P500 in Kalkfontein to more than P2 300 in Pelotshetla, with the average value of household farm equip-

ment ranging from P36 in Kalkfontein, to P507 in Mathotwana (Batlokwa area).^{1/}

In addition, however, there are some more or less common characteristics among the households surveyed. Family members have generally had little formal education and, on the whole, are relatively poor. The median household owns altogether perhaps 9 head of cattle and 3 or 4 goats or sheep. At best only 4-5 head of cattle are kept at the lands, along with a goat or two. The value of farm equipment owned by the median household is only about P35, with total household wealth little more than P1 000.^{2/}

Obviously any arable lands development program aimed at assisting the majority of Botswana's farmers will have to reckon with the fact that many farmers currently depend upon very meager resources, indeed. Despite the fact that farmers in some areas (Pelotshetla, for instance) are generally wealthier than those in others, by and large, many households engaged in crop production will almost certainly be unable or unwilling to make substantial cash outlays for new implements to expand their limited farm assets, or for inputs, even if subsidized by government. Accordingly, the Arable Lands Development Programme (ALDEF) planners, who are focussing on developing technical packages to meet the needs of different groups of farmers, should give special, careful attention to ways of maximizing the utility of limited equipment without taxing further a household's cash resources.

^{1/} The value of farm equipment (tractor, plow, planter, cultivator, etc.) was estimated at 50% of 1978 market prices. A working tractor was arbitrarily valued at P3 750. The value of a borehole owned by a household was included in farm equipment assets and valued at P4 000.

^{2/} Household wealth, or assets, includes value of farm equipment plus livestock (P100 ea) and dwellings (P3 00 ea).

Arable Land Survey

Table 2

Variable Name	Range/ Description	Average to Study Areas ²	Botetaba (Kolony) Southern	Palotomellia (Gwaketsa) Southern	Mokosi (Malete) South East	Mathothwana (Hokwa) South East	Likwididi (Katleng) Katleng	Muyabana/ Ilhabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalegadi	20 Areas Ngarelele
Sex of Head of HH	Male	76% (901)	48% (11)	90% (339)	78% (130)	66% (62)	77% (82)	79% (82)	69% (46)	56% (54)	64% (91)	- (-)
	Female	24% (280)	52% (12)	10% (37)	22% (36)	34% (32)	24% (25)	21% (22)	31% (21)	44% (43)	36% (52)	- (-)
	DK/NA ¹	(3)	(0)	(3)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
HH Education Level	0	36% (387)	30% (7)	58% (205)	48% (71)	9% (7)	22% (22)	16% (17)	8% (5)	23% (19)	25% (33)	- (-)
	1-2	34% (374)	35% (8)	30% (105)	35% (52)	32% (26)	42% (42)	43% (47)	26% (16)	41% (34)	33% (43)	- (-)
	3-4	20% (222)	30% (7)	8% (30)	12% (18)	29% (24)	27% (27)	26% (28)	53% (32)	21% (17)	30% (39)	- (-)
	5-7	10% (106)	5% (1)	4% (14)	4% (8)	31% (25)	10% (10)	13% (14)	13% (8)	16% (13)	12% (15)	- (-)
	Higher (9)	(0)	()	()	()	()	()	()	()	()	()	
	DK/NA	(95)	(0)	(25)	(19)	(12)	(0)	(0)	(3)	(0)	(8)	
	Mean	2.3	1.44	1.33	1.66	3.84	2.54	2.87	3.66	2.78	2.84	
Median	2.0	1.06	0.76	1.17	3.88	2.38	2.67	3.67	2.60	2.80		
Cattle at the Lands by Herd Composition (in LSU)	0	40% (392)	91% (21)	13% (47)	41% (64)	49% (32)		66% (71)	71% (38)	64% (14)	54% (67)	
	1-5	10% (101)	0 (0)	15% (53)	13% (21)	9% (6)		6% (6)	6% (3)		5% (6)	
	6-10	13% (130)	0 (0)	18% (66)	19% (30)	14% (9)		8% (8)	6% (3)		4% (4)	
	11-20	30% (291)	9% (2)	45% (160)	26% (41)	21% (4)		16% (17)	17% (9)	27% (6)	14% (16)	
	21-30	2% (25)	(2)	5% (17)	1% (2)	2% (1)		3% (3)		5% (1)	1% (1)	
	31-40	0% (0)		2% (6)								
	41-50	2% (16)		1% (2)		5% (3)		1% (1)			4% (5)	
	51-60	1% (9)		0 (1)		2% (1)					2% (2)	
	61-80	1% (12)						1% (1)		5% (1)	3% (3)	
	81-100	0% (0)		1 (2)							4% (4)	
	101-200	1% (6)									4% (4)	
	201-plus	0% (1)									1% (1)	
	DK/NA	(201)	(0)	(20)	(8)	(28)	(0)	(0)	(14)	(75)	(30)	
	Mean	10.6		14.18	6.55	8.76	7.50	5.10	3.59	8.87	18.13	
Median	5.0		11.00	3.99	2.00	3.01	0.06	0.02	0.18	0.02		

¹ DK= Do not know,
NA= Not Applicable

² because of rounding, all percentages do not add up to 100%

Variable Name	Range/ Description	Average of Study Areas	Botswana (Palapye) Southern	Beloriveribe (Tlokweng) Southern	Mogosi (Molete) South East	Matrothwana (Illoka) South West	Dikwididi Kgatleng	Moiyabana/ Tlhabala Central	Sechele North East	Kalkontein Ghanzi	Kang Katlaga	20 Areas Kgamiland
Total Livestock — Cattle plus smallstock (LSU)	0	31% (498)	44% (10)	7% (28)	38% (63)	36% (33)	32% (34)	32% (35)		42% (39)	34% (48)	
	1-5	17% (271)	4% (1)	10% (38)	11% (18)	11% (10)	11% (12)	8% (9)		13% (12)	8% (11)	
	6-10	13% (213)	18% (4)	14% (51)	12% (20)	12% (11)	14% (15)	8% (9)		6% (6)	6% (9)	
	11-20	28% (451)	26% (6)	53% (199)	35% (58)	32% (29)	33% (35)	25% (27)		21% (20)	14% (20)	
	21-30	3% (56)	4% (1)	6% (22)	2% (3)	2% (2)	5% (5)	8% (9)		4% (4)	4% (6)	
	31-40	0 (0)		0 (0)		4% (4)						
	41-50	2% (40)		5% (19)		2% (2)	2% (2)	6% (6)		1% (1)	5% (7)	
	51-60	1% (19)		2% (8)		1% (1)	1% (1)			2% (2)	5% (7)	
	61-80	4% (66)	4% (1)	1% (4)	2% (3)		3% (3)	10% (11)		2% (2)	8% (12)	
	81-100	0 (0)		1% (4)						9% (8)	11% (15)	
	101-200	1% (15)		1% (5)	1% (1)				2% (2)		5% (7)	
	201-plus	0% (1)		0 (0)							1% (1)	
	DK/NA	(20)	(0)	(1)	(0)	(2)	(0)	(0)		(3)	(0)	
	Mean	14.0		20.09	9.73	12.16	12.08	21.90	10.16	17.12	33.03	
Median	6.0		15.58	5.16	6.58	7.70	10.37	7.70	1.68	13.52		
Value of Farm Equipment (in Pula value)	0	30% (450)	35% (6)	14% (52)	26% (42)	37% (34)	55% (58)	24% (26)	22% (14)	39% (13)	41% (51)	35% (153)
	1-40	38% (575)	11% (2)	38% (145)	30% (49)	22% (20)	14% (15)	33% (36)	41% (27)	30% (10)	36% (44)	52% (227)
	41-80	12% (183)	24% (4)	18% (68)	16% (26)	20% (19)	10% (11)	13% (14)	17% (11)	21% (7)	16% (20)	1% (3)
	81-120	5% (81)		8% (29)	13% (21)	5% (5)	4% (4)	7% (8)	12% (8)	9% (3)	2% (3)	
	121-160	6% (95)		6% (24)	10% (16)		9% (10)	7% (8)	6% (4)		4% (4)	7% (29)
	161-200	4% (55)	6% (1)	5% (17)	2% (2)	2% (2)	4% (4)	8% (9)	2% (1)			4% (19)
	201-500	4% (55)	24% (4)	10% (38)	3% (5)	2% (2)	2% (2)	4% (4)				
	501-1000	0 (4)		1% (3)		12% (11)	2% (2)	1% (1)				
	1001-plus	1% (25)		- (2)	2% (3)			2% (2)	(1)		2% (2)	1% (2)
	DK/NA	(127)	(6)	(1)	(0)	(1)	(0)	(0)	(1)	(64)	(0)	(14)
	Mean	120.5		108.13	133.54	507.47	117.22	140.67	107.96		94.07	
	Median	35.3		39.64	36.59	37.30	2.07	36.52	36.02		33.69	

Variable Name	Range/ Description	Average H. Study Areas	Matlabe (P. lesoa) Southern	Polotlhethe (Tlokweng) Southern	Mokgosi (Molete) South East	Makhelebe (Tloko) South East	Dikwidi Katleng	Motvhaba/ Ihabala Central	Sechele North East	Kalkfontein Ghani	Kang Kgalegadi	20 Areas Ngamiland
Total HH Wealth (sum of livestock, farm equipt, dwellings). (In Pula value)	0	5% (84)	0 (0)	- (.1)								19% (83)
	1-300	17% (278)	26% (6)	- (1)	1% (1)	4% (4)	11% (12)	2% (2)	10% (7)	32% (30)	17% (24)	42% (189)
	301-600	12% (203)	13% (3)	3% (11)	11% (18)	11% (10)	12% (13)	10% (11)	15% (10)	18% (17)	18% (27)	19% (83)
	601-1000	15% (244)	9% (2)	9% (35)	35% (58)	28% (26)	17% (18)	25% (27)	13% (9)	5% (5)	6% (8)	12% (55)
	1001-3000	31% (511)	44% (10)	55% (207)	42% (70)	31% (29)	43% (46)	29% (31)	49% (33)	23% (22)	15% (22)	8% (38)
	3001-5000	11% (173)	4% (1)	23% (87)	8% (14)	12% (11)	10% (11)	16% (17)	9% (6)	7% (7)	12% (17)	- (2)
	5001-plus	9% (145)	4% (1)	10% (37)	3% (5)	15% (4)	6% (7)	19% (20)	3% (2)	14% (13)	32% (45)	- (1)
	DK/NA	(12)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(3)	(0)	(0)
Mean	1919.5		2764.99	1720	2311	1865.73	3022.98	1561.68	2117.62	3419.13		
Median	1018.5		2339	1265	1297	1514	1860.0	1240.00	600.30	1900.00		
Flooded last year	Yes	81% (1297)		99% (358)	88% (145)	92% (85)	84% (89)	92% (97)	97% (65)	28% (27)	50% (71)	76% (345)
	No	19% (312)		1% (3)	12% (19)	8% (7)	16% (17)	8% (9)	3% (2)	72% (68)	50 (72)	24% (110)
	DK/NA	(41)		(18)	(2)	(2)	(0)	(0)	(0)	(0)	(0)	(0)

II. IMPLEMENTS AND INPUTS

Background

Access to implements -- especially a single furrow plow -- and inputs -- particularly seed -- constitute constraints to crop production for many farmers in Botswana. In the FAO study of constraints, lack of implements ranked fifth in order of importance for farmers not planting more land than they had planted in the past, and fourth as the most important reason for planting less. In all, 30% of the sample considered the availability of seeds, and 16% the availability of inputs and implements in general, a serious constraint to increasing their production, while 45% of sampled households reported that implements were not always available to them when they were needed. (FAO 1974)

Implements

Without question, the most crucial implement in Botswana traditional agriculture is the single furrow plow. The following table reflects this clearly.

Table 3

Implements Owned or Used in Arable Agriculture
by Farming Households

	FAO Con- straints Study 1971/72	Ag Survey 1971/72	DAFS Annual Plan 1980 ^{1/}						Opschoor 1979	Bond 1974
			Southern Region	Gaborone Region	Central Region	Francis- town Region	Maun Region	Western Region		
Single furrow plow	93%	100%)								
Double furrow plow	16	9)	19%	54%	100%	48%	10%	68%	58%	100%
Planter	11	9	6	11	3	2	-	-	4	8
Harrow	8	9	5	1	-	-	-	-	22	9
Cultivator	5	6	4	8	1	1	-	-	2	3
Tractor	9	6	2	2	2	1	-	1	2	28

^{1/} DAFS Annual Plan figures and Opschoor figures reflect ownership only.

Source: FAO 1974: 61; Agricultural Survey 1973: 71; DAFS 1980: 16, 29, 43, 54, 66, 74;
Opschoor 1980: 31; Bond 1974: Table 5.8.

It is common for farming households to obtain the required implements to plow, plant, or cultivate from others in the community. For farmers dependent upon the tools of others, borrowing is the most common form of access, although hiring of equipment is not infrequent. It is not at all uncommon for draft power, labor, and equipment to form a package when plowing is hired. The table below indicates the findings of the 1971/72 Agricultural Survey regarding the proportion of farmers dependent upon various arrangements for obtaining the implements they need.

Table 4
Implement Securement Arrangements

	Owned		Borrowed		Hired	
	Ag Survey	Bond	Ag Survey	Bond	Ag Survey	Bond
Single furrow plow	62	54	25	24	12	22
Double furrow plow	85		14		1	
Planter	38	4	51	3	11	2
Harrow	46	9	48	1	6	
Cultivator	56		36	3	9	
Tractor	48	6	5		47	21

Source: Agricultural Survey 1973: 72; Bond 1974: Table 5.8.

As would be expected, it is the poorer farmers who are forced to rely on the implements of others in order to plow. The table below indicates the percentage of those who plowed in 1971/72 who used their own implements, by the number of cattle they owned. The progression toward independence with increasing cattle ownership is a clear one.

Table 5
Incidence of Plowing Households Using Own Implements,
and Cattle Ownership

Cattle				
0	1-10	11-20	21-40	40 plus
29%	74%	76%	87%	100%

Source: Agricultural Survey 1973: 74.

As for actual production, not surprisingly households using a borrowed or hired plow, plow smaller areas on the average, than those using their own equipment.

Table 6

Area Plowed*

	1-4.9 ac	5.0-9.9 ac	10.0-14.9 ac	15.0+ ac	Total
Plow borrowed or hired	34%	50%	7%	9%	100%
Plow owned	13%	35%	25%	22%	100%

* Land not measured.

Source: FAO 1974:63.

Inputs

Shortage of good seed can also pose a constraint to arable production. In the FAO constraints study, lack of seed was the second most important reason given for plowing smaller areas than in previous years -- especially if the previous year's crop was a poor one. In the Agricultural Survey of 1971/72 it was the third most important reason given for plowing less land than in the previous year. Bond's study of women in agriculture showed that nearly 10% of sampled households found poor seed germination their most serious agricultural constraint (Bond 1974: Table 5.11).

While, as Table 7 indicates, the proportion of Botswana traditional farmers regularly using improved seed varies greatly throughout the country, kraal manure is reportedly used by only a handful of farmers, while regular use of chemical fertilizers is rare.

^{1/} Perhaps 70% of all Botswana farmers obtain seed from their own household stores or from their neighbors. Others secure seed from such sources as local traders, government regional agricultural offices, or co-ops. (ALDLP (Seed Multiplication) 1979: 1)

Table 7

Households Using Improved Seed and Fertilizers

	Ag Survey 1971/72	DAFS 1980						FMS 1977/78	Opschoor 1979
		Southern Region	Gaborone Region	Central Region	Francistown Region	Maun Region	Western Region		
Use improved seed		6%	27%	16%	6%	14%	12%		
Use chemical fertilizers	1%	3%	2%	-	-	-	-	0%	2%
Use kraal manure	6%							2%	6%

Source: DAFS 1980: 16, 29, 43, 54, 66, 74; Agricultural Survey 1973:16; Opschoor 1980:31; FMS 1980: 4.

Lucas has summed up the situation succinctly in concluding that fertilizers and chemicals are not used at all among farmers with small holdings -- which is the bulk of Botswana's farmers (Lucas 1979: 17).

The Arable Lands Survey Results

Arable Lands Survey figures support the findings of previous studies that the implement -- and the only implement -- used by the overwhelming majority of farmers in Botswana is the single row plow. Even the double row plow is used by perhaps no more than 15% of the surveyed farming households, with the proportion of farmers using this tool varying substantially from district to district. The fact that today the planter in any form is used by only a handful of farmers in most districts has tremendous import for ALDEP, which has adopted as a major thrust of its program, the introduction of row planting on a very wide scale.

The value of farm equipment owned by a surveyed household reflects the relative absence of anything but the most basic farm equipment from the traditional agricultural scene, as well as the fact that implements are commonly borrowed or hired from others. According to Arable Lands Survey data, an average of about 30% of the households within a study area own no equipment at all, while about half of the households possess equipment valued at no more than P80. While the farmers in some areas are clearly richer than those in others, in this survey, as elsewhere, the vast majority of plowing households are, in fact, very poor.

As for agricultural inputs such as seed, commercial fertilizer, and manure, once again previous findings are re-enforced by Arable Lands Survey data. The study found that approximately 40% of farmers in the surveyed lands areas purchase seed, while fewer than 10% of the sample apply either manure or commercial fertilizer to their crops.

Given the reality in Botswana concerning implement use and ownership, if ALDEP is to popularize row planting widely, it is obviously on the right track in attempting to establish subsidized implement purchase programs. Recognizing that its target group is, more often than not, poor, ALDEP may want to consider seriously subsidizing implement purchases by groups as well as by individuals. Concomitantly, it may want to consider actively supporting the eventual local manufacture and repair of the thousands of new implements it hopes will be used in the fields. Given the thrust of Botswana's most recent national development plan to develop employment opportunities in rural areas, such efforts would surely receive government's whole-hearted support.

^{1/} This excludes hand tools such as the hoe.

In order to improve the accessibility of seed for those purchasing this input, ALDEP is justified in concentrating considerable effort upon the development of a well functioning distribution system, including lock-up stores, in as many small villages as possible. At the same time, in looking beyond the distribution of seed toward improving its absolute quantity and quality, planners in the long run will be alleviating an important constraint to arable production. On the other hand, if ALDEP is to recommend the use of manure or commercial fertilizer on crops, it must be certain that the returns warrant a household's investment of labor and funds. In short, the very important distinction between Gross and marginal returns must be kept clear.

Table 8

Variable Name	Range/ Description	Average 10 Study Areas	Mokotlako (Rolong) Southern	Pelotshetlha (Ruwaketse) Southern	Mokosi (Malete) South East	Mathothwana (Hokwa) South East	dikwididi Eastlong	Moiyabana/ Ihabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngabiland
No. Single-row ploughs used	0	31% (465)	65% (11)	15% (56)	21% (34)	61% (49)	50% (51)	20% (22)	11% (7)	11% (3)	40% (48)	42% (183)
	1	66% (973)	35% (6)	83% (310)	76% (122)	31% (25)	48% (49)	63% (68)	83% (55)	89% (24)	50% (65)	58% (249)
	2-plus	3% (49)		2% (8)	3% (5)	8% (6)	2% (2)	17% (18)	6% (4)		10% (6)	
	DK/NA	(163)	(6)	(5)	(5)	(14)	(0)	(0)	(1)	(70)	(24)	(20)
	Mean	1.46										
	Median	1.35										
No. Double-row ploughs used	0	86% (1267)	41% (7)	87% (325)	90% (146)	31% (29)	79% (81)	92% (98)	91% (61)	100% (16)	97% (116)	99% (387)
	1	13% (138)	53% (9)	13% (49)	10% (16)	50% (47)	21% (22)	5% (5)	3% (2)		3% (3)	10% (45)
	2-plus	1% (11)	6% (1)		1% (1)	5% (5)		4% (4)				
	DK/NA	(174)	(6)	(5)	(3)	(3)	(0)	(0)	(0)	(81)	(24)	(20)
	Mean	0.51	0.65	0.10	0.11	0.72	0.21	0.11	0.03	0.00	0.02	
	Median	0.1	0.67	0.05	0.06	0.75	0.14	0.04	0.02	0.00	0.01	
No. Single-row planters	0	88% (1295)	100% (16)	66% (247)	83% (135)	98% (98)	94% (95)	94% (100)	100% (63)	100% (16)	100% (119)	99% (429)
	1	11% (166)		34% (126)	16% (26)	2% (2)	6% (6)	3% (3)				1% (3)
	2-plus	1% (7)		- (1)	1% (2)			1% (4)				
	DK/NA	(182)	(7)	(5)	(3)				(4)		(29)	(20)
	Mean	0.12	0.00	0.34	0.19	0.02	0.06	0.10	0	0.00	0	
	Median	0.07	0.00	0.26	0.22	0.01	0.03	0.03	0	0.00	0	
No. Double-row planters	0	97% (1429)	41% (7)	96% (361)	96% (157)	96% (79)	98% (99)	91% (98)	100% (63)	100% (18)	100% (119)	100% (432)
	1	3% (40)	53% (9)	4% (13)	3% (4)	4% (3)	2% (2)	8% (9)				
	2-plus	0 (4)	6% (1)		1% (2)			1% (1)				
	DK/NA	(177)	(6)	(5)	(3)	(17)			(4)		(24)	(20)
	Mean	0.03	0.65	0.04	0.05	0.04	0.02	0.09	0	0.00	0	
	Median	0.02	0.67	0.02	0.02	0.02	0.01	0.04	0	0.00	0	

Implements and Inputs - 2

Variable Name	Range/ Description	Average 10 Study Areas	Botswana (Polana) Southern	Botswana (Kgama) Southern	Botswana (Mabete) South East	Botswana (Tlokweng) South East	Botswana (Katleng) Katleng	Botswana (Mababane/ Tlhabane) Central	Botswana (Sechela) North East	Botswana (Kalkfontein Shanji)	Botswana (Kang) Kang	Botswana (20 Areas Ngamiland)	
Source of Single-row planter	Own	1	66% (115)	- (-)	64% (81)	75% (21)	100% (2)	83% (5)	29% (2)	- (-)	- (-)	100% (3)	
	Borrowed	2	16% (28)	- (-)	14% (18)	25% (7)			43% (3)	- (-)	- (-)		
	Hire	3	16% (28)	- (-)	20% (25)			17% (1)	29% (2)	- (-)	- (-)		
	Combination	4-7	2% (3)	- (-)	2% (3)					- (-)	- (-)		
	DK/NA		(1010)	(23)	(0)	(138)	(92)			(-)	(-)	(465)	
No. of Cultivators used (incl. hand cultivators) ¹	0		81% (1199)	81% (13)	78% (291)	77% (125)	58% (46)	88% (89)	47% (48)	69% (43)	60% (5)	88% (105)	98% (423)
	1		14% (200)	19% (3)	22% (83)	21% (34)	30% (24)	5% (5)	18% (18)	8% (5)	40% (3)	8% (9)	2% (9)
	2-plus		5% (76)			3% (4)	12% (9)	7% (7)	36% (37)	23% (14)		4% (5)	
	DK/NA		(175)	(7)	(5)	(3)	(15)			(5)	(72)	(24)	(20)
	Mean		0.26	0.10	0.22	0.27	0.62	0.20	1.06	0.68	0.40	0.16	
Median		0.11	0.12	0.14	0.15	0.36	0.07	0.71	0.22	0.53	0.07		
No. Sledges, wagons, carts, used ²	0		76% (1114)	37.5% (6)	60% (225)	69% (112)	64% (51)	73% (74)	59% (62)	62% (40)	67% (14)	84% (100)	99% (429)
	1		23% (343)	37.5% (6)	39% (145)	28% (46)	33% (26)	27% (22)	40% (42)	38% (25)	29% (6)	13% (16)	1% (3)
	2-plus		1% (19)	25% (4)	1% (3)	3% (4)	4% (3)		1% (1)		5% (1)	3% (3)	
	DK/NA		(174)	(7)	(12)	(4)	(14)			(2)	(76)	(24)	(20)
	Mean		0.27	0.08	0.41	0.38	0.45	0.27	1.06	0.38	0.38	0.20	
Median		0.16	0.83	0.33	0.22	0.28	0.18	0.71	0.31	0.25	0.10		
Value of Farm Equipment (in Pula value)	0		30% (450)	35% (6)	14% (52)	26% (42)	37% (34)	55% (58)	24% (26)	21% (14)	40% (13)	41% (51)	35% (153)
	1-40		38% (575)	12% (2)	38% (145)	30% (49)	22% (20)	14% (15)	33% (36)	41% (27)	30% (10)	36% (44)	52% (227)
	41-80		12% (183)	23.5% (4)	18% (68)	16% (26)	20% (19)	10% (11)	13% (14)	17% (11)	21% (7)	16% (20)	1% (3)
	81-120		5% (81)		8% (29)	13% (21)	5% (5)	4% (4)	7% (8)	12% (8)	9% (3)	7% (3)	
	121-160		6% (95)		6% (24)	10% (16)		9% (10)	7% (8)	4% (4)		4% (4)	7% (29)
	161-200		4% (55)	6% (1)	5% (17)	1% (2)	2% (2)	4% (4)	8% (9)	2% (1)			4% (19)
	201-500		4% (55)	23.5% (4)	10% (38)	3% (5)	2% (2)	2% (2)	4% (4)				
	501-1000		0% (4)		1% (3)		12% (11)	2% (2)	1% (1)				
	1001-plus		1% (25)		- (2)	2% (3)			2% (2)	1% (1)		2% (2)	1% (2)
	DK/NA		(127)	(6)	(1)		(1)			(1)	(64)	(19)	
Mean		120.5		108.13	133.54	507.47	117.22	140.67	107.96	36.06	94.07		
Median		35.3		39.64	36.59	37.31	2.07	35.52	36.02	34.25	33.69		

¹ Unfortunately, this question encompassed the use of both mechanical cultivators and hoe, making it virtually meaningless.

² Sledges should have perhaps been excluded from the grouping since they require much lower capital investment and are capable of hauling goods much shorter distances than wagons and carts.

Implements and Inputs - 3

Variable Name	Range/ Description	Agencies in Study Areas	Mokhotlong (Kojima) Southern	Relateng (Gwalebe) Southern	Mokosi (Malete) South East	Mate Uziwa (Tloewa) South East	Sikwini Northern	Malibabane/ Uhabala Central	Sechese North East	Malkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngamiland
Inputs used	Seeds	93% (1214)	94% (16)	86% (13)	92% (141)	97% (61)	99% (87)	93% (98)	98% (64)	100% (29)	97% (74)	97% (331)
	Fertilizer	0 (1)		0 (2)			1% (1)					
	Insecticide	0 (2)		1% (33)								
	Seed & fert.	4% (54)	6% (1)	9% (7)	7% (11)			1% (1)				2% (8)
	Seed & insect.	2% (19)		2% (5)	1% (1)	3% (2)		6% (6)	2% (1)		3% (2)	
	Fert. & insect.	1% (5)		1% (2)								
	All 3 used	0 (4)		1% (3)				1% (1)				1% (1)
	DK/NA	(351)	(6)	(14)	(13)	(31)	(19)		(2)		(67)	(126)
Source of seed	Purchased	1	36% (466)	59% (10)	42% (150)	31% (52)	26% (16)	28% (24)	42% (44)	50% (8)	14% (4)	37% (131)
	Relative	2	4% (48)		5% (19)	4% (5)	8% (5)	6% (5)	8% (8)	12% (2)	1% (1)	1% (3)
	Own supply	3	53% (696)	41% (7)	52% (184)	57% (82)	62% (38)	65% (55)	46% (49)	31% (5)	85% (24)	45% (158)
	Purchased & from rel.	4	1% (6)		1% (4)	7% (11)		1% (1)				- (1)
	Purchased & own supply	5	6% (76)		0 (0)	1% (1)	3% (2)		4% ¹ (4)	7% (1)	3% (2)	12% (62)
	Rel. & own supply	6	0 (2)		0 (0)				1% (1)			- (1)
	All	7	0 (0)		0 (0)							
	DK/NA		(356)	(6)	(22)	(29)	(33)		(2)	(68)	(68)	(110)

17

¹ This figure may be low.

Supplements & Inputs - 4

Variable Name	Range/ Description	Average 12 Study Areas	Matlabe (Kalong) Southern	Peletshelha (Ngwakotse) Southern	Mogosi (Malote) South East	Mothoivana (Tlokwa) South East	Dikwididi Katleng	Moiyabana/ Mphahla Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngariland
Use Fertilizer	Yes	14% (157)	71% (5)	56% (92)	31% (29)		14% (9)	3% (2)				2% (1)
	No	84% (811)	29% (2)	44% (73)	69% (66)		86% (54)	97% (61)		100% (2)	98% (46)	
	DK/NA	(682)	(16)	(214)	(71)							(96)
Fertilizer on cereal crop (for those using fertilizer)	Trad. Crops	96% (52)	67% (2)	97% (34)	100% (12)	100% (1)	100% (1)	100% (2)				
	Cash Crops	4% (2)	33% (1)	3% (1)								
	DK/NA	(39)	(20)	(344)	(154)	(93)						
Fertilizer, quantity used (No. of 50 kg bags) (for those using fertilizer)	0(1 bag)0	27% (25)		2% (1)	87% (145)	10% (9)						
	1-2 1	14% (13)		17% (7)	3% (5)		100% (1)					
	3-4 3	14% (13)		19% (8)	3% (5)							
	5-6 5	10% (9)		17% (7)	1% (2)						100% (1)	
	7-8 7	2% (2)		5% (2)								
	9-10 9	3% (3)		3% (1)	1% (1)	1% (1)		50% (1)				
	11-20 11	15% (15)	50% (2)	19% (8)	2% (3)			50% (1)				
	21+ 21	14% (13)	50% (2)	19% (8)	1% (2)	89% (84)						
	DK/NA	(1091)	(19)	(237)	(3)							
	Mean	11.7	16.00	15.72		0.19						
Median	3.0	16.00	5.83		1.0							

III. FARMING PRACTICES

Background

Traditional farming practices in Botswana are alive and well today. The vast majority of rural households still plant through the broadcasting of their seed, and even many of those who plant in rows using an ox-drawn or tractorized row planter do not later in the agricultural season use mechanized cultivation, which takes advantage of the row planting which was done.^{1/} Other improved agricultural practices, including winter plowing, multiple weedings, thinning of shoots, and crop rotation, are employed to varying degrees in different parts of the country, although sporadically, if at all.

Table 9 summarizes the findings of several recent studies which have examined improved agricultural practices employed in different regions of Botswana as well as in the country as a whole. They reflect the fact that for the great majority of households plowing, agriculture today is fundamentally what it was half a century ago.^{2/}

^{1/} To quote the 1980 Farm Management Survey report, for example:

Of the 15 farmers (sampled) that planted at least some of their crops in rows, only 5 did any mechanical cultivating. Although 13 farmers used tractors for plowing, only four planted some of their crops in rows and none cultivated their crops mechanically. This is a very low incidence of cultivating of row planted crops since it is generally considered to be the primary reason for row planting. (FMS 1980: 4-5)

^{2/} See, for example, P. Parish, Crop Survey of the Bechuanaland Protectorate, Director of Agricultural Services, 1948, Botswana National Archives Box 500 Unit 5 500/20; or Isaac Schapera, Native Land Tenure in the Bechuanaland Protectorate, Lovedale Press, 1943.

Table 9

Improved Agricultural Practices
Regularly Used by Households

	DAFS 1980						Ag Survey 1971/72	Opschoor 1979 Kgatleng	Bond 1974
	Southern Region	Gaborone Region	Central Region	Francis- town Region	Maun Region	Western Region			
Planting in rows	16% (1363)	6% (854)	13% (2025)	2% (266)	2% (116)	- (4)	9%	5%	
Cultivating in contour	- (20)	- (52)	10% (1507)	- (4)	11% (95)	- (-)		51%	
Fallowing in rotation	2% (141)	1% (113)	3% (466)	1% (54)	1% (56)	- (-)		2%	
Using grain storage chemicals	3% (289)	13% (1840)	8% (1201)	2% (107)	3% (239)	- (-)	12%		
Fencing of lands	5% (452)	12% (1878)	21% (3293)	11% (538)	6% (432)	68% (820)			16%
Winter plowing							6%	3%	
Cultivating with the cultivator							6%		
Using insecticides							2%		
Treating seeds for planting							2%	51%	
Selecting seeds for re-use							26%		
Early weeding								93%	
Crop rotation								61%	
Thinning								2%	

Source: DAFS 1980: 16, 29, 43, 54, 66, 74; Agricultural Survey 1973:16; Opschoor 1980:31;
Bond 1974: Appendix VI, 3.

The Arable Lands Survey Results

From the following table several important points emerge. First, more than four-fifths of farmers interviewed report that they plow and plant concurrently through broadcasting their seed and then plowing it under, usually - as discussed previously - with a single furrow mouldboard plow. In some districts virtually all households surveyed plant in just such a fashion. Despite the alleged advantages of row planting, it is apparent that it is a practice which has been adopted by fewer than 5% of farmers in many surveyed areas, though in two areas known for their progressiveness, row planters are used by between 40-50% of surveyed households. Taken together, the figures indicate that on the whole planting is very much as it has always been.

Second, the Arable Lands Survey data indicate that households often appreciate the importance of weeding and thinning their crops. Nearly three-quarters of all respondents claimed that they do weed -- with substantial numbers of households in all the surveyed areas doing so. It is not so common, however, for households to weed more than once during the agricultural season. Likewise, the thinning of plants is not uncommon, but is done by widely varying proportions of surveyed households -- by no means universally in lands areas.

Third, improved agricultural practices such as winter plowing and crop rotation are, perhaps predictably, also practised by differing proportions of plowing households, generally more often in the southeastern part of the country than elsewhere. Given the level nature of much of the hardveld and sandveld terrain, it is understandable that few households contour plow. As for the fencing of fields, between one-third and two-thirds of households surveyed have erected at least bush fences to keep livestock out of their crops. All in all, from the Arable Lands Survey data, a picture of widely varying agricultural practices emerges, except for that very important practice of broadcasting seed.

Taking all the improved farming practices of row planting, weeding, plant thinning, fertilizer application, winter plowing, contour plowing, crop rotation and fencing, it appears that the median farmer surveyed in the Arable Lands Survey carries out one or two of these. Looking at the number of improved practices adopted by a farmer in relation to the number of those practices which he has actually heard about, the median surveyed farmer has adopted considerably fewer than half of those with which he is familiar. Obviously, for many, the constraint to improved agriculture is not primarily lack of knowledge about what improved agricultural practices are.

Today in Botswana a very low level of farm husbandry is practised by the bulk of those growing crops. Despite decades of extension effort, farmers have proved either unable or resistant to adopting the improved agricultural

methods which government agents have espoused and repeatedly demonstrated, and instead have adhered to the risk minimizing methods which have proved adequate, if only barely adequate, over the years. ALDEP, as presently formulated, in a sense is talking about revolutionizing arable agriculture, even with the introduction of the program's initial and minimum technological package. A recent paper states:

Under the system of broadcasting seed and plowing it under, there is little scope for improving upon the present low yields.... There are...certain basic components, which, even in the first (development) package, have to be adopted, for any worthwhile improvement in yields to be realized; these are, timely plowing and planting, row cropping and adequate weeding.... The seed is planted in rows...and weeding is carried out mechanically by cultivator.
(ALDEP (Technology Packages) undated: 1-2)

Obviously to carry out these operations successfully, the traditional farmer will have to alter his current cropping practices substantially -- considerably more than he has been willing to do over the decades since extension work in the country's rural areas began. Yet if ALDEP is truly to reach and assist Botswana's traditional farmer over the next few decades -- and not just the progressive farmer, who has often been reached in the past -- program planners must wrestle with this conundrum realistically and thoroughly now.

