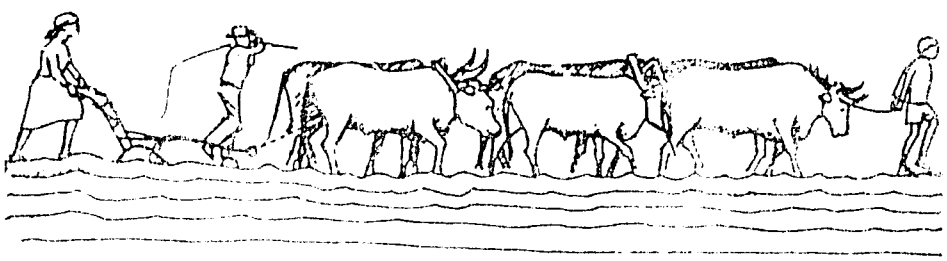
AGRICULTURAL TECHNOLOGY IMPROVEMENT PROJECT (ATIP)

ANNUAL REPORT NUMBER 7

PRINTED DECEMBER 1989



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PN-ABE-555

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MINISTRY OF AGRICULTURE
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FOREWORD

This report is divided into four parts as follows:

Part I: Executive Summary
Part II: Summary of Activities, September, 1988 - August, 1989
Part III: Work Plan, September, 1989 - August, 1990
Part IV: Financial Plan, September, 1989 - August, 1990

In addition, there is an appendix which contains a list of all the papers written by ATIP staff since the inception of the project.

An attempt has been made to continue the format adopted in the last few years of reducing the amount of empirical material reported on the survey and trial work. This material is available in papers listed in the appendix.

The reason for the delay in producing the Annual Report this year is because priority was given to working on the first draft of the "Farming Systems Handbook for Botswana". Because it is a little late, in Part II, some activities undertaken after August this year have also been discussed.

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GLOSSARY

AD	Agricultural Demonstrator
ADNP	Agricultural Development Ngamiland Project
AED	Academy for Economic Development
APD	Animal Production Division
APRU	Animal Production Research Unit
ARAP	Arable Rainfed Accelerated Project
ATIP	Agricultural Technology Improvement Project
BAC	Botswana Agricultural College
BAMB	Botswana Agricultural Marketing Board
CAPO	Chief Animal Production Officer
CARO	Chief Arable Research Officer
CBP	Contour Bed Plowing
CIMMYT	International Maize and Wheat Center
CPO	Crop Production Officer
CRSP	Collaborative Research Support Program
CTO	Central Transport Organization
DAO	District Agricultural Officer
DAR	Director of Agricultural Research
DAFS	Director of Agricultural Field Services
DLFRS	Dryland Farming Research Scheme
DPS	Division of Planning and Statistics
DPSM	Department of Public Service Management
EEC	European Economic Community
EFSAIP	Evaluation of Farming Systems and Agricultural Implements Project
FAB	Forestry Association of Botswana
FMFI	Farmer Managed and Implemented
FMU	Farm Management Unit
FSRLA	Farming Systems Research Liaison Agronomist
FSSR	Farming Systems Southern Region
FSW	Farming Systems Work
GIS	Geographical Information System
GOB	Government of Botswana
HPS	High Potential Site
IBSNAT	International Benchmark Sites Network for Agrotechnology Transfer
IDM	Institute of Development Management
IITA	International Institute for Tropical Agriculture
IFDC	International Fertilizer Development Center

IFPP	Integrated Farming Pilot Program
INTSORMIL	International Sorghum and Millet CRSP
ISNAR	International Service for National Agricultural Research
KSU	Kansas State University
LAC	Livestock Advisory Center
LBDR	Labor Based Drought Relief
LOP	Life of Project
LUO	Land Utilization Officer
LWMRP	Land and Water Management Research Project
MOA	Ministry of Agriculture
MDP	Molapo Development Project
MIAC	Mid-American International Agricultural Consortium
NORAD	Norwegian Aid Agency
OPEX	Operational Expert
PPS	Project Paper Supplement
RELO	Research Extension Liaison Officer
RAO	Regional Agricultural Officer
RECU	Research Extension Coordinating Unit
RIIC	Rural Industry Innovation Center
RMFI	Researcher Managed and Farmer Implemented
RMRI	Researcher managed and Implemented
RSU	Rural Sociology Unit
RTC	Rural Training Center
SACCAR	Southern African Center for Cooperation in Agricultural Research
SADCC	Southern African Development Coordination Conference
SLOCA	Services to Livestock Owners in Communal Areas
SMU	Seed Multiplication Unit
SMS	Subject Matter Specialist
SCS	Soil Conservation Section
UNDP	United Nation Development Program
USAID	United States Agency for International Development
USAID/B	United States Agency for International Development in Botswana

PART I: EXECUTIVE SUMMARY

CHAPTER 1: EXECUTIVE SUMMARY

1.1 PREAMBLE

The major purpose of the Agricultural Technology Improvement Project (ATIP) is to help develop and aid in the extension of farming systems recommendations, relevant to the needs of the small (limited resource) farmer. Essential to this effort are links with on-station research in the Department of Agricultural Research (DAR) and with extension staff in the Department of Agricultural Field Services (DAFS). Major components of the ATIP program are the Mahalapye and Francistown farming systems teams, and the liaison activities between research and extension. The actual steps and attributes of farming systems work (FSW) can be found in previous Annual Reports.

During the existence of ATIP there have been two External Mid-Term Reviews supplemented by a recently completed Internal Review. In general these have been favorable, and an attempt has been made to follow up on the recommendations that were made.

