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AGRICULTURAL TECHNOLOGY IMPROVEMENT PROJECT

(ATIP)

PROGRESS REPORT

COOPERATORS' BASELINE SURVEY, MAHALAPYE, 1988/89

NUMBER: ATIP PR M89-2

BY

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University of Botswana Commerce student, Victoria Petse, was recruited to administer the survey in Shoshong, Makwate, and Makoro villages. With the assistance of ATIP village staff in each location, she completed the survey in two months. ATIP staff who assisted her in identifying the farmers and undertaking the interviewing were C. Mahilo and I. Bane (Shoshong), K. Keoneeng (Makwate) and O. Kebaitse (Makoro).

Ms. Portia Monyane coded and entered the data into dBase III Plus.

Mrs. Y. Merafe, Head of the Rural Sociology Unit, Division of Planning and Statistics, MOA, reviewed an earlier draft of the paper and made constructive suggestions.

COOPERATORS' BASELINE SURVEY

INTRODUCTION

At the beginning of the ATIP project Multiple Visit Resource Unit (MVRU) Surveys were undertaken in both the Mahalapye and Francistown areas[1]. These were expensive surveys to undertake, therefore impractical to administer on a yearly basis. Consequently, in 1985/86 Francistown began undertaking a single interview Cooperators' Survey at the end of each cropping year[2]. The survey was designed to provide baseline information on what had happened each year, using as a sample farmers who had cooperated in trials over the years. Over successive years, such surveys can provide indicative data on changes that are occurring between years, and on trends that have developed over time. It should be recognized, however, that such surveys cannot elicit much in the way of accurate quantitative data, but can help provide some qualitative data.

This year (1988-89) was the first time such a survey has been undertaken in the Mahalapye area. Consequently, it is not possible to do a comparative analysis with earlier years, except in a very general sense. This should be possible in future years, particularly if some of the sample remains unchanged. The survey was undertaken in June and July. Since it included several farmers who have cooperated in trials over the years, the survey is not a random sample. Therefore, its potential for extrapolation is limited. Sixty-nine households were interviewed, of which 67 ploughed during the last year. Analysis is, therefore, based on the sample of 67 households.

In this report, results are presented in terms of the impacts of rainfall, production practices, cropping outcomes, and participation in government programmes. Where relevant, the sample has been stratified to highlight differences between households.

RESULTS

(1) STRATIFICATION

Village location, sex of household-head, and draught access and accessibility are important determinants of the type, level, and quality of agricultural activities across farms. Tables 1 to 4 present the sample breakdown according to these stratifications.

To simplify presentation and discussion, the relationship between the primary source of traction and accessibility to traction, in Table 2, was coalesced into four strata reflecting a combination of primary types of draught used and degree of dependency on others for obtaining draught. The four resulting **draught type** strata are defined in footnote 'a' in Table 2.

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[1]. 1982/83 and 1983/84 in the Mahalapye area, and 1983/84 in the Francistown area.

[2]. See for example: Bock, Worman, and Mabongo (1987) and Bock (1988).

TABLE 1: NUMBER OF HOUSEHOLDS BY VILLAGE AND SEX OF HOUSEHOLD HEAD

SEX OF HOUSEHOLD HEAD	SHOSHONG	MAKWATE	MAKORO	TOTAL
MALE	25	14	10	49
FEMALE	4	7	7	18
TOTAL	29	21	17	67

TABLE 2: NUMBER OF HOUSEHOLDS USING DIFFERENT TYPES OF DRAUGHT BY TYPE OF ACCESS[a]

TYPE OF DRAUGHT		TYPE OF ACCESS: OWN A	HIRE B	COOPER-ATIVE C	OWN/ HIRE D	COOPERAT-IVE/HIRE E	TOTAL
DONKEY	A	13	1	1	-	-	15
CATTLE	B	6	-	-	-	-	6
TRACTOR	C	4	29	1	1	1	36
DONKEY AND CATTLE	D	2	-	-	-	-	2
DONKEY AND TRACTOR	E	-	1	-	6	-	7
CATTLE AND TRACTOR	F	-	-	-	1	-	1
TOTAL		25	31	2	8	1	67

a. In the rest of the tables in the paper, type of draught used and method of access variables were combined into four draught type classes as follows:

Draught-Independent:

Tractor Owners -- includes those in cell CA. The total number of households = 4.