In doing so, it might be useful to recognize that Lightfoot has raised the question of whether or not productivity at the low levels which prevail today may be more closely correlated with the quality of traditional operations than with traditional agriculture itself. After analysis of the 1977-78 Farm Management Survey data, plus some experimentation, he has suggested that an alternative strategy for improving arable production might be "to determine and resolve constraints to farming quality and the development of improvements within these (traditional) systems" (Lightfoot 1980: 1). Given the history of the traditional farmer's resistance to even minimal agricultural system changes over the years, Lightfoot's question deserves the most careful attention from program planners.

Table 10

Variable Name	Range/ Description	Average 10 Study Areas	Mokotoko (Roleng) Southern	Pelotshelha (Ngwaketse) Southern	Motqosi (Molete) South East	Mathothwana (Ilakwa) South East	Gikwididi (Katleng) Katleng	Moiyabana/ Ilhabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngarileng
When ploughed ¹	Before Oct. 1	10% (137)		14% (52)	24% (36)	7% (6)	8% (7)	6% (6)	2% (1)	3% (1)	8% (6)	6% (12)
	Oct. - Dec. 2	56% (749)	100% (17)	74% (268)	63% (95)	68% (63)	49% (45)	35% (37)	63% (42)	35% (10)	30% (23)	44% (142)
	Dec. - Mar. 3	34% (448)		12% (42)	14% (21)	26% (24)	43% (39)	60% (64)	33% (22)	62% (18)	63% (49)	50% (69)
	DK/NA	(316)										(26)
Broadcasting	Yes	82% (813)	53% (9)	63% (230)	85% (123)	98% (92)	98% (89)	93% (100)	100% (65)		95% (73)	-
	No	18% (181)	47% (8)	37% (135)	15% (22)	2% (2)	2% (2)	7% (8)			5% (4)	-
	DK/NA	(190)	(6)	(14)	(21)				(2)		(66)	-
Row planting, practiced	Yes	40% (284)	83% (10)	71% (183)	33% (34)	13% (8)	34% (25)	18% (15)			7% (4)	-
	No	60% (432)	17% (2)	29% (74)	67% (70)	87% (52)	66% (48)	82% (68)		100% (21)	93% (50)	-
	DK/NA	(468)	(11)	(122)	(62)	(34)					(89)	-
Using Row Planter	Yes	21% (200)	47% (8)	41% (150)	15% (22)	2% (2)	6% (6)	9% (10)	9% (6)			-
	No	79% (773)	53% (9)	59% (215)	85% (124)	98% (91)	94% (86)	91% (98)	91% (59)			-
	DK/NA	(211)	(6)	(14)	(20)	(1)			(2)			-
Row Planting - by hand	Yes	1% (6)		0% (2)	1% (2)						3% (2)	-
	No	99% (969)	100% (17)	100% (364)	99% (144)	100% (93)	100% (92)	100% (108)			97% (75)	-
	DK/NA	(209)	(6)	(13)	(20)	(1)					(66)	-
Weeding, practiced	Yes	72% (325)	100% (4)	63% (19)	57% (31)		70% (39)	100% (104)			58% (37)	-
	No	28% (129)		37% (11)	43% (23)		30% (17)				43% (27)	-
	DK/NA	(1196)	(19)	(349)	(112)						(79)	-
Weeding - how often done	Once	65% (895)	67% (10)	68% (238)	89% (133)	69% (62)	88% (84)	84% (91)	94% (61)	100% (24)	87% (73)	30% (17)
	Twice	20% (272)	27% (4)	15% (54)	7% (11)	24% (22)	12% (11)	2% (2)	6% (4)		11% (10)	40% (54)
	Frequently	10% (140)	6% (1)	3% (10)	2% (3)	2% (2)		12% (13)			1% (1)	29% (11)
	Never	5% (66)		14% (49)	1% (2)	4% (4)		2% (2)				1% (2)
	DK/NA	(277)	(8)	(28)	(17)	(4)			(2)		(59)	6%

¹ Date categories overlap, making only the most broad interpretations of information possible.

Variable Name	Range/ Description	Average % Study Areas	Botswana		Molapo (Molapo)	Tlokweng (Tlokweng)		Mogalese (Mogalese)	Sechese North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Applicable
			(% of total Sample)	(Number of Households)		(% of total Sample)	(Number of Households)					
Thinning, practiced	Yes	56% (277)		80% (113)	59% (44)		55% (34)	46% (31)			35% (16)	-
	No	44% (220)	100% (1)	20% (29)	41% (30)		45% (28)	54% (36)			65% (30)	-
	DK/NA	(697)	(22)	(237)	(92)						(103)	-
Winter plowing practiced	Yes	40% (221)	33% (1)	71% (136)	47% (52)		30% (18)	9% (4)			5% (2)	-
	No	60% (339)	68% (2)	29% (55)	53% (59)		70% (42)	91% (40)		100% (18)	95% (39)	-
	DK/NA	(624)	(20)	(188)	(55)					(79)	(102)	-
Crop rotation, practiced	Yes	31% (298)	80% (4)	80% (126)	54% (43)		29% (17)	31% (21)			20% (9)	-
	No	69% (657)	20% (1)	20% (31)	46% (36)		71% (42)	69% (47)		100% (16)	80% (35)	-
	DK/NA	(695)	(18)	(222)	(9)						(94)	-
Contour Plowing practiced ¹	Yes	8% (125)	100% (1)	89% (77)			14% (6)	24% (12)			10% (3)	-
	No	92% (1524)		11% (9)			86% (36)	76% (39)		100% (17)	90% (27)	-
	DK/NA	(1)	(22)	(299)							(43)	-
Fencing, practiced	Yes	40% (406)		30% (29)	33% (56)		58% (45)	16% (15)		59% ² (27)	63% (49)	-
	No	60% (616)	100% (10)	70% (68)	67% (52)		42% (32)	84% (78)		41% (19)	37% (29)	-
	DK/NK	(628)	(13)	(282)	(88)					(51)	(65)	-
New Technology practiced New practices adopted	0	44% (733)	52% (12)	35% (126)			35% (36)	2% (2)			60% (86)	-
	1-2	25% (417)	17% (4)	20% (73)			23% (24)	45% (49)			15% (22)	-
	3-4	12% (199)	9% (2)	13% (49)			17% (18)	30% (32)			15% (21)	-
	5-6	7% (114)	18% (4)	10% (38)			6% (7)	12% (13)			6% (9)	-
	7-8	5% (76)		7% (26)			9% (9)	8% (9)			2% (3)	-
	9-10	4% (57)	4% (1)	9% (33)			6% (6)	2% (2)			2% (2)	-
	11+	3% (53)		6% (22)			4% (4)	1% (1)				-
	DK/NA	(1)		(12)								-
	Mean	5.4	1.09	3.89								-
Median	5.1	0.46	3.68								-	

¹ This variable had an inordinately high proportion of 'Do not know' or 'Not Applicable' responses.

² Actually nearly 100% of households fence their lands.

Variable Name	Range/ Description	Average 10 Study Areas	Mokotako (Rolong) Southern	Pelotshetlha (Ngwaketse) Southern	Mokqosi (Molete) South East	Mathothwana (Tlokwa) South East	Dikwididi Katlong	Moiyabana/ Ihabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Tjamilang
Adoption Index	0	13% (34)		5% (1)	17% (8)		16% (7)			50% (1)	41% (9)	-
(% adoption of practices known)	1-25%	24% (60)		9% (2)	12% (6)		27% (12)	58% (29)			5% (1)	-
	26-50%	31% (80)		10% (2)	37% (18)		27% (12)	36% (18)		50% (1)	32% (7)	-
	51-75%	17% (43)	100% (1)	19% (4)	19% (9)		18% (8)	6% (3)			9% (2)	-
	76-100%	15% (39)		57% (12)	15% (7)		12% (5)				13% (3)	-
	DK/NA	(928)	(22)	(358)	(118)						(121)	-
Mean		0.4	3.00	0.79								
Median		0.4	3.00	0.88								

IV. DRAFT POWER

Background

Timely access to draft power constitutes one of the severest constraints to crop production facing farmers throughout Botswana.^{1/} In a country of limited, erratic rainfall it is vitally important that the farming household be able to take advantage of showers over 25mm whenever they come in the late spring or early summer (November - December) to plow its fields and plant its seed. Without ready access to animal or mechanized draft, a farming household may be forced to plow either too late in the growing season or too little of its land to reap a harvest sufficient even for the subsistence of its members; of course, it may possibly find that it is unable to plow and plant at all.

Types of Draft Power Used

Although nearly 9/10th of those who plow use cattle -- and preferably oxen -- for draft, donkeys, horses, and tractors are also used. Table 11 indicates the distribution of households in various studies by the type of draft power used.

^{1/} In the FAO study of constraints to agricultural production, when households were asked why they planted less during the 1970/71 agricultural year than any previous year, the third most common answer, after drought and lack of seed, was that draft power was not available (FAO 1974:44). In the 1971/72 Agricultural Survey, the difficulty in obtaining draft power was ranked second, after drought, as the most important reason for not plowing a larger area (Agricultural Survey 1975: 10).

Table 11

Distribution of Households by Type of Draft Power Used

	Cattle	Donkeys	Tractors	Hand Hoeing	Oxen & Tractors	Oxen & Donkeys	TOTAL
Agricultural Survey 1971/72	89%	4%	4%	3%	-	-	100%
FAO Constraints Study 1971/72	88% ^{1/}	3%	6%	-	3%	-	100%
Opschoor 1979	37%	8%	55%	-	-	-	100%
Bond 1974	73%	-	22%	-	5%	-	100%
Farm Management Survey 1977/78	77%	7%	16%	-	-	-	100%

^{1/} approximately 67% used oxen only, while 21% used a mixed draft team of oxen and other types of cattle.

Source: Agricultural Survey 1973: 59-60; FAO 1974: 45;
Opschoor 1980: 26; Bond 1974: Table 6.1; FMS:1980: 4.

Source of Animal Draft Power

The table below shows that according to several studies carried out over the course of the last decade, perhaps at best only half of the 70 000 - 80 000 rural households which have farmed have ready access to draft animals which they either own or hold for others. Other households must either borrow draft, exchange it for their own animals, labor, or implements, or hire it from other members of the community. Clearly, there is a strong correlation between poor households and dependency on other people to provide draft power. (FAO 1974: 44)

Table 12

Distribution of Households Using Different Types of Plowing Arrangements with Draft Cattle

	Ag Survey 1971/72	FAO Study 1971/72	Curtis 1971	Opschoor 1979
Owned/mafisa'd	48%	50%	45%	59%
Borrowed/exch'd	28%	26%	36%	13%
Hired	11%	24%	19%	28%
Mixed arrang't	13%	-	-	-
Total households	40 200	51 730	279	150

Source: Agricultural Survey 1973: 63-64;
FAO 1974: 45; Curtis 1972: 77;
Opschoor 1980: 26.

Of those holding their own draft, approximately only 30 000 households own at least 10 head of cattle (RIDS 1976: 111), which is the minimum number required to provide a team of 6 animals, which is the minimum number needed to plow.^{1/}

^{1/} To have the ideal plowing team -- 8 oxen -- requires a herd of at least 22 head. Only about 17 000 households (RIDS 1976: 111), or 20% of all rural households own a herd at least that large. Approximately 16% of farming families have a herd capable of maintaining a team of 10 draft oxen. (ALDEP (Draft Power) 1978: 1)

According to the ALDEP Preparation Team:

Borrowing or exchanging draught power covers a variety of traditional mechanisms which provide for the distribution of draught to those without direct access. These are mainly composed of ... 'putting in hands', i.e. where labour is exchanged for the use of draught; 'ploughing together', i.e. usually where an implement is loaned or exchanged for draught; and 'ploughing for' which is common but confined to close family relations where frequently there is no immediate reciprocation. (Curtis 1972)

Hiring based on a payment in cash or kind may involve either oxen or tractor power. The latter in particular is extremely expensive, F25 per hectare being a commonly quoted contemporary figure. This type of arrangement is likely to be used by those households with no labour or implements to exchange or close family available to 'plough for'. Of the 20% approximately who hire, it is guessed that most hire tractors though the data to support this is sketchy. (ALDEP (Draught Power) 1978: 1-2)

Draft Power Availability and Time of Plowing

Whatever the form of draft used, it appears that households without ready access to draft power plow later in the planting season than those with ready access. The following table indicates that two-thirds of those surveyed in the FAO constraints study holding their own draft plowed before mid-December, while only half of those borrowing or exchanging draft were able to do so. Since only one-third of those hiring draft power were able to plow before mid-December, it appears that this is the least satisfactory method of obtaining plowing services.

Table 13

Plowing Dates Using Different Types of Plowing Arrangements with Draft Cattle

	Before Dec 15	After Dec 15
Cattle Held	67%	33%
Cattle Borrowed/Exchanged	54%	46%
Cattle Hired	34%	66%
Total	56%	44%

Source: FAO 1974: 47.

Draft Power Availability and Area Plowed

Furthermore, on the whole, those without ready access to draft power plow smaller acreages than those having their own draft.

Table 14

Average Acreage Plowed by Plowing Arrangements^{1/}

	FAO Study 1971/72	Hertel 1977		
		1974/5	1975/6	1976/7
Draft Power Held	14.3 ac	11.1 ac	13.3 ac	4.2 ac
Draft Power Borrowed/Exchanged	8.2	4.9	4.3	1.3
Draft Power Hired	8.5			

^{1/} Land not measured.

Source: FAO 1974: 47-48;
Hertel 1977: 28-29.

As the figures in Table 14 indicate, the difference in area plowed between those with and without their own draft is substantial, ranging anywhere from 71% to over 300% in the 1977 study of mafisa in the village of Losilokokong. Indeed, the FAO study of constraints on agri-

cultural development found that one-third of the households using draft power they held plowed at least 15 acres, compared to only one-eighth of the households dependent on borrowed, exchanged, or hired draft. Concomitantly, three-quarters of this latter group plowed fewer than 10 acres, while only two-fifths of those with their own draft power plowed fewer than 10 acres. (FAO 1974: 48)

The Arable Lands Survey Results

The following table summarizes the findings concerning availability and use of draft power for the ten areas included in the 1978 Arable Lands Survey. The ALS data confirm that draft power is, indeed, a constraint to arable production for many households. Use of and access to different types of animal or mechanical draft, however, vary greatly from one lands area to another. After oxen, tractors are commonly used and preferred in the southeast, for example, while donkeys predominate in the north and west. In most areas, borrowing of oxen is more common than hiring, hiring of tractors more common than borrowing, but in half of the surveyed lands areas borrowing of donkeys is more common than hiring, while in the other half, the opposite is true. Figures reflecting a household's ready and total access to draft power indicate wide variations among areas, reaffirming the validity of ALDEP's approach to alleviating agricultural constraints on a district by district basis.

Among those surveyed who both did and did not plow during the 1977/78 agricultural season, draft power shortages were ranked as the second most important constraint to household production;^{1/} perhaps two-fifths of these households did not enjoy ready access to the means by which their fields would be plowed and planted. Given the importance of timely access to draft power which has been demonstrated in studies over and over again, whatever can be done to alleviate draft power constraints -- even if primarily helping those still engaged in traditional, unimproved agriculture -- should reap substantial rewards.

^{1/} Lack of rain was excluded from consideration.

Table 15

Variable Name	Range/ Description	Average of Study Areas	Botlatako (Kolong) Southern	Pelalabellha (Gwaketse) Southern	Ekoposi (Molete) South East	Matthoana (Heke) South East	Ekwididi (Katleng) Katleng	Moiyabana/ Uhabala Central	Sechele North East	Kalkuntein Ghanzi	Fang Kgalagadi	2: Ar Kgalagadi
Access to Tractor	Own	27% (45)		52% (12)	18% (3)	28% (17)	24% (7)	12% (3)	33% (1)			-
	Borrow	10% (17)	100% (3)	4% (1)	18% (3)	5% (3)	14% (4)	12% (3)				-
	Hire	63% (106)		44% (10)	59% (10)	67% (41)	62% (18)	76% (18)	67% (2)			-
	Combination	0% (1)			(1)							-
	DK/NA	(466)	(20)	(356)	(61)	(27)			(23)			-
Source of Tractor	Relative	41% (65)	33% (1)	59% (13)	57% (8)	32% (19)	15% (11)	38% (9)	67% (2)		67% (2)	-
	Non-Relat.	59% (92)	67% (2)	41% (9)	43% (6)	68% (40)	85% (62)	63% (15)	33% (1)		33% (1)	-
	DK/NA	(12)	(20)	(357)	(15)	(35)					(140)	-
Access to Oxen	Own	70% (782)	36% (5)	92% (299)	69% (90)	58% (11)	46% (27)	41% (38)	43% (21)	56% (10)	84% (54)	100% (10)
	Borrow	18% (199)	57% (8)	4% (14)	23% (29)	11% (2)	32% (19)	33% (31)	57% (28)	33% (6)	13% (8)	100% (10)
	Hire	11% (122)	7% (1)	4% (14)	8% (10)	31% (6)	20% (12)	25% (23)		6% (1)	3% (2)	100% (10)
	Combination	1% (6)			1% (1)		2% (1)	1% (1)		(5)	(34)	100% (10)
	DK/NA	(541)	(9)	(62)	(36)	(75)			(18)		(45)	100% (10)
Source of Oxen	Relative	89% (660)	86% (12)	97% (313)	88% (103)	76% (13)	69% (40)	77% (64)	79% (37)	78% (14)	96% (65)	100% (10)
	Non-Relat.	11% (82)	14% (2)	3% (10)	12% (14)	24% (4)	31% (18)	23% (19)	21% (10)	22% (4)	2% (1)	100% (10)
	DK/NA	(442)	(9)	(4)	(49)	(77)			(20)	(79)	(79)	100% (10)
Access to Donkeys	Own	70% (62)	- -	95% ¹ (19)	100% (10)	73% (8)	33% (3)	68% (2)	27% (3)	20% ¹ (3)	35% ² (1)	100% (10)
	Borrow	12% (11)	- -	5% (1)		9% (1)	11% (1)	33% (1)		13% (2)	67% ² (2)	100% (10)
	Hire	17% (15)	- -			18% (2)	44% (4)		73% (8)	7% (1)		100% (10)
	Combination	1% (1)	- -				11% (1)			60% (9)		100% (10)
	DK/NA	(1095)	(23)	(359)	(156)	(83)			(56)	(1)		100% (10)
Source of Donkeys	Relative	87% (54)	- -	95% (20)	100% (9)	82% (9)	67% (4)	50% (1)	80% (4)	35% ² (10)	21% (3)	100% (10)
	Non-Relative	17% (8)	- -	5% (1)		18% (2)	33% (2)	50% (1)	20% (1)	62% (18)	100% (11)	100% (10)
	DK/NA	(27)	(23)	(358)	(16)	(83)			(62)	(68)	(140)	100% (10)

32

¹This figure is probably closer to 70%.

²This figure is probably closer to 80%.

³This figure should be considerably higher.

Variable Name	Range/ Description	Average 1 st Study Areas	Makatako (Kolonq) Southern	Pelotshelha (Manketse) Southern	Mokosi (Malets) South East	Muthothwana (Flokwa) South East	Dikwididi Kgatleng	Moiyabana/ Ithabala Central	Sachele North East	Kalkfontein Gauteng	Kang Kgalagadi	20 Areas North West
No. of Tractors used	0	89% (1316)	82% (14)	95% (354)	90% (147)	27% (24)	69% (71)	77% (82)	94% (59)	100% (18)	97% (116)	99% (439)
	1	11% (164)	12% (2)	5% (20)	10% (16)	73% (64)	29% (30)	22% (23)	6% (4)		3% (3)	1% (2)
	2-plus	0% (5)	6% (1)				2% (2)	2% (2)				
	DK/NA	(165)	(6)	(5)	(3)	(6)	(4)		(4)	(79)	(24)	(20)
	Mean	0.12	0.24	0.13	0.09	0.73	0.33	2.09				
Median	0.06	0.11	0.08	0.05	0.81	0.22	1.86					
Source of Tractors	Own	11% (18)			19% (3)	13% (8)	3% (1)	8% (2)	25% (1)		33% (1)	--
	Borrow	12% (22)	100% (3)	35% (7)	13% (2)	2% (1)	17% (5)	12% (3)			33% (1)	--
	Hire	75% (126)		45% (13)	69% (11)	84% (54)	80% (24)	80% (20)	75% (3)		33% (1)	--
	Combination	1% (1)				2% (1)						--
	DK/NA	(1017)	(20)	(0)	(150)	(30)			(63)		(190)	--
Total Cattle Ownership (LSU)	0	32% (367)	44% (10)	16% (59)	39% (65)	42% (37)	38% (41)	34% (37)	29% (19)	52% ¹ (44)	38% (54)	--
	1-5	8% (59)	4% (1)	10% (39)	12% (19)	6% (5)	8% (9)	7% (8)	15% (10)	2% (2)	4% (5)	--
	6-10	12% (138)	22% (5)	13% (50)	13% (22)	12% (11)	11% (12)	7% (8)	23% (15)	4% (3)	7% (10)	--
	11-20	33% (388)	26% (6)	48% (181)	32% (52)	30% (27)	33% (35)	26% (28)	26% (17)	24% (20)	13% (19)	--
	21-30	5% (60)		7% (25)	2% (3)	2% (2)	5% (5)	8% (9)	5% (3)	5% (4)	6% (9)	--
	31-40	0% (0)				3% (5)				1% (1)		--
	41-50	2% (26)		2% (9)		1% (1)	2% (2)	5% (5)	2% (1)		4% (5)	--
	51-60	2% (19)		1% (4)	1% (2)	2% (2)					6% (9)	--
	61-80	5% (58)	4% (1)	2% (6)	1% (1)		3% (3)	10% (11)		2% (2)	7% (7)	15% (21)
	81-100	0% (0)		0% (1)						4% (8)	2% (3)	--
	101-200	1% (14)		1% (4)	1% (1)			2% (2)			5% (7)	--
	201 Plus	0% (1)									1% (1)	--
	DK/NA	(14)		(1)	(1)	(5)			(2)			--
	Mean	16.5		16.78	9.09	11.97	11.00	21.22			16.79	
	Median	9.2		12.9	4.98	6.86	6.00	10.24			0.00	

¹ This figure is probably too high. Officials estimate that most farmers in Kalkfontein own 200 - 300 head.

Variable Name	Range/ Description	Average in Study Area	Mafikeng (Northern Southern)	Pretoria (Northern Southern)	Mokgosi (Molete) South East	Mathabane (Hlokwa) South East	Dikwadi (Kgatleng) Kgatleng	Botswana/ Tlokweng Central	Sechele North East	Polokwane Gauteng	Kang KwaZulu	20 Area Northern
Cattle at the Lands by herd composition (in LSU)	0	40% (392)	91% (21)	13% (47)	41% (64)	49% (32)	45% (37)	66% (71)	71% (38)	64% (14)	54% (67)	
	1-5	10% (101)		15% (53)	13% (21)	9% (6)	7% (6)	6% (6)	6% (3)		5% (6)	
	6-10	13% (130)		18% (66)	19% (30)	14% (9)	8% (9)	8% (8)	6% (3)		4% (4)	
	11-20	30% (291)	9% (2)	45% (160)	26% (41)	21% (14)	33% (35)	16% (17)	17% (9)	28% (6)	14% (16)	
	21-30	2% (25)		5% (17)	1% (2)	2% (1)	5% (5)	3% (3)		4% (1)	1% (1)	
	31-40	0% (0)		2% (6)								
	41-50	2% (16)		1% (2)		5% (3)	2% (2)	1% (1)			4% (5)	
	51-60	1% (9)		- (1)		2% (1)					1% (2)	
	61-80	1% (12)					3% (3)	1% (1)		4% (1)	3% (3)	
	81-100	0% (0)		1% (2)							4% (4)	
	101-200	1% (6)									4% (9)	
	201-plus	0% (1)									1% (1)	
	DN/NA	(201)			(20)	(8)	(28)			(14)	(75)	(30)
	Mean		10.6		14.18	6.55	8.76		5.09		8.86	
Median		5.0		11.00	3.99	2.00		0.05		0.17		
Ready access to draft power in LSU (Oxen, donkeys, tractors owned and mifisa's only)	0	43% (620)	78% (18)	26% ¹ (98)	44% (72)	13% (11)	37% (31)	48% (52)	69% (40)	82% ¹ (23)	68% (81)	
	1-3	18% (297)		19% (71)	23% (37)	3% (3)	7% (6)	2% (2)	10% (5)	7% (2)	4% (5)	
	4-6	15% (221)	9% (2)	25% (93)	18% (29)	3% (3)	11% (9)	11% (12)	16% (6)	11% (3)	6% (7)	
	7-9	5% (69)		10% (37)	3% (5)	1% (1)		6% (6)	3% (2)		3% (3)	
	10-13	7% (102)		11% (39)	4% (6)	25% (22)	12% (10)	11% (11)	5% (3)		8% (9)	
	14-16	2% (24)		3% (12)	1% (1)	1% (1)	4% (3)	3% (3)	3% (2)		3% (3)	
	17-19	0% (0)										
	20-23	2% (29)	9% (2)	2% (7)	1% (2)	7% (6)	7% (6)	2% (2)			3% (4)	
	24-plus	8% (122)	4% (1)	4% (16)	7% (12)	47% (41)	23% (19)	19% (20)			6% (7)	
	DK/NA	(196)		(6)	(2)	(6)				(9)	(69)	(24)
	Mean		6.0		5.78	4.68	19.18		8.91			
	Median		1.7		4.12	1.50	20.50		2.00			

34

¹ This figure is very high and is probably up on the survey average of 38%.

Variable Name	Range/ Description	Average 10 Study Areas	Mokatako (Rolong) Southern	Pelotshatlha ('gwaketse) Southern	Mokgosi (Maletle) South East	Mathothwana (Tlokwa) South East	Dikwididi Kgatleng	Moiyabana/ Tlhabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngamiland
Total Access to draft power in LSU's (inc. cows and borrowed and hired animals/tractors)	0	38% (540)	78% (18)	14% (53)	36% (59)	19% (13)	35% (29)	41% ¹ (44)	71% (39)	80% (16)	61% (72)	
	1-3	14% (199)		8% (29)	10% (16)	4% (3)	6% (5)	4% (4)	11% (6)		4% (5)	
	4-6	10% (151)		14% (52)	12% (19)	6% (9)	2% (2)	8% (8)	14% (8)		3% (3)	
	7-9	8% (109)		16% (57)	14% (22)	1% (1)	7% (6)	5% (5)	4% (2)		1% (1)	
	10-13	13% (183)	13% (3)	18% (67)	19% (30)	36% (25)	19% (16)	22% (23)		5% (1)	9% (10)	
	14-16	5% (68)		11% (40)	5% (8)	7% (5)	6% (5)	4% (4)		15% (3)	2% (2)	
	17-19	0% (0)										
	20-23	6% (79)	9% (2)	9% (33)	4% (7)	13% (9)	18% (15)	6% (6)				4% (5)
	24-Plus	6% (90)		10% (36)	1% (1)	14% (10)	6% (5)	12% (13)				18% (21)
	DK/NA	(231)		(12)	(4)	(24)			(12)	(4)		
	Mean		7.2		11.24	5.75	12.74		8.57		6.70	
	Median		3.1		9.00	5.25	10.08		6.00		0.50	

¹This figure may be too high.

Background

Extension activity in Botswana, as in many other African countries, has often been considerably less successful in achieving its objectives than proponents would have liked it to be. Since Bechuanaland's Department of Agriculture began an outreach program in the late 1920's, the content and method of extension activity has altered course considerably. Initially a modest effort in which agents demonstrated improved farming techniques on small plots which they had developed in various farming areas, the service later moved toward becoming a program which focussed its attention primarily upon progressive farmers who had joined the department's highly touted Fupil Farmer Scheme, a program in which farmers themselves practised what extension agents preached. Given disappointing results from this approach, in the early 1970's the government's extension service shifted its emphasis toward reaching a much wider group than that merely of Scheme participants. (Curtis 1975: 22-29; Parish 1948)

The effort to reach ever-greater numbers of farmers is a long-term one. Today, according to the 1980/81 annual plan of the Department of Agricultural Field Services, between 15% and 25% of farmers within an agricultural district have at least had enough contact with an extension agent to have had a personal agricultural information card filled out by the local agent. Table 16 indicates the department's estimate of both the total number of farm families and the number of those families actively reached by Agricultural Demonstrators in various regions of the country.

Table 16
Farm Families and
Personal Contact with Extension Agents

	Southern Region	Gaborone Region	Central Region	Francistown Region	Maun Region	Western Region
Number of record cards completed	2 448	2 208	3 316	1 816	2 132	-
Total number of farm families	9 759	15 180	15 500	10 850	12 900	-
Percentage of farm families with cards completed	25%	15%	21%	17%	17%	-

Source: DAFS 1980: 14, 26, 40, 52, 63.

Not surprisingly, it seems that the majority of farmers reached by agents are still the wealthier, more progressive ones. Bond, in her study of women in agriculture, concluded that both direct and indirect agriculture extension efforts were reaching only a very small proportion of farmers, while women, despite their crucial importance to crop production, had been neglected in the extension effort (Bond 1976). Kooijman, in her examination of Bokaa village, confirmed Bond's general findings and echoed the conclusions of the 1971/72 Agricultural Survey which pointed out that while the concentration of extension and other services among Scheme farmers had led to their producing a significant portion of the national food supply, the neglect of the subsistence farmers had led over the years to their producing less and less (Ag Survey 1973: 16). Kooijman attributed the failure of extension activity to the poverty of farmers, their labor shortages, limited rewards for a great deal of extra hard work, and traditional beliefs that mystical powers could influence the results of even the most earnest efforts to increase yields. (Kooijman 1978) Curtis, in his analysis of Botswana's extension service, similarly concluded:

Farmers often lack the resources to be able to use the new techniques (recommended by the extension service); their activities (are) further curtailed by the rules of the society of which they are a part and by the active sanctions of fellow villagers.
(Curtis 1975: 204)

The Arable Lands Survey Results

The Arable Lands Survey data concerning extension activity cluster around two primary focal points: membership in various organizations and contact with the local Agricultural Demonstrator. From this and other information regarding radio listenership, course attendance, and awareness of the government's Tribal Grazing Land Programme, an index of household extension contact was derived.

Obviously, membership in organizations such as co-ops, Farmers' Committees, or 4B clubs varies from area to area as the very existence of those clubs varies. It is interesting to note, however, that membership in burial societies^{1/} is often high, while relatively few belong to their local Village Development Committee. The proportion of those

^{1/} Burial societies are indigenous insurance schemes to which local people regularly contribute to be assured of a proper funeral. Like life insurance programs, they can sometimes be borrowed against in time of need.

interviewed who knew the name of their Agricultural Demonstrator was remarkably high (averaging about 60%), though considerably fewer (36%) had received advice within the preceding year. These figures, however, should be viewed within the context of a lands area enumeration. It is quite likely that proportions of farmers having periodic contact with the Agricultural Demonstrator are much higher here than among farmers as a whole.

In an attempt to discern the source of information regarding improved agricultural practices, respondents were asked who had told them about winter plowing, contour plowing, row planting, use of fertilizer, plant thinning, crop rotation, fencing, and weeding. Generally the primary sources of information were the Agricultural Demonstrator or friends (about 25% each), with the Chief and radio programs coming in a poor second and third (5% and 2% respectively). On a continuum of overall extension contact ranging from 0 to 21+ points, the median farmer could boast only about 4 points.

A common plea from the districts regarding extension activity is that there be more of it. Ghanzi and Kgalagadi Districts, which have benefitted relatively little from extension work over the years, claim that lack of extension agents is the foremost obstacle to arable production facing farmers today. Other districts -- Kgatleng and South East, to name two -- echo this cry. With only three-quarters of the country's extension areas manned by Agricultural Demonstrators -- and none in the West -- it is no wonder that this is so.

Yet the future picture does not look much brighter than the past's. Manpower shortages will continue to plague the entire extension effort for at least several years to come. Given these current staff shortages and heavy work loads, an informed observer recently reckoned that one could not reasonably expect contact in its many forms to be received by and acted upon by any more than 20-30% of the rural population.

This, of course, has several implications for ALDEP. First, agricultural extension staff -- Agricultural Assistants, Agricultural Demonstrators, Agricultural Supervisors, District Agricultural Officers, and Regional Agricultural Officers -- must do everything possible to maximize their limited resources by reaching groups of individuals rather than focussing primarily upon individuals themselves. This is very much a part of the extension philosophy today which can directly benefit arable lands development. Second, the program must make the best use it possibly can of resources outside the classical extension network. Group Development Officers and co-op staff, for instance, can contribute a great deal to various phases of program experimentation and implementation and in some places have already done so.

Going beyond these resources, ALDEP might find that it can take advantage of the outreach opportunities which such organizations as churches, burial societies, VDC's, PTA's or women's groups offer. A church-based development trust in the Pitseng lands area near Jwaneng, for example, is supporting a range of agricultural projects; burial societies could, similarly, provide a base for expanding rural credit facilities. The very substantial extension input which the introduction of even the minimum ALDEP technological packages will require makes it imperative that planners consider every possible opportunity for maximizing government's extension resources.