The contract with the Mid-America Agricultural Consortium (MIAC) will finish on September 28th, 1990. However, USAID will continue some funding for FSW by supporting an Operational Expert (OPEX) position, and possible post-ATIP linkages between MIAC and Botswana. The Sorghum and Millet Collaborative Research Support Program (INTSORMIL) will continue supporting one agronomist position at the main research station at Sebele.

This report continues the practice of the last two years, of recording results and the proposed work program in terms of themes. Therefore, to facilitate comparisons with the work plan drawn up and outlined in the last Annual Report No. 6 (Chapters 9 to 13), the section numbers used in the work plan have been given after the relevant heading in this report. In terms of chapter headings direct comparison is possible as shown in Table 1.1.

TABLE 1.1 CROSS REFERENCES BETWEEN ANNUAL REPORT NO. 6 AND THE CURRENT ANNUAL REPORT

Topic	Chapter in Report	
	Current Report	Annual Number 6
Personnel and Equipment	3	9
Training	4	10
Sebele/Gaborone	5	11
Mahalapye	6	12
Francistown	7	13

1.2 PERSONNEL AND EQUIPMENT

There have been a number of changes in staff over the last year. Mr. K. Kelemogile (APRU, DAR) was assigned to work with the Animal Scientist in Francistown, while Dr. B. Hill (RECU), Mr. C. Bernhardt (SMU) and Mr. A. Caplan left. Unfortunately Dr. B. Hill had to leave because of family health problems, while Mr. Bernhardt had to resign because of ill health. Mr. A. Caplan (PCV, Mahalapye) left to take a one year appointment at the central Peace Corps Office in Gaborone. The contributions of all three individuals have

been greatly appreciated. It is anticipated there will be no further changes in professional staff (expatriate as well Batswana) during the remaining part of the project.

There have been a few changes in support staff during the reporting period, most notably a net increase of three individuals seconded from DAFS.

In terms of trips and consultancies, a group of senior Ministry of Agriculture (MOA) officials visited KSU at the invitation of the President of KSU, while Dr. W. Miller, the new Executive Director of MIAC, visited Botswana. Three individuals experienced in Geographical Information Systems (GIS) visited Botswana under an Alabama A&M/KSU Strengthening Grant during the reporting period, while use was made of two local consultants.

During the reporting year an Internal Review was held which looked at progress since the last External Review in 1986, and also provided an opportunity to evaluate ATIP plans for the coming year. Details on these activities are given in Chapter 2.

Equipment purchases were concentrated on three vehicles, six microcomputers, additional printing equipment for the Agricultural Information Section in DAFS, and a fume cupboard for the soil laboratory at DAR. No major purchases are anticipated during the remaining part of the project apart from 25 rotary injection planters, purchase of which has been approved by GOB and USAID/B.

1.3 TRAINING

During the project a total of 23 individuals (25 degrees) have, or are receiving training, directly supported by ATIP (19 degrees), or with GOB matching funds (6 degrees). This does not include two and possibly three others who are receiving partial ATIP support towards their degrees. In terms of those receiving complete support the project has been fairly equitable in training individuals from DAR (8 degrees), DAFS (9 degrees) and DPS (8 degrees). Training was also equally divided between BS (13 degrees) and MS (12 degrees). During the reporting year two individuals returned from long-term training and six departed, with the possibility of another one scheduled to leave in January.

Short-term training continued with nine MOA individuals attending courses in the USA, Togo, Zimbabwe and Ethiopia. The sponsoring agency, GOB, and ATIP often shared costs involved in attending the courses.

ATIP staff have given a number of lectures at BAC and the University of Botswana, and have continued on-the-job training of ATIP staff.

In addition as far as farmers are concerned, ATIP have helped -- often in conjunction with extension/development agency staff -- in organizing farmer field days, extension-led farmer groups, row-planting competitions at agricultural shows, row-planting and cultivation courses for farmers, etc.

In-service and on-the-job training, in particular, will continue to receive considerable emphasis during the coming year.

1.4 LIAISON BETWEEN RESEARCH AND EXTENSION

Linkage activities between research and extension have continued to receive emphasis during the reporting year. The RECU has continued the same activities as in previous years such as sitting on a number of professional and training committees, facilitating processing of farming system type articles for Agrinews, processing Agrifacts and other extension publications, etc. Currently there is some uncertainty about the future of RECU which will hopefully be resolved in the near future, in such a way as to give the unit more authority in facilitating linkages between research and extension, not only at the center, but also between the center and the field.

In addition, ATIP staff in general, continued to spend much more time in research/extension type activities through helping extension staff in organizing and running extension-led farmer groups, training courses, field days and competitions for farmers, etc. These linkages will continue to receive emphasis during the coming year, while at the same time efforts will be made to make these linkages more formal.

1.5 ACTIVITIES OF THE FIELD TEAMS

1.5.1 ACTIVITIES, SEPTEMBER 1988 TO AUGUST 1989

In the early part of the rainy season (September to November/December) the rains in the Mahalapye and Francistown areas were somewhat poorer than the Gaborone area (Table 1.2). Thus, little planting was done before Christmas. However after this period rainfall amounts improved, and the totals for the year approached the long-term average. The totals for the Mahalapye and Francistown areas were 449mm (long-term average 465mm) and 438mm (long-term average 435mm), respectively. Because most of the planting was late, crop production from many of the trials was not very impressive.