Animal Traction Owners -- includes those in cell AA (donkey traction), those in cell BA (cattle traction), and those in cell DA (donkey and cattle traction). The total number of households = 21.

Draught-Dependent:

Partial -- includes those with own traction who also hire i.e., those in cells CD (own tractor hire tractor), ED (own donkeys and hire tractor) and FD (own cattle and hire tractor). The number of households = 8.

Complete -- includes those depending completely on borrowed/cooperative traction, i.e., cells AC (donkeys) and CC (tractor), borrowed/cooperative and hired traction, i.e., cell CE (tractor), and hired traction, i.e., cells AB (donkeys), CB (tractors), and EB (donkeys and tractor). Total number of households = 34.

TABLE 3: NUMBER OF HOUSEHOLDS BY VILLAGE AND DRAUGHT TYPE

VILLAGE	DRAUGHT INDEPENDENT: TRACTOR	ANIMAL	DRAUGHT DEPENDENT: PARTIAL	COMPLETE	TOTAL
SHOSHONG	4	7	-	18	29
MAKWATE	-	8	4	9	21
MAKORO	-	6	4	7	17
TOTAL	4	21	8	34	67

TABLE 4: NUMBER OF HOUSEHOLDS BY SEX OF HOUSEHOLD HEAD AND DRAUGHT TYPE

SEX HOUSEHOLD HEAD	DRAUGHT INDEPENDENT: TRACTOR	ANIMAL	DRAUGHT DEPENDENT: PARTIAL	COMPLETE	TOTAL
MALE	3	19	7	20	49
FEMALE	1	2	1	14	18
TOTAL	4	21	8	34	67

Highlights from Tables 1 to 4 are as follows:

(a). Table 1. Twenty-six percent of the household heads were female-headed. The Shoshong sample had the lowest proportion of female-headed households (14%).

(b). Table 2. A high proportion of the households depended on hiring tractors for all their ploughing (43%), while those using only animals for traction were in a minority (31%). In the case of those using animal traction, oxen were only used exclusively by 28% of the households[3]. Finally, where complete dependency on hiring was the case, 94% of the households hired tractors. Although constituting only 12% of the total households, there were a group of farmers who owned their own traction but also hired tractors to some extent. Seventy-five percent of these had donkeys as their own traction source.

(c). Table 3. The dependency on hired traction was highest in Shoshong (62%) where the use of tractors was most common. In addition, all four tractor owners in the sample were from Shoshong.

(d). Table 4. A much higher proportion of female household heads were dependent on hiring draught (78%) than was the case with male head households (41%). This probably reflects the lower economic status of female-headed households, and/or a lack of labour for handling draught animals.

There has obviously been a major shift over the years to increased dependency on hired traction in the form of tractors, decreased emphasis on oxen, and an increased emphasis on donkeys where households do not depend upon others for traction. This has major implications for timing and quality of agricultural operations.

(2) RAINFALL

Table 5 indicates the rainfall during the cropping year compared with the long-term average, and earlier years in the Mahalapye area. In terms of total rainfall, the 1988/89 season was the second best since ATIP started -- in terms of total annual -- and, in fact, corresponds very closely to the long-term average. However, looking at the annual total masks the unfavourable distribution of rainfall that occurred. Until the end of December, the total amount of rainfall was very poor; lower than many of the drought years indicated in the table. This obviously had a negative impact on agricultural activities. As Table 5 indicates, there were relatively minor differences in the distribution of rainfall in the ATIP villages of Shoshong, Makwate and Makoro.

(3) PRE-PLOUGHING/PLANTING ACTIVITIES

Pre-ploughing/planting activities were minimal and were confined to fencing and destumping.

[3]. This excludes two households using both oxen and donkeys.