Table 17

Variable Name	Range/ Description	Average 10 Study Areas	Mokatako (Rolong) Southern	Pelotshellha (Ngwaketse) Southern	Mokosi (Malote) South East	Mathethwana (Flokwa) South East	Dikwididi (Kgatleng)	Mojiyabana/ Ihabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Area Ngarileng
Membership Pupil/farmer Scheme	Yes No DK/NA	5% (73) 95% (1504) (73)	100% (21) (2)	6% (21) 94% (357) (1)	13% (21) 87% (137) (8)	3% (3) 97% (33) (8)	6% (6) 94% (94) (8)	11% (11) 89% (93)	100% (67)		1% (1) 99% (142)	2% (10) 98% (415)
Membership Coop	Yes No DK/NA	16% (183) 84% (965) (36)	100% (21) (2)	24% (87) 76% (288) (1)	3% (7) 97% (198) (11)	3% (3) 97% (83) (8)	18% (19) 82% (85)	18% (19) 82% (85)	25% (17) 75% (50)		15% (21) 85% (122)	- - -
Membership Farmers Committee	Yes No DK/NA	8% (95) 92% (1058) (31)	100% (21) (2)	12% (44) 88% (334) (1)	17% (27) 83% (130) (3)	3% (3) 97% (83) (8)	6% (6) 94% (98)	12% (12) 88% (92)	1% (1) 99% (66)		1% (2) 99% (191)	- - -
41 Membership 4B	Yes No DK/NA	11% (125) 89% (1024) (35)	48% (10) 52% (11) (2)	1% (4) 99% (373) (1)	2% (3) 98% (153) (10)	12% (10) 88% (75) (9)	27% (28) 73% (76)	36% (37) 64% (67)	37% (26) 61% (41)		3% (4) 97% (139)	- - -
Membership, Other Organizations	Church Burial Society VDC PTA Women's Group More than 1 or Other Nil DK/NA	9% (91) 13% (123) 2% (17) 1% (6) 4% (36) 2% (32) 68% (645) (234)	19% (3) 44% (7) 37% (6) - - - (7) (7)	1% (4) - - - 1% (3) 2% (7) 97% (351) (18)	6% (7) 8% (9) 1% (1) - 3% 9% (7) 85% (101) (48)	24% (18) 47% (36) (2) - 3% 9% (7) 17% (13) (18)	9% (8) 60% (52) 1% (1) - 6% (5) 2% (2) 22% (19) (18)	9% (9) 7% (3) 2% (2) - 12% (12) 7% (7) 70% (70) (22)	39% (17) 7% (3) 9% (4) - 11% (5) - 34% (15) (22)		55% (68) 22% (27) 1% (1) 4% (5) 4% (5) 7% (9) 7% (9) (25)	- - - - - - - -
Attended Courses on Agriculture	Yes No DK/NA	12% (181) 88% (1336) (83)	14% (3) 86% (18) (2)	4% (17) 96% (362) (0)	29% (46) 71% (114) (6)	7% (6) 93% (77) (11)		7% (8) 93% (99)	8% (5) 92% (62)		9% (12) 91% (129) (1)	- - -
Know AD by name ¹	Yes No DK/NA	60% (325) 40% (129) (1196)	95% (18) 5% (1) (4)	41% (149) 59% (213) (17)	94% (156) 6% (9) (1)	23% (21) 77% (71) (2)	89% (94) 11% (12)	94% (102) 6% (2)	84% (56) 16% (11)		4% (5) 100% (54) (25)	74% (371) 26% (113) (32)
Received Advice from AD	Yes No DK/NA	34% (922) 66% (603) (125)	72% (13) 28% (5) (5)	21% (72) 79% (266) (41)	69% (110) 31% (49) (7)	18% (13) 82% (61) (20)	33% (38) 62% (62)	67% (72) 33% (35)	48% (30) 52% (33) (4)		100% (13)	28% (121) 72% (313) (29)

¹ Figure may be too high because of the sample, i.e. people found primarily at the lands.

Extension - 2

Variable Name	Range/ Description	Average in Study Areas	Mokotlong (Rolong) Southern	Polokwane (Ngwaketse) Southern	Mogosi (Molete) South East	Matrofwana (Tlokwa) South East	Dikwidi Kgatleng	Malyahana/ Tlhabani Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngamiland
When last advised by AD	Last week	15% (76)	43% (6)	12% (6)	14% (15)	17% (2)	8% (3)	6% (4)	6% (2)			5% (37)
	Last month	42% (251)	50% (7)	14% (7)	58% (61)	33% (4)	46% (18)	66% (47)	25% (8)	100% (34)		4% (65)
	Last Year	19% (114)	7% (1)	9% (5)	20% (21)	42% (5)	38% (15)	21% (15)	41% (13)			6% (39)
	Over 1 yr	26% (154)		65% (34)	8% (8)	8% (1)	8% (3)	7% (5)	28% (9)			0% (0)
	DK/NA	(0)	(9)	(327)	(61)	(82)			(35)			(31)
Radio Ownership	Yes	38% (615)	52% (11)	18% (65)	46% (77)	64% (58)	63% (67)	50% (54)	46% (31)	27% (25)	44% (64)	7% (165)
	No	62% (989)	48% (10)	82% (300)	53% (80)	36% (33)	37% (40)	50% (54)	54% (36)	73% (68)	56% (79)	3% (277)
	DK/NA	(46)	(2)	(8)	(3)	(3)						(26)
Aware- ness of TGLP	Aware (Attended meeting)	56% (466)	59% (10)	48% (91)	54% (65)	36% (15)	55% (45)	77% (67)	82% (46)			-
	Unaware (Heard about)	44% (321)	41% (7)	52% (98)	46% (55)	64% (27)	45% (36)	23% (19)	18% (10)			-
	DK/NA	(401)	(6)	(190)	(46)	(52)	(5)	(1)	(11)			-
42 Extension Contact ¹	0	6% (90)	18% (4)	3% (11)	1% (1)	1% (1)				37% (36)	6% (8)	4% (19)
	1-2	22% (361)	4% (1)	41% (156)	4% (6)	35% (33)	6% (6)	4% (4)	9% (6)	18% (17)	36% (52)	7% (37)
	3-4	31% (511)	4% (1)	22% (83)	29% (48)	29% (27)	34% (36)	23% (25)	22% (15)	23% (22)	29% (42)	7% (212)
	5-6	16% (262)	18% (4)	10% (37)	23% (38)	11% (10)	7% (8)	30% (32)	28% (19)	3% (3)	11% (16)	9% (26)
	7-10	15% (244)	35% (8)	12% (46)	19% (32)	18% (17)	36% (39)	19% (20)	27% (18)	7% (7)	12% (19)	3% (38)
	11-20	9% (155)	21% (5)	11% (42)	17% (28)	5% (5)	16% (17)	19% (21)	10% (7)	4% (4)	4% (6)	4% (30)
	21-plus	1% (27)		1% (4)	8% (13)	1% (1)	1% (1)	6% (6)	3% (2)			
DK/NA	(0)		(0)									(0)

¹ Figure may be too high because of the sample, i.e. people found primarily at the laos.

² This index was derived from a summation of the household's organization membership, attendance of courses, knowledge of an AD's name, whether or not advice had been received from an AD within the previous week, month or year, and radio listenership.

VI. LABOR

Background

A series of fairly well-defined farming activities dictate the labor demands of traditional agricultural production in Botswana. Beginning as early as October, but more often in December, agricultural tasks include plowing, planting, weeding, bird scaring, harvesting, threshing, and crop storage, in a production cycle which generally ends in June. Obviously, each of these activities, if undertaken thoroughly, demands substantial labor at different times throughout the cropping season. This is often unavailable in sufficient quantities from either within or outside the household, thus posing a very real and considerable constraint to production.

The Farm Management Survey (Table 18) found that a typical farming household spends an average of 111 man/days annually on crop production, with millet and with sorghum, the most commonly grown cereal, receiving the highest labor input per hectare of all crops widely grown (FMS 1980: 14-15).

Table 18

Average Per Hectare Labor Utilization (Man/Days)
for the Production of Selected Crops
by Agricultural Activity, 1977/78

	Sorghum	Maize	Beans	Sun-flower	Millet
Plow	1.92	1.92	1.92	1.92	1.92
Plant	0.56	0.56	1.12	0.56	-
Hoe	4.05	3.39	5.56	0.40	4.35
Pest Control	7.50	-	-	0.56	6.92
Harvest	3.00	2.56	7.79	4.49	5.07
Cart	0.75	0.80	0.94	0.67	1.25
Thresh	1.15	0.97	1.73	1.03	2.26
Winnow & Bag	0.80	0.70	0.85	0.77	1.20
Total Labor Input:					
When Broadcasting	19.17	10.34	18.79	9.84	22.97
When Planting	19.73	10.90	19.91	10.40	-
Average total labor per year per household ^{1/}	53.00	18.00	16.00	7.00	9.00

^{1/} Number of man/days per year per household spent on other crops such as groundnuts, watermelon and sweet reed is 8.

Source: FMS 1980: 49,55.

There is a clear, if not rigid, distinction between women's and men's farming activities, with plowing and planting falling to men, and weeding (the most time-consuming of all farming tasks), bird scaring, harvesting, threshing and crop storage falling to women (Kerven 1979: i, 12; Bond 1974: 13; FMS 1980: 15). While this means that men and women have different seasonal peaks for providing agricultural labor (December for men, March for women), overall, the woman is regarded by others as the primary food producer, both in terms of managing agricultural inputs and actually performing agricultural tasks. Indeed, Bond found that 82% of labor expended on farming operations after plowing was provided by women (Bond 1974: 13), although Kerven concludes from an analysis of Activity Survey data gathered in 1977/78 that, altogether, men and women spend almost the same amount of their total time in raising crops (Kerven 1979: 13).^{1/}

Whatever the agricultural task and the person responsible for undertaking it, all too often the labor pool available to the household, both internally and externally, is too small to meet the household's farming needs. Bond found, for example, that 13% of sampled households considered lack of labor their main farming problem. In most households there are some family members, often children, available to assist the farming effort, but frequently there are not enough people to do the necessary work at the optimum time. Thus it is common for a household to need outside help. While the necessity of utilizing non-household labor is especially prevalent in plowing -- the use of non-household labor is closely associated with the hiring, borrowing and exchanging of draft power^{2/} -- it is also commonly required for carrying out such tasks as destumping, weeding, bird scaring, and harvesting. Nevertheless, even for some who can afford to pay outside help in cash or kind, lack of available labor is a constraint to agricultural production. The FAO study found, for instance, that 66% of all households reported having considerable difficulty in hiring labor -- more difficulty than they had had in the past. All in all, if one considers on the one hand the opportunity costs of farming for house-

^{1/} Lucas, after analyzing Rural Income Distribution Survey data, concludes: "It is clear that adult women provide most of the labor time on crops." He does acknowledge, however, that RIDS shows that time men spend on crop husbandry is surprisingly widely spread over the crop cycle. (Lucas 1979: 37-38)

^{2/} The FAO constraints study estimates that 20% of all households, or 16% of the households that plowed in 1971/72, exchanged or borrowed draft power to get their fields plowed (FAO 1974: 54).

hold members, and on the other the fact that work as a farm laborer on the average pays far less than other types of work, then it is not particularly surprising that the labor resources available to a household growing crops are often so limited. (FAO 1974: 7, 53-54; Bond 1974: 20, Table 5.11; Lucas 1979: 58).

The Arable Lands Survey Results

The following table summarizes data concerning labor resources and inputs from the Arable Lands Survey. These data indicate surprising consistency in the labor profile from one lands area to another. Generally 1-4 family members, especially children and grandchildren of the household head, and his wife if he is male, do the bulk of the weeding and harvesting. A higher proportion of non-family individuals help in the plowing of fields than in any other farming activity queried about in the survey. This undoubtedly results in large part from the fact that many plowing arrangements are package deals in which labor to drive a tractor or a team of oxen is part and parcel of the draft power being provided. Very little payment for services from people outside the family is ever made in cash, and only occasionally is payment made in kind (commonly a share of the harvest, plowing services, or home-brewed beer). Exchanges of labor sometimes occur as part of a complex system of reciprocities. Overall, there are between 1-3 males and 1-3 females present in the household between the ages of 5 and 65, giving a total household labor work force of about 4 persons. Surprisingly, the survey showed that there were more males at the average household's lands than females during the 1977/78 agricultural season. This result may have stemmed from enumerator confusion about a question, with some survey teams asking about labor present for plowing rather than about labor present at the lands for the entire cropping year.

Given the average farming household's tremendous reliance upon family labor in traditional agriculture, and especially upon children, as ALDEP gets off the ground, it is most fortunate that school holidays are being arranged to coincide with peak agricultural work periods in the future. In view of the fact that so few surveyed households at the lands pay cash wages, but instead rely upon in-kind or exchange arrangements when using non-family labor, it is quite possible that even should ALDEP farmers succeed in increasing their previous returns to labor, a quantum jump in cash exchanges will not soon occur. If the Arable Lands Survey findings are applicable more widely, it appears that any labor schemes which capitalize upon the current practices and understandings among people, rather than upon increasing wage payments, are apt to find more acceptance among the majority of farmers than those based upon exchanges of pula and thebe. This is particularly true if it is recognized that even should a farmer's yields increase under ALDEP, thousands of farmers who now achieve very low yields will undoubtedly still be unable to make cash outlays for labor.

Table 19

Variable Name	Range/ Description	Average 10 Study Areas	Makalako (Katona) Southern	Pelotshetlha (Eqwabeha) Southern	Mokqosi (Matole) South East	Matnothwana (Hokwa) South East	Ikwididi (Katlona)	Moiyabana/ Ihabala Central	Sechele North East	Kalkontein Ghanzi	Kang Kgalagadi	20 Areas Northern
No. family members helping to plow	0	18% (189)	6% (1)	19% (67)	9% (13)	15% (13)	25% (24)			12% (4)	11% (47)	-
	1-2	46% (473)	29% (5)	50% (181)	40% (61)	46% (37)	51% (48)			42% (14)	29% (33)	-
	3-4	27% (276)	36% (6)	25% (89)	41% (62)	30% (24)	17% (16)			37% (12)	22% (25)	-
	5+	9% (99)	29% (5)	6% (22)	10% (15)	9% (7)	7% (7)			9% (3)	4% (10)	-
	DK/NA	(156)	(6)	(20)	(15)	(13)				(64)	(28)	-
	Means	2.1	3.29					2.35				
Median	2.0	3.33					2.17					
Relation to head of HH of family mbrs. helping to plow	Head	7% (56)	13% (2)	5% (14)	5% (6)							-
	Wife	10% (80)	4% (1)	10% (28)	12% (15)						4% (5)	-
	Child, G'child	65% (520)	50% (8)	67% (196)	69% (87)						39% (56)	-
	Parents	1% (5)		1% (3)								-
	Fa/Bro)	0% (4)		1% (3)	1% (1)							-
	Mo/bro)uncle	1% (8)	6% (1)	1% (4)	1% (1)							-
	Sis,bro	8% (66)	19% (3)	8% (24)	6% (8)						1% (2)	-
	Niece/nephew	2% (18)		2% (7)	2% (2)							-
	Other relative	4% (32)	6% (1)	3% (10)	3% (4)						5% (7)	-
	Non-relative	2% (12)		2% (5)	1% (2)						51% (73)	-
DK/NA		(7)	(78)								-	
No. Non-family people helping to plow	0	76% (724)		83% (284)	90% (134)	44% (31)				52% (13)	89% (94)	-
	1-2	19% (181)	50% (3)	10% (34)	8% (12)	54% (38)				8% (2)	4% (4)	-
	3-4	4% (42)	33% (2)	5% (18)	1% (1)	2% (2)				36% (9)	5% (5)	-
	5+	1% (8)	17% (1)	2% (6)	1% (1)					4% (1)	3% (3)	-
	DK/NA	(229)	(17)	(38)	(18)	(23)				(72)	(37)	-
	Mean	0.47	1.67	0.40	0.17	0.73		0.68				
Median	0.16	1.50	0.10	0.05	0.65		0.26					

Variable Name	Range/ Description	Average 10 Study Areas	Mokatake (Rolong) Southern	Peletshelha (Ngwaketse) Southern	Mokgosi (Molete) South East	Mathothwana (Tlokwa) South East	Dikwididi Kgaleng	Moiyabana/ Ilhabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngamiland
No. family members helping to weed	0	24% (247)	18% (3)	33% (118)	15% (23)	16% (13)	21% (20)		14% (9)	11% (4)	44% (50)	-
	1-2	52% (541)	29% (5)	43% (153)	54% (81)	68% (55)	59% (57)		66% (41)	69% (25)	28% (32)	-
	3-4	19% (192)	35% (6)	20% (71)	26% (38)	10% (8)	17% (16)		18% (11)	14% (5)	17% (19)	-
	5+	5% (49)	18% (3)	4% (16)	5% (7)	6% (5)	3% (3)		2% (1)	6% (2)	11% (13)	-
	DK/NA	(155)	(6)	(21)	(17)	(13)			(5)	(61)	(29)	-
	Mean	1.61	2.65	1.57	1.82	1.54		2.12		1.63		-
Median	1.35	2.67	1.35	1.55	1.19		1.88		1.27		-	
Relation to head of HH of family members helping to weed	Head	6% (43)		7% (17)	4% (5)	5% (5)	10% (7)			13% (4)	8% (5)	-
	Wife	30% (219)	7% (1)	21% (50)	36% (41)	30% (28)	29% (21)	21% (21)		50% (16)	38% (25)	-
	Child, G'child	54% (394)	64% (9)	64% (157)	56% (63)	23% (21)	56% (41)	46% (46)		34% (11)	50% (32)	-
	Parents	2% (16)		2% (5)	2% (2)	1% (1)		6% (6)			2% (1)	-
	Fa/Bro)	0% (1)						1% (1)				-
	Mo/Bro)uncle	0% (0)										-
	Sis, brother	4% (30)	29% (4)	4% (9)	1% (1)	1% (1)	3% (2)	12% (12)		3% (1)		-
	Niece, nephew	1% (7)		(1)				6% (6)				-
	Other rel.	2% (18)		2% (4)	1% (1)	40% (38)	1% (1)	8% (8)			32% (24)	-
	Non-rel	1% (4)		(1)			1% (1)	1% (1)			2% (1)	-
DK/NA	(462)	(9)	(135)	(53)					(65)	(79)	-	
No. non-family people helping to weed	0	89% (787)	80% (8)	81% (239)	96% (138)	90% (54)		93% (99)	90% (45)	83% (15)	96% (105)	-
	1-2	8% (71)	10% (1)	11% (32)	4% (5)	10% (6)		6% (6)	8% (4)	6% (1)	4% (4)	-
	3-4	2% (18)	10% (1)	5% (15)				1% (1)		11% (2)	1% (1)	-
	5+	1% (14)		3% (8)	1% (1)				2% (17)			-
	DK/NA	(294)	(13)	(85)	(22)	(39)			(2)	(79)	(32)	-
	Mean	0.26	0.50	0.50	0.09	0.15		0.11				-
Median	0.26	0.12	0.12	0.02	0.06		0.03				-	

Variable Name	Range/ Description	Average % Study Area	Botswana (Folung) Southern	Botswana (Kgwele) Southern	Malgosi (Molete) South East	Mathethwana (Hlokwa) South East	Dikwi tidi (Kgatleng) Katleng	Mojimane/ Tlhalala Central	Sebele North East	Malibonoin Mankai	hang Kgalebadi	20 Areas Ngabileng
No family members helping to harvest	0	18% (188)	13% (2)	22% (78)	14% (21)	8% (7)	69% (83)	7% (7)	12% (7)	11% (4)	42% (47)	-
	1-2	56% (566)	47% (7)	48% (169)	57% (88)	67% (56)	10% (9)	65% (70)	70% (43)	69% (24)	45% (50)	-
	3-4	22% (226)	33% (5)	24% (87)	27% (41)	20% (17)	1% (1)	23% (25)	18% (11)	17% (6)	12% (13)	-
	5-plus	4% (46)	7% (1)	6% (22)	1% (2)	4% (4)		5% (5)		3% (1)	1% (1)	-
	DK/NA	(158)	(8)	(23)	(14)	(10)			(6)		(32)	-
	Mean	1.75	2.27	1.88	1.79	1.88		2.07		1.62		
Median	1.50	2.20	1.73	1.68	1.38		1.84		1.34			
Relation to head of HH of family mbrs. helping to harvest	Head	5% (42)	8% (1)	4% (12)	7% (8)	7% (5)	8% (6)	20% (20)	43% (16)	13% (4)	10% (6)	-
	Wife	30% (235)	8% (1)	21% (60)	33% (38)	52% (35)	36% (27)	45% (45)	46% (17)	48% (15)	36% (23)	-
	Child,G'child	53% (414)	59% (7)	62% (175)	57% (66)	35% (24)	49% (37)	6% (6)	3% (1)	32% (10)	52% (33)	-
	Parents	2% (19)		4% (10)		2% (1)		1% (1)				-
	Fa/bro)	0% (1)						10% (10)	3% (1)			-
	No/bro)uncle	0% (3)	17% (2)	4% (12)		2% (1)	3% (2)	7% (7)		3% (1)		-
	Sis, bro	4% (31)		1% (2)	1% (1)			10% (10)	5% (2)			-
	Niece, nephew	1% (11)	8% (1)	3% (9)	1% (1)	2% (1)	3% (2)	1% (1)		3% (1)		-
	Other rel.	4% (28)		1% (2)		2% (1)	1% (1)				2% (1)	-
	Non-rel.	1% (4)							(30)			-
DK/NA	(396)	(1)	(95)	(51)	(26)					(79)	-	
No. non-family people helping to harvest	0	92% (844)	50% (3)	89% (289)	97% (144)	92% (60)	93% (81)	91% (96)	98% (50)	84% (16)	94% (104)	-
	1-2	5% (46)	50% (3)	5% (17)	2% (4)	6% (4)	6% (5)	8% (8)	2% (1)	11% (2)	1% (2)	-
	3-4	2% (22)		4% (13)		2% (1)	1% (1)	2% (2)		5% (1)	4% (4)	-
	5+	1% (9)		2% (5)							1% (1)	-
	DK/NA	(263)	(17)	(55)	(18)	(29)			(16)	(78)	(32)	-
	Mean	0.20	0.67	0.32	0.03	0.17		0.16		0.42		
Median	0.04	0.50	0.06	0.01	0.04		0.05		0.18			

Variable Name	Range/ Description	Average 10 Study Areas	Mukatako (Rolong) Southern	Pelotsheliba (Ruwakotse) Southern	Mokqosi (Malete) South East	Mathothwane (Itakwa) South East	Dikwididi (Equleqa) Equleqa	Moiyabana/ Ihabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngarilang
Non-family paid in cash (harvest)	0	62% (39)		33% (8)		83% (10)	1% (25)	100% (11)	100% (4)	50% (1)	50% (1)	-
	1-2	27% (17)		38% (5)		17% (2)	3% (75)			50% (1)	50% (1)	-
	3-4	8% (5)		21% (5)								-
	5+	4% (3)		3% (2)								-
	DK/NA	(857)		(355)	(166)	(82)			(63)	(95)	(142)	-
	Mean	0.9		1.88						1.00		
Median	0.3		1.17						1.30			-
Non-family paid in kind (harvest)	0	45% (19)	75% (3)	24% (3)		89% (8)		33% (3)	100% (3)		1% (1)	-
	1-2	40% (17)	25% (1)	38% (5)	100% (1)	11% (1)	100% (3)	44% (5)				-
	3-4	14% (6)		38% (5)				11% (1)				-
	5+	1% (2)										-
	DK/NA	(877)	(19)	(366)	(165)	(85)			(64)		(142)	-
	Mean	1.0	0.50	1.77				1.11				
Median	0.7	0.33	1.37				0.87					-
Non-family in exchange for (harvest)	0	81% (26)	100% (3)	75% (3)		100% (3)		78% (7)	75% (3)		33% (1)	-
	1-2	13% (4)		25% (1)				22% (2)	25% (1)		33% (1)	-
	3-4	3% (1)									33% (1)	-
	5+	3% (1)										-
	DK/NA	(889)	(10)	(375)	(166)	(85)			(63)		(140)	-
	Mean	0.4	0.00	0.25				0.22				
Median	0.1	0.00	0.17				0.14					-
Non-family unpaid (harvest)	0	64% (27)	75% (3)	19% (2)		(9)		89% (8)	100% (4)		25% (1)	-
	1-2	17% (7)	25% (1)	27% (3)			(1)	11% (1)			23% (1)	-
	3-4	12% (5)		27% (3)							50% (2)	-
	5+	7% (3)		27% (3)								-
	DK/NA	(879)	(19)	(368)	(165)	(85)			(63)		(139)	-
	Mean	1.03	0.25	3.09								
Median	0.3	0.17	2.75									-

Variable Name	Range/ Description	Average 10 Study Areas	Matatiele (Koloro) Southern	Paletotontina (Mwaketse) Southern	Mokgosi (Maletle) South East	Matsothwana (Hlokwa) South East	Dikwi Jisi (Katleng) Northern	Majiyabana/ Ilhabala Central	Sebele North East	Matfontein Gauteng	King Kgalagadi	20 Areas Northern
No. Family members helping to thresh	0	19%(195)	19% (3)	21% (76)	18% (28)	11% (9)	17% (16)	7% (7)	8% (5)	11% (4)	42% (47)	-
	1-2	53%(540)	37.5%(6)	45% (159)	56% (85)	63% (53)	58% (55)	64% (68)	69% (42)	69% (24)	42% (47)	-
	3-4	23%(233)	37.5%(6)	26% (92)	24% (37)	19% (16)	21% (20)	24% (26)	23% (14)	17% (6)	14% (16)	-
	5+	5% (57)	6% (1)	8% (27)	1% (2)	7% (6)	4% (4)	6% (6)		3% (1)	1% (1)	-
	DK/NA	(159)	(7)	(85)	(14)	(10)			(6)	(62)	(32)	-
	Mean	1.8	2.19	1.96	1.68	1.87		2.15		1.65		-
	Median	1.5	2.25	1.78	1.44	1.39		1.9				-
No. Non-family people helping to thresh	0	91%(334)	40% (2)	89% (292)	98% (143)	94% (59)	89% (77)	89% (94)	92% (49)	84% (16)	92% (101)	-
	1-2	6%(52)	60% (3)	5% (17)	2% (3)	3% (2)	9% (8)	8% (8)	4% (2)	11% (2)	5% (5)	-
	3-4	2%(23)		4% (12)		3% (2)	1% (1)	4% (4)	4% (2)	5% (1)	3% (3)	-
	5+	1%(10)		2% (6)							1% (1)	-
	DK/NA	(265)	(18)	(52)	(20)	(31)			(14)	(78)	(33)	-
	Mean	0.20	1.00	0.32	0.03	0.10		0.22		0.42		-
	Median	0.05	1.00	0.06	0.01	0.03		0.06		0.18		-
Total Male HH Labour	0	11% (123)	9% (2)	14% (52)	8% (12)	5% (4)	8% (8)	2% (2)	5% (3)		13% (17)	-
	1-3	67% (766)	70% (16)	72% (263)	70% (105)	58% (50)	72% (70)	52% (55)	75% (48)		66% (89)	-
	4-6	20% (226)	21% (5)	13% (49)	20% (30)	35% (30)	22% (23)	42% (45)	17% (11)		21% (28)	-
	7-9	2% (18)		1% (4)	3% (4)	2% (2)		5% (5)	3% (2)		1% (1)	-
	10-12	0% (0)										-
	DK/NA	(51)		(11)	(15)	(8)			(3)		(8)	-
	Mean	2.3	1.13	1.97				1.49	1.18			-
Median	2.1	1.09	1.74				1.42	1.10			-	
Total Female HH Labor	0	17% (200)	13% (3)	19% (69)	17% (25)	12% (10)	12% (12)	12% (13)	12% (3)		22% (30)	-
	1-3	68% (763)	87% (20)	71% (260)	66% (99)	61% (52)	65% (67)	71% (77)	70% (45)		61% (84)	-
	4-6	14% (160)		10% (39)	17% (26)	26% (22)	23% (24)	17% (18)	16% (10)		15% (20)	-
	7-9	1% (4)			1% (1)	2% (2)					1% (1)	-
	10-12	0% (1)							2% (1)			-
	DK/NA	(51)		(11)	(15)	(8)			(3)		(8)	-
	Mean	1.5	0.87	1.76				1.04	1.07			-
Median	1.7	0.92	1.63				1.03	1.03			-	

All these present in the household between the ages of 5 and 65.

Variable Name	Range/ Description	Average in Study Areas	Matatane (F. Juma) Southern	Felchabothla (Agakhatse) Southern	Makanyi (Malete) South East	Mathotlana (Tloko) South East	Dikwididi Kgatleng	Moiyabana/ Tlhabala Central	Sechele North East	Makfontein Ghanzi	Kang Kgalagadi	20 Areas Ngarilang
Total HH Labor ¹	0	3% (33)		3% (12)	2% (3)	4% (3)	2% (2)		3% (2)		2% (2)	-
	1-3	40% (458)	44% (10)	50% (182)	33% (19)	18% (15)	33% (34)	21% (27)	37% (24)		44% (58)	-
	4-6	39% (442)	52% (12)	38% (141)	46% (70)	34% (29)	40% (41)	46% (43)	41% (26)		40% (54)	-
	7-9	15% (166)	4% (1)	8% (29)	16% (24)	10% (34)	21% (22)	18% (30)	14% (9)		12% (16)	-
	10-12	3% (34)		1% (4)	3% (5)	6% (5)	4% (4)	7% (3)	5% (3)		4% (5)	-
	DK/NA	(51)		(11)	(15)	(8)			(3)		(8)	-
	Mean		4.2	1.61	5.06	4.48	5.85		5.50	1.79	2.51	
	Median		3.9	1.62	4.50	4.63	6.19		5.21	1.73	2.33	
Actual Male HH Labor ²	0	2% (22)	19% (3)	15% (41)	11% (16)	5% (4)	21% (16)	7% (7)	7% (4)	10% (9)	11% (7)	-
	1-3	37% (343)	81% (13)	81% (226)	87% (123)	93% (77)	77% (58)	83% (87)	87% (47)	61% (57)	29% (59)	-
	4-6	37% (342)		4% (11)	2% (3)	2% (2)	1% (1)	10% (10)	6% (3)	28% (26)		-
	7-9	18% (159)								1% (1)		-
	10-12	6% (53)										-
	DK/NA	(265)	(7)	(101)	(24)	(11)			(13)		(77)	-
	Mean		4.6	0.81		4.18		1.00	0.98			
	Median		4.2	0.89		3.40		1.01	0.98			
Actual Female HH Labor ²	0	78% (1292)	55% (13)	55% (208)	85% (141)	86% (81)	57% (61)	82% (88)	69% (46)		85% (120)	-
	1-3	21% (343)	44% (10)	41% (157)	15% (25)	14% (13)	43% (46)	19% (20)	31% (21)		14% (20)	-
	4-6	1% (15)		4% (14)							1% (1)	-
	7-9	0% (0)										-
	10-12	0% (0)										-
	DK/NA	(265)		(0)								-
	Mean			0.44				0.18	0.31			
	Median			0.38				0.11	0.22			
Actual HH Labor ²	0	3% (22)		2% (6)	5% (7)		5% (4)	1% (1)	5% (3)	3% (1)	32% (36)	-
	1-3	37% (343)	53% (9)	32% (105)	31% (45)	52% (43)	45% (39)	18% (19)	38% (23)	77% (23)	38% (26)	-
	4-6	37% (342)	47% (8)	38% (124)	46% (67)	31% (26)	37% (26)	32% (34)	38% (23)	20% (6)	10% (7)	-
	7-9	17% (159)		20% (63)	15% (22)	1% (1)	13% (11)	35% (37)	13% (8)			-
	10-12	6% (53)		8% (26)	3% (4)	4% (3)	3% (3)	13% (14)	5% (3)			-
	DK/NA	(265)	(6)	(55)	(21)	(11)			(7)		(74)	-
	Mean		4.5	1.47		4.45		6.20	1.75	2.56		
	Median		4.2	1.44		4.32		6.50	1.67	2.50		

¹ This figure may well be too high.

² All household members actually present at the lands during the last planting season between the ages of 5 and 65.

Labor - 7

Variate Name	Range/ Description	Average To Study Areas	Botetata (Koloro) Southern	Letimotlha (G. part use) Southern	Mogosi (Molete) South East	Mothothwana (Hokwa) South East	Dikwidi Kg. Long	Molayaana/ Ihabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas North East
Potential Labor Force ³	0		100% (8)	3% (12)		82% (9)	82% (28)	61% (25)	23% (15)			83% (34)
	1-3			50% (182)		18% (2)	18% (6)	39% (16)	2% (1)			17% (7)
	4-6			38% (141)		(3)						
	7-9			8% (29)								
	10-12			7% (4)					75% (43)			
	DK/NA		(15)	(11)		(83)			(3)			(102)
	Mean		0.60	0.12				0.39				
	Median		0.00	0.67				0.32				

³ Total household labor less all household members in school, on leave, or working for wages, but including absentees seeking work

VII. LAND

Background

Land in Botswana has traditionally been a commodity to which every household head has had a right. While that has not changed in customary law, today it appears that there may not be sufficient land for all farming households to plow as much land as each would like to, particularly if the proximity of that land to a household's residence, its fertility, and the availability of nearby grazing and water are taken into account.

The FAO constraints study found that 13% of sampled households had no land whatsoever and that only 45% of households thought that they had sufficient land. Opschoor found that nearly 20% of households plowing in the Kgatleng wanted more land. The following table from the FAO study summarizes opinions concerning land sufficiency according to household holdings and the proportion of holdings actually planted.

Table 20
Considerations of Land Sufficiency

		Percentage of households which consider land available as		
		Sufficient Acreage	Insufficient Acreage	
Households holding land:	(59 460)	62%	38%	100%
All holders plowing:	(50 400)			
All land plowed -	(24 450)	53	47	100
Not all land plowed -	(25 950)	68	32	100
All holders plowing:	(50 400)			
Did not plant -	(9 060)	69	31	100
Households not holding land:	(9 040)	8	92	100
Planting -	(1 330)	31	69	100
Not planting -	(7 710)	4	96	100

Source: FAO 1974: 53.

Whether or not a household considers that it holds sufficient land to meet its plowing objectives, it seems that it is common for the land which is held to be distributed across more than a single field. Several village studies, for example, undertaken in the past two years indicate that perhaps a quarter of family households plant more than one field (Kooijman 1978: 67; Opschoor 1980: 23). More important than the number of fields at a household's disposal, however, is the fact that the distribution of land holdership is highly skewed in favor of larger holders. The Agricultural Survey of 1971/72 indicates that half of the holders planted only 20% of the total hectareage, while 20% of the holders planted half of the total hectareage. Looked at another way, over one-third of the holders planted only 8% of all hectareage planted (fewer than 4 hectares), while approximately one-tenth of the holders planted one-third of the total hectareage (more than 10 hectares).^{1/} (Ag Survey 1973: 30)

Table 21

Distribution of Agricultural Holders
by Hectareage Planted

Hectareage Planted	Thousands of Holders	Thousands of Hectares	Percentage	
			Holders	Hectareage
0	3.5	0	5.5	0
1- 2	17.9	21.1	28.2	8.2
2- 4	17.6	49.3	27.6	19.1
4- 6	11.6	55.2	18.2	21.4
6- 8	6.5	43.8	10.1	17.0
8-10	3.6	32.1	5.7	12.4
10-20	2.5	37.9	3.9	14.7
20-40	0.3	6.3	0.5	2.5
40+	0.2	12.3	0.3	4.7
Total	63.7	258.0	100.0	100.0

Source: Agricultural Survey 1973: 30.

^{1/} The Farm Management Study reported that 46% of households sampled plowed less than a 4 hectare area, while only 19% planted 10 hectares or more (FMS 1980: 7).

Not surprisingly, the 1971/72 Agricultural Survey found that there is a positive correlation between the distribution of holders of farming land and the area they planted, with the number of cattle these households hold. In short, generally wealthier farmers plant larger areas than do their poorer counterparts.

Table 22

Distribution of Agricultural Holders
by Hectarage Planted and Herd Size

Hectarage Planted	No. of agricultural holders by no. of cattle held							
	0	1-10	11-20	21-40	41-60	61-80	80+	Total
0	40	490	450	750	900	450	450	3 530
1- 2	9 320	2 750	2 900	1 720	550	450	250	17 940
2- 4	4 890	4 430	3 100	3 840	750	600		17 610
4- 6	2 470	2 500	2 090	2 290	1 200	450	600	11 600
6- 8	1 170	1 670	1 170	1 690	750			6 450
8-10	980	400	680	920	320	150	150	3 600
10-20	170	170	530	700	450	170	300	2 490
20+			60	60	40		320	480
Total	19 040	12 410	10 980	11 970	4 960	2 270	2 070	63 700

Source: Agricultural Survey 1973: 33.