A summary of the status of the trials, studies and surveys at Mahalapye and Francistown is given in Tables 1.3 and 1.4. As can be seen many farmers were involved in the work program, although it should be noted that some were involved in more than one item. The section numbers refer to those in which they are discussed in this report.

(a). ***Mahalapye.*** A range of issues were dealt with at Mahalapye during the 1988-89 season. Linkages were improved with several other agricultural units including several commodity or groups of Sebele researchers, and with extension staff in the Central Agricultural Region. Other main elements of the Mahalapye work have dealt with farming systems team organization, data collection and handling procedures, as well as with soil building, water management, and commodity-related work as research topics.

Soil building is an area of research that has not received sufficient attention in past work plans. An interest in this topic is growing among extension staff in the Mahalapye area, although farmer's generally have been reluctant to invest in soil building. Clearly, a number of questions need to be answered regarding this topic. Mahalapye activities included under this theme are: assessing manure availability and the evaluating its value via a trial.

Water management research has been part of the Mahalapye work since the first year of the project, and is continuing. This work divides into two sections. The first is focused on tillage strategies, the National Tillage Trial. The second has a focus on semi-permanent water control structures, the Rainfall Runoff Management Study, that

TABLE 1.2: MONTHLY RAINFALL (MMS) AT MAHALAPYE AND FRANCISTOWN, 1982-87*

Month	Mahalapye								Francistown							
	30 Year Average	1982 -83	1983 -84	1984 -85	1985 -86	1986 -87	1987 -88	1988 -89	30 Year Average	1982 -83	1983 -84	1984 -85	1985 -86	1986 -87	1987 88	1988 -89
July	2	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0
August	3	0	1	0	0	0	0	3	1	4	12	0	0	0	0	0
September	10	0	0	5	0	0	6	5	8	0	0	0	0	12	4	0
October	31	85	20	34	44	64	6	43	24	63	89	34	31	66	7	57
November	65	51	99	45	10	62	64	16	62	24	123	76	14	67	54	16
December	77	35	64	30	67	62	149	44	102	39	84	49	49	61	234	76
January	85	49	58	58	7	36	35	83	99	61	5	137	34	68	41	75
February	71	30	13	26	71	15	350	134	84	42	20	134	33	51	254	166
March	54	46	97	45	14	12	91	37	46	42	146	18	59	7	114	8
April	30	22	6	0	59	14	72	52	26	108	17	0	112	0	12	51
May	7	6	1	5	0	0	0	2	11	6	0	0	0	0	0	0
June	1	5	0	0	0	0	0	20	2	0	0	0	0	0	21	0
Total	435	329	361	248	272	266	773	458	465	389	496	448	332	312	741	449

The figures for the individual years are the averages for the ATIP villages in each area. The long-term averages are for Mahalapye and Francistown.

TABLE 1.3: STATUS OF SURVEYS AND TRIALS, ATIP MAHALAPYE, 1988-89 SEASON[a]

Theme, Survey or Trial	Section	Type	Current Status
Cropping Systems:			
Sorghum/Melon Mix	6.1.1	Descrip/Diag ST	12 sites implemented
Evaluation of Agro-Forestry Improvement Potential	6.1.2	Descrip/Diag SU	National survey to be implemented by NORAD consultant
Phosphate Fertilizer and Utilization of L. purpureus	6.1.3	RMFI Testing TR	Five sites implemented
Commodities:			
Evaluation of Medium Maturity Cowpea Variety (TVX3236)	6.2.1	FMFI Testing TR	33 sites implemented
Evaluation of Drought Resistance Groundnut Variety (55-437)	6.2.2	FMFI Testing TR	23 sites implemented
Mung Bean Variety Trial	6.2.3	FMFI Testing TR	Two sites implemented
Tillage and Planting Practices:			
National Tillage Trial	6.3.1	RMRI Testing TR	Three sites implemented
Row-planter Condition Study	6.3.2	Descrip/Diag SU	84 farmers interview in six villages
Cultivator Evaluation Trial	6.3.3	RMRI Testing TR	Four sites implemented
Row-plant Fertilizer Trial	6.3.4	RMFI Testing TR	Eight sites implemented
Soil and Water Management:			
Manure Resource Assessment	6.4.1	Descrip/Diag ST	Twenty farmers surveyed
Evaluation of Manure Application	6.4.2	RMFI Testing TR	Six sites implemented
Evaluation of Run-off Management Systems	6.4.3	RMRI Design TR	Four sites implemented
Whole Field Run-off Control	6.4.4	RMFI Design TR	Work not implemented
Farm Equipment:			
Rotary Injection Planter	6.5.1	FMFI Testing TR	Five sites implemented
Improved Donkey Harnesses	6.5.2	FMFI Testing TR	Eight farmers participating
Groundnut Planter	6.5.3	RMFI Testing TR	Four sites implemented
Dutch Hoes	6.5.4	FMFI Testing ST	Ten farmers given hoes
Household Circumstances:			
Cooperating Farmers Study	6.6.1	Descrip/Diag SU	About 70 farmers surveyed
Environmental Monitoring:			
Rainfall and Temp. Monitoring	6.7.1	Descrip/Diag ST	Done as planned
Rainfall Run-off Measurement	6.7.2	Descrip/Diag ST	Monitoring continuing
Methodology:			
Standardization of Units of Measurement	6.8.1	Descrip/Diag ST	Study implemented
Research Group Monitoring	6.8.2	RMRI Design ST	Monitoring continuing

a. See footnote in Table 1.4 for details.