TABLE 5: MONTHLY RAINFALL (MMS) IN THE MAHALAPYE AREA, AND FOR THE ATIP VILLAGES DURING THE SURVEY YEAR[a]

MONTH	30 YEAR AVERAGE	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	RAINFALL 1988-89		
								MAHALAPYE	SHOSHONG	MAKWATE	MAKORO
JULY	2	0	2	0	0	1	0	0	0	0	0
AUGUST	3	0	1	0	0	0	0	1	0	0	2
SEPTEMBER	10	0	0	5	0	0	6	9	3	8	17
OCTOBER	31	85	20	34	44	64	6	43	14	37	78
NOVEMBER	65	51	99	45	10	62	64	16	21	20	6
DECEMBER	77	35	64	30	67	62	149	44	49	38	44
JANUARY	85	49	58	58	7	36	35	85	97	81	76
FEBRUARY	71	30	13	26	71	15	360	137	159	150	104
MARCH	54	46	97	45	14	12	91	38	32	32	50
APRIL	30	22	6	0	59	14	72	52	51	34	72
MAY	7	6	1	5	0	0	0	2	0	3	2
JUNE	1	5	0	0	0	0	0	23	18	39	12
TOTAL	435	329	361	248	272	266	773	450	444	442	453

a. The figures for the individual years are the average for the three ATIP villages. The 30 year (i.e., long-term) average is for Mahalapye itself.

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Only 10% of the households did any fencing during the year. ARAP contributed the costs of materials and labour for erection in 71% of the cases. The average area fenced by those who fenced fields was 2.6 hectares.

Also only 7% of the households destumped any land during the year. All those who did destump received reimbursement from ARAP. An average of two hectares was destumped per farm, by those who undertook this activity.

(4) PLOUGHING

(a). Area Cultivated: According to the results in Table 6, an average of 6.57 hectares was cultivated. In terms of individual strata, Makwate households cultivated more than the other villages, male-headed households cultivated more land than female-headed households, and draught-dependent households cultivated least. Those owning tractors or using tractors in conjunction with their own draught appeared to cultivate larger areas.

ARAP proved to be very important in the ploughing operation. On average, 93% of the land was ploughed under ARAP auspices. The average amount ploughed, per farm, under ARAP was 6.13 hectares compared with 0.44 hectares outside the ARAP programme. Draught-dependent households received less total ARAP assistance than other households -- because of the smaller areas they had ploughed -- and in addition did not plough any land independent of ARAP assistance. This does raise the question as to what will happen to the draught-dependent households when ARAP assistance is withdrawn. In recent years the increased monetization of agriculture, due in part to government assisted programmes, may have pushed up local prices and also led to a decline of more traditional arrangements, which were based on barter rather than money (e.g., cooperative arrangements). Only 18% of the households ploughed more land than that supported under the ARAP programme.

(b). Draught Arrangements: Only 4% of the households participated in borrowing traction under some form of cooperative arrangement. Under the cooperative arrangements, the payment for traction was usually in the form of labour.

About 60% of the households made some use of hired traction. Of those households involved, only 10% expressed dissatisfaction with the quality of ploughing done by hired traction. When dissatisfaction did occur, the most frequent complaint was with reference to the ploughing being too shallow, thus leaving seeds near the surface.

In terms of ploughing, the general start was late -- on average January 7th. This was certainly partially due to the late rains (Table 5). Draught-dependent households and female-headed households, on average, started later than draught-independent and male-headed households. Female-headed households tended to start late because the majority were also draught-dependent (Table 4).

(c). Double Ploughing: Research on the potential value of double ploughing has been a major focus of ATIP's research activities over the years. However, only two farmers (i.e., only 3% of the sample) double ploughed on their own

TABLE 6: AREA OF LAND PLOUGHED AND ROW PLANTED (AVERAGE HECTARES/HOUSEHOLD), PERCENT OF HOUSEHOLDS ROW PLANTING AND PLOUGHING LAND INDEPENDENT OF ARAP, AND DATE OF PLOUGHING (AVERAGE PER HOUSEHOLD), BY STRATUM