This general trend is supported by Lucas's analysis of the Rural Income Distribution Survey data, from which he concludes that there is clearly a positive relationship between the acreage planted by a household and the number of cattle held and that female-headed households, which tend to be poorer than male-headed households, have 33% less land than do male-headed households, among households with land (Lucas 1979: 4-13). Regarding actual holdership, Bond, in her study of women's involvement in agriculture, found that it is more common for men to hold land than for women to do so, although it is not uncommon for women to hold land in their own right (Bond 1974: Table 5.1).

The Arable Lands Survey Results

Table 25 summarizes frequencies concerning land holdership and land improvements from the Arable Lands Survey. These figures indicate that, as with other factors of arable production, land holdership and improvements vary widely from area to area. Only 2% of households in Pelotshetlha, for example, reported holding no fields, while that figure was 24% in Mokgosi lands area. Only 10% of households at Mokatako hold 3 acres or less, while in Central District's Moiyabana and Tlhabala, 45% reported no more arable land than that. While 6% of households at Pelotshetlha have improved no more than a quarter of their holdings, it appears that approximately 50% of those residing in Moiyabana or Tlhabala have fully improved no more than a quarter of their lands.

A workshop held in February 1980 to review the findings of the Arable Lands Survey confirmed that land profiles vary considerably from one area to another. At the same time, however, there was consensus that except for Ngamiland, all districts are experiencing some degree of land shortage. The following table summarizes the situation as viewed by district agricultural, lands, and development officials.

Table 23

Reported Pressure on Land, by District

Southern	Severe in East
South East	Severe
Kgatlang	Severe
Central	Moderate
North East	Severe
Ghanzi	No fertile land
Kgalagadi	No fertile land
Ngamiland	None
Chobe	Shortage of grazing land
Kweneng	Shortage in East

Furthermore, a ranking of constraints in the Arable Lands Survey indicated that while those plowing did not see a serious land constraint, shortage of land was the main constraint for those not plowing.

Table 24

Constraints to Production

Households Plowing the Previous Season	Households Not Plowing the Previous Season
<ol style="list-style-type: none"> 1. Crop damage by birds and pests. 2. Draft power and implement shortage. 3. Cash and labor shortages. 	<ol style="list-style-type: none"> 1. Land shortage. 2. Draft power. 3. Crop damage by birds and pests. 4. Implement and cash shortages.

In light of this, it is clear that Botswana's extensive efforts to carry out land use planning at the district level have been well-placed and that the attention which is now being given to the planning of agricultural and grazing areas and the registration of holdings in and around villages is essential if the land resource is to be maximized. This planning will be particularly important if, in the future, thousands of households which want to participate in ALDEP, but which may not have the 6 hectare minimum holding recommended by the program begin to request new allocations.^{1/} Given the fact that the proximity and number of fields held by a household, not just the size of those fields, will be an important factor in a household's agricultural management system, careful planning of land use now can only have a positive and beneficial effect upon ALDEP implementation.

^{1/} Arable Lands Survey data indicate that the median holding in the 10 study areas is only 3.9 ha.

The land pressures reported by nearly all the districts participating in the 1961 Land Survey suggest that any efforts under ALDEP to encourage the debushing and careful destumping of fields, so that virtually all lands held by a household can be plowed and planted, will be warranted. The fact that the average household in surveyed areas had not improved all of its holdings indicates that, in this realm, there is an opportunity to expand the current effective land resource base. Even with land improvement incentives or programs, however, it is clear that any suggestions that ALDEP encourage much more extensive agriculture, rather than more intensive farming, are in the long run unrealistic. Indeed, it could be that in advocating a program which recommends that households have 6 hectares at their disposal for plowing, ALDEP will run into trouble if it is truly to reach the tens of thousands of farming families which it hopes will participate in different facets of the program over the decades to come.

Table 25

Variable Name	Range/ Description	Average No Study Areas	Mokatako (Kolomo) Southern	Pelotshetlha (Ggwaketse) Southern	Mokgosi (Maletse) South East	Mathothwana (Ilakwa) South East	Gikwididi (Katleng) Katleng	Moiyabana/ Tlhabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	2: Areas Mamfild
Total No. of Fields	0	10% (116)		2% (9)			12% (13)	9% ¹ (0)	3% (2)	52% ² (35)	40% ³ (53)	-
	1	64% (725)	52% (11)	70% (264)		62% (58)	65% (68)	40% (43)	79% (53)	47% (32)	55% (74)	-
	2	17% (197)	53% (7)	14% (53)		32% (30)	22% (23)	31% (33)	15% (10)	2% (1)	5% (7)	-
	3-4	8% (87)	15% (3)	12% (44)		5% (5)	1% (1)	23% (25)	3% (2)			-
	5-plus	1% (14)		2% (7)				6% (6)				-
	DK/NA	(45)	(2)	(2)		(1)						-
	Mean	1.30	1.62	1.48								
	Median	1.13	1.46	1.18								
Total Acreage	0	2% (22)		(1)	1% (1)						1% (1)	2% (19)
	1-2	3% (44)		2% (5)	1% (1)				4% (3)	46% (15)	11% (9)	2% (3)
	3-4	18% (258)		6% (19)	7% (17)				18% (12)	18% (6)	24% (20)	17% (17)
	5-6	10% (141)	5% (1)	16% (50)	17% (26)	17% (16)			8% (5)	9% (3)	15% (16)	1% (1)
	7-8	14% (194)	5% (1)	13% (41)	18% (27)	11% (10)			8% (5)	3% (1)	19% (7)	20% (27)
	9-10	9% (122)		11% (34)	21% (32)	12% (11)			8% (5)	9% (3)	7% (6)	7% (5)
	11-15	18% (251)	5% (1)	21% (63)	15% (23)	24% (22)			16% (11)	6% (2)	12% (10)	16% (7)
	16-20	13% (180)	10% (2)	12% (40)	9% (14)	10% (9)			16% (11)	3% ³ (1)	6% (5)	11% (5)
	21-30	6% (88)	25% (5)	8% (27)	8% (12)	13% (12)			14% (9)		1% (1)	1% (1)
	31-50	4% (62)	15% (3)	5% (17)	1% (2)	10% (9)			6% (4)	6% ³ (2)	9% (7)	1% (1)
	51-plus	3% (37)	35% (7)	5% (18)	1% (2)	3% (3)						1% (1)
	DK/NA	(251)	(3)	(59)	(15)	(2)						(9)
	Mean				20.87				(2)	(64)	(61)	(13)
	Median				11.21							

59

¹ District officials believe this figure should be about 10%

² In fact the majority of households own one field

³ District officials feel these figures are too high

Variable Name	Range / Distribution	Agreya 14 Study Areas	Montats (Kalonge) Southern	re-located (Dwarakudu) Southern	Maposi (Mabete) Southern	Matshwane (Hokwa) North East	Dikwidi (Kgatleng)	Mojabana/ Tlohaba Central	Sechele North East	Mokfontein Gharzi	Kang Kgalema	20 Areas Mamibia
Acreage Debused	0	2% (19)		4% (12)	1% (2)	2% (2)	1% (1)				3% (3)	-
	1-2	6% (58)		2% (5)	4% (5)	3% (3)	2% (2)	13% (13)	6% (4)	50% (15)	14% (10)	-
	3-4	11% (105)	7% (1)	6% (20)	14% (20)	6% (6)	9% (8)	12% (16)	15% (12)	20% (6)	22% (16)	-
	5-6	16% (149)	7% (1)	16% (52)	17% (25)	15% (14)	11% (9)	23% (22)	9% (6)	10% (3)	23% (17)	-
	7-8	11% (104)	13% (2)	12% (38)	17% (25)	13% (12)	11% (9)	10% (10)	6% (4)		6% (4)	-
	9-10	13% (120)		11% (36)	17% (25)	12% (11)	16% (14)	14% (14)	15% (10)	7% (2)	11% (8)	-
	11-15	15% (141)		20% (64)	12% (17)	18% (16)	20% (17)	10% (10)	11% (7)	7% (2)	11% (8)	-
	16-20	10% (90)	20% (3)	10% (33)	10% (14)	9% (8)	14% (12)	7% (7)	14% (9)	3% (1)	3% (2)	-
	21-30	8% (70)	13% (2)	9% (27)	6% (8)	11% (10)	8% (7)	5% (5)	14% (9)		3% (2)	-
	31-50	5% (43)	27% (4)	5% (17)	1% (2)	7% (6)	6% (5)	1% (1)	5% (3)	3% (1)	6% (4)	-
	51-plus	3% (23)	13% (2)	5% (16)	1% (1)	3% (3)	1% (1)					-
	DK/NA	(262)	(8)	(59)	(21)	(3)			(3)	(67)	(49)	-
	Mean	14.1	7.07	19.08	10.25	15.26	14.0	8.34			8.8	
	Median	9.3	7.75	10.36	8.21	10.08	10.0	6.14				
69	Acreage Destumped	0		5% (18)	12% (17)	11% (10)	6% (5)	54% (51)	48% (31)		29% (25)	5% (35)
		1-2		2% (6)	8% (11)	2% (2)	4% (3)	10% (9)	9% (6)	50% (15)	11% (8)	1% (4)
		2-4	24% (329)	13% (2)	6% (21)	13% (19)	9% (8)	11% (9)	9% (6)	20% (6)	21% (15)	53% (231)
		5-6	10% (131)	7% (1)	17% (55)	18% (26)	17% (15)	11% (9)	8% (8)	7% (2)	14% (10)	0% (1)
		7-8	12% (160)	7% (1)	11% (34)	12% (18)	15% (14)	9% (7)	3% (3)		4% (3)	18% (74)
		9-10	7% (91)		11% (34)	16% (23)	11% (10)	12% (10)	3% (3)	10% (3)	4% (3)	1% (2)
		11-15	11% (154)		19% (62)	19% (13)	15% (14)	18% (15)	3% (3)	7% (2)	8% (6)	8% (33)
		16-20	9% (125)	20% (3)	11% (35)	6% (9)	9% (8)	14% (11)	5% (5)	3% (1)	3% (2)	11% (47)
		21-30	4% (49)	13% (2)	8% (24)	4% (6)	6% (5)	7% (6)	2% (2)		1% (1)	0% (1)
		31-50	3% (35)	27% (4)	5% (15)	2% (3)	3% (3)	6% (5)		3% (1)	6% (4)	
		51-plus	1% (22)	13% (2)	5% (16)		2% (2)	1% (1)	2% (1)			
		DK/NA	(301)	(8)	(59)	(21)	(3)		(3)	(67)	(70)	(20)
		Mean	10.1	6.93	18.52	8.31	11.74	13.0	3.30	2.12	6.6	
		Median	5.9	7.75	10.14	6.47	8.06	10.0	0.4	0.67		

Variable	Range/ Description	Alupane N. Study Areas	Makotako (Belong) Southern	Polekhatlho (Gwaketse) Southern	Makgadi (Galeto) South-East	Mantlana (Galeto) South-East	Dikwidi Northern	Mojabana/ Tlhabala Central	Sechele North-East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Northern	
Acreage Planted	0	11% (147)	7% (1)	11% (36)	1% (2)			1% (1)			8% (6)	13% (99)	
	1-2	6% (77)		6% (18)	6% (8)	3% (3)	4% (3)	13% (13)	6% (4)	53% (16)	14% (10)	1% (2)	
	2-4	23% (315)	13% (2)	10% (33)	22% (32)	18% (16)	13% (11)	27% (27)	25% (16)	20% (6)	25% (20)	6% (154)	
	5-6	11% (146)	7% (1)	13% (40)	19% (27)	23% (21)	11% (9)	22% (22)	14% (9)	3% (1)	21% (15)	0% (1)	
	7-8	15% (203)	13% (2)	12% (39)	17% (24)	20% (18)	20% (17)	12% (12)	11% (7)		6% (5)	19% (80)	
	9-10	8% (103)	13% (2)	10% (32)	15% (21)	9% (8)	18% (15)	7% (7)	11% (7)	10% (3)	10% (7)	3% (54)	
	11-15	12% (161)	7% (1)	15% (49)	8% (11)	12% (11)	17% (14)	8% (8)	9% (6)	7% (2)	6% (5)	4% (34)	
	16-20	7% (103)	7% (1)	8% (27)	9% (13)	9% (8)	8% (7)	6% (6)	6% (4)	3% (1)	3% (2)	0% (1)	
	21-30	4% (55)	13% (2)	7% (23)	3% (5)	4% (4)	8% (7)	3% (3)	13% (8)		4% (2)	0% (0)	
	31-50	2% (27)	20% (3)	4% (13)	1% (2)	1% (1)	1% (1)		5% (3)	3% (1)	(3)	0% (0)	
	51-plus	1% (13)		4% (11)		1% (1)		1% (1)				0% (0)	
	DK/NA	(300)	(8)	(39)	(21)	(3)			(3)	(6)	(70)	(27)	
	Mean		9.4	5.40	14.74	9.63	10.13	10.0			5.20	7.6	
	Median		6.4	5.25	8.89	7.20	7.19	9.0			2.36		
Proportion Improved Land	0	13% (166)		5% (16)	12% (17)	11% (10)	6% (5)	53% (49)	49% (31)		29% (20)	4% (17)	
	1-25%	5% (60)	13% (2)	1% (3)	4% (5)	2% (2)	10% (8)	8% (7)	8% (5)	3% (1)	3% (2)	6% (25)	
	26-33%	2% (30)	13% (2)	4% (12)	17% (24)	22% (20)	15% (12)	15% (14)	11% (7)	3% (1)	11% (8)	5% (61)	
	34-50%	10% (131)	7% (1)	9% (28)	12% (17)	12% (11)	16% (13)	5% (5)	6% (4)	3% (1)	11% (8)	9% (37)	
	51-67%	6% (83)	67% (10)	81% (256)	55% (76)	52% (47)	52% (42)	17% (18)	25% (16)	91% (27)	47% (34)	15% (264)	
	68-75%	3% (42)									1% (1)	(21)	
	76-100%	61% (792)											
	DK/NA	(346)	(8)	(0)	(27)	(4)			(4)	(6)	(71)	(27)	
Proportion of Land Planted	0	10% (125)	7% (1)	11% (34)	1% (2)			1% (1)			7% (5)	10% (80)	
	1-25%	5% (72)	26% (4)	7% (19)	4% (5)	8% (7)	12% (10)	10% (10)	3% (2)	7% (2)	4% (3)	3% (10)	
	26-33%	3% (36)	33% (5)	8% (26)	17% (23)	33% (29)	22% (18)	26% (25)	22% (14)	3% (1)	11% (8)	6% (23)	
	34-50%	10% (133)	7% (1)	8% (26)	16% (22)	23% (20)	22% (18)	15% (15)	8% (5)	3% (1)	13% (9)	0% (37)	
	51-67%	8% (103)	27% (4)	66% (205)	63% (87)	37% (33)	45% (37)	48% (47)	67% (43)	87% (26)	65% (47)	12% (250)	
	68-75%	4% (52)											
	76-100%	60% (779)											
	DK/NA	(347)	(8)		(27)	(5)			(3)	(67)	(71)	(32)	

¹ This figure should perhaps be 80-85%.

² Virtually all fields in this area are completely debused and destumped.

VIII. SOIL AND LAND IMPROVEMENT, WATER RESOURCES

Background

The ecological problems facing Botswana farmers are thorny ones to which, until relatively recently, Government had given little concerted attention or thought. The country's natural constraints were recently summarized by those preparing the Arable Lands Development Programme:

The ecology of Botswana is a very fragile one and can easily be upset by misuse. The annual rainfall is on the average about 450 mm and falls mainly during a four month period from October to February. The rain usually comes in heavy showers of short duration. The remaining part of the year has little or no precipitation. Most of the soils of Botswana are light and sandy and are therefore very susceptible to erosion. The situation is aggravated by a sparse vegetation cover which is easily damaged by overgrazing, veld fires in the dry season and human mismanagement.
(ALDEP (Soil Conservation) undated: 1)

Furthermore, Botswana's soil is basically poor, sorely lacking phosphate, nitrogen, and other nutrients which are important to achieving good yields. Lands areas which have long been used are today often depleted to the point that farming households cannot justify plowing and planting of those fields. Indeed, in-depth interviews carried out during the FAO study of agricultural constraints revealed that many households considered the land they held to be insufficient to meet even their subsistence needs because its condition was so poor (FAO 1974: 60). Use of commercial fertilizers has always been too expensive for most and the application of kraal manure too labor intensive or too logistically difficult for many. Yet today it is no longer possible for communities to resettle in a different area when their land resources have been depleted, as they once did.

If the natural conditions for growing crops in Botswana are poor, and have been made worse with previous agricultural efforts, additional problems face farming households in the debushing and destumping of their fields. While comprehensive data concerning such improvement of land have not been great, there is no question that considerable tracts have either never been debushed and destumped or, more likely, that they have been cleared but subsequently allowed to grow over with thorn bush through disuse. Destumping, especially in the northern parts of the country where trees grow large and are supported by relatively deep root systems, has proved particularly difficult for farmers over the years --

especially for subsistence farmers with limited resources.
(Taukobong 1980: 1)

As for water as an agricultural resource, the ALDEP Preparation Team has stated that its non-availability in lands areas during autumn and spring will possibly be the single most important constraint on developing more intensive, better farming (ALDEP (Review) 10/79: 2). Whether or not that will, in fact, prove so, unquestionably water supplies -- be they from hand-dug holes, pans, streams, springs, wells, dams, underground storage tanks of rain water, or boreholes -- currently determine seasonal movement between the village and lands of many farm families (ALDEP (Water Development) 1978: 1).^{1/} Work currently being carried out in a comprehensive investigation of water points in the eastern communal areas of the country will undoubtedly shed considerable light on this crucial subject.

The Arable Lands Survey Results

The following table brings together information from the Arable Lands Survey areas regarding soil and land improvement and the water resources depended upon by enumerated households. These findings indicate that specific soil improvement and conservation measures are not widely practised by Batswana farmers. As discussed previously in the section on agricultural inputs and implements, commercial fertilizers are used by only a handful of farmers, while kraal manure, which is available to many farmers, is also used by only a few. The reasons for this may well lie in transport and labor constraints in hauling the manure and in the fact that manured lands produce more weeds than unmanured fields and possibly little, if any, extra yield.

Contour plowing is practised by a few farmers, perhaps as much along river beds as on hillsides in this relatively flat country. Some surveyed farmers actually rotate their crops, although given the mixed cropping which so many farmers carry out in traditional agriculture, the need for rotation is not so great as if mono-cropping were more widespread. Data on fencing indicate that on the average almost as often as not fields are, in fact, set off with wire or brush. The implications of fencing, which keeps cattle out of crops, for the improvement of agricultural practises over the long term are obvious.

^{1/} Specific information concerning water supplies in the Shoshong area can be found in Syson 1973: 29-33.

Actual improvement of arable land through debushing and destumping, reviewed previously in the section on land, varies considerably from area to area, although it appears that, on the whole, considerably more land has been debushed than destumped. If the proportion of land not altogether cleared in the Arable Lands Survey ten study areas is any indication of the situation elsewhere -- perhaps 40% of households' fields have not been fully improved -- innovative programs under ALDEP for the clearing of land will be very important to future agricultural development. Given the potential erosion of soils from destumping, however, programs to encourage the total clearing of fields must be very carefully formulated and monitored.

Arable Lands Survey data indicate that dams and haffirs are a very important source of water at the lands although in most districts wells are also widely depended upon. Unfortunately, dams are not always as reliable a source of water as are wells. Boreholes, while the most reliable source, both are extremely expensive and can easily lead to overgrazing. In most lands areas surveyed significant proportions of households own their own water source, although many more depend upon a Council or communally owned facility. Generally, more than half of those surveyed in eastern Botswana reported that they were less than 500 meters from their primary water source, while nearly a third of the households reported having to haul water at least 2 kilometers.

Water development in lands areas, therefore, will clearly have to be a major component of ALDEP, although it will have to be undertaken with the utmost care. Permanent water contributes to permanent settlement, with all its advantages for carrying out farming. However, water supplies which draw livestock in large numbers into plowing areas beyond basic draft power requirements will be counter-productive. Special efforts, such as proposed under the Communal Area Planning and Development program, to assist communities to demarcate clearly their arable and grazing areas will help considerably to assure that water development is properly planned. The development of water catchment tanks under ALDEP is also a step in the right direction, though obviously, at best, will meet only some of the water requirements of those settling permanently near their fields. Wells may be worthy of careful consideration because they are both relatively inexpensive and unlikely to attract livestock in large numbers. The Water Points Survey may help identify new ways of tackling this most difficult, but crucial issue of water availability at the lands.

Table 26

Variable Name	Range/ Description	Average IG Study Areas	Mokotoko (Polono) Southern	Polotshelhe (Tswakelhe) Southern	Mokosi (Salote) South East	Mothothwana (Hloka) South East	Gikwididi (Katleng) Katleng	Moiyabana/ Ithabala Central	Sechele North East	Kalkfontein (Chanzi) Chanzi	Kang (Kgalaqadi) Kgalaqadi	20 Areas Ngamiland
Use of Manure or Fert.	Fertilizer	5% (71)		14% (53)	10% (15)	1% (1)	1% (1)	1% (1)				
	Manure	3% (39)	25% (4)	2% (7)	4% (6)	1% (1)	2% (2)	2% (2)		3% (1)		
	Both	0% (1)			1% (1)							1% (16)
	Neither DK/NA	92% (1323) (216)	75% (12) (7)	84% (306) (4)	85% (126) (18)	98% (8) (3)	97% (95) (9)	97% (105)	100% (64) (3)	97% (28) (68)	100% (27) (56)	93% (411)
Contour Plow	Yes	8% (125)	100% (1)	89% ² (77)		11% (4)	14% (6)	24% ¹ (12)	5% (2)		10% (3)	
	No	92% (1529)		11% (9)		89% (31)	86% (36)	77% (39)	95% (33)		90% (37)	
	DK/NA	(1)	(22)	(1)		(59)	(45)	(57)	(27)		(43)	
Crop Rotation	Yes	31% (298)	80% (4)	80% (126)	54% (43)	48% (25)	29% (17)	31% ² (21)	43% (20)		21% (9)	1% (33)
	No	69% (657)	20% (1)	20% (31)	46% (36)	52% (27)	71% (42)	69% (47)	57% (27)	100% (15)	80% (35)	99% (395)
	DK/NA	(692)	(18)	(222)	(37)	(42)	(48)	(40)	(20)		(99)	(38)
Fencing	Yes	40% ¹ (406)		30% (29)	33% (56)	48% (30)	58% (45)	16% (15)	51% (27)	59% (77)	63% ⁴ (49)	1% (15)
	No	60% (616)	100% (10)	70% (68)	67% (52)	52% (33)	42% (33)	84% (78)	49% (26)	41% (15)	37% (29)	63% (269)
	DK/NA	(628)	(13)	(289)	(88)	(31)	(30)	(15)	(14)	(31)	(65)	(39)
Arreage Debushed	0	2% (19)		4% (12)	1% (1)	2% (2)	1% (1)		6% (4)		3% (3)	
	1-2	6% (58)		2% (5)	4% (6)	3% (3)	2% (2)	13% (13)	15% (12)	50% (15)	14% (10)	
	2-4	11% (105)	7% (1)	6% (20)	14% (20)	7% (6)	9% (8)	16% (16)	9% (5)	20% (6)	22% (16)	
	5-5	16% (199)	7% (1)	16% (52)	17% (25)	15% (14)	11% (9)	22% (22)	6% (4)	10% (3)	23% (17)	
	7-8	11% (104)	13% (2)	12% (38)	17% (25)	13% (12)	11% (9)	10% (10)	16% (10)		6% (4)	
	9-10	13% (120)		11% (36)	17% (25)	12% (11)	17% (14)	14% (14)	11% (7)	1% (2)	11% (8)	
	11-15	15% (141)		20% (64)	12% (17)	18% (16)	20% (17)	10% (10)	14% (9)	7% (2)	11% (8)	
	16-20	10% (90)	20% (3)	10% (33)	10% (14)	9% (8)	14% (12)	7% (7)	14% (9)	3% (1)	3% (2)	
	21-30	8% (70)	13% (2)	9% (27)	6% (8)	11% (10)	8% (7)	3% (5)	5% (3)			
	31-50	5% (43)	27% (4)	5% (17)	1% (2)	7% (6)	6% (5)	1% (1)		3% (1)	3% (2)	
	51-plus	3% (23)	13% (2)	5% (16)	1% (1)	3% (3)	1% (1)		(3)		6% (4)	
	DK/NA	(262)	(8)	(59)	(21)	(3)	(22)	(10)		(67)	(49)	
	Mean	14.1	7.07	19.08	10.25		14.0	8.389			8.8	
	Median	9.3	7.75	10.36	8.21		10.0	6.143				

¹ A figure of 8% may be more correct.² This figure is probably too high.³ Wire fencing is thought to be much less prevalent than this figure indicates. In evaluation in some areas, brush fences were probably included in recorded figures.⁴ District officials think this figure is actually closer to 100%.

Soil and Land Improvement - 2

Variable Name	Group/ Description	Average 19 Study Areas	Makotako (Kolong) Southern	Feletshetlha (Agwaketse) Southern	Mojososi (Mafetse) South East	Matrothwana (Tlofwa) South East	Dikwidi E. Katleng	Moiyabana/ Tlhabane Central	Sechele North East	Kalkfontein Ghanzi	hang Kgalagadi	20 Areas Ngarilang
Acreage Destumped	0	14% (189)		5% (18)	12% (17)	11% (10)	6% (5)	54% (51)	48% (31)			8% (35)
	1-2	5% (64)		2% (6)	8% (11)	2% (2)	4% (3)	10% (9)	9% (6)	50% (15)		1% (4)
	2-4	24% (329)	13% (2)	6% (21)	13% (19)	9% (8)	11% (9)	12% (11)	3% (6)	20% (6)		53% (231)
	5-6	10% (131)	7% (1)	17% (55)	18% (26)	17% (15)	11% (9)	8% (8)	5% (4)	7% (2)		0% (1)
	7-8	12% (160)	7% (1)	11% (34)	12% (18)	15% (14)	9% (7)	3% (3)	3% (2)			18% (78)
	9-10	7% (91)		11% (34)	16% (23)	11% (10)	12% (10)	3% (3)	5% (3)	10% (3)		1% (2)
	11-15	11% (154)		19% (62)	10% (13)	15% (14)	18% (15)	3% (3)	9% (6)	7% (2)		8% (33)
	16-20	9% (125)	20% (3)	11% (35)	6% (9)	9% (8)	14% (11)	5% (5)	5% (3)	3% (1)		11% (47)
	21-30	4% (49)	13% (2)	8% (24)	4% (6)	6% (5)	7% (6)	2% (2)	3% (2)			0% (1)
	31-50	3% (35)	27% (4)	5% (15)	2% (3)	3% (3)	6% (5)				3% (1)	
	51-plus	1% (22)	13% (2)	5% (16)		2% (2)	1% (1)		2% (1)			
	DK/NA	(301)	(8)	(59)	(21)	(3)			(3)	(67)		(28)
	Mean		10.1	6.93	18.52	8.31	11.74	13.0	3.30	2.12		
	Median		5.9	7.75	10.14	6.47	8.06	10.0	0.40	0.66		
Proportion, Improved Land	0	13% (160)		5% (16)	12% (17)		6% (5)	53% (49)	49% (31)			6% (25)
	1-25%	5% (60)	13% (2)	1% (3)	4% (5)		10% (8)	8% (7)	8% (5)	3% (1)		15% (61)
	26-33%	2% (30)	13% (2)	4% (12)	17% (24)		15% (12)	15% (14)	11% (7)	3% (1)		9% (37)
	34-50%	10% (131)	7% (1)	9% (28)	12% (17)		16% (13)	5% (4)	6% (4)	3% (1)		65% (264)
	51-67%	6% (83)	67% (10)	81% (256)	55% (76)		52% (42)	19% (18)	25% (16)	9% (27)		
	68-75%	3% (42)										
	76-100%	61% (752)										
	DK/NA	(346)	(8)	(0)	(27)				(4)	(67)		(32)
	Mean		0.7	3.27	0.88	0.68	0.67		0.27			
	Median		1.0	3.75	1.00	0.80	0.79		0.00			

Variable Name	Range/ Description	Average 10 Study Areas	Mokotako (Rolong) Southern	Pelotshelha (Hqwaketse) Southern	Mokgosi (Maletle) South East	Mathothwana (Illokwa) South East	Dikwididi (Kgatleng) Kgatleng	Moiyabana/ Ilhabala Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	2) Areas Ngamiland
Primary Water Source	Dam ¹	59% (539)	14% (1)	95% (302)	48% (66)	84% (77)	59% (53)	31% (33)	9% (5)	5% (1)		
	Borehole	17% (160)		1% (4)	12% (17)	12% (11)	6% (5)	19% (20)	33% (18)	53% (10)	83% (75)	
	Pan	6% (59)	72% (5)	4% (11)	4% (6)	3% (3)	4% (4)	14% (15)	20% (11)	5% ³ (1)	3% (3)	
	Deep Well	8% (71)	14% (1)	0% (1)	18% (25)	1% (1)	6% (5)	24% (25)		37% (7)	7% (6)	
	River	3% (25)			5% (7)		2% (2)	9% (9)	13% (7)			
	Shallow Well	7% (60)			12% (15)		23% (21)	4% (4)	24% (13)		7% (6)	
	DK/NA	(270)	(16)	(61)	(29)	(2)			(13)	(74)	(53)	
Ownership of Primary Water Source	Self	27% (238)		40% (127)	19% (23)	31% (28)	25% (22)	23% (24)	17% (9)	11% (2)	3% (3)	
	Syndicate	0% (3)		0% (1)			2% (2)					
	Council	11% (99)		1% (3)	8% (10)	8% (6)	2% (2)	8% (8)	28% ² (15)	26% (5)	57% (50)	
	Communal/tribal	30% (263)	83% (5)	9% (27)	58% (71)	40% (36)	39% (34)	46% (48)	17% (9)	32% (6)	31% (27)	
	Other	32% (289)	17% (1)	50% (160)	15% (19)	22% (20)	32% (28)	24% (25)	39% (21)	32% (6)	9% (8)	
DK/NA	(22)	(17)	(61)	(43)	(4)			(13)	(78)	(55)		
Distance to Primary Water Source	Less than 500m	44% (571)	73% (11)		57% (75)	53% (48)	52% (43)	22% (23)	79% (42)	8% (1)	27% (24)	
	Less than 1km	26% (343)	20% (3)	51% (153)	17% (23)	22% (20)	34% (28)	40% (42)	17% (9)	62% (8)	34% (31)	
	2km	10% (136)		26% (77)	8% (11)	8% (7)	2% (2)	14% (15)	2% (1)	8% (1)	6% (5)	
	3km	5% (71)	7% (1)	10% (31)	2% (2)	3% (3)	2% (2)	7% (7)		15% (2)	6% (5)	
	4km	3% (35)		6% (17)		1% (1)	6% (5)	5% (5)		8% (1)	8% (7)	
	5km	4% (55)		2% (6)	2% (3)	5% (5)	1% (1)	10% (10)			3% (3)	
	6km	1% (18)		3% (9)	2% (2)	1% (1)	1% (1)	3% (3)			1% (1)	
	7km	1% (13)		0% (1)	2% (2)	3% (3)	1% (1)				3% (3)	
	Over 7km	6% (73)		2% (6)	11% (14)	2% (2)			2% (1)		12% (11)	
	DK/NA	(335)		(79)	(34)	(4)		(1)	(14)	(6)	(53)	
	Mean	1.2	0.40	1.02	0.67	1.13		1.72		1.77	1.50	
Median	0.6	0.18	0.48	0.27	0.42		1.18		1.19			

¹In enumeration, this term may have been interpreted to include haffirs and waterholes.

²In fact, everyone in Sechele fetches water primarily from a Council borehole.

³Most cattle in Kalkfontein are watered from wells in the pans.

IX. YIELDS

Background

Uncertainty is part and parcel of arable agriculture in Botswana, more so than in many other countries. Because of unpredictable rainfall, and pests and diseases, crop production differs markedly from one part of the country to another from year to year and even from crop to crop within a relatively small geographic area. Altogether, growing crops in Botswana is a very risky and often unrewarding activity.

Cereals constitute the bulk of crops grown in Botswana, comprising perhaps 90% of all hectareage planted in any one year (Agricultural Survey 1973: 6). Sorghum is planted by nearly all farming households, 98% of planting households surveyed in the FAO study of constraints, followed by millet (72% of farming households) and maize (70% of those planting). Approximately three-quarters (72%) of planting households also attempt to grow legumes -- primarily beans and cowpeas -- either for home consumption or for sale as a cash crop (FAO 1974: 42). As for hectareage planted, according to the Agricultural Survey, those planting sorghum put in an average of 3.4 hectares in 1971/72, while maize and millet were planted by a household on 1.1 and 1.4 hectares, respectively. Table 26 summarizes the hectareage in cereal crops over a five-year period.

Table 27

Annual Variations in Hectareage Planted
of Major Crops, 1967/68 - 1971/72

Crop	67/68	68/69	69/70	70/71	71/72
	Hectareage Planted (1 000 hectares)				
Sorghum	57	103	120	161	180
Maize	30	42	26	38	26
Millet	12	30	18	29	24

Source: Agricultural Survey 1973: 13 .

Whatever crops are planted by a household, however, commonly the area actually harvested is somewhat less than the area planted. According to the Agricultural Survey of 1971/72, of 230 000 hectares planted in sorghum, maize and millet that agricultural season, more than 13 000 hectares were without any harvest whatsoever. In effect, 9% of those

planting sorghum, 27% of those planting maize, and 14% of those planting millet received virtually no yields in those crops for their efforts. (Agricultural Survey 1973: 6)

Yields, in any case, tend to be very low in Botswana. Although the 1971/72 Agricultural Survey found that the yield per hectare planted in sorghum was 379 kg., in maize 390 kg., and in millet 251 kg., the FAO constraints study estimated that yields of sampled households averaged perhaps only 225 kg./hectare (Agricultural Survey 1973: 6; FAO 1974: 73). The Farm Management Study notes that while cereal yields monitored varied among households from 0-900 kg./hectare, they averaged only 150 kg./hectare (FMS 1980: 7).

These low yields mean that most farming households in Botswana can think of arable agriculture only in subsistence terms.^{1/} According to the 1971/72 Agricultural Survey,

More than half of the total arable farmers produced less than 10 bags (907.2 kgs.) of major cereal crops (sorghum, maize and/or millet).... (Agricultural Survey 1973: 14)

The FAO constraints study similarly found that the average farming household planted 4.5 hectares, with an average total yield of only slightly more than 1 000 kg., and that 91.7% of the households surveyed considered that they infrequently or never produce enough food (FAO 1974: 36, 50, 73). Likewise, the Farm Management Survey report estimates that the average total household yields are slightly less than 1 000 kg. (FMS 1980: 7). Any of these figures fall far short of the average rural family's annual caloric subsistence needs of approximately 1600-1700 kg. (Alverson 1978: 3).

The Arable Lands Survey Results

Following is a tabulation of data gathered by the Arable Lands Survey reflecting yields per acre of sorghum, maize, millet and beans in the Survey's various study areas.