TABLE 1.4: STATUS OF SURVEYS AND TRIALS, ATIP FRANCISTOWN, 1988-89 SEASON[a]

Theme, Survey or Trial	Section	Type	Current Status
Cropping Systems:			
Sorghum/Cowpea Intercropping	7.1.1	RMRI Testing TR	Six trials implemented as planned
Crop Mix Study	7.1.2	FMFI Testing TR	One trial implemented by FTG
Agro-Forestry/Alley Cropping	7.1.3	RMRI Testing TR	Implemented, 1200+ plants distributed
Tillage and Planting Practices:			
Double Plowing Systems Trials	7.2.1	RMFI Testing TR	Six trials implemented as planned
National Tillage Trial	7.2.2	RMRI Testing TR	Two locations implemented, one failed
Farm Equipment:			
Evaluation of Improved Donkey Harnesses	7.3.1	FMFI Testing TR	Implemented as planned
Evaluation of Rotary Injection Hand Row-planter	7.3.2	FMFI Testing TR	Implemented in FTG's
Livestock Production Systems:			
Improved Production Goat Milk	7.4.1	RMFI Design TR	Implemented with change to RMRI
Diagnosis of Kid Mortality	7.4.2	Descrip/Diag SU	Implemented for all age animals
Household Circumstances:			
Cooperating Farmers Study	7.5.1	Descrip/Diag SU	Annual survey completed, 27 farmers
Markets:			
Small Stock and Grain Trading and Prices	7.6.1	Descrip/Diag SU	Price data collected, small stock data incomplete
Extension Linkages:			
FMFI Options Testing with Extension Led Farmer Assessment Groups	7.7.1	FMFI Testing TR	Implemented in 2 villages with 37 farmers (39 trials)
Environmental Monitoring:			
Rainfall and Temp. Monitoring	7.8.1	Descrip/Diag SU	Implemented as planned
Methodology:			
Researcher Led FMFI Options Testing Farmer With Assessment Groups	7.9.1	FMFI Testing TR	Implemented in 3 villages with 128 farmers doing 140 trials

RMRI = Researcher Managed/Researcher Implemented
RMFI = Researcher Managed/Farmer Implemented
FMFI = Farmer Managed/Farmer Implemented
RIIC = Rural Industries Innovation Center
TR = Trial
SU = Study
FTG = Farmer Testing Group (Researcher led)

does not rely so heavily on an increase in tillage investment.

The commodity-related research is an on-going activity designed to promote linkages between on-station and on-farm research, and for the verification of on-station findings under on-farm conditions. For the 1988/89 season, the commodity program included the trials on cowpea, mung bean and groundnuts varieties, a fodder trial, and testing of a groundnut planter and a rotary injection planter.

As in every Botswana cropping season, cropping patterns and trials implementation are directly influenced by the rainfall pattern. Because plowing and planting rains were relatively late, some trials could not be put in. However, because of the efficiency of the staff, this problem was not too serious. Mid and late season rainfall was slightly above average, and harvest outcomes were at least average.

A number of surveys were undertaken including the Cooperators Survey which indicated generally rather poor results for many farmers, and a survey looking at the condition of row-planters which has subsequently been undertaken in the FSSR and ATIP Francistown areas. Results from this survey will shortly be available.

On the link with extension, stress was placed on two row-planting training courses for farmers, and in organizing farmer row-planting competitions at three agricultural shows.

(b). ***Francistown.*** The 1988-89 cropping season was relatively poor for crop production in the Francistown area. Total rainfall was only slightly below the long-term annual average, but distribution was poor. There were only four rainfall events greater than fifteen millimeters in the main planting season (November, December, and January) at most locations. This reduced the amount of land farmers could plant, and hindered proper trials implementation. There was a prolonged dry period between early January and late February, which caused fairly severe stressing of cereal crops, and reduced yield potential. Subsequently, quite a lot of planting was done during the rainy period in late February (including some experimental work). However, again there was a prolonged dry period between early March and late April. Moisture stress and cool night temperatures, during this period, slowed crop growth to such an extent that these late planted crops did not produce a significant grain yield.

Planting was further disrupted by large scale rat invasions. Particularly hard hit were row-planted crops where the rats could go down the rows and dig up seeds planted at regular intervals and depths. Other pests included small animals and birds.

On a more positive note, the National Tillage Trial produced yields of over one ton per hectare, giving an indication of potential production even in this relatively poor year.

FMFI testing conducted through researcher managed farmer groups continued to be a major part of the overall research program during 1988-89. In the three ATIP villages, 127 farmers participated in group activities and conducted 140 trials of the following technologies: double plowing, groundnut seed treatment, cowpea and groundnut varieties, fertilizer, and long and short season crop mixes. Hand row-planters, groundnut planters, Dutch hoes, and the Maun cultivator were available for testing while implementing other trials. Double plowing continued to outperform the traditional system. Given the stressed water situation, groundnut seed treatments and varieties did not show any major differences. Indeterminate cowpea varieties did better than determinate varieties, and fertilizer trial results were varied. A survey of

farmer group participants indicated that 26 percent had spontaneously adopted one or more of the technologies they had tested during the 1986-88 period. They used the "new" technologies on 14 percent of their land.

Increased emphasis was placed on working with the Department of Agricultural Field Services, both in planning and coordinating trials work, and in supporting two extension-led farmer groups, whose 37 members implemented 39 trials, mostly of row-planting equipment. Work with ALDEP on donkey harnesses and hand row planters continued, with both being included in the ALDEP participatory demonstration program.