STRATUM	LAND PLOUGHED (HA)			PERCENT OF HOUSEHOLDS		PERCENT LAND ROW PLANTED	DATE OF PLOUGHING[a]		
	ARAP	OTHER	TOTAL	PLOUGHING OTHER LAND	ROW PLANTING		START	MOST	END
OVERALL	6.13	0.44	6.57	17.6	17.9	15.3	Jan 7	Jan 16	Jan 24
VILLAGE:									
SHOSHONG	5.73	0.39	6.12	13.8	10.5	2.6	Jan 9	Jan 17	Jan 25
MAKWATE	7.86	0.76	8.72	23.8	38.1	34.0	Jan 2	Jan 28	Feb 6
MAKORO	4.77	0.12	4.89	[illegible]	5.1	2.4	Jan 9	Jan 13	Jan 24
GENDER OF HEAD:									
MALE	6.31	0.58	6.89	[illegible]	20.4	18.4	Jan 5	Jan 16	Jan 26
FEMALE	5.67	0.06	5.73	[illegible]	11.1	6.8	Jan 13	Jan 13	Jan 17
DRAUGHT TYPE:									
INDEPENDENT:									
TRACTOR	7.75	2.37	10.02	50.0	0.0	0.0	Dec 31	Jan 7	Jan 16
ANIMAL	6.14	0.31	6.45	23.8	33.3	30.7	Jan 8	Jan 21	Feb 2
DEPENDENT:									
PARTIAL	7.94	1.69	9.53	50.0	25.0	17.6	Dec 26	Jan 8	Feb 9
COMPLETE	5.51	0.00	5.51	0.0	8.8	6.9	Jan 11	Jan 15	Jan 16

a. In the survey, the dates asked were expressed in terms of month only. These figures should therefore be interpreted with caution. In deriving actual dates, the figures on the forms were assumed to be the 15th of the month.

volition during the survey year. In the Mahalapye area, there has always been less enthusiasm for double ploughing than in the Francistown area, where double ploughing has been perceived to be worthwhile by a substantial proportion of farmers in the ATIP villages[4]. The two households that did double plough were from Makwate, were male-headed households, and owned their own animal traction. On average, they double ploughed 5.5 hectares and indicated that they would recommend the practice to other farmers.

(d). Row Planting: All ploughed land was planted. This is not surprising since much of the land was seeded with the broadcast method and then ploughed in.

According to the results in Table 7, almost 20% of the households owned a row planter and 18% (Table 6) of the households actually row planted, including 62% of the households who owned a row planter. According to the results in Table 6, about 15% of the land ploughed was row planted. Of those households who row planted most of them (82%) obtained funds for this from ARAP (Table 7). Most indicated, however, that they would have row planted without government assistance. However, those asked were already row planting and therefore did not have to be convinced of its value. The answer may well have been different if the whole sample had been asked if they would ever consider row planting without government assistance. Nevertheless, a substantial proportion of the households (43%) indicated that they would consider row planting if it could be done on a custom-hire basis. Such an approach was tested by ATIP in Mahalapye in the 1987/88 growing season (Modiakgotla, 1989).

TABLE 7: FURTHER INFORMATION ON ROW PLANTING (PERCENTAGE OF HOUSEHOLDS)

STRATUM	OWN ROW PLANTER	OBTAINED ARAP HELP[a]	WOULD ROW PLANT WITH NO ARAP[a]	WOULD ROW PLANT IF CUSTOM-HIRE[a]
OVERALL	19.4	81.8	72.7	42.6
VILLAGE:				
SHOSHONG	13.8	100.0	66.7	60.9
MAKWATE	38.1	71.4	85.7	14.3
MAKORO	5.9	100.0	0.0	52.9
GENDER OF HEAD:				
MALE	22.4	80.0	80.0	41.9
FEMALE	11.1	100.0	100.0	44.4
DRAUGHT TYPE:				
INDEPENDENT:				
TRACTOR	25.0	0.0	0.0	100.0
ANIMAL	33.3	85.7	75.0	25.0
DEPENDENT:				
PARTIAL	37.5	50.0	25.0	37.5
COMPLETE	5.9	100.0	0.0	53.1

a. These columns only include those households who row planted. One household who row planted but gave no response to this question was also excluded.

[4]. This may be partially due to the fact that the benefits to double ploughing have not been demonstrated so conclusively in the Mahalapye area.

As far as individual strata are concerned, row planting was most popular with Makoro farmers, with male-headed households, and with those households owning animal traction who hire tractors as well. The custom-hire row planting scheme, referred to above, was particularly successful in Makwate, which may account for the relatively high proportion of those households row planting during the survey year, and hence the relatively low proportion of households that would be interested in having their land custom-hire row planted overall. Not surprisingly, the draught-dependent households had a high degree of interest in the custom-hire row planting scheme. Two implications arising from this are that:

(i). There is a demonstration value in terms of convincing farmers of the value of row planting.