^{1/} The Agricultural Survey of 1971/72 estimated that, while more than half of all arable farmers accounted for only 16% of Botswana's total production, 11% of the farmers produced more than half the total 1971/72 yield (Agricultural Survey 1973: 14).

The Arable Lands Survey Results

The ALS data confirm the results of previous surveys which indicate that yields per hectare are very low. The average yield of households surveyed was 260 kg/ha, a figure very close to the FAO constraints study figure of 225 kg/ha. What is more striking, however, is the fact that the median household produced only 104 kg/ha in 1977/78 and on its total plowed holdings, only 726 kg. Thus half of the households surveyed in the Arable Lands Survey's ten study areas reaped yields which were nearly 1 000 kg short of caloric subsistence minima for the average rural family of 6-7 people. Given ALDEP estimates of subsistence needs, at least 87% of households enumerated in the survey did not produce enough food for self-sufficiency.

By comparison, studies conducted between 1932 and 1948 indicate that while yields per hectare have risen slightly, total household production may actually have fallen. Those studies indicate that the total crop yielded per family was typically somewhat under 900 kg, about 185 kg per hectare, not including what may have been consumed during the growing season at the lands. (Parish 1948) Fifty years of extension efforts promoting methods not radically different from those proposed under ALDEP have produced remarkably little change.

Nevertheless, there is clear potential for bringing about significant changes in yields in rural Botswana. The wide variation in productivity among traditional farmers in any one of the lands areas suggests that major improvement is possible. The task facing ALDEP is to determine why such wide variations exist. It is perhaps by explaining these that ALDEP can make its greatest impact.

Table 28

Variable Name	Range/ Description	Average 10 Study Areas	Mokatako (Rolong) Southern	Pelotshatlha (Ngwaketse) Southern	Mokgosi (Malete) South East	Mathothwana (Tlokweng) South East	Dikwididi Kgatleng	Moiyabana/ Tlhabane Central	Sechele North East	Kalkfontein Ghanzi	Kang Kgalagadi	20 Areas Ngamiland
Sorghum Productivity ¹ (bags/acre)	0	14% (128)	42% (5)	2% (5)	19% (26)	18% (15)	13% (11)	2% (2)	14% (9)	50% (5)	31% (16)	39% (34)
	.1-.25	11% (100)	8% (1)	5% (15)	18% (25)	19% (16)	20% (17)	7% (7)	17% (11)		4% (2)	7% (6)
	.26-.50	17% (156)	25% (3)	9% (25)	29% (40)	12% (10)	28% (24)	18% (17)	25% (16)		23% (12)	10% (9)
	.51-.75	9% (80)		7% (19)	14% (19)	15% (12)	10% (9)	6% (6)	11% (7)		10% (5)	3% (3)
	.76-1.0	9% (73)		8% (21)	5% (7)	7% (5)	8% (7)	15% (14)	5% (3)	20% (2)	4% (2)	18% (16)
	1.1-2.0	21% (185)	17% (2)	31% (84)	10% (13)	18% (15)	15% (13)	24% (23)	20% (13)	20% (2)	17% (9)	13% (11)
	2.1-3.0	5% (74)	8% (1)	13% (35)	4% (6)	6% (5)	1% (1)	15% (14)	3% (2)	10% (1)	8% (4)	6% (5)
	3.1-5.0	5% (49)		12% (32)	1% (1)	2% (2)	3% (3)	6% (6)	3% (2)			3% (3)
	5.1-plus DK/NA	6% (50) (284)		13% (37) (106)		2% (2) (29)	1% (1) (11)	7% (7)			4% (2) (91)	1% (1) (364)
	Mean Median	1.4 0.7	1.92 1.0	2.41 1.67	0.58 0.40	0.95 0.57	0.7 0.4	1.75 1.12	(4)	0.76 0.08	0.9	
Maize Productivity (bags/acre)	0	36% (235)	46% (7)	11% (22)	26% (12)	47% (22)	71% (35)	53% (43)	50% (27)	35% (8)	46% (30)	33% (34)
	.1-.25	6% (36)	7% (1)	5% (9)	8% (3)	4% (2)	6% (3)	3% (2)	8% (4)		7% (4)	8% (8)
	.26-.50	14% (91)	13% (2)	15% (29)	20% (9)	15% (7)	6% (3)	9% (6)	10% (6)	9% (2)	16% (10)	16% (17)
	.51-.75	4% (23)	13% (2)	4% (8)	4% (2)		2% (1)	2% (1)	4% (2)		2% (1)	6% (6)
	.76-1.0	16% (104)	7% (1)	21% (40)	18% (8)	13% (6)	8% (4)	10% (7)	15% (8)	39% (9)	11% (7)	13% (14)
	1.1-2.0	13% (86)	7% (1)	20% (38)	22% (10)	6% (3)	2% (1)	7% (5)	5% (3)	13% (3)	10% (5)	15% (16)
	2.1-3.0	5% (34)	7% (1)	10% (19)		9% (4)		4% (3)	4% (2)	4% (1)	2% (1)	3% (3)
	3.1-5.0	3% (22)		6% (12)		2% (1)	2% (1)		4% (2)		3% (2)	4% (4)
	5.1-plus DK/NA	3% (23) (996)		8% (16) (8)		2% (1) (12)	4% (2) (47)	2% (1)	2% (1) (16)		2% (1) (81)	1% (1) (349)
	Mean Median	1.3 0.5	1.73 1.00	2.19 1.00	0.80 0.51	3.17 0.25	0.5 0.01	0.41 0.02		0.79 0.91		

¹ 1 bag = 70 kg.

Yields/Productivity - 2

Variable Name	Range/ Description	Average to Study Areas	Makalako (Rolong) Southern	Pelotshetlha (kgwaketse) Southern	Mogosi (Maletja) South East	Mathothwana (Illoke) South East	Dikwidedi (Kgatleng)	Moiyabana/ Tlhabala Central	Sechela North East	Kalibontsin Bantzi	Kang Kgalegaati	20 Areas Kgamiland	
Millet Productivity (bags/acre)	0	34% (31)		20% (1)			23% (3)	25% (1)	67% (16)	100% (1)	-	13% (8)	
	.1-.25	9% (8)						50% (2)	13% (3)		-	9% (3)	
	.25-.50	18% (16)	100% (1)	20% (1)			15% (2)		8% (2)		-	13% (10)	
	.51-.75	5% (5)					7% (1)				-	3% (3)	
	.76-1.0	22% (20)		60% (3)			38% (5)	25% (1)			-	14% (5)	
	1.1-2.0	8% (7)					7% (1)		8% (2)		-	1% (4)	
	2.1-3.0	3% (3)							4% (1)		-	5% (2)	
	3.1-5.0	1% (1)					7% (1)				-		
	5.1-plus	0% (0)									-		
	DK/HA	(1093)	(22)	(374)							-		(417)
	Mean		0.6	2.00	0.54			1.0	0.36		0.0		
Median		0.4	2.00	0.58			1.0	0.22		0.0			
Beans Productivity (bags/acre)	0	31% (136)	25% (1)	24% (30)	25% (14)	31% (11)	39% (17)	52% (12)	67% (14)		37% (14)	34% (18)	
	.1-.25	5% (21)	25% (1)	4% (5)	2% (1)	9% (3)	9% (4)			4% (1)	8% (4)	4% (2)	
	.26-.50	14% (62)		8% (11)	34% (19)	14% (5)	11% (5)	13% (3)		4% (1)	17% (9)	17% (9)	
	.51-.75	1% (5)		32% (40)	4% (2)				33% (7)	7% (2)	2% (1)	30% (16)	
	.76-1.0	25% (112)	25% (1)	19% (24)	13% (7)	23% (8)	20% (1)	26% (6)		32% (9)	17% (9)	7% (4)	
	1.1-2.0	14% (61)	25% (1)	5% (6)	20% (11)	11% (4)	4% (2)	4% (1)		18% (5)	17% (9)	2% (1)	
	2.1-3.0	3% (15)		4% (5)	2% (1)	9% (3)				14% (4)		4% (2)	
	3.1-5.0	3% (14)		4% (5)			2% (1)			18% (5)	2% (1)	2% (1)	
	5.1-plus	4% (16)			2% (1)	3% (1)	14% (6)	4% (1)		4% (1)			(394)
	DK/HA	(742)	(19)	(253)	(110)	(59)			(45)				
	Mean		1.4	2.50	1.31	0.80	2.77	3.0	0.43		2.03	0.6	
Median		0.7	1.50	1.00	0.50	0.50	0.3	0.18		1.28			

Yield/Prod. Class	Sample Size (No.)	Average No. Studs./Acres	Total Area (Acres)		Total No. (Bags/Acre)		Total Yield (Tons)		Production/Unit Area		20 Areas	
			Western Southern	Eastern Southern	Western Southern	Eastern Southern	North East	Central	North East	Ghanzi	Kgalagadi	North West
Total Yields (Absolute no. of bags)	0	22% (320)	35% (6)	2% (7)	18% (27)	14% (13)	11% (10)	3% (3)	14% (9)	6% (2)	28% (21)	50% (220)
	1	8% (112)	18% (3)	1% (5)	13% (19)	10% (9)	10% (9)	15% (10)	11% (7)	13% (5)	9% (7)	12% (33)
	2-3	16% (226)		3% (10)	28% (42)	24% (22)	22% (20)	18% (19)	32% (21)	26% (9)	10% (14)	13% (69)
	4-10	29% (410)	18% (3)	35% (125)	29% (43)	37% (26)	38% (34)	41% (43)	35% (23)	34% (11)	20% (22)	13% (30)
	11-20	12% (174)	12% (2)	25% (90)	6% (9)	13% (12)	9% (8)	11% (12)	3% (2)	4% (3)	11% (8)	11% (22)
	21-40	8% (114)	12% (2)	20% (74)	5% (8)	3% (3)	3% (3)	9% (9)	5% (3)		4% (3)	1% (9)
	41-plus	5% (72)	5% (1)	14% (51)	1% (2)	6% (5)	7% (6)	4% (4)		3% (6)	1% (1)	1% (1)
	DK/NA	(222)	(6)	(19)	(16)	(4)			(2)		(67)	(12)
	Mean	10.1	2.12	22.56	5.39		10.0	8.30		5.59	5.5	
	Median	4.2	1.33	13.65	2.18		4.0	4.92		3.30		
Total Productivity (Bags/Acre)	0	17% (205)	29% (4)	2% (5)	16% (22)	15% (13)	15% (8)	2% (2)	13% (9)	7% (2)	20% (19)	27% (121)
	.1-.25	12% (140)	22% (3)	5% (14)	20% (23)	16% (14)	20% (23)	8% (8)	18% (12)	7% (2)	9% (5)	11% (34)
	.26-.50	18% (211)	14% (2)	10% (27)	28% (38)	23% (20)	23% (19)	21% (21)	27% (16)	10% (3)	23% (15)	13% (34)
	.51-.75	10% (119)	14% (2)	7% (19)	12% (16)	9% (8)	11% (9)	12% (12)	9% (6)		5% (2)	11% (34)
	.76-1.0	9% (105)		8% (23)	9% (12)	9% (8)	6% (5)	11% (11)	6% (4)	31% (9)	8% (5)	11% (29)
	1.1-2.0	15% (187)	14% (2)	26% (73)	9% (13)	14% (12)	8% (7)	27% (27)	16% (11)	17% (5)	17% (11)	11% (26)
	2.1-3.0	7% (87)	7% (1)	16% (44)	5% (7)	8% (7)	5% (4)	4% (4)	3% (2)	10% (3)	5% (3)	11% (12)
	3.1-5.0	5% (60)		11% (31)		2% (2)	1% (1)	6% (6)	3% (2)	17% (5)	3% (2)	7% (11)
	5.1-plus	6% (67)		15% (42)	1% (2)	5% (4)	7% (6)	8% (8)			5% (3)	11% (22)
	DK/NA	(469)	(9)	(101)	(28)	(5)			(3)		(77)	(121)
	Mean	1.5	2.07	3.11	0.71	1.53	1.0	1.69	2.54		1.1	
	Median	0.6	1.50	1.73	0.43	0.5	0.4	0.99	2.11			

I
ARABLE LANDS SURVEY

Mokatako (Rolong)

Southern District

In this report the following topics will be considered:

1. Household Profile
2. Land
3. Soil and Land Improvement
4. Draft Power
5. Labour
6. Inputs and Implements
7. Farming Practices
8. Water.

1. Household Profile

In Mokatako 52.2% of the households have female heads. This is less than the national average.

Education level: 66% have a maximum of Standard 2, 95% have a maximum of up to Standard 4. These figures are approximately the same as the national average.

Cattle on the lands: 91.3% have no cattle on the lands. This is high in comparison with the nation.

Smallstock on the lands: 95.7% have no smallstock on the lands. This is high, too, in comparison with the nation.

Cattle ownership: 43.5% have no cattle at all, and 52% have only 1-20 LSU.

Botswana average: More cattle.

Smallstock ownership: 78.3% have no smallstock at all, and only 21.7% have 1-5 LSU.

Botswana average: More smallstock.

Value of farm equipment: 35.3% have a value of P1-P80 and 23.5% have a value of P210-P500. These figures approximate the national ones.

Total household wealth: 26.1% have P1-P300; 48% have less than P1000; 43.5% have P1001-P3000. These figures approximate the national average.

Ploughing: 72.2% had ploughed the previous year. This is less than the national average.

The only conclusion we can draw is that livestock is not so important in Mokatako.

2. Land

Number of fields: 50% have one and the rest have more than one. People in Mokatako have more fields.

Total average: 75% have more than 21 acres. This is much more than the national average.

Acreage debushed: 75% have more than 16 acres debushed. This is much higher than the national average.

Acreage destumped: See acreage debushed.

Acreage planted: 93% planted 3-50 acres; 33% planted 21-50 acres. Mokatako plants much more acreage than the rest of Botswana.

Proportion improved land: 66.7% improved 51-67% of their land. This figure is lower than the average, which is understandable. Proportion of land planted: 67% planted less than 33%.

Conclusion: Mokatako people have more land, more debushed, destumped and planted. In Mokatako exists a larger difference between total land and used land.

3. Soil and Land Improvement

Use of manure or fertilizer: 75% use neither; 25% use manure. Compared with the nation: Mokatako uses less fertilizer, but more manure. Contour ploughing practised: no response. Crop rotation: insufficient valid cases. Fencing practised: 45% say no, the rest do not answer. Acreage debushed, destumped and planted: (see no.2) much more acreage than the national average. Proportion improved land: (see no.2) less than average.

Conclusion: In Mokatako people have improved the soil and land more than average.

4. Draft Power

Tractors used last time: only one farmer used a tractor and he borrowed it. Tractor from whom secured: bad response. Source of oxen: in Mokatako oxen are more often borrowed than owned, which is the opposite of the Botswana average. Oxen from whom secured: 85.7% got them from a relative, which approximates the national average. Source of donkeys and donkeys from whom secured:

no response. Cattle at the lands: practically none, which is far less than average. Total cattle ownership: 43.5% have no cattle, 52% have 1-20 LSU. This is less than the national average. Ready access to draft power and total access to draft power: \pm 80% have no access, which is far less than average.

Conclusion: The information is insufficient to draw conclusions.

5. Labour

Number of family members helping to plough: 66% have more than 3, which is more than the average. 50% of them are children, which is less than average. Number of family assisting: bad response. Number of family members helping to weed: 53%: more than 3, which is more than average. Of these family members 64.3% are children, and 23.6% are brothers and sisters. These figures are higher than the average. Number of non-family people helping to weed: bad response. Number of family members helping to harvest: 80%: 1-4 (=average). Number of non-family people helping to harvest: bad response. Non-family paid in cash: bad response. Non-family paid in kind: bad response. Non-family paid in exchange deal: bad response. Non-family unpaid: bad response. Number of family members helping to thresh: 75%: 1-4 (=average). Number of non-family people helping to thresh: bad response. Total male household labour: 70%: 1-3 (=approximate national). Total household labour: 43.5%: 1-3; 52.2%: 4-6 (average less than 4-6). Actual female household labour: 43.5%: 1-3, 47.1% 4-6 (=average). Potential labour force: no response. Household education level: 65%: up to Standard 2; 30.4% 3-4 (=average).

Conclusion: More children and more women are involved.

6. Inputs and Implements

Number of double row ploughs used: 52.9% used one (higher than average). Number of single-row ploughs used: 64.7%: 0; 35.3% used one. (The usage is less than average). Number of double-row planters used: 52.9% used one (higher than average). Number of single-row planters used: nil. Source of single-row planter: no response. Number of cultivators used: 81.3%: 0; 18.7%: 1 (=average). Number of sledges, wagons, carts used: 37.5%: 0; 37.5%: 1; 25%: 2-plus (these figures show that the usage in Mokatako is higher). Inputs used: no data. Source of seed: Purchased: 58.8%; own supply: 41.2% (purchase is higher than national average).

Conclusion: Mokatako residents use more inputs and implements than average.

7. Farming Practices

Mokatako farmers plough in the months October, November and December only (average: 56% during these months). Broadcasting: compared with the average, broadcasting is a rare phenomenon in Mokatako. Using row planter: 47.1% used a row planter, which is much more than average: only 21%. Row planting by hand is not practised in Mokatako and not in the nation. Use of manure or fertilizer: 75% used neither of them, 25% used manure. (The nation used less manure.) Quantity of fertilizer and manure on which crops used: bad response. Weeding: 93% weeded once or twice, which is average. Inputs used: no data. Winter ploughing and contour ploughing had no response. Row planting: 83% planted in rows (average: 40%). Use of fertilizer, thinning and crop rotation had bad or no response. Practice of fencing: average response: no fencing. Weeding practised and adoption index: bad or no response. New technology practised/adopted: almost 50% of the farmers used new technology (48%) of which 45% adopted 1-6 new practices. (National average adopts more because the farmers in Mokatako are already more advanced.)

Conclusion: The farming practices in Mokatako are more advanced than in the nation as a whole.

8. Water

Primary water source: 71.4% use primarily a pan. Botswana as a whole uses primarily dams. In the country as a whole only 6% of the farmers use pans. Distance to primary water source: 73% less than 500 metres and 93.3% less than 1 kilometre. These distances are shorter than the average (66% less than 1 kilometre). Ownership of primary water source: 83.3% communal/tribal. This figure is higher than the national average (30% is communal).

Conclusion: In Mokatako the primary water source is a pan which is communal. Botswana as a whole uses dams as the primary water source.

II
ARABLE LANDS SURVEY
Pelotshetlha (Ngwaketse)
Southern District

This particular survey was carried out in 1974 and was the pilot for the National Survey. In the following pages these topics will be considered:

1. Household Profile
2. Land
3. Soil and Land Improvement
4. Draft Power
5. Labour
6. Inputs and Implements
7. Farming Practices
8. Water.

1. Household Profile

Unlike the results of the National ALDEP survey, male heads of households of the Pelotshetlha area are predominant. This is probably not characteristic of the district at large because the survey area is somewhat distinct. Pelotshetlha is a lands area of Kanye - the largest village of the district and presumably the wealthiest. The educational level in the survey area is lower than the National average; 58% of the households reported no educational background compared to 34% for the National Survey.

Households in the Pelotshetlha area keep significantly more cattle at the lands (14 head on average) than their counterparts in the national survey. This is in spite of the fact that total ownership of cattle is roughly the same (mean - 16.7 for Pelotshetlha). Distribution of livestock ownership in the survey area is slightly less skewed than in the national data. The figures suggest that the total value of farm equipment owned by the Pelotshetlha households is less than the national average. Even accounting for inflation in the intervening years of the two surveys, it seems that the Pelotshetlha farmers invest a greater share of wealth in cattle than in other productive assets.

2. Land

Most of the households in the survey area own only one plot (70%) which on average is about 20 acres. We would say that this is probably fairly consistent throughout the district if the Barolong Farms is excluded. In the Barolong Farms individual plot sizes are much larger and many households own more than one plot (43 acres each, only one-third of which is actually planted). From the survey there seems to be considerable under-utilization of arable holdings in the Southern District. This may be a function of the availability of draft power or lack of it, which is certainly the case in Mokatako, but unused lands are a considerable problem throughout the district in the communal areas.

Problems and Recommendations

The initial zoning of the district under the TGLP Land Use Planning Exercise did not take into account the communal/arable land use which exists at the eastern boundary of the commercial zone or in the western river valleys. "Arable" holdings have expanded into these areas and are quite large. The Pelotshetlha data suggest that farmers have acquired more land than they can presently plough in one year as a hedge against future land shortage, a 'land grab' of sorts. Arable land is already in short supply and is competing for grazing land in communal areas.

The cattle ownership patterns described initially together with this land use information imply that arable holdings might prove to be productive if farmers could use their "excess" land to provide cattle management. Fencing pilot projects should reflect this.

Several short-term solutions to the problem of land shortages in communal lands have been suggested: Rezone the TGLP commercial area where it is obvious that communal/arable activities predominate. Our TGLP third development area should be relocated to an area east of Sekoma where there are no land use conflicts. (These recommendations have not been posed to the Ngwaketse Land Board as yet.) The Rolong Land Board should reinstate its land registration program to include the whole of the Barolong Farms. This is not unfeasible, it has the support of most of the Barolong, and arable agriculture has progressed beyond the present system of land allocations and disputes.

3. Soil and Land Improvement

By and large the farmers of the Pelotshetlha area are better than average where soil conservation techniques are concerned. Fencing of land is not so widespread in this part of the district while drift fencing is the hallmark

of the Pelotshetlha area. Nearly 16 percent, or twice the proportion of the National average, use fertilisers or manure. Nearly 89 percent contour plough, although this figure should be suspect in that the ploughing lands of Pelotshetlha are usually fairly level. As was mentioned in the discussion of land, most farmers hold more land than they have developed. Not one farmer in the survey indicated that he had improved more than 67% of his land.

Problems and Recommendations

Progressive farmers are now discouraged from early ploughing because of the inability of all farmers in the area to cooperate in sending their cattle outside the drift fence. Fencing of individual plots needs to be stimulated. Further development of now unused land can be encouraged by Land Board limiting its new allocations to a certain size, disapproving extensions unless existing holdings are fully developed, and imposing the 5 years clause of the Tribal Land Act. In spite of the apparent progressiveness of the Pelotshetlha farmer, considerable sheet erosion is evident throughout the area. This condition is probably caused by overgrazing, indicating the need for better joint management of the cattle and arable enterprises. Such joint management is possible only after holdings are fenced.

4. Draft Power

Almost all of the farmers of the Pelotshetlha area did not use tractors in the planting preceeding the 1974 survey. Of those that did (5%), two-thirds hired tractors, usually from a relative. 91% of the households used oxen that they themselves owned while the rest borrowed or hired them from relatives. Only 20 households (5%) reported using donkey draft, which is consistent with our experience elsewhere in the district. There are regions in the district, however, where donkeys are used extensively, notably the Barolong Farms and some lands areas to the west, and the price for donkeys varies widely.

The use of oxen reflects the distribution of cattle at the lands which was noted in the household profile section. Pelotshetlha households have significantly better access to draft power than is indicated in the national survey. This is indicated in the table below:

Access to Draft Power

	<u>Ready Access to Draft</u>	<u>Total Access to Draft</u>
Pelotshetlha	Mean = 5.8 Median= 4.1	Mean = 11.2 Median= 9.0
Arable Lands Survey, 10 Study Areas	Mean = 6.0 Median= 1.7	Mean = 7.2 Median= 3.1
Barolong Farms (Mokatako)	Mean = 3.4 Median= 0.5	Mean = 3.04 Median= 1.4

It appears from this table that the reason for the underutilization of ploughing land in the Barolong may be attributed to the lack of draft power. We would guess that the more typical situation for farming households in the district lies somewhere between the Pelotshetlha and Barolong farmers.

Problems and Recommendations: We guess that draft power is now a serious problem for the arable farmer. We will pilot a donkey draft scheme in the district next year to see how significant are the social and practical constraints which militate against the more widespread use of donkeys. It is clear that the promotion of animal draft power will increase the pressure on communal grazing. This will be true as long as livestock plays the dual role of store of wealth and productive capital. Again, the conflict between livestock and a growing arable sector arises. Expansion of the communal areas will only serve to ease the problem in the short-run; this will also be the case of introducing more efficient draft power and better implements.

5. Labour

In most aspects the farming household of the Pelotshetlha area differs little from the average with respect to its source of labour. It appears that the farming family is a nuclear one depending on outside help for only a fraction of its peak labour requirements. The Pelotshetlha farmer, however, is less likely to pay for this labour. About 26% of the labour acquired from outside the household is unpaid in any way. The educational level of the Pelotshetlha farmer is slightly lower than the national average.

Problems and Recommendations

More available labour at the lands would probably permit a wider development of land. Farmers in this part of the district may be induced to use more labourers (and pay them) if returns to agriculture would improve.

Labour shortages in this district are likely only to be relieved through cash or in-kind employment, which may be antithetical to a viable subsistence arable sector.

6. Inputs and Implements

There is not much difference here between the Pelotshetlha farmer and his national counterparts. They both use similar equipment. The same kinds and intensity of inputs, and the value of the farm capital is nearly the same.

Problems and Recommendations

In spite of the concerns of the local Land Board members and other district officials, the subsidy of a double-row planter is not indicated from the data. Most farmers who use planters seem to prefer single row.

7. Farming Practices

As indicated in the section on land and soil improvements, the Pelotshetlha farmer is, on average, a better farmer. The ALDEP survey adoption index for Pelotshetlha and the nation is listed:

<u>Adoption Index</u>		
<u>Percent Adoption</u>	<u>% of Pelotshetlha Farmers</u>	<u>ALS, 10 Study Areas Average</u>
0	4.8%	13%
1 - 25%	9.2%	24%
26 - 50%	9.5%	31%
51 - 75%	19.0%	17%
76 - 100%	53.1%	15%

These figures may not be indicative for the rest of the district because Pelotshetlha is composed of farmers who are fairly better off than the rest and who, as residents of Kanye, may have had better exposure to extension over a longer period of time.

Problems and Recommendations

The Extension/Implement package which has been provided by ALDEP will probably be successfully adopted in the district in view of the kind of farmer who works lands here. The Integrated Farming Pilot Project (IFPP) extension approach has been rather successful. Incentives

for adoption of new techniques is called for, and perhaps should have priority over the adoption of new equipment.

8. Water

Fully 95 percent of the households of the Pelotshetlha area depend on dams as their primary water source. More significantly, very few households depend on boreholes in the communal areas. As a matter of fact, there were four unequipped boreholes in the survey area which were owned by Council and intended for use by syndicates. Most households reported that they were using dams that they owned themselves (40%). This implies that each household had in the past made some contribution to developing a private water source which was designed to support the household's livestock enterprise. Most of the respondents in the Mokatoko area get their water from a pan according to the survey. Private water development has not been necessary because of the small family herds. Personal observations indicate also that water sources are best developed in cattle post areas and not at the lands.

Problems and Recommendations: Water is the problem at the lands -- or so that is the perceived doctrine among planners and farmers alike. It is becoming more apparent that it is only a necessary, but by no means sufficient condition to arable development. The best, most immediate solution to water constraints is the better management of Council boreholes, proper support of syndicates and their management, and the possible take-over of private boreholes where reliable substitutes do not exist. We run the risk, however, of turning lands areas into cattle posts but this is not a certainty. The IFPP is presently promoting the construction of rain catchment tanks in the household's compound and we have adopted this project as one of our pilots. The lack of water at the lands remains a constraint more to livestock than to arable production.

ARABLE LANDS SURVEYMathothwana and MokgosiSouth East DistrictI. General Remarks

Two lands areas in South East District have been questioned under the ALDEP arable lands survey in 1978. These are Mathothwana in the Tlokweng Tribal Territory and Mokgosi in the Maletle Tribal Territory. Both are thought to be quite representative for the Tribes. But farming conditions in Tlokweng are quite different from those in Maletle and this is also well shown in the survey results. For this reason, Mathothwana and Mokgosi will be treated separately.

The survey was held just after the cropping season, in winter. At that time there was little arable activity; most people actually staying at the lands were there to look after livestock, amongst them very few women. The ALDEP survey was not a representative sample of farming families in Botswana, but just included a number of villages chosen for different reasons. The averages for all the areas surveyed thus do not give an estimate of average conditions in Botswana. However, it is interesting to make comparisons with Overall Survey Figures now and then. Hereafter they will be referred to under the abbreviation OSF. The abbreviation HH will be used for households.

II. Mathothwana - Tlokweng

The Mathothwana lands area is situated at about 9 km north east of Tlokweng Village, where all farmers have their permanent homes.

The sample size was 94 HH.

(1) Household Profile

The proportion of female-headed HH is very high, 34% of total (OSF = 24%). It is not known why this is so high, but maybe some HH where men are on temporary absence are included.

Education level in Tlokweng is high, the median being 3.8 years against OSF = 3.0 years. Since all people have their homes at Tlokweng Village, no people live very far from schools.

Cattle ownership is more limited than elsewhere.

42% of HH own no cattle at all and only 10% own more than 20 Livestock Units (L.S.U.). Since the grazing areas are already under heavy pressure, there is little scope for increased cattle ownership. Of the cattle, 55% was kept at the lands, which at the time of questioning were opened for grazing after harvest. Tlokweng has a drift fence system.

Ownership of smallstock is quite limited; only 26% of HH own any and the largest flock amounts to 3.3 L.S.U. Total HH wealth is estimated quite high compared to OSF, but there are large differences. 14% of HH own less than P600 (OSF = 34%) and 26% own more than P3000 worth (OSF = 20%). The mean value of farm equipment is relatively high because there are some HH owning tractors. The median for this variable is almost the same as OSF.

Batlokwa are still very eager to plough, despite job opportunities in Gaborone. More than 90% ploughed during the 1977/78 season. It is known that in many families where the men have regular jobs, the women will spend the cropping season at the lands where the men will join them for the weekends.

(2) Land Holdings

All questioned HH have fields, mostly 1 or 2. Only 5% hold more than 2 fields. All holdings are more than 5 acres. Most of the holdings are quite small; 28% hold 5-8 acres and 26% hold 9-15 acres. There is, however, a significant number of larger holdings; 10% hold 31-50 acres and 3% more than 51, the largest holding being 99 acres.

These figures do not suggest an acute land shortage, but this may well arise soon with further population growth.

(3) Soil and Land Improvement

In Tlokweng, most ploughing takes place on clay soils. It is possibly related to this that only 2% of HH use fertiliser or kraal manure. Since the ploughing area has no slopes exceeding 1%, there is no need for contour ploughing. About 87% of the lands is debushed and 67% is also destumped. 32% of HH claim to practice fencing, but it is not clear whether they all refer to individual fencing (as there is also a drift fence). 27% say they practice crop rotation.

(4) Draught Power

A very high proportion of Batlokwa farmers rely on tractor ploughing, namely 58%. This is mainly because the use of oxen or donkeys is very troublesome on heavy clay soils. 8.5% or 18% (figures from different questions) of HH own tractors, the lower figure being more probable. Hiring is the dominant arrangement to obtain tractors, on which 44-57% of HH rely. Oxen are used by 18% of HH, mostly by their owners but in some cases they are borrowed or hired. 12% of HH use donkeys; these are very seldom borrowed or hired.

Access to draught power is in general much better than in other surveyed areas. 12.5% claim to have no access to draught power at all (OSF = 34%), but less than 10% did actually not plough during the 1977/78 season.

(5) Labour

As elsewhere, farming is still a family enterprise. Only in ploughing are many non-relatives involved, because tractors are normally hired with drivers. In other activities help from non-relatives is rare, and payment in cash or kind is almost non-existent.

The total labour force is on the average somewhat higher (around 6) than OSF (around 4). Both males and females contribute to this.

(6) Implements

Because of the use of tractors, more than half of the HH have ploughing done with double row ploughs. Only 5% use planters; all others broadcast. Cultivators are used by about 35% of HH, but we do not know what types. About 30% of HH own sledges, wagons or carts and only 3% have more than one. Transport is said to be in short supply in Tlokweng.

(7) Farming Practices

Few people ploughed before October, and 26% did so after December. Since many HH are to be served by a limited number of tractors, some people may be forced to plough at an unfavourable time. Almost all farmers broadcast.

27% of HH weed more than once and very few do not weed at all. Thinning is done by 15% of HH. 6% claim to practice winter ploughing.

The use of fertilisers (1%), manure (1%) and insecticides (2%) is all very limited. Most HH (65%) use seed of their own and 8% obtain it from relatives. 26% of HH buy their seed.

(8) Water

The main water sources for Mothothwana are dams, from which 84% of HH draw water. It should, however, be realised that people may shift to different sources throughout the season. 12% of HH rely on a borehole and 4% have other sources.

Most people stay not very far from water, 72% within 1 km. However, some people have to go a considerable distance for water.

(9) Yields and Productivity

Productivities show a wide range for all crops. For sorghum, the average productivity is somewhat below OSF. Maize shows 47% of complete failure, but some farmers had good harvest so that the average is still quite high. Millet was grown by two farmers only. Beans showed 31% crop failure but the average is still fair. It is clear that the differences among farmers are very prominent, so that mean values do not tell us much.

(10) Extension

Tlokweng is not strongly covered by agricultural extension. Some possible reasons for this are 1) almost nobody lives at the lands permanently and 2) there is only one Agricultural Demonstrator for the whole of Tlokweng. Membership of the Farmers' Committee is very low, so that there is no strong basis for group activities.

Since agricultural practices in Tlokweng are much different from other places, it is not realistic to compare adoption of modern practices.

64% of HH own a radio.

III. Mokgosi - Malete

The Mokgosi lands area is situated about half-way between Ramotswa Village and Otse, at 10-12 km from both villages. The sample size was 166 households.

(1) Household Profile

Female-headed households count for 22% of the total, which is comparable to the OSF.

The education level is quite low, the median being 1.2 years of school against OSF = 2.0 years. This may reflect that at Mokgosi some people stay at the lands almost permanently and that these are mostly older people who are engaged full time in agriculture.

Over the last few years school enrolments in Malete have been rapidly increasing.

39% of the HH own no cattle. Most of those HH who own cattle have only small herds. Not more than 4% of HH own more than 20 L.S.U. After the cropping season the arable areas are used for grazing intensively, since they count up to about half of the Malete Tribal Territory. During the cropping season cattle are kept in the grazing areas or in the villages; few people have separate cattle posts. 22% of HH own any smallstock, and only 1% has more than 5 L.S.U. smallstock.

Although the Malete people own few stock compared with other areas in Botswana, their territory is severely overgrazed because of the high population density.

On the average, total household wealth is slightly higher than OSF. 11% has less than P600 worth (OSF = 34%) and 11% has more than P3000 (OSF = 20%). The mean value of farm equipment is comparable to OSF. During the 1977/78 season 88% of HH did plough.

(2) Land Holdings

Most HH hold 1 or 2 fields, and 5% hold more than 2. At the moment the Malete Land Board allocates fields of about 5 acres. Some older allocations however must have been much larger, since 24% of HH hold between 11 and 20 acres and 11% hold more than 20 acres. During the 1977/78 season 70-80% of the land was planted.

There is already a slight scarcity of land to allocate for ploughing, resulting in a small size of allocated fields compared to most other districts. This scarcity may grow worse fast with further population growth.

(3) Soil and Land Improvement

9% of HH in Mokgosi use fertiliser, but only half of these use more than 4 bags. This is significantly more than OSF. Another $3\frac{1}{2}$ % use Kraal manure. Extension staff is always² propagating the use of manure and fertiliser.