Researcher managed trials included the national tillage systems trial in conjunction with the National Tillage Group, and continuation of the cropping systems and double plowing systems trials. One of the national tillage trial sites produced good results while the other failed entirely. The cropping systems and double plowing systems trials produced mixed results.

Monitoring of the farming system continued with the cooperating farmer survey, small stock and grain trading and prices study, and the rainfall and temperature monitoring activities. One-third of the cooperator farmers interviewed row planted at least some of their crops, while half double plowed at least some of their crops. Participation in government programs by this group of farmers remained high.

1.5.2 PROPOSED ACTIVITIES, SEPTEMBER 1989 TO AUGUST 1990

A summary of the proposed studies, trials and surveys for Mahalapye and Francistown is given Tables 1.5 and 1.6.

(a). ***Mahalapye.*** Proposals for work during the coming year emphasize continuation of many research activities from the past year. Examples of continued work include the kraal manure work, the rainfall run-off management work, and the commodity support testing. Even though closure on investigations into specific technologies is desirable, and maybe possible in some cases (i.e., new varieties, some farm equipment, etc.), many of the trial activities should be viewed as "pipelines" linking commodity or program units of DAR with on-farm work. In this pipeline context, research could continue in the future on similar or related technologies.

Emphasis is also put on developing standard research methods that can be readily used in future work. In this regard, attention is given to completing standard data forms and data handling procedures and to developing protocols, within the team, on how to manage RMFI and RMRI trials, and farmer group activities.

Research-extension linkages will continue to focus on promotion of a basic row planting and inter-row cultivation package. Hopefully, it will be possible for the RECU to become increasingly involved in this activity.

Emphasis will also be placed on writing a series of papers summarizing work carried out on various topics during the life of ATIP, and in finalizing the "Farming Systems Handbook for Botswana".

(b). ***Francistown.*** During the 1989-90 year, the Francistown research program will be conducted, where possible, by GOB personnel with back-up provided by the USAID scientists, who will spend more of their time completing analyses and writing up the

TABLE 1.5: PROPOSED SURVEYS AND TRIALS, ATIP MAHALAPYE, 1989-90 SEASON*

Theme Survey or Trial	Section	Type	No.[b]	Sample Size	Investigator Main	Co.	Final Year
Commodities:							
Evaluation of Early Maturity Cowpea Variety (B097)	12.2.1	RMFI Testing TR	0	15 Farmers	FM/AG		Unknown
Evaluation of Groundnut Production Package	12.2.2	RMFI Testing TR	0	9 Farmers	FM/AG		Unknown
Tillage and Planting Practices:							
National Tillage Trial	12.3.1	RMRI Testing TR	2	2 Farms	AG	FM	Unknown
Cultivator Evaluation	12.3.2	RMFI Testing TR	1	9 Farmers	AG	FM	1989-90
Soil and Water Management:							
Evaluation of Manure Application	12.4.1	RMFI Testing TR	1	9 Farms	AG	FM	Unknown
Evaluation of Runoff/ Management Systems	12.4.2	RMRI Design TR	3	4 Farms	AG	FM	1989-90
Whole Field Runoff Control	12.4.3	RMRI Design TR	1	2 Farms	AG	FM	Unknown
History of Cultivation Study	12.4.4	Descrip/Diag ST	1	4 Villages	AG/FM		1989-90
Farm Equipment:							
Rotary Injection Planter	12.5.1	FMFI Testing TR	3	9 Farmers	FM/AG		1989-90
Dutch Hoe	12.5.2	FMFI Testing TR	1	12 Farmers	FM/AG		1989-90
Groundnut Planter	12.5.3	RMFI Testing TR	2	4 Farmers	FM/AG		1989-90
Environmental Monitoring:							
Rainfall and Temp. Monitoring	12.6.1	Descrip/Diag SU	7	Variable	AG		Unknown
Household Circumstances:							
Cooperating Farmers Study	12.7.1	Descrip/Diag SU	1	30 Farmers	FM	AG	Unknown

RMRI = Researcher Managed/Researcher Implemented
RMFI = Researcher Managed/Farmer Implemented
FMFI = Farmer Managed/Farmer Implemented

AG = Agronomy
AP = Animal Production
FM = Farm Management
EX = Extension and/or ALDEP
VS = Veterinary Service

TR = Trial
SU = Survey

[b] Indicates number of years already undertaken.

TABLE 1.6: PROPOSED SURVEYS AND TRIALS, ATIP FRANCISTOWN, 1989-90 SEASON*

heme Survey or Trial	Section	Type	No.[b]	Sample Size	Investigator Main	Co.	Final Year
ropping Systems:							
Perennial Forage Crops	13.2.1	RMRI Testing TR	2	Various	FM	AG	1989-90
Tillage and Planting Practices:							
National Tillage Trial	13.3.1	RMRI Testing TR	1	2 sites	AG	EX,FM	Unknown
Livestock Production Systems:							
Improved Production Goat Milk	13.4.1	RMRI Design TR	1	3 villages	AP	FM,AG	1989-90
Diagnosis of Kid Mortality	13.4.2	Descrip/Diag SU	1	Variable	AP	VS	1989-90
Markets:							
Small Stock Trading and Prices	13.5.1	Descrip/Diag SU	5	Variable	FM		Unknown
Grain Trading and Prices	13.5.2	Descrip/Diag SU	5	3 villages	FM		Unknown
Farmer Participatory Research:							
FMFI Options Testing With Researcher Led Farmer Assessment Groups	13.6.1	FMFI Testing TR	4	100 150 farmers	AG	FM,EX	Unknown
FMFI Options Testing with Extension Led Farmer Assessment Groups	13.6.2	FMFI Testing TR	2	2 villages	EX,AG	FM	Unknown
Environmental Monitoring:							
Rainfall and Temp. Monitoring	13.7.1	Descrip/Diag SU	6	Variable	AG		Unknown
Household Circumstances:							
Cooperating Farmers Study	13.8.1	Descrip/Diag SU	6	27 farmers	FM		Unknown