(ii). It is unreasonable to expect row planting to be adopted by households who do not own their own animal traction, unless there is some sort of custom-hire scheme.

ATIP Mahalapye have, in recent years, become convinced that the pay-off to row planting is very much a function of learning to row-plant properly[5], and combining it with inter-row weeding with the help of animal traction[6]. Custom-hire row planting does not require the rapid acquisition of such skill by each individual household.

The relative significance of row planting in terms of independent animal draught households -- and the partially dependent draught households -- is the fact that they are in a better position to pursue timeliness in their operations than those completely dependent on hiring draught[7]. Probably the lack of row planting amongst the tractor owners was more a function of their being busy doing contract ploughing for other households.

(5) CROPS PLANTED

By far the most dominant crop planted according to results in Table 8, was sorghum, followed by cowpeas and maize. Other more minor crops were millet, jugobeans and sweetreed. Maize continues to be popular in spite of the problem of growing it during dry years. The rankings across strata were fairly consistent apart from two exceptions:

(a). Millet was popular in Makoro probably because some of the households

[5] Because of this ATIP Mahalapye have, for the last two years, cooperated with other agencies in the Mahalapye area (DAFS, ALDEP, Mahalapye RTC and Palapye Development Trust) in organising row planting training courses for farmers, and row planting competitions at agricultural shows.

[6]. Thus, even if there were no direct yield benefit from row-planting, there are potential savings in labour, through controlling weeds by mechanical means. If this substitutes for very limited labour availability, then better control of weeds could in turn benefit crop yields.

[7]. This is in fact a potential disadvantage of custom-hire row planting schemes.

TABLE 8: CROPS GROWN (AVERAGE FREQUENCY PER HOUSEHOLD) AND CROPPING PRACTICES ADOPTED (PERCENTAGE OF HOUSEHOLDS) BY STRATUM

STRATUM	RANKING OF CROPS GROWN (AVERAGE OF HOUSEHOLDS)[a]							USE OF CROP PRACTICES (PERCENT OF HOUSEHOLDS)				
	SORGHUM	MILLET	MAIZE	SWEET-REED	COWPEAS	JUGO-BEANS	MELONS	USE FERT	WANT TO USE FERT	WEEDED ALL PLOTS	THINNED	GAP	DID BOTH
OVERALL	0.92	0.07	0.45	0.09	0.51	0.20	0.22	50.8	46.7	11.9	11.9	6.0	11.9
VILLAGE:													
SHOSHONG	0.95	0.00	0.48	0.13	0.52	0.20	0.18	56.0	62.2	6.9	3.4	10.3
MAKWATE	0.93	0.06	0.53	0.04	0.47	0.23	0.23	55.0	42.9	4.8	0.0	19.0
MAKORO	0.87	0.20	0.32	0.09	0.52	0.19	0.26	37.0	64.7	29.4	17.6	5.9
GENDER OF HEAD:												
MALE	0.94	0.05	0.46	0.08	0.48	0.21	0.23	58.1	45.1	10.2	6.1	10.2
FEMALE	0.88	0.13	0.43	0.12	0.57	0.48	0.18	33.3	73.1	16.7	5.6	16.7
DRAUGHT TYPE:												
INDEPENDENT:												
TRACTOR	0.87	0.00	0.75	0.12	0.44	0.12	0.12	66.7	75.0	0.0	0.0	0.0
ANIMAL	0.89	0.07	0.39	0.08	0.48	0.18	0.2[illegible]	50.0	62.0	14.3	9.5	9.5
DEPENDENT:												
PARTIAL	1.00	0.03	0.56	0.03	0.56	0.13	0.16	71.0	38.0	12.5	0.0	12.5
COMPLETE	0.94	0.09	0.46	0.11	0.51	0.24	0.18	48.0	56.0	11.8	5.9	14.7

a. In the survey respondents were asked to list in order of importance the crops they grew. No respondent listed more than four crops. A weighted proportion was obtained through first calculating the proportion of households growing each crop in each stratum by whether it was their 1st, 2nd, 3rd or 4th choice. Then for a given crop, the sum of the proportions was calculated through summation by weighting each proportion by the appropriate weight (multiply by 4 the proportion that reflects the crop being the 1st choice, multiply by 3 the proportion that reflects the crop being the 2nd choice, multiply by 2 the proportion that reflects the crop being the 3rd choice, and multiply by 1 the proportion that reflects the crop being the 4th choice). Consequently the higher the figure was, the more commonly the crop was grown.

migrated from the northern part of the country where millet is more commonly grown.