There are no slopes that require contour ploughing. Almost all the land held by questioned HH is debushed and about $\frac{2}{3}$ of it is destumped.

Only 16% of HH practice fencing, which is not many compared to OSF. This may be because at Mokgosi fields are in large clusters and stock may be sent elsewhere for grazing. 26% of HH claim to practice crop rotation.

(4) Draught Power

It is known that this is one of the main problems for many Malete farmers.

10% of Mokgosi HH used tractors during 1977/78, most of these relying on hiring; only 2% of HH own a tractor.

Hiring is also common among relatives. In 1979 the charges were about P12 to 15 per acre.

78% of the farmers use oxen to plough; of these $\frac{2}{3}$ claim to use their own and most others borrow from relatives; oxen are seldom hired. This suggests that almost all cattle owners use beasts for ploughing and that many, given their small herd size, are only just able to raise a span.

Donkeys are used by 6% of HH, all of them being used by their owners.

(5) Labour

At all stages of the cropping season, farmers get help from relatives. The bulk of this help comes from wives and children/grandchildren (80% for ploughing and more than 90% for other activities). This emphasises the sociological importance of having children to help and also indicates a decline in the "extended family" structure, since very few farmers get help from uncles/aunts, nephews/nieces and brothers/sisters.

Payment in cash or kind to non-relatives is almost non-existent, so most non-relative help will come from friends. It has been suggested that nowadays people want to work for others only for an appropriate cash wage, which farmers cannot economically afford to pay.

Total HH labour is slightly higher than OSF.

(6) Implements

The distribution of implements is not much different from OSF. 15 to 20% of HH use row planters, which is quite high. 3/4 of these HH own the planters. 23% use cultivators. 10% use double row-ploughs; these are the HH who use tractors.

About 30% of HH own sledges, carts or wagons and 2 1/2% have more than one.

(7) Farming Practices

Winter ploughing seems to be quite widespread, 24% indicating they plough before October. Only 14% ploughed after December, but this may be due to favourable rains early in the season.

People not using planters almost all broadcast; only 2 farmers row-plant by hand.

Most of the HH weed their crop once (80%) and 9% more than once. About 10% of HH do not weed. Insufficient weeding is a major reason for low productivity, but many HH do not have the labour to do it more intensively. 27% of HH claim to practice thinning, which is more than OSF.

10% of HH use fertilizer, some with very good results. 4% use kraal manure. Only 1 farmer uses insecticide. 57% of HH use their own seed and 3 1/2% get it from relatives, 7% partly from relatives and 31% had to purchase all their seed.

(8) Water

People at Mokgosi rely on a variety of water sources. The main ones are dams (48%), boreholes (12%) and wells (30%). Most of the people do not have to go very far for water (73% are within 1 km). However, 12% claim to be 7 km or more from water.

(9) Yields and Productivity

Productivity shows a very wide range, due to many varying circumstances and practices. Mean productivity is low compared to OSF, especially for sorghum

and beans. Very few farmers grow millet. The resulting total productivity is also low. Mean total yield is about 1/2 of OSF, but this may also be related to the small size of land holdings. The survey does not make clear whether low productivity is structural or due to the peculiarities of a certain year.

(10) Extension

All indicators show that Mokgosi is very well covered by its Agricultural Demonstrator. This reflects itself in somewhat higher adoption of modern practices and in a high membership rate of the Farmers' Committee, compared with OSF.

46% of HH own a radio.

Ramotswa
March, 1980

D. Luijt
District Officer (Lands)

ALDEP Arable Lands Survey 1978

SOUTH EAST DISTRICT

Selected Data

Variable	Categories	Mathothwana	Mokgosi	OSF
Sex of HH head	Male	66%	78%	76%
	Female	34%	22%	24%
Membership of farmers committee	Yes	3.5%	17%	8%
	No	96.5%	83%	92%
Total No. of fields held	0	-	2.4%	10%
	1	62.4%	73.3%	64%
	2	32.3%	19.4%	17%
	3-4	5.4%	4.2%	8%
	5 plus		0.6%	1%
Use of planters	Yes	5%	20%	18%
	No	95%	80%	82%
Use of cultivators	Yes	35%	23%	23%
	No	65%	77%	77%
No. of sledges, wagons, carts	0	64%	69%	76%
	1	32%	28%	23%
	2 plus	4%	3%	1%
Source of tractors	Owned	8.5%	2%	1.5%
	Borrowed	1%	1%	2%
	Hired	57.5%	7%	6%
	Combination	1%	-	-
	Don't use	32%	90%	90.5%
Source of Oxen	Owned	12%	54%	47%
	Borrowed	2%	17%	12%
	Hired	6%	6%	7%
	Combination	-	0.5%	0.4%
	Don't use	80%	21.5%	33%
Source of donkeys	Owned	9%	6%	5%
	Borrowed	1%	-	1%
	Hired	2%	-	1%
	Don't use	88%	94%	93%

Variable	Categories	Mothothwana	Mokgosi	OFS
When ploughed	Before Oct.	6%	22%	8%
	Oct - Dec	67%	57%	45%
	Jan - March	25%	13%	27%
	Not ploughing	1%	8%	29%
Ploughed 1977/78	Yes	90%	87%	80%
	No	10%	13%	20%
Use of fertilizer and manure	Fertilizer	1%	9%	4%
	Manure	1%	3.5%	2%
	Both	-	0.5%	-
	Neither	98%	87%	94%
Weeding how often done	Once	66%	80%	54%
	Twice	23%	7%	16%
	Frequent	2%	2%	8%
	Never/don't know	9%	11%	21%
Source of seed	Purchased	26%	36%	36%
	Relative	8%	3.5%	4%
	Own supply	62%	57%	53%
	Purchased & relative	-	-	6%
	Purchased & own	3%	3.5%	0%
Primary water source	Dam	84%	48%	59%
	Borehole	12%	12%	17%
	Pan	3%	4%	6%
	Deep well	1%	18%	8%
	River	-	5%	3%
	Shallow well	-	11%	7%
Thinning practiced	Yes	15%	27%	23%
	No/don't know	85%	73%	77%
Total Cattle Ownership (LSU)	0	41.6%	39.4%	32%
	1-5	5.6%	11.5%	8%
	6-10	12.4%	13.3%	12%
	11-20	30.3%	31.5%	33%
	21-30	2.2%	1.8%	5%
	31-40	4.5%	-	0%
	41-50	1.1%	-	2%
	51-60	2.2%	1.2%	2%
	61-80	-	0.6%	5%
	81-100	-	-	0%
	101-200	-	0.6%	1%

Variable	Categories	Mothothwana	Mokgosi	OFS
Total smallstock ownership (L.S.U.)	0	74%	78%	53%
	1-5	26%	21%	34%
	6-10	-	0.5%	9%
	11-15	-	0.5%	3%
	16 & more	-	-	1%
Total acreage	0	-	0.7%	2%
	1-2	-	0.7%	3%
	3-4	-	7.3%	18%
	5-6	17.3%	17.2%	10%
	7-8	10.9%	17.9%	14%
	9-10	12.0%	21.2%	9%
	11-15	23.9%	15.2%	18%
	16-20	9.8%	9.3%	13%
	21-30	13.0%	7.9%	6%
	31-50	9.8%	1.3%	4%
	51 & more	3.3%	1.3%	3%
Total yields (in bags)	0	14.4%	18.0%	22%
	1	10.0%	12.7%	8%
	2-3	24.4%	28.0%	16%
	4-10	28.9%	28.7%	29%
	11-20	13.3%	6.0%	12%
	21-40	3.3%	5.3%	8%
	41 & more	5.6%	1.3%	5%
Total productivity (bags/acre)	0	14.8%	15.9%	17%
	0.1 - 0.25	15.9%	20.3%	12%
	0.26- 0.50	22.7%	27.5%	18%
	0.51- 0.75	9.1%	11.6%	10%
	0.76- 1.0	9.1%	8.7%	9%
	1.1 - 2.0	13.6%	9.4%	16%
	2.1 - 3.0	8.0%	5.1%	7%
	3.1 - 5.0	2.3%	-	5%
	5.1 & more	4.5%	1.4%	6%

Preliminary results of Arable Allocation Policies
Survey of various Land Boards in Botswana (Ministry
of Local Government and Lands, March 1980):

<u>Land Board</u>	<u>Maximum allocation per person</u>
Ngwato	40 ha
Tati	8 ha
Rolong	100 ha
Kweneng	20 ha
Tlokweng	2 ha
Malete	2 ha

IV
ARABLE LANDS SURVEY

Dikwididi

Kgatlang District

1. Household Profile

The survey data reinforce the case for extension that reaches the 24% female-headed households and deal with their special problems such as lack of draft power.

The problem of extension work with 22% having no formal education and 64% having an average of only 2 years formal education is critical. Literacy and media work should focus on giving all farmers a functional ability to read and record basic farming information.

With a mean total livestock per household of 12 and a median of 8 (even lower than national figures) the problem of shortage of capital and draft power is highlighted. Farm equipment is also desperately inadequate with a mean value of P117 and an incredible P2. Fifty percent reported no investment in farm equipment and indeed did not own even a plough!

The same picture is seen in land usage, 80% having less than 10 acres and only 30% more than 20 acres. The reason is most likely lack of equipment to utilise more land on the part of poorer households.

Recommendation

Clearly the ALDEP scheme for implement and draft subsidy is vital to upgrade the farming of at least 50% of farmers.

2. Land

As mentioned above, land "ownership" is highly differentiated. The median field size is 14 acres, which is below the subsistence minimum of 10 ha. As large numbers of farmers are fencing (58% in Dikwididi and 40% nationally) and there is a growing scarcity of good arable land, the different levels of land "ownership" may create socio-economic tensions in future.

Recommendation

A pilot land registration process will be started in Kgatlang (and elsewhere) to monitor land distribution and exchange, selling and following practises.

3. Soil and Land Improvement

Less than 1% were reported as using manure or fertiliser perhaps because 73% have no transport. The reason why 71% do not practice crop rotation is less clear unless they have simply not had its benefits explained fully. Most people seem to clear and destump (10 ac) most of the land they own (14 ac).

Recommendation: Draft power and cart transport must be a major constraint on soil and land improvement. The donkey subsidy scheme will help. Something more concrete is needed to stimulate and/or subsidise the production and use of small carts.

4. Draft Power

With a median herd size of 8 and 37% of households reporting no access to draft power, the constraint on ploughing is clearly severe. A further 54% had only 6 oxen or less available to plough. Only 31% had ready access to tractors and of those who did plough with a tractor, 81% had to hire. A small number of farmers (6%) used donkeys.

Recommendation: Due to the high cost and low availability of oxen and tractors it seems the use of donkey draft is more appropriate for the small arable farmer. A pilot project is proposed. Draft power training schemes with donkeys and oxen should be piloted and efficient harnesses developed. Kgatleng Development Board (Brigade Unit) has some experience in this area.

5. Labour

51% of households had 3 or fewer family members to help with farming. 82% reported no potential labour force which is probably a survey error but if not indicates a chronic situation!

Recommendation: This problem of farm labour shortage probably reflects the lack of attraction of farming and land life. Until profitability and service are improved, the counter attraction of urban life and incomes will cause out-migration from the lands.

6. Inputs and Implements:

Dikwididi has a low adoption of new practises compared with national figures, e.g. 28% buy seed compared with 40% nationally; 8% plant in rows compared with 22% nationally; 48% use a single row plough compared with 69% nationally.

As mentioned above the value of farm equipment per household is very low.

Recommendation: The ALDEP implement subsidy scheme is obviously needed. The manufacture, repair and supply of spares for agricultural equipment needs to be investigated and strongly supported by government if possible. Tractor hire charges may need to be subject to price control.

Improved seed needs to be made more easily and regularly available.

7. Farming Practices

With 48% planting after December, 98% broadcasting and 88% weeding only once, a low level of farm husbandry is indicated. Apart from unreliable or late rain, the lack of labour, implements and draught are probably factors in the poor farming practices.

Recommendation: As for 5 and 6.

8. Water

A diversity of water sources are used but in many places like Dikwididi dams are used by many families (59%). These are unreliable due to no maintenance and poor management. 23% report using shallow wells which are a health hazard and evaporate almost as fast as dams. Only 6% have deep wells. 39% report using a communal water source.

Recommendation: Dams must be better managed and repaired using extension to get Farmers' Committees to do this work better. A maintenance unit or demonstration of ox or tractor scoops should be tried. Water tanks are going to be built by many Kgatleng farmers to enable timely ploughing.

Deep wells are the most reliable and safe water supply and will be encouraged where appropriate, and equipped with hand pumps and wind mills.

9. Yields/Productivity

The figures for maize and sorghum are even lower than nationally but for millet and beans yields are double the national average. The wide range of yields (0.25 - 5 bags/acre) indicates the possibility of raising overall production. Clearly the reasons for low productivity of most farmers are complex and varied but linked to all the other factors outlined in this paper.

Recommendation: As for the other issues. A 'package' approach is necessary to ensure that investment of capital and labour lead to increased yields.

10. Extension

Although only 11% did not know the AD's name compared with 40% nationally, 66% had had no advice and 48% of those who had, had had it a year ago!

Recommendation: Group courses and addresses to Kgotla or farmers associations, etc., must be used in preference to an individual farmer approach. ADs must be made sufficiently well informed and confident through regular seminars, workshops, field trips, etc., and strongly supported by specialists in the field.

Dikwididi and other extension area vacancies must be filled urgently.

ARABLE LANDS SURVEYMoiyabana and TlhabalaCentral District1. Household Profile

The survey in Central District was carried out at the villages and lands of Moiyabana and Tlhabala, south-west of Serowe. A total of 105 households were included in the sample and the average number of members in a household was nine (the median being greater).

There was an average of 5.5 persons per household aged between five and sixty-five years, which suggests a fairly large proportion of household members aged less than five.

It has been agreed that the target group for ALDEP should be small farmers. The Ministry of Agriculture's paper to NDDC 7 defined these as farmers ploughing less than 20 hectares (50 acres) and this would include 99% of all farming households. Within the target group, thus defined, can be identified households with different basic characteristics, which means that for ALDEP's projects and programmes to be successful, several target sub-groups will need definition. The MoA's NDDC paper defined a prime target sub-group as those households without ready access to draught power, approximately 50% of all farming households. Perhaps target sub-sub-groups will be needed.

The definition of ALDEP's target group or groups requires reconsideration. Who, in Botswana, is a small farmer? If we take the median household as the dividing line, then small farmers have the following characteristics: they own less than 10 head of cattle and no small stock; they hold less than 4 hectares of lands and plant less than 2.5 hectares; they produce less than 4.5 bags of grain; their total household wealth is less than P1,500 including up to P35 of farm equipment; and they have ready access to less than 2 LSU of draught power. At whom, therefore, should ALDEP direct most attention and resources? A target group including 99% of farming households is meaningless. One or more target groups need to be defined and, if more than one, their relative importance in terms of receiving resources needs to be specified.

The success of ALDEP depends on the extent to which the decisions of households can be influenced to devote more labour and resources to arable agriculture. Such decisions will be made in the light of the range of (expected) income opportunities facing each household and it is therefore important to know what this range consists of and what is the relative importance of each opportunity to each household. Unfortunately the survey data do not help in this respect, giving neither an estimate of total income nor any indication of households' non-agricultural economic activities. The nature of the household economy is still not fully known or understood, particularly in its dynamics.

How are decisions made on the allocation of labour between the several income earning opportunities? How are savings and investment decisions made? What is the propensity to save? How great is the household's risk aversion? The design of ALDEP programmes and projects will be improved with better understanding of the micro-economics of the household and perhaps more research needs to be done in this area.

2. Land

District data indicate that all households own one or more fields. It is felt that the National figure of 10% with no lands is more correct. Of people with lands the results show the average to hold two fields.

The total average hectarage from District data, 4.88 ha, compares favourably with other district results and the national data. The area desbushed, 3.3 ha, seems reasonable with district results while the national results are much too high. Most people do not clear every centimeter of land allocated, as indicated.

The area completely destumped, 1.3 hectares, again seems reasonable for the District. The national figures again seem too high in comparison to Central District. The area planted of 3.15 ha. is slightly higher than what is felt to be the District average.

Implications

As population and the number of households entering into agriculture increase there is bound to be greater and more competition for the higher classes and better located land. Priority on land for grazing versus land for cropping will become an issue. There is a need to plan for the expansion of arable lands.

Because of the number of presently scattered fields, increasing total arable area may lead to un-economic distances in time and labour. Conversely single fields on a homogeneous soil type may not spread the risk (i.e. sandy vs black cotton soil) in an agricultural system with large climatic variations. Soil, crop and climate interactions should be taken into consideration when planning or recommending detailed farm system layouts.

The area of land needed for sustained production without significant fertilizer inputs should be studied. It is necessary to determine the long-term rotational patterns (i.e. one field every other year, every 5 years, etc.). This will again affect the amount of land and type of possible tenure systems to improve the agricultural industry.

The introduction of the new farming packages should consider the very small area of lands completely destumped. This destumping should be carried out with care so as not to damage the environment and ultimately, agricultural production.

3. Soil and Land Improvement

It is agreed that very few people use fertilizer or manure (97.2%). The District data indicate that 23.5% practise contour ploughing. This data may be inaccurate because the Soil Conservation Unit has been demonstrating contour ploughing in the area for the last two and a half years (although no one uses the fields which were contoured). It is felt that the national data including Ngamiland are more correct. Under crop rotation practiced it is felt that an even larger percentage do not practice planned rotations on separate fields. Internal field rotation is practiced fairly often, however, possibly in agreement with the 30.9% results. Other considerations are the periods of abandonment, re-use, and the new clearing of lands which is a form of long-term rotation.

The District results of 16.1% farm families practicing wire fencing is thought to be correct. The national figure of 40% is much too high, possibly including bush fences.

Implications

It is probable that erosion is caused as much by wrong contour ploughing as ploughing on the edges of rivers, banks, dongas and roads. Tree cutting in general and especially on sensitive land areas also contributes to erosion. Contour ploughing should be encouraged along with other conservation practices (i.e. forestry, fallow crops, veldfire control, etc.).

Very little information is available on soil fertility and the rotation period needed for sustained production without fertilizers. The internal use of each field varies greatly through time and little is known of regional or long-term rotational practices. Again, this will affect the total hectareage needed for each family. It is recommended that the rotations necessary for sustained yield should be looked at in detail under traditional and proposed systems. The desire of farmers to fence their lands (with wire) is very high. To reduce costs many farmers have grouped themselves and have been assisted with funds by the government.

Fencing protects the crops as well as leading to a two or more paddock system based on cropping seasons. In many group drift fence projects the fence divides large areas of grazing from arable land. This is excellent now but may cause future problems if arable lands expand (de facto

boundary). Group fence projects contribute to the feeling of solidarity among villagers which may lead to other communal projects. However, inter-group disputes can arise and with other physical factors (land/grazing areas which are mixed) should not cause individual fencing to be ignored. Consideration of the environmental effects of pole cutting must be taken into account. In some areas this may be impossible and extra funding provided for purchased poles. Forestry projects should again be encouraged with other production development projects.

4. Draught Power

The survey data for Central District reveal that the great majority of households uses oxen for ploughing, over 80%. This figure is probably too high for the District as a whole, the true figure being closer to the national figure, say, between two-thirds and three-quarters of households. Of those using oxen, 4 % (70% nationally) owned them, 33.3% (18% nationally) borrowed them and 25% (11% nationally) hired them. Two-thirds of households secured the oxen from a relative.

23% of households used a tractor or tractors, twice the national figure, but only three households owned one. Three other households borrowed a tractor and the rest (18 households) hired it. Nine households obtained the tractor used from a relative and fifteen from a non-relative.

According to the survey data only 2% of households use donkeys for ploughing. This is certainly not the case throughout the District and the overall District figure may even be higher than the 8% of households shown by the national data. The use of donkeys, however, varies from area to area.

41% of households are shown to be without any access to draught power. But if every household planted, as is also shown, how did this 41% prepare their fields? There is also a discrepancy with the number of households shown to be using ploughs: only 20% did not use a single-row plough. Access to draught power is, however, clearly a problem for many households and is perceived as such by them.

The heavy reliance on oxen as a source of draught power is brought out in both the District and national data. Since one-third of all households do not own any cattle and a further 15% own less than ten head (the number required to ensure a ploughing team of six), it is not surprising that less than half of those households using oxen for draught power actually owned the oxen. (Nationally this figure is 70%). Borrowing and hiring of oxen for ploughing are significant practices but details of the types of exchanges involved are not known. However,

two-thirds (89% nationally) of households using oxen secured them from a relative and some of these must have hired them from a relative. The use of tractors is even more involved with direct exchanges and less with traditional exchange relations. (Will this occur with all new technologies?)

The question facing ALDEP, therefore, is how to improve access to draught power, particularly at the time that it is needed. (Do most farmers plant in summer because they have no access to draught power earlier?) Which type of draught power should be assorted, bearing in mind the emphasis on the small farmer?

5. Labour

The average total household labour in the Central District sample is 5.5 persons, about one person per household greater than in the national data. An average of 5 persons per household aged between 5 and 65 years is believed to be more or less correct. The data, however, show average actual household labour (6.2 persons) to be greater than average total household labour, i.e., the average number of people per household staying at the lands is greater than the average total number of people per household. It is not known what interpretation can be put on this result and how this, together with the result that 60% of households do not have any 'potential' labour, can be used to assess the labour supply for arable agriculture.

The district and national data both show only a small proportion of households using non-family labour in various farming activities. More households use non-family labour for ploughing than for any other activity (weeding, harvesting, threshing): 35% for ploughing compared with approximately 10% for other activities.

The survey data thus show that arable agriculture is very dependent on labour from within the family. This is not the same thing as labour from within the household, the economic unit. Payment for family labour from another household must be made somehow, probably through provision of reciprocal labour services or as part of the traditional and complex system of social and kinship exchanges.

The survey does not reveal how much family labour is from outside the household nor how it is paid. The method of payment for non-family labour is only shown for one activity, harvesting, and unfortunately not for ploughing, which is more dependent on non-family labour. It is likely, however, that payment in kind is a common method.

The above raises at least one important question. Should ALDEP attempt to build on existing (traditional) labour arrangements, or should the agricultural labour market be further and more rapidly integrated into the cash

economy? Will the strategy followed affect the size of surplus over subsistence needs which a farming household will need to produce?

The cross tabulations reveal that households with more actual labour produce more because they plant a greater hectareage. Yields per hectare are more or less the same for all households. In other words, for a given technique, returns to scale are constant. Should ALDEP, therefore, aim primarily to increase output through the application of more labour to more land, or should yield per hectare be increased through changing techniques? The farmer approach would require an increase in product prices to enable greater returns to labour. The latter approach would in its details depend upon substitution effects on output of changes in the relative prices of capital and labour, and its effects on total employment are more uncertain. Which approach is more likely to succeed?

6. Inputs and Implements

(a) Inputs:

The sample in Central District revealed only three households (3%) using either fertilizer or manure. This is consistent with the national data which also show over 90% of households not using fertilizer. The few households that do use fertilizer do so on traditional crops, and the indications are that more households would use fertilizer if it were more readily available and cheaper to the farmer. Should fertilizer be subsidised?

Almost half of all households supplied all of their own seed (46% in Central District, 53% nationally) and about 40% purchased all their seed. The remainder (12% in Central District, 11% nationally) obtained their seed from a relative as from more than one source. It is believed that the survey data do not truly reflect the proportion of households which obtains seed from more than one source. The survey of AD's showed approximately 70% of farmers buying seed and more than half storing grain for seed.

Unfortunately the data do not include details of where seed is purchased nor which variety and amounts are purchased. Seed availability is not perceived as one of the most important constraints, but the relative costs of purchasing and storage facilities could be important to the household economy. (Seed quality and suitability has not been considered in the survey.)

(b) Implements:

The most common farm implements are single row ploughs (80% of households) and cultivators (53% - but how many of these are hand cultivators or are efficiently used when under 10% row plant?). Approximately nine out of ten households use neither double-row ploughs nor any kind of planter, and perhaps as many as two-thirds of households (59% is shown in the District data) do not use sledges, wagons or carts. The data reveal the median value of farm equipment per household to be about P35.

Not surprisingly, the cross tabulation analysis shows that households with a higher value of farm equipment plough more hectares, are more likely to row plant and to use fertilizer, and have a higher adoption index of progressive methods. In other words, the rich are in a better position to get richer. Access to implements could assist small farmers to produce more but how is improved access to be brought about? It is unlikely that a majority of households could themselves service even a low interest loan. Should group cooperative ownership of farm equipment be promoted? Should Government subsidise farm equipment purchases to groups and/or individuals?

7. Water

The primary water sources in the district land areas vary considerably. However, it is agreed that most water sources are seasonal. It is felt that the district and national data are misleading under the heading "dam". From our A.P. Survey of June 1978 it was found that many water sources are haffirs and waterholes. If these are included under dams then a distorted picture of the permanence of water sources used is created.

Under the ownership of primary water sources it would be important to identify the types of ownership with different water sources. Most of the year water sources such as boreholes and wells are owned individually or by small syndicates.

Implications

The large number of temporary water sources used will make it difficult for many farmers to practice winter ploughing and early seeding. Increasing the number and permanence of watering points will improve the capacity of farmers to adopt more intensive methods of production. However, some impediments to water development can be identified. Permanent water sources can lead to permanent settlements which are against District policy. Uncontrolled permanent water sources will increase the potential for increasing cattle numbers and therefore, eventually, overgrazing.

As previously stated it is agreed that improvements to water supplies be mainly from local initiative with some government financial and technical assistance. The use and location of all new water sources should be planned and monitored so as to avoid an increase in local overgrazing. The type of water sources supported in the District should depend on local conditions but avoid recurrent and high cost investments (i.e. boreholes) where practical.

E.L. Yaxley
(District Officer, Lands)

ARABLE LANDS SURVEYSectionNorth East District1. Draft Power

The replies to the direct question on ploughing last season give 65 of the sample of 67 as having ploughed. Inferences from other questions give a slight variation in this number.

The questions on type of draft power used indicate that 73% used oxen, 4.5% tractors, 16.5% donkeys and 6% (i.e. 4 people) by inference not ploughing.

Of those ploughing 40% used their own draft power while 60% borrowed or hired. Oxen were not hired, only borrowed (44% of sample), while donkeys and tractors were hired and not borrowed (10%). The largest group ploughing are people borrowing someone else's oxen. Although there is some inconsistency in the data, it appears that 3/4 of the cases were from relatives and 1/4 from non-relatives. Even these 10 people reporting the use of non-relatives' oxen for ploughing apparently borrowed them without financial charge.

The results generally follow the national pattern and variations are probably not significant. The social acceptability of hiring oxen versus donkeys or tractors might be investigated.

The North East District has already identified draft power availability as a major constraint in arable agriculture and has identified the acceptability of donkeys for draft power. It supports the introduction of a subsidy scheme for donkey draft power.

Interestingly, according to the interpretation of the data, 39 people had no access to draft power whatever and by inference would be unable to plough. In fact only 2-4 people reported not ploughing. How to account for these 35 mystery tillers? Study of the questionnaire shows that this information must be derived from questions 10 and 11 and possibly 4. It is hard to see how it is possible to declare total access to draft power from this information. It illustrates as do several other instances the dangers of attempting to infer more than the limited and often inconsistent basic survey data permit.

2. Extension

Membership in various bodies appears to be somewhat higher than nationally, particularly 4B, where 39% of respondents reported a 4B family member against 11%

nationally. This information may, of course, only imply that Sechele is one of a minority of villages with a 4B club.

A high 83% knew the AD's name, and this in spite of Sechele not being his domicile. He has, however, been stationed in the extension area for 10 years or more. 45% had at some time received advice from him and 73% of these within the last year (versus 34% and 94% nationally). However, 121 more people reported receiving advice from the AD in question 21(c) and 21(b).

Extension contact overall was lower than nationally but probably not significantly so.

Despite the fair degree of agricultural extension contact, and a relatively high adoption rate of practices actually heard about, there was an overall low adoption rate of new practices indicating that several new practices had not been heard of.

3. Land

80% of the farmers at Sechele have one field. The total surveyed area is 885 acres. The mean size is 13.6 acres and the median is 12 acres.

It can be seen that 20% of the farmers have more than 20 acres, which is the largest area that the Land Board allocates.

Debushed area : Total area: 800 ac. Mean: 12.56 ac.
Median: 1 ac.

Destumped area: Total area: 280 ac. Mean: 4.4 ac.
Median: 1 ac.

This means that only 32% of the total area is destumped.

Planted area : Total area: 700 ac. Mean: 11 ac.
Median: 6.5 ac.

4. Water

There are only a few people living outside Sechele village and almost nobody has more than one place to stay.

Council has a borehole in the village from which everyone is fetching water. So it is difficult to understand why only 33% use the borehole as their primary water source.

5. Implements and Inputs

59 people used a single row plough, 2 used a double row plough; it is not known if these were used with oxen or tractor. Nobody used a planter. The use of a cultivator is not clear. In the questionnaire the question put is cultivator/hoes; this is somewhat like equating a bicycle and Mercedes Benz ownership and in all probability some enumerators recognized this which accounts for the 43 respondents who reported not having a cultivator. Other enumerators with less common sense but probably more familiarity with the demands of this sort of survey must have asked the question as stated, thus permitting 14 respondents to own 2 or more hoes/cultivators. We must assume that these are hoes, since the occurrence of broadcasted fields being weeded by 2 or more cultivators is surely a rarity.

25 people with carts, wagons, or sledges is quite high. However the comparison of a sledge with a cart or wagon is not really valid. (A sledge has very low capital investment, and very restricted use, both in things carried and distance.)

Only 12% of the sample bought seed; this is considerably lower than the national average and may be significant. Why? Likewise the overall value of farm equipment was low (only 4 farmers with equipment they valued at over P121).

The picture is one of basic subsistence production with the minimum of inputs.

Kalkfontein

Ghanzi District

1. Household Profile

97 households (30-40% sample) were surveyed in the village of Kalkfontein. Of these, 44.3% were female-headed and 55.7% male-headed. (National figures: 24% FHHs, 76% MHHs). Our results therefore show a far greater number of FHHs compared with the national average. We believe this figure is an exaggeration - a survey carried out in the village of Kule and Nojane in August 1979, showed only 25-30% of the households were headed by females. We suggest this as a more realistic figure for most villages in the Ghanzi District. The problems facing FHHs have been described in several papers. These would be similar in the Ghanzi District. It was found in the Kule-Nojane survey that many FHHs obtained a large portion of their income from the sale of liquor, which appears to be a profitable business in many of the villages.

Education - 41% of the households have at least Standard 1 or 2 levels of education. Only 22.9% have no education at all. Education levels compare favourably with the national figures:

<u>Education Level</u>	<u>District</u>	<u>National</u>
0	22.9%	36%
1-2	41.0%	34%
3-4	20.5%	20%
5-7	15.7%	10%

However, as far as improved arable production is concerned, the relatively higher education level is not fully utilised since there are no AD's or Extension staff at the village level. In the Remote Area Settlements education amongst many of the older people is non-existent. The Remote Area Agricultural Advisor (RAAA) therefore has an extremely difficult task in promoting arable production, especially since this is a new concept to many of these people. AD's in these areas are essential.

Lands - The Ghanzi District is characterised by having lands areas and cattle posts in close proximity to each other, if not at the same place. The survey is somewhat confusing on this issue, since 36% of households claim to have cattle at the lands. However, since there were only 22 out of 97 valid cases, the results are probably inaccurate. The problem of members of the household staying at the lands does not really exist in the Ghanzi District.

Problems/Recommendations

The basic problem in the Ghanzi District is the complete absence of extension staff, particularly at the village level, for arable production. This, in conjunction with the lack of seeds, fertiliser, and implements makes it difficult for farmers to improve their farming techniques and increase their yields.

Since both the lands and the cattle posts are in the same area, manure could easily be collected, e.g., using fields prior to ploughing as kraals. This would improve both the texture and fertility of the soil. This can only be encouraged by active extension work.

It is hoped that when BAMB establishes itself in Ghanzi, lock-up stores will be provided in most of the large villages, making improved seeds more accessible to the farmers. The lack of implements still remains a major problem.

2. Land and Soil Improvement

The results show that 51.5% of households held no fields, whereas the national figure shows only 10% of households having no fields. We feel the figure for Kalkfontein is unrealistic since the majority of households own one field.

Most fields are between 3 and 5 acres in the Kalkfontein area, although in many villages most fields are smaller than this. The results indicate a mean size of 6.485 acres which is larger than the majority of fields. It is unlikely that any fields in the village areas exceed 15 acres and it is certainly incorrect that 6% of the people have fields of 31-50 acres (with the exception of the freehold farms).

The results indicate that 70% of households debush and destump 1-4 acres (mean 5.2 acres). Since most fields are between 3-5 acres, this shows that most farmers clear a large portion of their fields, although the results indicate that 90% of households improve only 51-67% of their lands. We suggest that this figure is closer to 80-85%.

Since most fields are less than 5 acres, (this is true of most of the Ghanzi District), destumping and debushing is not a big problem. These are traditional practices carried out by most farmers. However, new techniques regarding land and soil improvement are rarely practised due to lack of advice. 97% of households use neither fertilizer nor manure and there is no crop rotation. The results indicate that only 58.7% of households fence their fields -- this is incorrect since it has been observed

that almost 100% of the farmers fence their land. This is essential because in the Ghanzi District, where lands and cattle posts occupy the same area, there is a great danger of damage to crops from grazing cattle. In some of the remote area settlements some fields are poorly fenced because of lack of knowledge and the new concept of growing crops, and some damage is caused by grazing cattle. The RAAA is doing his utmost to advise the Remote Area Dwellers on improved farming techniques.

Problems/Recommendations

The lack of basic extension work is again the main problem. A project memorandum requesting funds for 4 Agricultural Assistants, 2 in the village areas and 2 in the remote areas, has been submitted to the ALDEP team. They will carry out basic extension work and demonstrations to encourage farmers to adopt improved techniques. As said earlier, the use of manure would greatly improve the soil texture and fertility and this could easily be done by using lands areas as kraals during the winter months. However, without advice and demonstrations it is unlikely that improved techniques will be adopted. This will result in rapid deterioration of the soil and thus smaller yields.

3. Draft Power

About 75% of the farmers in the Ghanzi District use donkeys for draft power. The results indicate that only 50% of households own their own donkeys -- this figure is probably closer to 70% -- and those that borrow donkeys rarely do so from non-relatives. It therefore appears that the results which indicate that only 30.8% of households secure donkeys from relatives, are inaccurate -- this figure should be closer to 80%.

Only 55.6% of households which use oxen for ploughing own oxen. The national figures indicate that 70% of households own oxen which is somewhat higher than in this district. No residents in Kalkfontein own tractors, which is typical of the whole district with the exception of the freehold farms where fields are larger and finance is easily accessible.

In the Ghanzi District there are few, if any farmers' groups or committees at the village level. In the eastern parts of Botswana farming cards are used to indicate livestock ownership, arable practices, yields, etc., but in the Ghanzi District no such thing exists. Many farmers are reluctant to indicate the number of cattle and small stock they own and thus any such survey is likely to underestimate the total number of cattle. In Kalkfontein, the majority of households own cattle, on an average of 200-500 head. Other villages are similar although there are many households that own very few cattle and a minority that own very large herds.