RMRI = Researcher Managed/Researcher Implemented
RMFI = Researcher Managed/Farmer Implemented
FMFI = Farmer Managed/Farmer Implemented

AG = Agronomy
AP = Animal Production
FM = Farm Management
EX = Extension and/or ALDEP
VS = Veterinary Service

TR = Trial
SU = Survey

[b] Indicates number of years already undertaken.

research work which has been completed. Selected databases created over the last six years will be documented. The entire team will participate in finalizing the "Farming Systems Handbook for Botswana."

In the 1989-90 crop season, the agronomy research in Tutume Agricultural District will focus on the same primary issues as last season. That is, it will continue to focus on water conservation and improved tillage/planting systems, largely in collaborative trials with ALDEP. Further, examination of the potential of other useful interventions will be conducted through farmer group activities. There will be continued collaboration with extension in the area of technology testing, adaptation and dissemination through work with two farmer groups in the Communal First Development Area, NE District.

Animal production work will continue with the objectives of investigating small stock losses, especially as they relate to management-related problems. Descriptive work will continue on the identification of production parameters of goats in the smallholder sector. The focus of the testing stage will center on the management systems for goats, purpose grown fodder and its intensive usage. Day-to-day management and data collection for the projects will be completely localized by the end of the year. Current structure of the project and status of the animals will be maintained so that all data currently being collected can be completed. The facilities and livestock will be maintained in such a manner that research can be continued without interruption when complete localization occurs, and the expatriate technical staff leave.

The 1989-90 season will complete the localization of the farm management section, with all of the trial-related activities supervised by the Motswana agricultural economist assigned to the team. Activities will emphasize continued collaboration in the agronomy and animal production trials to collect data and to provide an economic analysis of the trials; and participation in farmer group activities to obtain farmer assessment of trials during the year and to increase team understanding of farmers' attitudes. Assistance will be provided to DAFS staff who are working with similar groups in non-ATIP villages.

Expatriate staff will continue analysis and documentation of descriptive/diagnostic and trials data already collected, with preparation of final reports on most trials and surveys. In order to promote the acceptance of the farming systems approach to research, emphasis will be placed on improving channels of communication with other organizations, providing information on ATIP for dissemination in extension publications, and addressing methodological issues with the entire ATIP team.

1.6 OTHER INFORMATION

During the year a large number of visitors made contact with ATIP staff, while ATIP also hosted the Annual Farming Systems Workshop in Mahalapye and Francistown which was attended by about 70 people from different departments in GOB.

During the year a number of papers were produced, a detailed list of which is given at the end of this report.

Rough estimates indicate the recurrent cost to GOB of ATIP and ATIP-related activities for the period September, 1989 to August, 1990 will be in the region of P660,086 of which P275,975 is a short-run commitment -- mostly training -- that GOB should not have to incur

in the long-run. As far as USAID support is concerned, costs that will eventually have to be absorbed by GOB are estimated to be around P142,016 for the period September, 1989 to August, 1990.

It is anticipated that a major activity during the next few months will be in helping, as requested, to ensure a smooth transition of activities to be undertaken after the end of the ATIP contract in September, 1990, and in institutionalizing farming systems work in the Department of Agricultural Research in the Ministry of Agriculture. The principle of doing this has already been accepted within the MOA.

CHAPTER 2: ATIP STATUS

2.1 INTRODUCTION

The last External Evaluation of ATIP took place in 1986. At that time a number of recommendations were made (see Table 3.1 in ATIP Annual Report Number 5). In preparation for the Internal Review that has recently been completed, a status report on progress with reference to the 1986 recommendations was made. This progress is summarized in Section 2.2.

Because a number of changes have taken place during the last two to three years, a revised logframe was developed. This revised logframe presented in Table 2.1 has now been approved by the Director of DAR, by the Ministry of Finance and Development Planning, and by the former ADO and the Director of USAID/B. The revised logframe places greater emphasis on encouraging the acceptance of the process of FSW in Botswana, and less on being responsible for institutionalizing it. This recognizes who is ultimately responsible for making such decisions, and the necessary trade-off decisions that GOB has to make in the allocation of scarce resources.

It is obviously important that ATIP fulfills the obligations outlined in the logframe. Therefore, in Section 2.3 an attempt is made to incorporate the earlier comments of individuals into the project outcomes listed in the logframe. Individuals whose comments were solicited included the Directors of DAR and USAID/B, the former ADO and ATIP staff. There is also an attempt to include recommendations arising out of the Internal Review which was undertaken by Ms. T. Melaku (DPS, MOA), and Drs. K. B. Paul and B. McColaugh (REDSO, Nairobi) in October-November, 1989.

In order to present comprehensive accounts in Sections 2.2 and 2.3, there is inevitably some repetition in the material presented.

In general, the following discussion indicates major benefits resulting from extending the initial five year ATIP project to an eight year life. The support of USAID/B and GOB in facilitating this has been critically important. The Internal Review notes the importance of longer-term horizons with respect to projects analogous to ATIP.