(b). Tractor owners tended to place relatively more emphasis on maize, probably reflecting the shortage of labour for bird scaring other crops.

Segaolane, Tswana and Kalahari Early Pearl (KEP) were the most common varieties of sorghum, cowpeas and maize, respectively, that were grown. Sorghum seed was mostly obtained under ARAP, while ARAP was also a significant supplier of maize. The major source of millet, cowpea, jugobeans and millet was from seed that farmers had left over from last year. Local traders were a significant source of seed for maize, cowpeas and, to a lesser extent, jugobeans.

The vast majority of households (90%) said they had enough seed, and 60% indicated that they had not planted all the seed they had received from ARAP.

Those who did not have enough seed (10% of the households) faced a shortage of mainly Tswana cowpea and sorghum seed. Beans, jugobeans and maize were also mentioned as being in short supply.

(6) POST PLANTING CROPPING PRACTICES

(a). Fertilizer: Only 7% of the households used fertilizer which was always obtained from ARAP. Those using fertilizer purchased 2.2 bags each. However, 51% of the sample wanted to use fertilizer. Among the major reasons given for not using it were that: it wasn't available, they didn't get round to finding out whether it was available, or they didn't use it due to a shortage of labour or time.

Table 8 shows that Makoro farmers, female-headed households, and draught-dependent households were the least interested in fertilizer. Possible reasons for these observations are that Makoro has not had a strong AD presence for several years, while in the other two cases the households tend to be at the poorer end of the wealth spectrum.

(b). Weeding: Forty-three percent of the households did not weed all their plots. Female-headed households and farmers with tractors appeared to be most conscientious about weeding all their plots. Shortage of labour followed by too few plants were the major reasons given for not weeding. The latter reason probably best describes the situation of the partially draught-dependent households who planted relatively large areas (Table 6).

(c). Thinning and Gap Filling: About 12% of the farmers both thinned and gap filled, while another 12% only thinned and another 6% only gap filled. The figures in Table 8 indicate that thinning and gap filling were most popular in Makoro, with female-headed households, with draught-independent households depending on animal traction, and with draught-dependent households. Not surprisingly, tractor owners did not thin and gap fill, presumably because land was not a limitation, and labour was likely to be more limiting.

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(1) STRATIFICATION

Village location, sex of household-head, and draught access and accessibility are important determinants of the type, level, and quality of agricultural activities across farms. Tables 1 to 4 present the sample breakdown according to these stratifications.

To simplify presentation and discussion, the relationship between the primary source of traction and accessibility to traction, in Table 2, was coalesced into four strata reflecting a combination of primary types of draught used and degree of dependency on others for obtaining draught. The four resulting draught type strata are defined in footnote 'a' in Table 2.

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[1]. 1982/83 and 1983/84 in the Mahalapye area, and 1983/84 in the Francistown area.

[2]. See for example: Bock, Worman, and Mabongo (1987) and Bock (1988).

TABLE 1: NUMBER OF HOUSEHOLDS BY VILLAGE AND SEX OF HOUSEHOLD HEAD

SEX OF HOUSEHOLD HEAD	SHOSHONG	MAKWATE	MAKORO	TOTAL
MALE	25	14	10	49
FEMALE	4	7	7	18
TOTAL	29	21	17	67

TABLE 2: NUMBER OF HOUSEHOLDS USING DIFFERENT TYPES OF DRAUGHT BY TYPE OF ACCESS[a]

TYPE OF DRAUGHT		TYPE OF ACCESS: OWN A	HIRE B	COOPERATIVE C	OWN/HIRE D	COOPERATIVE/HIRE E	TOTAL
DONKEY	A	13	1	1	-	-	15
CATTLE	B	6	-	-	-	-	6
TRACTOR	C	4	29	1	1	1	36
DONKEY AND CATTLE	D	2	-	-	-	-	2
DONKEY AND TRACTOR	E	-	1	-	6	-	7
CATTLE AND TRACTOR	F	-	-	-	1	-	1
TOTAL		25	31	2	8	1	67

a. In the rest of the tables in the paper, type of draught used and method of access variables were combined into four draught type classes as follows:

Draught-Independent:

Tractor Owners -- includes those in cell CA. The total number of households = 4.