The survey results indicate that 51.8% of households own no cattle. We believe this figure is too high. The results also indicate that the majority of farmers owning cattle have no more than 20 LSU although most farmers in Kalkfontein own 200-300 head of cattle. Likewise, most farmers own 20-50 head of small stock, whereas the results indicate that 47.2% of households own no small-stock and 50% of those that do have no more than 10 LSU.

Since most households own livestock, access to draft power should not be a problem. However, the results indicate that 82.1% of households have no ready access to oxen or donkeys (owned or mafis'd) and 66.7% of households have no ready access to any form of draft power, be it owned, borrowed, or hired. These figures are very high compared to the national figure of 38% of households having no access. This figure would be more realistic for the Ghanzi District.

Problems/Recommendations

Draft power is not a big problem in the Ghanzi District. In the Remote Area settlements funds have been allocated to secure livestock including donkeys for the Remote Area Dwellers. At present these are sufficient since the establishment of settlements is progressing very slowly. However, as new settlements are formed a pilot project under ALDEP may be submitted to help secure livestock for the Remote Area Dwellers.

As indicated by Carol Kerven, female-headed households may experience difficulties in securing draft power of their own. However, borrowing from relatives is widely practised and draft power, using donkeys, is not a serious problem. Oxen are used by fewer households for ploughing, but this is not an indication of the difficulty in having access to oxen. Donkeys are used often in preference to oxen.

4. Labour

The results regarding help with farming activities are very similar to the national figures. It is common practice to have family members helping with ploughing, weeding and harvesting. In the Ghanzi District, 62.1% of this help is from children or grandchildren.

42% of households also have non-family members helping with ploughing and 15-20% of households have non-family members helping with other activities. This is very similar to the national figures. Since the lands areas and cattle posts are in the same location, the problem of children remaining at the lands and thus not attending school is not a problem. Nevertheless there is poor attendance at many schools because of the reluctance to attend classes.

Access to a labour force does not appear to be a problem. However, implements are scarce and therefore farming practices are not carried out effectively.

5. Inputs and Implements

Double row ploughs, double row planters and single row planters are not used in Kalkfontein. This is typical of most of the Ghanzi District, and the national figures indicate that only a few households own such implements. The national figures show that 14% of households use cultivators, but the district results indicate 40% of households use cultivators in Kalkfontein. This is highly unlikely considering the national figures. The DAO has seen no cultivators in Kalkfontein, which is typical of the whole district.

28.6% of households own sledges, which compares favourably with the national figure of 23%. These figures account for the low value of farming equipment in the survey, P36 being the mean in Kalkfontein as compared with the national mean of P120.

Fertiliser is not used and manure is only applied by a small percentage of farmers. Only 14.3% of households purchase seed - 85% of households use their own seeds. The national figure indicates that 53% of households purchase seed which is a far greater percentage than in the Ghanzi District. This presents a real problem -- ISM seed has not been available until this year and now the shortage of extension staff does not make seed available to the majority of villagers. Through Council, subsidised seed has been made available to the Remote Area Dwellers, but there still remains the problem of distributing this seed at the appropriate time.

Problems/Recommendations

The availability of seeds and implements is a major problem. It is hoped that when BAMB establishes itself in Ghanzi this problem may be alleviated - this will only be achieved if lock-up stores are provided in the main villages to make seeds readily accessible to most villagers. This has been suggested under ALDEP and it is hoped that the Agricultural Assistants (also a pilot project) will assist in distributing the seed.

Implements still remain a problem. The Agricultural Office is still not stocked sufficiently and again Ghanzi is not in a central location to most of the district villages. Efficient arable production can only be achieved if good seed and effective implements are used. Basic tools should be made available and easily accessible, both financially and in distance. Further research is essential

to determine suitable seed and implements for the Kalahari environment. Prior to the establishment of a research station, AD's and Agricultural Assistants should carry out demonstrations/experiments in this field.

6. Farming Practices

In the Ghanzi District very few improved farming techniques have been adopted. Broadcasting is practised by most households, (in a recent survey of Nojane-Kule over 95% of households), there is no row planting or crop rotation, no winter ploughing, weeding is only done once, no fertilisers or insecticides are used, and most farmers fence their land with brush fence.

Adoption of improved practices can only be done if seeds and implements are readily accessible and if there is extension work to demonstrate and encourage the adoption of new and improved techniques. This is the major obstacle to arable production in the Ghanzi District. A large percentage of households (70-80%) plough lands and attempt to grow crops despite the conditions which are not conducive to arable production. At the ALDEP workshop it was agreed that due to these conditions, both the Ghanzi and Kgalagadi districts would be treated as special cases. This is very important and in addition it must be remembered that both districts are large and many villages are remote and therefore extension staff should be located in the villages; likewise, lock-up stores should be made accessible to the majority of households who do not have transport.

7. Water

The scarcity of water is always a major problem. The results of the survey indicate that 52.6% of households in Kalkfontein use boreholes and 36.8% of households use deep wells. It is surprising that only 5.3% of households use pans -- in Kalkfontein the majority of cattle are watered from wells and pans, whereas most water for domestic consumption is taken from the Council borehole. Although several boreholes, owned privately, exist along the Okwa Valley, relatively near Kalkfontein, most households use communal wells or boreholes owned by Council.

The erratic rainfall is the only source of water for arable production which has greatly been affected in the last few years. If a solution could be found to storing water so that crops receive water at critical periods, arable production would not be such a risky proposition.

61.5% of households in Kalkfontein walk less than 1 km to their primary water source. In many villages in the Ghanzi District the distance is often far greater. In both Kule and Nojane many villagers walk 3-5 kms to water which is time consuming and tedious.

Problems/Recommendations

Much research and technical advice is necessary before such a thing as water storage tanks can be introduced. Even then these would only be practical in small "backyard" plots, since much water is required. Reticulation of water is also impractical due to the enormous costs involved.

The solution could be drought resistant crops. Research is essential in this field. A sandveld research station has been proposed by IFAD. We strongly support such a project or a similar project on a lesser scale making use of extension staff (if available) and setting up demonstrations within village areas so that results can be observed by the residents, for whom the research is being done.

8. Yield/Productivity

Sorghum, maize and beans are the main crops grown in the Ghanzi District. The yields for both sorghum and maize are about 50% of the national yields, although from the results it appears beans do twice as well in the Ghanzi District.

	District (<u>Mean bags/acre</u>)	National (<u>Mean bags/acre</u>)
Sorghum	0.76	1.4
Maize	0.796	1.3
Beans	2.037	1.4

The latter could be inaccurate -- most households grow 2 been crops per year and it is unlikely that 1 bag/acre is produced.

The low yields of both sorghum and maize are caused by using varieties commonly used, rather than varieties which are drought resistant. However, to encourage farmers to use new varieties, demonstrations are needed to show better yields. Research is needed to determine suitable varieties.

Recommendations

Although arable production is not on a vast scale in the Ghanzi District, the majority of households grow crops for self sufficiency. However, if improved seeds were made available and extension work could be carried out, even in drought years farmers could produce a surplus, thus creating income for themselves.

However at present, ALDEP should aim towards encouraging all households to grow crops and increase their yields by making improved seeds, implements, and above all extension assistance readily available. In conjunction with this, research is essential to determine crop varieties suitable for the conditions in western Botswana.

9. Extension

Extension is the foremost obstacle to arable production in the Ghanzi District. There are no AD's concerned with arable production in the field and although the DAO and his staff can carry out some extension work, it is impossible to carry out effective extension in such a large district.

There are no pupil/farmer schemes and no farmers' committees. A co-operative existed in Kule but due to mismanagement and misappropriation of funds it has collapsed and as a result, people are very suspicious of anything of this kind.

Only 26.9% of households own radios, but nevertheless, over 60% of households had either heard of, or attended meetings concerning TGLP. This compares favourably with the national figures. However, there still appears to be some misunderstanding over some aspects of TGLP, but these should gradually be overcome.

Problems/Recommendations

The lack of co-operatives and farmers' committees is a major problem. In the land use planning exercise in Kule and Nojane this problem will be addressed. However, with the acute shortage of agricultural staff, the establishment of co-operatives in other parts of the district will be difficult. We would welcome any assistance from the Ministry of Agriculture and the Department of Co-operatives in this matter.

As said earlier, under ALDEP a pilot project requesting 4 Agricultural Assistants is being submitted. These will alleviate the problem of lack of extension work to some degree, but AD's are still essential. Arable production can only be improved with active extension work.

VIII
ARABLE LANDS SURVEY

Kang
Kgalagadi District

1. Household Profile

General Results

There are more female-headed households than the national average (36% x 24%).*

The education level is slightly above the national average, with 25% of households x 33% having no education at all, and 63% x 54% having 1 - 4 years education.

Number of cattle and smallstock at the lands is not really applicable since the lands are interspersed with the grazing and residential areas.

Cattle Ownership: There are more households without cattle than the national average (38% x 32%). There are fewer households with a small number of cattle, 1-10 LSU: (10% x 20%), while there are more larger owners (29% with more than 50 cattle against 8% nationally).

In general, cattle ownership is more unequally divided than the national average.

Smallstock Ownership: There are more households without small stock (60% x 53%) and fewer households with a small number of smallstock (1 - 15 smallstock - 31% x 46% nationally). This is not representative of the district, since towards the south the keeping of smallstock becomes more important than cattle.

Total Livestock Ownership: There are fewer small owners (1-30 LSU: 32% x 50%) and more large owners (40 LSU: 33% x 8%). The number of households without livestock is similar to the national average.

Value of Farm Equipment: There are more households without equipment (41% x 30%) and fewer with expensive equipment (value over P80 - 7% x 20% nationally). In general, the value of farm equipment is considerably below the national average, which is not surprising.

Household Wealth: There are fewer households than the national average with a wealth of P1-5000 (60% versus 86%) and considerably more rich households (households with over P5000: 31% versus 9% nationally).

Ploughed Last Year: Considerably fewer households ploughed (50%) compared with the national average of 80%.

*Throughout this paper the first figure indicates the Kang Village percentage; the second figure represents the average of all villages (called 'national').

2. Land

General Results

The number of fields per household is smaller than the national average (0.6 x 1.3). The percentage of households without fields is considerably higher (40% x 10%).

Average: The majority of fields (54%) is less than 6 acres compared with 33% nationally. In general, the fields are smaller (10.4 x 14.1 acres).

Dubushing - Destumping: The figures indicate that a smaller than average percentage is debushed and destumped (100% have their land from 0-75% improved, compared with 39% nationally). It appears that this figure is incorrect as virtually all fields are completely debushed and destumped.

Proportion of Land Planted: Most households (93%) planted only 0-67% of the lands; nobody planted more than 2/3 of his land, compared with 64% nationally.

Problems

There are more households without fields than nationally. Seeing the abundance of land in Kgalagadi this is surprising. It might however reflect the general lesser significance of arable agriculture. Also, the high number of households without livestock could play a role (lack of draft power), although half of the households who have a field do not plough anyway.

3. Soil and Land Improvement

General Results

Use of manure or fertilizer: This is not practised at all, compared with 8% household adoption nationally .

Contour ploughing is adopted by 10% of the households, which is surprising, as contouring is not really that applicable with the highly permeably sandy soil and the general absence of relief.

Crop rotation is less adopted than the national average (20% x 31% of households).

Fencing: 63% of households have their fields fenced compared with 40% nationally. We believe that this figure is close to 100% since the fields are generally interspersed in the grazing area.

Problems

Adoption of use of manure is very low, as is crop rotation.

Recommendations

Try to promote use of manure, crop rotation.

4. Draft Power

Number of Tractors: There is one tractor in Kang; it was used by 3 households. This is clearly not an important source of draft power; oxen are mostly used for ploughing. Of the 48% households who used oxen, most were owned (85%), a slightly higher figure than nationally (70%). Donkeys seem to be used by only 2% of the households in Kang, which can be considered as too low a figure.

The question of smallstock at the lands does not really apply since the lands are near the grazing areas.

Access to draft power is severely limited (60% have no access to draft power compared with 38% nationally).

In general, donkeys are more common as a source of draft power in southern Kgalagadi, while oxen are used mainly in the north.

Problems

A high number of households have no access to draft power. However, it is difficult to say whether this is a serious constraint or whether shortage of labour is the limiting factor.

Recommendations

Investigate the possibility of improving access to draft power. District Agricultural Officer (DAO) to follow-up. A donkey subsidy scheme is likely to be well received.

5. Labour

A higher than average number of households have no helpers to plough at all (41% versus 18%) and also the number of helpers is below average (50% have 1-4 helpers compared with 73% nationally).

Most helpers are non-relatives (51%) compared with 2% nationally. The importance of children is much lower than nationally (39% versus 65%).

Probably the question was not understood as the percentage of non-family people helping to plough was only 11%. The number of family members helping to weed is below average: 1-5 members helping: 56% versus 76%.

Most weeders are children (50%), followed by the wife (37%). This is comparable to the national figures. Non-family members weeding: this is not important (5%). 57% of households have 1-4 helpers for harvesting (national: 78%); 42% harvest alone (10% nationally). The helpers with harvesting are mainly the children (52%) and the wives (36%). Almost no non-family members help with the harvest (only 6%).

The questions on payment in kind or cash were probably not understood.

An above average number of households have no family helpers to thresh (42% versus 19%). The total male and female household labour is comparable to the national average, but the actual male household labour shows a difference: 89% of households have 1-3 male labourers at the lands. Larger groups of male labourers are not present at the lands, while the national figures show that 61% of the households have 4-12 male labourers. The actual female household labour is comparable to the national average. The actual household labour is below average. Most of the households (52%) have no labourers at all at the lands while 38% have 1-3 labourers.

Problem

In general, the figures indicate that the number of labourers helping at the lands is below average. Most helpers are from within the family, mainly the children and the wife of the household head. Assistance from non-relatives is relatively non-important. The below average number of labourers corresponds to the general lower inputs, the smaller field sizes and the smaller planted areas. However, as figures for Kang are at present not available on the constraints, it is difficult to say whether there is a serious shortage of labour or whether lower input, smaller fields, and smaller planted areas are caused by factors such as lower average rainfall, poorer soil conditions and a higher crop failure rate.

Recommendation

Investigate the Kang figures on constraints to inputs. (From field experience it appears that shortage of labour is a severe constraint to arable agriculture.)

6. Inputs and Implements

2% of households used double row ploughs, against 13% nationally. 49% of households used single row ploughs against 69% nationally.

Planters are not used at all.

Cultivators were used by 10% of households against 19% nationally.

Sledges, wagons, etc. were used by only 13% of the house-

holds (against 24% nationally).

Source of land: figures are comparable to the national average.

Problems

In general it can be said that the use of implements is below average. Whether the increased use of implements is really a profitable investment is, however, questionable because of generally low yields and erratic rainfall.

Recommendation

Investigate possibility of increased adoption of implements (especially single row ploughs).

7. Farming Practices

About 52% of the households ploughed against 81% nationally. Late ploughing is most common due to the generally late rains (highest rainfall usually in January - March). 63% of household ploughed after December.

Broadcasting is very popular (95%) versus 82% nationally.

Row planting by hand is virtually not practiced; row planters are not available in Kang.

Manure is not used at all.

Weeding: Most households weed only once (87% versus 68%), 13% weed twice or more (versus 35% nationally).

Winter ploughing is almost not practiced which is not surprising since the soils are very permeable and able to hold water even without winter ploughing.

Row planting is not generally practiced (7% x 40% nationally).

Fertiliser was used by 1 household.

Thinning was practised at a below average level (25% x 56%), as well as crop rotation (20% x 31%), and weeding (58% x 72%). The general level of knowledge of new practices is lower than the national figure (60% have not adopted any improved practice against 44% nationally).

Problems

In general, farming practices are even less sophisticated than the national ones. However, some practices are relatively simple to learn; adoption of practices such as row planting by hand, use of manure, more intensive weeding and thinning can be increased without adding

anything to the capital input. The problem is who is going to do this? There are no AD's in the district. Is this the task of the DAO?

Recommendation

Investigate the possibility of increasing the adoption rate of simple practices as mentioned above. Further, it is highly recommended that research is done in farming practices suitable for the sandveld areas. Is row planting really more applicable than broadcasting? What is the increased output of using planters compared with hand-row planting, etc?

8. Water

Boreholes are the most common source of water (83% x 17% nationally), wells follow (14% x 15% nationally) and pans are last (3% x 6%).

Distance to the water: The figures are comparable to the national average. The most used water source is the Council borehole (57%); communal ownership follows (30%). With the recent hand-over of 2 boreholes to the Kang community, this situation will change when the boreholes are equipped.

Problems

The importance of boreholes for watering is clearly illustrated. Dams (hafirs) are not very widespread over the district; some do occur in pans (i.e Tsabong pan) and in the Molopo River.

Recommendation

Under the ALDEP pilot projects, the DAO will try to build some underground water catchments to supply water at the lands. Further, some existing dams will be excavated or otherwise improved.

It is recommended that research be undertaken to investigate the possibility of using salty borehole water for irrigation. There are a number of high yielding boreholes which have salty water and are useless at present. It would be worthwhile trying to make these productive.

9. Yields/Productivity

Sorghum - 31% of households did not get anything at all versus 14% nationally; 57% of households get 0.1- 2 bags against 67% nationally. Mean yield: 0.9 bags/acre versus 1.4 bags/acre nationally.

Maize - 48% did not get anything at all versus 36% nationally. 43% of households got 0.1 - 2 bags against 53% mean yield: 0.6 versus 1.3 bags/acre nationally.

Millet is not grown in Kgalagadi.

Beans - Mean yield: 0.6 bags/acre versus 1.4 bags/acre nationally.

The total yield is an average 5.5 bags compared with 10.1 bags, or 1.1 bags/acre compared with 1.5 bags/acre nationally.

Problems

In general it can be said that yields are considerably lower for sorghum, maize and beans. This may reflect the generally lower input and use of farming practices, as well as the lower soil fertility and the lower rainfall.

Recommendation

To increase the yields can be tried by the increased adoption of farming practices and by breeding drought resistant crop varieties.

Research on drought resistant varieties suitable for the sandveld areas is highly recommended.

10. Extension

One household had participated in the pupil-farmer scheme, 15% of households were members of a co-op. Farmers' Committees and 4B are not very popular (1.4%, 2.8% are members). Most households belong to a church (58%), 23% to a burial society. Those last figures are considerably higher than the national average.

Only 6% are not members of any organization, compared with 68% nationally. The number of people having attended courses on agriculture is slightly below average. AD's are not available in Kang (nor in the rest of the district). Radios are owned by 45% of households versus 38% nationally.

Tribal Grazing Land Programme awareness is slightly below average (59% x 64%).

Problem

There is not a single AD in the District. Without ADs even simple improvements to farming practices will be difficult to implement. The 2 DAO's and the Agricultural Supervisor (AS) have a heavy workload since they are now

fulfilling the job of ADs, AS, DAO, and RAO. Their coverage of farmers is limited to a number of progressive farmers, mostly the larger ones.

As in most of the recommendations, extension is the most important tool with which to improve arable agriculture; here lies a serious block to further advancement of ALDEP.

Recommendation

That some ADs or assistant ADs be posted to the District with urgency.

General

It must be realised that Kang is the village that received the highest average rainfall in the whole of Kgalagadi. Therefore the results of Kang are likely to be too positive. In the rest of Kgalagadi, especially the south, arable agriculture is even more hampered by low rainfall.

Summary

One of the most important goals of the Ngamiland District Plan 1977-82 is self-sufficiency in basic food crops. As the first step towards achieving this goal, the collection of the more baseline data on the District's arable agriculture has been necessary. The results offer a profile of arable practices and problems at the district level.

The agricultural practices of the District arable farmers are characterized by:

- Two types of arable cultivation, molapo and dryland.
- The majority of cultivated fields are not registered with the Land Board.
- Ploughing is most commonly done by mouldboard plough although hand hoeing is sometimes used.
- Broadcasting is the universally accepted method of planting.
- Although farmers use their own seed there is a heavy reliance on Ministry of Agriculture seeds.
- Nearly all farmers practice mixed cropping.
- Water is accessible in the lands areas.
- The family plays an important role in providing agricultural labour.

The major problems confronting arable farmers in the District are:

- Lack of agricultural implements.
- Need for fencing fields from livestock and wild animals.
- Shortage of finances to purchase inputs.
- Poor seed supply.
- Unreliable rainfall.
- Weeds.
- Pests - livestock, birds, insects, diseases.
- Poor and expensive transport facilities.
- Small localized market.

This report attempts to outline the scope of the arable agricultural practices and the magnitude of its problems. Its importance will be drawn from the recommendations which appear at the end of each topic. From these, short-term projects will be proposed in order to give immediate support to arable farmers.

1. Introduction

Background to Survey

A presentation on an Arable Agriculture Program was given to the National District Development Conference in January 1978. At the conference the District recommended that the ALDEP program focus on: the poorest group of farmers, arable lands areas within the communal areas, local self-sufficiency, and should be wide enough to cover smallstock, poultry and horticulture.

The conference resolved that an Arable Agriculture Program should be drawn up and implemented at the district level. It is this last resolution that promoted this district to take action on developing of an Arable Agriculture Program which started with this survey.

Purpose

The main purpose of the agricultural survey conducted in Ngamiland was to provide base line data on the Agricultural practices of farmers. This data will facilitate the development of an Agricultural Program by identifying the constraints facing the farmers and indirectly suggesting steps which can be planned to help the farmers in the agricultural activities.

Planning and Organization

The District Administration and Ministry of Agriculture (Maun) were informed in early September 1978 that a planning Statistics Team would be available till the first of December to do any survey work that the District wanted done. The District chose this opportunity to conduct an arable agriculture survey.

The Institute of Development Management provided a series of questionnaires from previous agricultural surveys from which the Agricultural Research Officer, RAO and DOD formulated a questionnaire. The questionnaire was designed to be administered only to arable farmers.

The questionnaire was prepared and the Northwest District Council, Tawana Land Board and Tribal Administration were consulted as to the content and intention of the survey. LUPAG was chosen as the district body responsible for the Arable Agriculture Development Program.

The Planning Statistics Team was briefed on the questionnaire 20 September, 1978 and then conducted a pretest of the survey in the Maun village. Suggestions made by the Statistics Team were evaluated and the appropriate changes made. The Statistics Team returned to survey work and completed Maun village on 28 September 1978 and then left Maun to begin coverage of the remaining areas.

On 6 October a second Statistics Team arrived from Gaborone. This team was also briefed on the questionnaires. They as a unit conducted the survey in the Eastern Ngamiland area and the Boteti Block of Central District.

The total survey was completed by 30 November.

Processing the Data

Due to time constraints the questionnaire had been hastily written resulting in numerous duplications and some ambiguous questions. The following items were taken into consideration when deciding which questions to record: concentration on information about arable agriculture, information available elsewhere within the survey, sociological data for the District currently available elsewhere within the survey, poor response to the question, complexity of question and the inability to code comment questions.

The twenty-five villages were divided into six subdistricts according to geographical area in order to simplify the handling and understanding of the data.

Labour proved to be a major problem in processing the data. The existing district planning staff was unable to devote time to this without seriously neglecting existing projects. Also no funds were available from either the Ministry of Agriculture or at the district level for hiring.

Coincidentally a Peace Corps Volunteer moved to Maun and was able to devote time to the project as a Survey Assistant (SA).

Tabulation and analysis was started the last week of October and completed the third week of December. Analysis consisted of averages and percentages. More sophisticated analysis was not undertaken at this time due to difficulty of hand analysis and the promise of such analysis by a computer at a later date.

Meanwhile the Rural Sociology Unit of the Ministry of Agriculture had developed and initiated an arable agriculture survey to be administered on a national basis. In order for Ngamiland to be included in the

national data, it was agreed that information from the Ngamiland survey which fit into the national coding framework would be coded onto the national survey code-sheets and forwarded to the Institute of Development Management for processing with the other districts.

The Rural Sociology Unit agreed to fund this coding of the data into the national arable agricultural survey and for addition of cards to the computer program for use by Ngamiland District. The additional cards were used for information gathered with the Ngamiland survey but not included in the national survey. This allowed a more detailed analysis to be made available.

Location of Data

The data tables and a brief analysis of each question can be found in Volume II of this report. Due to the bulk of this volume only a limited number of copies were produced. Volume II can be found in the following locations:

National Archives
Ministry of Agriculture
 Permanent Secretary
 Director of Field Services
 Agricultural Statistics
 Rural Sociology
Maun Regional Agricultural Office
Ngamiland District Commissioner's Office

2. Land Issues

General Results

Nearly half (48.3%) of the farmers interviewed have not registered their fields with the Land Board as opposed to 35.5% registered. Another 9% are using borrowed, hired or shared lands which may or may not be registered.

The majority of farms in Ngamiland District are below 10 acres in size. The results show the following distribution of farm sizes: 1-4 acres - 39.1%; 5-9 acres - 20.3%; 10-14 acres - 15.9%; 15-19 acres - 6.4%; 20+ acres - 11.9%.

The same sixty percent who indicated fields below 10 acres in size also said they would like to have more land. In another part of the survey, only 47.9% responded that they intend to increase their field size in the near future. The average increase in field sizes indicated by these farmers ranged from 3.3 acres to 10.1 acres in the various regions of the District.

Dryland farming is the predominant form of cultivation in the District with 85% of the respondents indicating that they practice dryland farming while 35% practice molapo farming. The molapo farming is concentrated in the Maun, Boteti and Western Delta regions.

The data show that no major changes in District agriculture have been made over the last ten years except that a significant amount of effort has been directed at destumping land (43.3%). Only 4% of the farmers have decreased their acreage while 10.4% have increased their acreage. Very few farmers (2.2%) have moved from dryland to molapo farming and 8.2% have moved from molapo to dryland farming.

Explanation of Present Situation

In order to raise the level of crop production in the District, it is very important to examine the system of land tenure.

The Subordinate Land Boards are responsible for the allocation, extensions and registration of ploughing lands. The process of submitting the application, hearing and finally allocating the land takes no less than thirty days. The Subordinate Land Boards, due to transport constraints, delay the actual allocation. This delay has resulted in first self allocation and secondly delay in developing the sites for planting during the year. Farmers who owned land before the inception of the Land Boards have no incentive of registering their lands with the Land Board because of this long process. They, after all, see no threat from anyone challenging their right over the land. When allocating land, the Subordinate Land Board is guided by the applicant and they give him the amount he/she requires. No serious thought is given to the capability of the applicant in fully developing the site in order to reap the best harvest from the land.

Recommendations

It is therefore important that in order to achieve the District agricultural goals, the following points should be considered in regard to land issues:

- i) The Subordinate Land Boards assisted by LUPAG and Agricultural Extension should intensify the registration of all ploughing lands so that a clear arable land use plan can be made. With a defined arable land use plan we can therefore be able to determine the need for future expansion of lands.
- ii) The conflict between arable and stock farming needs to be examined.
- iii) Land Board should come up with a policy on the size of land to be granted to an applicant so as to have a standard arable size per person. Extensions should be considered only when there is real need for more land.

- iv) Molapo farming should be encouraged by the use of bunds e.g. the Goroku scheme should be extended to other parts of the District. Places such as Shorobe, Nokaneng and Gomare need this service because molapo farming has been practised for many years and people only resort to dryland farming in times of disaster flooding.

3. Water Issues

General Results

The accessibility of water within the District is good with farmers indicating that the nearest water supply is within 2 kilometres of their lands. The greatest distance to water occurs in the Sandveld, where farmers may walk long distances to get either good water to the more common brackish water, and in the Northern region where farmers depend on the Okavango River.

As the distance to water is relatively short, most of the farmers (58.3%) indicated that it required less than an hour to get water to the lands.

Explanation of Present Situation

The case of access to water exists because the District is blessed with a surface water network known as the Okavango Delta River System. Most major villages and commonly cultivated lands are near this perennial water system.

Recommendations

An attempt should be made to make water more available in arable lands areas, although it need not be a top priority item as water is currently relatively easily available. A variety of means will have to be used to suit different conditions and circumstances. One method might be the improvement of existing waterholes, natural water-pans and seasonal streams plus fencing of these natural reservoirs. Hand dug wells, underground water storage tanks and haffir dams could be used to supplement water for domestic use only in order to allow farmers to work their lands during the dry season. Syndicate dams and boreholes might be an alternative for some farmers. Also, the Ministry of Agriculture could extend its Small Dam Construction Service to this district.

The data does not indicate the quantities or quality of the water available to arable lands, therefore farther investigations should be undertaken along these lines.

4. Extension

General Results

Twenty-two percent of the farmers responded that they do not have an Agricultural Demonstrator (AD) in their area. Of the farmers interviewed 27.4% were visited in the last year with an average of 9 visits. And only 30% believe they benefit from their extension officer which includes other extension agencies besides Agriculture.

In the last 5 years, 15% of the District farmers have attended courses at the Nxaraga Rural Training Centre. About half of these (8%) have attended a course in the last year.

Only 2% of the farmers interviewed were members of the Pupil Farmer Scheme.

Thirty seven percent of those surveyed claim to own a radio. Of these 17.4% listen to farm broadcasts every day, 9.1% listen frequently, and 6.4% listen occasionally.

Explanation of Present Situation

A major contributing factor in the fact that 22% of the farmers said they do not have an AD in their area is that four of the villages surveyed did not have ADs at the time of the survey.

The ADs find it very difficult to visit the 200-300 farming families in their area with any regularity of frequency due to lack of transport.

The poor attendance at RTC courses can be explained by the tendency all over Botswana for the same individuals to attend the same courses year after year - resulting in a very thin coverage of the farming community.

As the Pupil Farmer Scheme concentrated on 25-35 farmers per AD throughout its lifetime in Botswana, its impact was very minimal and almost nonexistent in Ngamiland.

In Agricultural Extension, the owning of a radio implies that the owner has some access to farm radio broadcasts.

Recommendations

There is a greater need for a directed effort aimed at group extension as opposed to individual extension, as it is the simplest method of covering a greater proportion of the farming public. At the same time ADs should strive to visit each farming family at least once every two months. Closer supervision and guidance of the ADs by District Agricultural Officers should aid in achieving these goals.

The new Farmers Record Cards should help agricultural staff identify farmers who can gain from attending FTE courses and also to see that it isn't always the same farmers attending the courses.

The Agricultural Extension staff will continue to persuade farmers to listen to the farm radio broadcasts and to encourage farmers who do not own radios to join a neighbor who does.

5. Farming Practices

General Results

More than 80% of the farmers answered that they plough and plant at the same time, i.e. seeds are broadcasted on the land just before ploughing. This is usually a mixture of maize, sorghum, beans, millet and melons in so called mixed cropping. Seven point five percent of the interviewed farmers ploughed first and planted later, while almost 25% practiced some kind of mono-cropping.

Ploughing is commonly done by a small one-furrow mouldboard plough drawn by a span of donkeys or oxen. Ploughing on dryland starts after good rains but usually not before December and continues till the end of February. Ploughing in the molapo is started earlier if possible after the recession of the floods and continues as the water further recedes.

Weeding is done once (36.6%) or twice (52.1%) and usually within the first month (65) or the second month after planting (21%).

Seventy percent of the farmers do not plan to introduce new crops. Of those who plan to introduce new crops, almost half of them plan to plant fruit tries, while others thought of tobacco (2.6%), sunflowers (7%) and groundnuts or beans.

Explanation of Present Situation

District farmers believe that early ploughing will result in greater weed infestation and that ploughing is more effective as control after the first weed seeds have germinated. Weeding is generally accepted as beneficial but farmers do not realize that early weeding is essential.

The ploughing and planting of small areas over a 2 or 3 month period spreads out the risks of crop failure due to erratic rainfall. Likewise, mixed cropping gives the farmer some assurance that at least one of the crops will produce in a low rainfall year.

Dryland farming is considered less risky than molapo farming due to the unpredictability of the floods and the higher labour requirements due to weeding, although it is realized that molapo soils are more productive.

Recommendations

A mouldboard plough is generally accepted as a superior tillage implement but it has some disadvantages, requiring relative high amount of draught power, consuming a great deal of time, and losing soil moisture due to exposure. Although experiments have not produced conclusive results, a minimum tillage could be more beneficial. A primary autumn mouldboard plough is recommended if necessary wind and water erosion measures are observed and followed by a secondary light tillage just before planting. Therefore the cultivatable acreage is increased and soil moisture, which is usually very critical, better conserved.

Row planting is advised as it is generally accepted by agricultural officers to be more productive than broadcasting because it allows a better and more regular stand, easier management during weeding and harvesting and is essential for mechanical practices.

Mixed cropping as such is a good practice and in fact does not require crop rotation, but for more commercial production more cropping has to be recommended along with clear and pure seed. This would require at the same time the introduction of proper crop rotation. However experiments at Mahalapye showed no significant better response for continuous mono-cropping.

Weeding, either by hand or mechanical means, should be much more emphasized, especially during early crop growth stages.

As the lack of implements often restrains farmers from using these practices, subsidized implements, especially row planters, mouldboard ploughs and scotch-carts, should be made available.

An appropriate extension package must be developed to encourage farmers to use these recommended farming practices. This should include demonstrations in local areas of the beneficial effects of improved agricultural practices.

6. Molapo Farming

General Results

Approximately 35% of the farmers have practiced molapo farming in the past 10 years; only 7.1% did so in 1977/78. Fifty-five percent of the farmers never ploughed in the molapo.

During the last 10 years, 8.2% of the farmers "moved" from molapo farming to dryland farming, while only 2.2 moved in the opposite direction.

Explanation of Present Situation

The data shows a general decrease in the number of farmers practising molapo farming, although some regions - ie. Boteti, Maun and Western Delta - showed a slight increase. The current trend is partially explained by the heavy flooding of molapo areas over the past four years, making molapo farming virtually impossible. Also molapo farming has been discouraged by the Extension Service of the Ministry of Agriculture promoting dryland farming, stating that the latter is less risky. In addition there are regional and ethnic traditions of molapo farming which have received very little technical or infrastructural assistance. The regional rise in molapo farming in the Boteti region may be associated with less perennial flooding if compared with most other areas.

Recommendations

It is generally believed that molapo farming is more rewarding in terms of yields. Two projects are already planned to rehabilitate this type of cultivation by giving assistance to improved bund building. Subsequently an appropriate extension package for molapo farming will be developed.

It will be recommendable to practice dryland and molapo farming side by side to reduce risks of pests, floods and rainfall.

7. Soil and Land Improvement

General Results

Eighty-four percent of the farmers do not practice any type of crop rotation or use a fallow period.

Ninety percent of the farmers have never used any kraal manure which is readily available. Almost 60% of these farmers said they have no knowledge of its benefits, another 20% said they have no transport to carry the manure to their fields. Others believe that manuring causes a heavy weed problem.

Although no data exists on the percentage of the total land destumped, 13% of the farmers had destumped some part of their land during the past 10 years.

Only 13 of the farmers reported ever using chemical fertilizers.

Explanation of Present Situation

Crop rotation and fallowing are not required because of the mixed cropping patterns of local farmers.

Apparently, kraal manure is not recognized as a soil improver. Where its benefits are understood the resulting weed problem discourages its use. Transport should not really be considered a constraint as manure can be carried in a bag on a donkey's back or on a sledge if no scotchcarts are available.