2.2 ATIP PROGRESS ON RECOMMENDATIONS OF 1986 EVALUATION[1]

In discussing progress on the recommendations arising out of the 1986 External Evaluation, the recommendations are ordered in terms of the time by which action was supposed to be completed. In general progress has been made on most of the recommendations although action often took longer than envisioned in the evaluation. Progress on each of the recommendations is as follows:

1. **One or more qualified Batswana should be assigned to the RECU when the**

[1]. The figures in the brackets refer to: (a) the number of the recommendation in the Evaluation Report, (b) the agencies responsible for action being taken and, (c) the date the action was supposed to be completed by.

TABLE 2.1: NEW APPROVED ATIP LOGICAL FRAMEWORK, JULY 1989

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
A-1. Programme or Sector Goal: the Broader Objective to which this Project Contributes:	**A-2. The Measure of Goal Achievement:**	**A-3.**	**A-4. Assumptions for Achieving Goal Targets:**
To assist the GOB in developing an agricultural system that provides relevant technology leading to increased productivity for Botswana farmers	Organizational changes made within MOA to institutionalize FSW.	MOA official papers.	Agricultural research and extension continue to be high priorities of GOB, and that MOA will review the effectiveness of its approaches.
	Increased returns to labor and other inputs demonstrated.	Farm surveys.	
	Increased crop production under specified rainfall conditions.	Farm surveys and meterological data.	The amount and distribution of rainfall is sufficient to enable production to occur.
B-1. Project Purpose:	**B-2. Conditions that will Indicate Purpose has been Achieved: End-of-Project Status:**	**B-3.**	**B-4. Assumptions for Achieving Purpose:**
To improve the capacity of the Ministry of Agriculture's research and extension programmes to develop and effectively extend improved technology and practices relevant to the needs of small farmers in selected pilot areas.	The Ministry of Agriculture's DAR will be able to participate effectively in on-going FSW and be responsive to farmers' needs.		
Sub-Purposes:			
(a). Improve the capacity of the Ministry of Agriculture's Research (DAR) to develop technologies for small farmer needs.	1. On station agronomic research at DAR strengthened in sorghum, millet and cowpeas.	DAR's Annual Report and records. Reports of INTSORMIL and Bean/Cowpea CRSP.	That potential exists in the agricultural system to improve productivity.
	2. Systems established for DAR to respond to requests from farming systems teams and conduct trials based upon these requests.	Records of meetings/workshops held with DAR/DAFS staff.	That research for small farmers continues to be given high priority.
(b). To improve the capability of the extension service to transfer appropriate technologies and strengthen the linkages between research, extension and farmers.	Improved linkages will have developed between the MOA research, extension and planning, resulting in more relevant adaptive technologies.		That the extension positions in the pilot area will be staffed and have sufficient time to engage in farming systems related work.
	1.The Subject Matter Specialists trained and working effectively.	MOA staffing pattern and manpower training plans.	
	2. DAFS disseminating tested technologies in the ATIP areas.	DAFS and contractor records.	That improved technologies can be identified, tested and made available for extension.

TABLE 2.1: NEW APPROVED ATIP LOGICAL FRAMEWORK, JULY 1989 (CONTINUED)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
(c). To provide Botswana farmers in selected pilot areas with relevant innovations in agricultural production technology and methods through field trials, demonstration and farmer training.	Technologies identified which improve returns to labor/capital and/or increased production and/or reduce risk of failure.	Project Records.	
C-1. Project Outcomes	**C-2. Magnitude of Outputs:**	**C-3.**	**C-4. Assumptions for Achieving Outputs:**
(a). Farming systems designed, developed and tested in two areas.	1. Progress has been made towards localization of farming systems work.	Project Records.	That the GOB will implement its current research strategy.
	2. Handbook for farming systems work in Botswana prepared.	Project Records.	
	3. Alternative crop and livestock technologies tested on farmers'farms at ATIP locations.	Project Records.	That potential exists in system to improve new technologies.
	4. Helped DAR in implementing a system for approving recommendations for onward transmission to DAFs.		That DAR has capacity to test technologies. That DAR is able to respond to FSW requests for on-station trials.
(b). Institutional capability and skills developed within MOA to carry out FSW in selected pilot areas.	1. Qualified staff developed in needed speciality areas, 25 persons trained at the M.S. and B.S. level, 27 in short-term farming system related courses, and 156 in in-service training courses.	MOA Records.	That sufficient numbers of qualified staff can be released for training
	2. Helped DAR, as requested, in evaluating farming systems work.	Project Records and GOB policy/planning documents.	That GOB concludes farming systems work has merit and has the resources to incorporate it.
	3. Helped DAR, as requested, in establishing systems for integrating research, extension and planning to maximise the benefits of FSW.	MOA Records.	That DAFS, DAR and DPS are willing and able to share responsibility for farming systems work.
(c). Necessary FSW support activities strengthened.	1. Seed Multiplication Unit strengthened and progress made on localization of all positions.	MOA Records.	
	2. Training plan implemented for at least 6 Subject Matter Specialists		
	3. On-station agronomic research programmes on sorghum, millet and cowpeas strengthened.		Bean/Cowpea and INTSORMIL Projects will continue to receive the bulk of their training and TA support from centrally funded CRSP projects.