Animal Traction Owners -- includes those in cell AA (donkey traction), those in cell BA (cattle traction), and those in cell DA (donkey and cattle traction). The total number of households = 21.

Draught-Dependent:

Partial -- includes those with own traction who also hire i.e., those in cells CD (own and hire tractor), ED (own donkeys and hire tractor) and FD (own cattle and hire tractor). Total number of households = 8.

Complete -- includes those depending completely on borrowed/cooperative traction, i.e., cells AC (donkeys) and CC (tractor), borrowed/cooperative and hired traction, i.e., cell CE (tractor), and hired traction, i.e., cells AB (donkeys), CB (tractors), and EB (donkeys and tractor). Total number of households = 34.

TABLE 3: NUMBER OF HOUSEHOLDS BY VILLAGE AND DRAUGHT TYPE

VILLAGE	DRAUGHT INDEPENDENT: TRACTOR	ANIMAL	DRAUGHT DEPENDENT: PARTIAL	COMPLETE	TOTAL
SHOSHONG	4	7	-	18	29
MAKWATE	-	8	4	9	21
MAKORO	-	6	4	7	17
TOTAL	4	21	8	34	67

TABLE 4: NUMBER OF HOUSEHOLDS BY SEX OF HOUSEHOLD HEAD AND DRAUGHT TYPE

SEX HOUSEHOLD HEAD	DRAUGHT INDEPENDENT: TRACTOR	ANIMAL	DRAUGHT DEPENDENT: PARTIAL	COMPLETE	TOTAL
MALE	3	19	7	20	49
FEMALE	1	2	1	14	18
TOTAL	4	21	8	34	67

improved practices, obtained the highest cereal yields per hectare, presumably due to their being able to carry out their operations in a timely manner. In terms of other strata, Shoshong and male-headed households also had relatively superior results. Once again, however, it is the households with their own animal traction supplemented with the hiring of tractors, that produced the best results after tractor owners.

TABLE 11: ADOPTION OF IMPROVED PRACTICES BY HOUSEHOLDS[a]

STRATUM	PERCENT HOUSEHOLDS ADOPTING 'X' PRACTICES 0	1	2	3	4	NUMBER OF PRACTICES	AVERAGE KG. CEREAL PER HA[b]
OVERALL	44.8	29.9	16.4	7.5	1.5	0.91	71
VILLAGE:							
SHOSHONG	55.2	27.6	10.3	3.4	3.3	0.72	101
MAKWATE	33.3	23.8	28.6	14.3	0.0	1.24	62
MAKORO	23.3	35.0	18.2	20.0	0.0	0.82	27
GENDER OF HEAD:							
MALE	44.9	30.6	14.3	8.2	2.0	0.92	76
FEMALE	44.4	27.8	22.2	5.6	0.0	0.89	55
DRAUGHT TYPE:							
INDEPENDENT:							
TRACTOR	50.0	50.0	0.0	0.0	0.0	0.50	171
ANIMAL	33.3	38.1	23.8	0.0	4.8	1.05	47
DEPENDENT:							
PARTIAL	37.5	12.5	12.5	37.5	0.0	1.50	93
COMPLETE	52.9	26.5	14.7	5.9	0.0	0.73	68

a. Improved practices included the following: destumping, fencing, growing of a new crop, use of fertilizer, double ploughing, row planting, thinning and gap filling.

b. This was estimated for each household by dividing the sum of the production of cereal crops (sorghum, millet and maize) by the total area ploughed. Thus, it was assumed that the whole area cultivated had a cereal crop on it. This was probably not an unrealistic assumption.

CONCLUDING REMARKS

The 1988/89 cropping year was poor for the farming households in the ATIP villages in the Mahalapye area. In spite of this, there was quite a variation in the results achieved by different households, reflecting to a great extent differences in the resources they had at their disposal. This was particularly evident with respect to traction. Some of the most interesting findings were the relatively good results achieved by households owning their own animal draught, but also hiring tractors (partially dependent draught households). Intuitively, a two-pronged subsidisation approach -- continuing provision of animal traction subsidies, combined with availabilty of tractors to hire -- may be the best solution to attaining the dual national goals of equitability and food security.

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