At the current level of agricultural management the pressure for farmers to destump their fields is marginal. It would seem likely that the large labour requirement for destumping offsets the farmer's natural inclinations to remove them.

Chemical fertilizers are expensive and normally not available to local farmers.

Recommendations

If more cropping is introduced, a 3 or 4 year rotation with legumes is recommended for maintaining and improving the soil's natural fertilizers although this may not be immediately reflected in the yields.

Kraal manure applied in modest amounts has proved to be able to double yields. With heavy application the residual effect on subsequent crops may be considerable. Indeed weed control is a necessity but even so the use of kraal manure is recommended.

Chemical fertilizers are expensive and their use is not always economical. Further research is required. Modest applications of Nitrogen (30-50 kg N/ha) with or without a light sift of Phosphorus (10-20 kg P/ha) usually give a significant increase in yield on non-calcareous soils.

For improved agriculture, destumped land is a prerequisite and this land improvement should be heavily emphasized.

8. Draft Power

General Results

The results showed that 59.6% of the arable farmers surveyed believe they have enough draft power. Of the 35.1% of the farmers who indicated not having enough draft power, 18.5% depended on hiring while 17.2% borrowed draft power. This indicates that the District arable farmers depend primarily on their own draft power but rely on hiring and borrowing draft power on a nearly

equal basis. As only farmers currently involved in arable farming were surveyed, the data does not show how many potential farmers are restrained by lack of draft power.

Animal draft power is by far dominant over mechanical draft power in the District. Only 1.8% of the farmers surveyed used mechanical draft power and those are located in only two regions, Maun and Lake Ngami.

Due to the low percentage of people who hire draught power, there were few responses concerning commercial ploughing rates. As no differentiation was made between animal and mechanical draught power, an average rate per acre of P6 is unreliable. However, the information did indicate that rates decrease as the distance from Maun increases.

Explanation of Present Situation

The high percentage of farmers reporting adequate draught power could be a result of the questionnaire design since it would be possible for a farmer to respond that he has enough draught power but also hires draught power. The mixture of arable lands and livestock located along the edges of perennial water sources offers better access to draught power than in other areas of the country.

In these areas where lack of draught power was reported, usually this response reflects on special conditions not general problems. The Sandveld can be expected to indicate a draught power shortage due to a low level of livestock farming and their rather recent start in arable agriculture. The people in Etsha are largely refugees who settled in the area in 1971 and have not yet acquired adequate capital to buy draught power.

The lack of spare parts and fuel combined with high capital and recurrent costs of mechanical draught power preclude its use in a poor, rural area such as Ngamiland.

Recommendations

The data gathered indicates that generally farmers have access to draught power and that it is not a major constraint for District farmers. Due to the lack of adequate detail in the data, it is recommended that further investigation be done as to how many people are not ploughing due to the lack of draught power and how is available draught power distributed during peak demand.

9. Labour

General Results

The survey results show that approximately one-fourth of District farmers hire labour for their crop activities while three-fourths depend on family labour. The Maun region hired labour most frequently with a steady decline in hired labour in more remote areas.

Explanation of Present Situation

Hired labour is much more extensively used around large villages where persons employed in the cash sector hire labour to overlook their agricultural holdings.

Though some hired labour is paid with cash, the greater portion is paid in kind. Payment in kind can take many different forms, such as smallstock, local beer, a share in the harvest or use of draught power. This system of payment is very complicated and difficult to assess in pula and thebe terms.

The use of family labour is by far the most prevalent means used to work arable lands. There are, however, some constraints to using family labour which include a limited number of people available for work and a preoccupation by family members for other household activities.

Recommendations

The goal of developing agriculture is not to absorb workers into the agricultural sector. Rather it is to provide an adequate return to the farmer so that farming will continue to be a viable economic activity. There are methods of employing more labour in the agricultural sector which can also increase the returns to farmers and should therefore be recommended. These are weeding, application of kraal manure, destumping and others.

10. Pest Control

General Results

Nearly 78% of the farmers indicated they practise some kind of pest control. However, their crops are particularly vulnerable to disease and insects and 76% said they did not practise any pest control in these instances.

Bird scaring is the most common form of pest control (79.7%). Fencing is also prevalent (34.9%). Only 1.1% of the farmers said they used chemical spraying.

Explanation of Present Situation

Most pest control is aimed at birds, cattle and goats. Bird scaring is not confined to any particular area as both sandveld and molapo crop areas suffer bird damage each year.

Efforts to fence fields have been successful in some areas in minimizing crop damage caused by livestock. Most dryland fields are bush fenced and a few are wire fenced. In molapo area fencing is often impractical because the fencing materials are far away and annual flooding creates special problems. It is in these areas that the conflict between livestock and arable farming is growing. It has been reported that the ploughing lands have been reduced to accommodate livestock. Nevertheless, even with fencing, pests such as elephants and baboons are able to cause crop damage and only the cooperation of the Wildlife Department can effect a permanent solution.

Chemical sprays, when available, are expensive and often complicated for use by the local farming community. The

The most popular chemical input is malothiane which is used by some farmers for seed treatment. However, the bulk of farmers use elevated grass bins or mud cones which are lined with cow dung and wood ash for seed storage.

Recommedations

The practice of fencing lands should be encouraged to prevent crop damage by livestock in dryland areas. In molapo areas fencing large areas in a communal effort to prevent crop damage should be investigated. This could be planned to allow water points for cattle at certain intervals so that a more compatible land use system could be developed. AE10 could be utilised.

Bunding work could also help reduce flood damage and make more land available through water control. This is however best suited to smaller molapo areas.

The introduction of disease resistant crop varieties along with regular crop rotating may alleviate disease damage. Insecticides could reduce the damage caused to crops by insects but high prices and the lack of a distribution system need to be overcome. The MOA should also investigate the practicality of providing each AD with storage facilities which could be used by farmers. Workshops should be held at village level to outline the options available to farmers for pest control,

Some village level program for hiring labour for bird scaring could be beneficial.

11. Inputs

General Results

The agricultural inputs included in the survey were seed supplies, fencing and implements.

Nearly 52% of the farmers reported using seed from the Ministry of Agriculture and 62% used their own supply from the previous year. This indicates that some farmers are using both.

Seed is a problem for 56% of the farmers who said they experienced difficulty in obtaining seed when they needed it. The most prominent constraint reported by 27% of the farmers is lack of cash.

Only 27.6% of the farmers are intending to wire-fence their lands in the near future.

Concerning farm implements over 41% of the farmers feel they have enough implements while 52% feel they need more.

Borrowing tools is practiced by 23% of the farmers and 10% hire private tools.

Explanation of Present Situation

The Ministry of Agriculture has made an important impact on the district seed supply. Some of the reasons which created this situation have been poor storage facilities in the villages, lack of transport, and weak participation from the private sector. Many farmers prefer the MOA seed even when they have their own because they believe it to have better germination rates and to be more drought resistant.

Wire fencing is much more expensive in this district than in most other areas of the country, over P500 per kilometre. On top of this the access to transport is very limited in most areas outside Maun. Likewise, the benefits of a wire fence as compared to a bush fence have not been adequately measured.

The farmers who are dissatisfied with their present stock of agricultural implements are the farmers nearest the Maun market and also the same ones who presently have the greatest amount of implements. Borrowing tools is commonly practised by farmers throughout the District and a tool hire market is operating in the Maun area.

Recommendations

Since there is a great dependence on outside seed it is imperative to have a functioning distribution system. Distribution from the Maun depot is logistically impractical. It is recommended that the Ministry of Agriculture continue to distribute seeds until a system which will also cover western Ngamiland is developed.

In order to promote the use of agricultural implements a distribution system will need to be established. The existing trader network is claimed to be extracting unjust profits and the BAMB depot is out of the reach of most farmers. In the short run, Agricultural Extension should take orders and provide delivery of the necessary implements. In the longer run, price subsidies should be made for basic implements delivered through the coops or Livestock Advisory Centre.

A cost/benefit analysis of wire fencing should be undertaken.

The manufacturing of small agricultural implements should be undertaken in the District.

12. Credit

General Results

Only two and a half percent of the farmers surveyed have ever used credit for their crop activities and only 23 percent believe they will need outside financial help for future agricultural activities.

Of those who will need financial help, 17% plan to borrow from the National Development Bank, 0.6% from commercial banks, 0.6% from cooperative banks and 2.4% from other sources, chiefly relatives and friends.

When asked if they had ever heard of the National Development Bank (NDB), 30.5% said yes and 66% said no. Two-thirds of those who are aware of the NDB heard about it from some source other than the NDB itself or relatives.

Explanation of Present Situation

These results make it evident that borrowing money for agricultural activities is not a widespread practice in the District. This could stem from several reasons: a general ignorance concerning credit, static agricultural practices, family support in the form of kind transactions and a lack of credit facilities.

Commercial banks do not have any offices outside of Maun and their loan requirements tend to be rigorous to meet. Likewise, cooperatives have never developed the facilities for lending money in this district.

The NDB is the most popular source of credit especially in areas where livestock farming is also practised on a large scale. The inter-connection between these two is due to the NDB doing a large amount of business in cattle loans.

Recommendations

The most important needs for credit in crop production is for machinery purchase, fencing, clearing of land, and for seed and fertilizer purchases.

For machinery, seeds and fertilizer the easiest system would be for BAMB to sell machinery on credit to farmers. The government should guarantee a percentage of these loans to reduce the risk for BAMB. This is similar to what they do for NDB and Barclay's Bank. This would be the most inexpensive way to provide credit to many farmers and would insure that machinery was available for purchase - because BAMB would be making a profit on these sales. This system could also be used with Coops. In this way farmers would be encouraged to deal with BAMB but would be free to deal with traders also.

For land clearing and fencing the best source of credit is NDB. These loans are not so timely and fit better into a conventional banking system - ie. the time needed to assess the land and the borrower in insure repayment.

To speed up the establishment of a NDB office in Maun maybe government could provide office space and housing until the NDB acquires its own.

13. Horticulture

General Results

The arable farmers interviewed overwhelmingly stated that they do not intend growing vegetables in the near future (79.5%). People in the Boteti area were more inclined to grow vegetables while people in the Lake Ngami and Northern subdistricts had little enthusiasm for the idea.

Ten percent of the farmers interviewed plan to introduce fruits in the near future. These were heavily concentrated in the Boteti and Maun regions.

Explanation of Present Situation

The economic feasibility of horticulture depends upon having a market and sufficient water, conditions which are only found in the Maun and Boteti areas.

Also, horticulture requires a higher level of management which is scarce in the District.

Recommendations

Our local climates are different than other areas of Botswana, with milder winters and hotter summer temperatures. For those villages bordering the swamps or perennial streams, the water supply and quality is excellent for irrigating these crops. Other villages are now having water reticulation systems installed, so that even the kitchen waste water could be beneficially utilized for some family fruit trees. Some borehole waters, such as in Sehitwa, are too brackish and can not be used for irrigating gardens although Lake Ngami water is good.

There definitely should be an educational campaign and village demonstrations as to the local possibilities of family vegetables and fruit production. People generally desire and crave fresh vegetables and fruits and they are required for an improved diet and health benefits.

The potentials are here. There is adequate kraal manure for a cheap source of excellent fertilizer. Manpower is not lacking with many school children available part of each day, Saturdays and holidays to be kept busy, aside from the lucrative and training aspects. A few producers in each village could make a reasonable living from horticultural products, depending upon the input of capital, labour and dedication.

Aside from the basic requirements of water, a goat-proof fence or barrier is an absolute necessity before any garden or fruit and shade trees are planted. Also, the use of mulch can do much to reduce the water requirements.

With good recommended varieties of vegetable seeds now available from our local BAMB, along with insecticides at the Veterinary Supply Store, these two basic obstacles have been eliminated.

During the hot summer months from October to March, maize, melons, pumpkins, peppers, eggplants, and heat-resistant varieties of head cabbage, Chinese cabbage and cauliflower produce at their best. Whereas during the cooler winter months carrots, beetroots, beet spinach, spinach, onions, peas, cabbage, turnips and tomatoes can easily be grown with a minimum amount of consistent attention, provided there are no frosts.

Fruit trees are not only useful for producing nutritious foods but also serve as shade, wind-breakers and add beauty. Mulberries, Pawpaw, Guava, Oranges, Lemons, Limes, Mosentselas, Pomegranates and Figs all do well in this area.

14. Marketing

General Results

Approximately one-fourth of the respondents said that they never have a surplus. Of those who sell a surplus, 1.5% sell it to BAMB, 1.5% sell it to traders, and 31.3% sell it to other farmers. The majority of farmers, if they don't sell it, store their surplus (45.5%) while a good number brew local beer (15%) and some give it to relatives (3.8%). Only farmers in the Maun and Boteti regions sold to BAMB and even then in very limited numbers.

Forty-three percent of the farmers interviewed indicated the nearest crop market is over two kilometres from their fields. Only fifteen percent have a market for their crops within two kilometres.

Slightly more than half (55.6%) of the farmers surveyed transport their crops to their market and/or village via their own scotchcart or sledge. A few farmers hire transport (7.1%) or own their own vehicle (3.3%). Nearly twenty percent use some other means of transporting their crops such as donkeys or carrying it themselves.

The results show that only 34.7% of the district farmers are aware of the Botswana Agricultural Marketing Board (BAMB) and that the most effective means of spreading the news about it is through other farmers.

Three-quarters of the people interviewed believe that prices offered by BAMB for crops are not fair. When asked prices BAMB should offer and what prices do they sell for in the local market the prices were very similar. However these prices were 200% of what BAMB currently offers for maize and sorghum. Farmers appear to agree with the price offered for beans.

Explanation of Present Situation

Those farmers who do sell their surpluses can be expected to sell to other farmers since that is the most established market and presents the least logistical problems for the farmer.

Traders are limited in their buying of crop produce for several reasons. First they do not have storage facilities or the processing equipment to handle large quantities of grain. Their incentive to develop such facilities is reduced by the widely fluctuating supply and the resulting fluctuations in price. Likewise the traders are reluctant to act as middlemen because the high transport costs result in unacceptable profit margins and producer prices.

The Botswana Agricultural Marketing Board should increase its effect on marketing. Currently BAMB only affects farmers who are close enough to use its only depot which is located in Maun. Since this depot only opened in May 1978, few farmers are aware of its services.

The farmers are clearly not satisfied with the prices offered by BAMB largely because of the large price differentials between BAMB prices and local market prices. Western Delta farmers are particularly unhappy since they must first transport their crops 200 kilometres at considerable cost before selling to BAMB.

Recommendations

Marketing is a major problem when there is no infrastructure to support it, for it is the market more than anything else which will encourage farmers to produce beyond the subsistence level.

Since the local market within the District is well established and heavily relied upon, effort should be made to support it. Because little is known about the workings of this local market, further investigation is recommended. Initially storage facilities could be established in villages or groups of villages to allow farmers to store their surplus for sale later in the season and establishment of a milling unit in the District could be investigated.

The Botswana Agricultural Marketing Board is very important to arable agriculture development in this district as the District has a large production potential but only a small local market (population). Currently, the impact of this organization is very weak due to lack of publicity and the logistical problems encountered by farmers trying to sell produce to BAMB. In order to publicize the availability of BAMB, Agricultural Demonstrators should be encouraged to tell farmers about it and pamphlets written in Setswana could be periodically distributed.

Several actions could be taken to improve farmers' access to BAMB. Since it would be very expensive to establish and maintain additional buying depots, BAMB could establish mobile depots within the District. It would be very helpful if storage facilities could be built where farmers could store their produce until BAMB's mobile depot could buy. Agency buyers, such as the Livestock Advisory Boards and Cooperatives, should be used to help BAMB purchase crops.

Another project that would greatly aid farmers in marketing their crops would be subsidization of transport. This could be in the form of direct subsidies for hired transport or to help farmers buy scotchcarts.

The possibility of establishment of a cooperative marketing system within the District should also be investigated as an alternative.

METHODOLOGICAL NOTE

The Institute of Development Management (IDM) and the Ministry of Agriculture (MOA) designed the Arable Lands Survey in late 1978 to provide reliable and useful data in as short a time as possible for both local and national planning of arable lands development. In undertaking such a survey, they wanted to ensure high levels of local participation, minimize survey costs and delays, and maximize utilization of existing resources. It was hoped that survey data would be comparable with information gathered in 1974/75 in the target area of the Integrated Farming Pilot Project (IFPP), upon which much ALDEP planning was to be based, and that it would provide a broad baseline in other parts of the country against which future changes could be measured. Given that no detailed nation-wide survey of arable lands areas had yet been conducted in Botswana which both gave a comprehensive view of arable practices, production, and extension activities, and could be disaggregated for use by district planners, it was especially hoped that information could be gathered in the survey that would be useful to each participating district in its ALDEP planning.

Within this framework of objectives and in light of the constraint that the survey had to be conducted at short notice during a period of approximately six weeks in order to take advantage of the schedule of the MOA's Agricultural Statistics Unit enumeration staff, it was decided to utilize the following methodology:

1. Case studies of lands areas in participating districts would be conducted in communities selected by district authorities as meeting the three criteria of:
 - Being representative communities in lands areas,
 - Being potential sites for ALDEP pilot projects,
 - Having at least 100 households.
2. Every occupied dwelling would be enumerated under the supervision of local authorities.
3. The questionnaire administered would be that previously used in the detailed baseline study conducted in the Pelotshetlha lands area prior to the implementation of the IFPP, modified only to clarify certain questions and to facilitate coding for computer analysis.

The decision to use purposively selected lands areas of at least 100 households for 100% enumeration was made in order to ensure logistical and supervisory simplicity and to help maximize accuracy and minimize sampling errors. At the same time this strategy would provide the participating districts with in-depth information about a representative community potentially targeted for ALDEP pilot projects, and enable follow-up studies to measure readily changes in the future.

Accordingly the Land Use Planning Advisory Groups (LUPAGs) in Southern, South East, Kgatleng, North East, Ghanzi, and Kgalagadi Districts selected lands areas for surveying. The Central District Planning Sub-Committee of the District Development Committee, because of other pressing commitments, declined to participate directly, but instead assisted the staff of the German Development Institute to carry out the survey in two areas in conjunction with a larger study of nutrition and basic human needs. The Ngamiland LUPAG elected to design its own, very extensive questionnaire, informally sample a number of households in 20 villages, and carry out most of its data processing and analysis locally. Where possible, the data from the Ngamiland survey were merged with that of the Arable Lands Survey, giving a maximum of 1650 households for many of the variables analyzed. Altogether, the areas included in the survey were:

Southern (Rolong)	Mokatako Lands Area	23 households
Southern (Ngwaketse)	Pelotshetlha Lands Area (1974/75)	379 households
South East (Malete)	Mokgosi Lands Area	166 households
South East (Tlokwa)	Mathothwana Lands Area	94 households
Kgatleng	Dikwididi Lands Area	107 households
Central (Ngwato)	Moiyabana & Tlhabala Village/Lands Areas	105 households
North East	Sechele Village/Lands Area	67 households
Ghanzi	Kalkfontein Village/Lands Area	97 households
Kgalagadi	Kang Village/Lands Area	143 households
Ngamiland	20 Village/Lands Areas	466 households
	Village Unspecified	<u>3 households</u>
TOTAL, including Ngamiland sample		1 650 households
TOTAL, excluding Ngamiland sample		<u>1 184 households</u>

Implementation of the Arable Lands Survey was a joint effort of the MOA, the IDM, and the LUPAGs. The Rural Sociology Unit (MOA) provided the questionnaire, which was a revised and amended version of that used in the baseline IFPP survey at Pelotshetlha. In addition it provided training and supervisory assistance during enumeration in the field and during the coding and analysis phases. The Agricultural Statistics Unit (MOA) provided enumeration teams, vehicles, and drivers, and assisted with initial coding in the field. The district LUPAGs selected the survey sites and supervised the MOA enumeration teams in the field, analyzed the data returned to them and prepared short reports on the data which were presented at a workshop on survey findings in February 1980. The IDM organized initial enumerator training, coding of the data and its processing by computer at the University of the Witwatersrand,¹⁾ and the returning of results to the districts. It also hosted the two-day workshop to review survey results and prepared both the workshop report and this document. Additional assistance was provided by the ALDEP Planning Team, which handled most communications with the districts and provided continuing guidance throughout the study, by officers of the Evaluation of Farming Systems and Implements Project (EFSAIP), who both contributed papers to the workshop and helped with data analysis, and from a variety of interested officers in other Ministries and departments who gave help at every phase.

Survey preparations began during September 1978 and questionnaire revisions and general planning were completed during October. Enumerator training took place in early November, enumeration was completed in early December, and by March 1979 coding had been finished and checked. Computer processing of the data took place between April and December. The concluding workshop was held in Molepolole February 11 and 12, 1980, and this report completed in May 1980.

1) Computer processing was originally slated to be done on the Government computer with the assistance of National Migration Study personnel, but because of staff constraints, processing was transferred to the University of the Witwatersrand.

LANDS AREA AGRICULTURAL SURVEY

1. <u>IDENTIFICATION</u>	12
Location	13
Ward	
Enumeration	
Questionnaire No.	
Checked	
Date	

PERSONAL INFORMATION.

Name of head

--

Sex Male/Female

--

 14

(If respondent is not Head of the Household ask:)

Name of respondent:

--

Relationship to head:

--

 15

2. HOUSEHOLD LISTING

List all members living in the household
(including household head and respondent)

A	1	2	3	4	5
NAME	SEX	AGE	RELATION TO H HEAD	EDUCATION	OCCUPATION
1		21	22 HH Head	23	24 25
2		21	22	23	24 25
3		21	22	23	24 25
4		21	22	23	24 25
5		21	22	23	24 25
6		21	22	23	24 25
7		21	22	23	24 25
8		21	22	23	24 25
9		21	22	23	24 25
10		21	22	23	24 25
11		21	22	23	24 25
12		21	22	23	24 25

3. List all members of the household who are not living at home

A	1	2	3	4	5	6	7
NAME	RELATION TO HEAD	SEX	AGE	LENGTH OF TIME AWAY	LOCATION	OCCUPATION	REMITTANCE SENT HOME
1	31	32	33	34	35	36	YES/NO 37
2	31	32	33	34	35	36	YES/NO 37
3	31	32	33	34	35	36	YES/NO 37
4	31	32	33	34	35	36	YES/NO 37
5	31	32	33	34	35	36	YES/NO 37
6	31	32	33	34	35	36	YES/NO 37

4. List all places where the head of the household has homes:

A	1	2	3	4
NAME OF PLACE WHERE DEWLLING IS	VILLAGE LANDS CATTLE POST	NO. OF CATTLE IN EACH PLACE	NO. OF SMALL STOCK IN EACH PLACE	FREQUENCY (IN MONTHS) EACH PLACE IS VISITED
1	41	42	43	44
2	41	42	43	44
3	41	42	43	44
4	41	42	43	44

5. Check question 4 to see how much time was spent at the lands. If all time was spent at the lands go to question 6(a).
(If all year was not spent at the lands ask):

What prevents you from spending all the year at the lands?

1. No Water _____	51
2. No school, clinic, shops _____	52
3. No work for family _____	53
4. Have a house/relatives, friends in village _____	54
5. No reason _____	55
6. Other (specify) _____	56

(Now go to question 6(b))

6(a) (If all time was spent at lands last year or last time you ploughed)
 Ask: How many times did you visit your village last year, or last time you ploughed?

61

1. Once a week
2. Once a month
3. Rarely
4. Never
5. Do not know

(Tick only one)

(b). How many of your family were at lands with you last year or last time you ploughed?
 (Specify which person from household list-question 2).

1:	2:	3:	4:	5:	6:	7:	8:	9:	10:	11:	12:
----	----	----	----	----	----	----	----	----	-----	-----	-----

7(a) Are any members of the household members of the following organizations?

A	1	2	3
SOCIETY	YES/NO	YEAR JOINED	RELATIONSHIP OF MEMBER TO HEAD
1. Pupil farmer Scheme	71	72	73
2. Cooperative Society	71	72	73
3. Farmers Committee	71	72	73
4. 4B	71	72	73
5. Other (Specify)	71	72	73

(b) Did any members of the household attend any courses in the management of crops, livestock in the last two years?

YES/ NO/ DO NOT KNOW 74

8. If yes:-

1	2	3	4	5	6
NO. OF COURSES ATTENDED	COURSE IN CROPS/ LIVESTOCK	ORGANISED BY	PLACE HELD	YEAR HELD	LENGTH OF TIME IN WEEKS
81	82	83	84	85	86
81	82	83	84	85	86
81	82	83	84	85	86
81	82	83	84	85	86

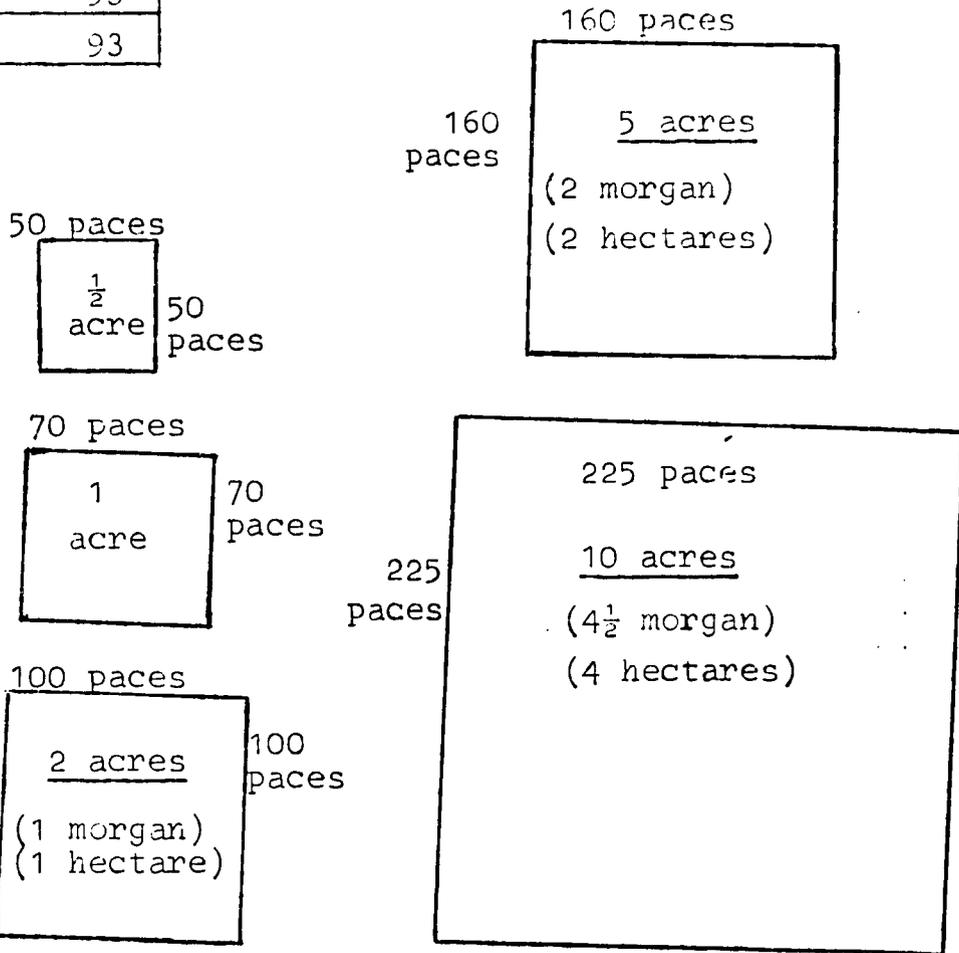
9.

SIZE OF LAND HOLDINGS

How many fields do you and your wife/husband have eg ploughed fields, an unploughed and abandoned fields: including field owned separately by the husband or wife?

1. No 91 TOTAL number of fields, all locations

2	3	4	5	6
How big is the field(acres)	When was it last ploughed	Area, debushed in acres	Are destumped in acres	Area planted cultivated in acres
1. 92	93	94	95	96
2. 92	93	94	95	96
3. 92	93	94	95	96
4. 92	93	94	95	96
5. 92	93	94	95	96
6. 92	93			
7. 92	93			
8. 92	93			
9. 92				
10. 92				



Conversions

1 morgan=2,2a
1 hectare=2,5a

10. What farm equipment did your household use last year at the lands

A	1	2	3	4
ITEM	NUMBER	OWNED	BORROWED (FROM WHOM)	HIRE (FROM WHOM)
1. Tractor	101	102	103	104
2. Plough-double row	101	102	103	104
3. Plough-single row	101	102	103	104
4. Planter-double row	101	102	103	104
5. Planter-single row	101	102	103	104
6. Cultivator/Hoe	101	102	103	104
7. Sledge/Wagon/Cart	101	102	103	104
8. Other (Specify)	101	102	103	104

11. How many of your livestock at lands are:-

A	1	2	3	4	5	6
LIVESTOCK	OWNED	MAFISAD IN	ON LOAN FROM	ON HIRE FROM	MAFISAD OUT	OTHER OUT
1. Bulls	111	112	113	114	115	116
2. Cows	111	112	113	114	115	116
3. Oxen	111	112	113	114	115	116
4. Tollies	111	112	113	114	115	116
5. Heifers	111	112	113	114	115	116
6. Calves	111	112	113	114	115	116
7. Goats	111	112	113	114	115	116
8. Sheep	111	112	113	114	115	116
9. Pigs	111	112	113	114	115	116
10. Chickens	111	112	113	114	115	116
11. Donkeys	111	112	113	114	115	116
12. Horses	111	112	113	114	115	116

12. CROP PRODUCTION

What draught power did you use to plough last season?

A	1	2
DRAUGHT POWER	WHERE FROM? (HIRED, LOANED ETC.)	WHO FROM (RELATIONSHIP)
1. Tractor	121	122
2. Oxen	121	122
3. Donkeys	121	122

13(a)

When did you plough last season?

1. Before October
2. October - December
3. December - March

131

Tick one only

(b) How did you plant last season?

1. Broadcast
2. Planter
3. Row planting by hand

132
133
134

(c) Did you use any fertiliser the last time you ploughed?

Commercial Fertilizer 135 Manure 135 Both 135
 Neither 135 Do not know 135

(d) If he uses manure or fertiliser answer the following:

A	1	2
MANURE or NAME OF FERTILISER	AMOUNT USED	USED ON WHICH CROPS.
136	137	138
136	137	138
136	137	138

(e) Did you weed your land the last time you ploughed?

YES / NO / DO NOT KNOW

14. If the answer is yes, how many times did you weed your land the last time you ploughed?

1. Once	_____	(Tick one only)
2. Twice	_____	
3. Several times	_____	

15. Who helped you with your farming the last season you ploughed?

ACTIVITY/WORK A	FAMILY MEMBERS		FRIENDS/EMPLOYEES				UN PAID 7
	NO. 1	RELATIONSHIP TO HH HEAD 2	NO. 3	PAYMENT			
				CASH 4	KIND 5	EXCHANGE 6	
Ploughing	151	152	153	154	155	156	157
Planting	151	152	153	154	155	156	157
Weeding	151	152	153	154	155	156	157
Harvest	151	152	153	154	155	156	157
Threshing	151	152	153	154	155	156	157

16. Where did you get farm supplies the last season you ploughed?

SUPPLIES A	PURCHASED 1	RELATIVE 2	OWN SUPPLY 3	AMOUNT USED	
				NO. 4	MEASURE (SPECIFY WEIGHT) 5
1. Seeds	161	162	163	164	165
2. Fertiliser	161	162	163	164	165
3. Insecticides	161	162	163	164	165
4. Other {Specify}	161	162	163	164	165

17. From where do you usually get water whilst at the lands?

SOURCE A	DISTANCE FROM HOUSE (METRES) 1	TIME OF YEAR AVAILABLE OR USED 2	OWN/COMMUNAL OTHER 3
2. Borehole	171	172	173
3. Pan	171	172	173
4. Well-deep	171	172	173
5. River	171	172	173
6. Well-shallow	171	172	173

18. What crops did you grow and harvest the last time you ploughed?

CROPS GROWN	NO. OF Acres	TOTAL WEIGHT HARVESTED (BAGS)	WEIGHT USED BY HW (BAGS)	WEIGHT SOLD (BAGS)	WHC SOLD TC	MONTH HARVESTED
1. Sorghum	181	182	183	184	185	186
2. Maize	181	182	183	184	185	186
3. Millet	181	182	183	184	185	186
4. Beans	181	182	183	184	185	186
5. Other (specify)	181	182	183	184	185	186

19. NEW PRACTICES

Have you ever heard of or practiced any of the following?

PRACTICE	HEARD OF YES/NO	PRACTICED YES/NO	FREQUENTLY PRACTICED	SOURCE OF INFORMATION	YEAR STARTED
1. Winter/Autumn Ploughing	191	192	193	194	195
2. Contour Ploughing	191	192	193	194	195
3. Row Planting	191	192	193	194	195
4. Commercial Fertiliser	191	192	193	194	195
5. Thinning Plant	191	192	193	194	195
6. Crop Rotation	191	192	193	194	195
7. Fencing Lands	191	192	193	194	195
8. Weeding	191	192	193	194	195

If you have heard of, but not practiced any of the above, why not?

1 PRACTICE	2 REASON
1. Winter/Autumn ploughing	201
2. Contour ploughing	202
3. Row planting	203
4. Fertiliser (commercial)	204
5. Thinning plants	205
6. Crop rotation	206
7. Fencing lands	207

21. EXTENSION CONTACT

- (a) Do you know the name of the A.D. in this area? YES/NO/NO A.D. ²¹¹
- (b) Have you ever received advice from the A.D.? YES/NO/DO NOT KNOW ²¹
- (c) If yes when was the last time
- | | |
|-----------------|-----|
| LAST WEEK | 213 |
| LAST MONTH | 219 |
| LAST YEAR | 212 |
| OVER A YEAR AGO | 213 |
- (Tick one only)
- (d) About what did he advise you? 214
- (e) Do you have a radio YES/NO/DO NOT KNOW ²¹⁵

22(a)

If yes, which of the following Agriculture/Livestock programs do you listen to?

	FREQUENTLY	RARELY	NEVER
Pitso ya batemi	221	221	217
Sethitso le boitumelo	221	221	223
Thibang diphotlha	221	221	223
Setshwantsho	221	222	223
Molemi ithute	221	221	223

(b)

Have you ever attended a meeting or heard of programs to improve grazing and try to help people at the lands improve their farming livestock?

1. Attended meeting
2. Have heard about it
3. Have not heard anything
4. I do not know

224
224
224
224

GENERAL

23. There are many problems that most Batswana face in farming. Lack of rainfall is probably the biggest problem. After rain what are the most important/difficult problems you face: Please give the three biggest problems you face in order of importance or difficulty for you to overcome.

Did you plough last season?			IF YOU PLOUGHED LAST SEASON	IF YOU DID NOT PLOUGH LAST SEASON
	501 YES	501 NO		
1. Lack of draft power when you need it			401	501
2. Lack of implements " " " them			402	502
3. Lack of labour when you need it			403	503
4. Crop damage by cattle sheep goats			404	504
5. Crop damage by pests, birds, insects, wild animals			405	505
6. Shortage of land			406	506
7. Shortage of seeds			407	507
8. Shortage of cash to buy inputs			408	508
9. No problems, not applicable			409	509
10. No answer, do not know			410	510
11. Other (specify)			411	511

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