TABLE 2.1. NEW APPROVED ATIP LOGICAL FRAMEWORK, JULY 1989 (CONTINUED)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
(d). Research and information	1. ATIP socio-economic and technological data systematically entered on microcomputers to facilitate future data collection and accessibility by trained Batswana.	Project Records.	
	2. Data collected by ATIP made available and used by other GOB personnel	Project Records.	That other GOB staff perceive a use for the data and can easily access it.
D-1. Project Inputs:	**D-2. Implementation Target**	**D-3.**	**D-4. Assumptions for Providing Inputs:**
(a). AID:			
Technical Assistance	56.5 person years long-term.	AID Records.	That funds are made available from bilateral and supporting centrally funded sources.
	52 person months of short-term consultancies.	AID Records.	
Local Staff Training	8 person years.	AID Records.	
	45 person months of short-term training.	AID Records.	
	52 person years of long-term training	AID Records.	
(b). GOB:			
Counterparts	109 person years.	GOB Records.	That funds are available.
Other Staff	10 person years PCVs (local support costs).	GOB Records.	
	16 person years secretaries.	GOB Records.	
	24 person years drivers.	GOB Records.	
	176 person years technical staff.	GOB Records.	
	Casual labor (P4,000/year for eight years.	GOB Records.	
Commodities	5 vehicles and replacements.	GOB Records.	
	14 houses for MIAC staff and counterparts.	GOB Records.	
Training	15 person years.	GOB Records.	

present RELO counterpart goes on training (1; MOA/AID; 8/86). Mr. G. Ramolemana was reassigned to RECU after his return from New Mexico State University on completion of an MS degree in Agronomy, in August, 1987.

2. **The GOB should establish a system for more timely submission of AID payment vouchers** (25; MOA/AID; 9/86). This has never been resolved satisfactorily, but both GOB and AID have been more liberal in their actions. AID have been willing to issue larger PILs and also have been willing to issue another PIL before all the funds on the previous PIL have been accounted for. GOB have, when necessary, permitted overspending pending final approval on a new PIL. ATIP funds have also recently been used to purchase a microcomputer plus printer for the Finance Officer, MOA, which should help improve the efficiency of the submission process to AID.

3. **Suitable housing should be provided for all professional Batswana assigned to the field teams** (6; MOA/AID; 9/86). Little progress has been made, particularly in Francistown, where none of Batswana professional staff have been provided with housing. Housing shortages are particularly acute in Francistown, and there appears little can be done on the part of GOB to resolve this problem. The housing shortage exists for all GOB employees in Francistown. However, in Mahalapye all the professional staff now have housing.

4. **USAID and MIAC should seek additional funds for long and short-term training for FS related positions** (11; MIAC/AID; 9/86). More funds for long-term and short-term training were allocated in the current contract. In addition, GOB have provided the matching long-term funds they agreed to in the original project agreement. Also, advantage has been taken of opportunities for fully or partially funded short-term training by other agencies, e.g., CIMMYT, SIDA, etc.

5. **The project should employ administrative and computer help for the COP** (16; MIAC/AID; 9/86). Additional administrative support was hired in September, 1988, and is working out very well. There were a number of reasons for the delay in fulfilling this recommendation, some of which were the responsibility of the ATIP COP. The person filling this post (Mrs. J. Snyder) also does some editing and word processing for other staff in DAR.

6. **AID should determine what local currency expenditures are eligible for project funding, articulate this to ATIP and establish suitable reimbursement procedures with the GOB** (24; AID; 9/86). No written instructions have been received, but the issue seems to have been resolved in that a good deal of equipment, especially desktop microcomputer and printing equipment, is now purchased in Botswana using funds outside the MIAC contract.

7. **Project funded participant trainees in the USA should be kept fully informed about current ATIP activities and operations** (27; MIAC; 9/86). A monthly newsletter on ATIP activities has been initiated and is distributed to ATIP-related trainees in the USA on long-term training.

8. **Project funds should be provided to complete the Agrifacts update and facilitate the publication and distribution of Agrifacts and the Extension Handbook** (21; AID/ATIP; 10/86). A number of Agrifacts have been updated and ATIP funds have been used to set up a small printing press in the Agricultural Information Section, in DAFS. A microcomputer plus scanner and a laser printer were also purchased. An experienced PCV is training Batswana in the use of all the equipment. The

installation of the equipment has greatly speeded up the process of publication of Agrifacts, Agrinews, etc., within the MOA. All departments within the ministry now make use of this facility, including DAR, where another laser printer and related computer equipment has been purchased with ATIP funds, for the use by the department as a whole.

The recommendation on the Extension Handbook is unclear -- the COP ATIP is unaware of the existence of such a document.

9. **The ATIP project should provide funds to enable its professional staff to attend and participate in regional and international seminars and workshops** (18; AID; 11/86). Funds have been made available for AID-funded ATIP professional staff to attend one international seminar or workshop per two-year tour. Two or three staff have participated in this.

10. **Alternative strategies for institutionalizing or gaining greater acceptance of FSR should be developed** (2; ATIP; 12/86). GOB has now accepted, in principle, that FSW will continue in Botswana after the end of ATIP in September, 1990. The Director of DAR (Dr. L. Gakale) is supportive of this. Also currently plans are being finalized within GOB to place all farming systems type work in DAR. It is also likely that a national coordinator for farming systems type work will be appointed. Thus, Farming Systems Southern Region (FSSR) and the Molapo Development Project (MDP) will be transferred to DAR in the near future. The most likely model for FSW appears to be one of establishing regional sub-stations or experimental fields at which are stationed teams responsible for on-station and on-farm work. It is likely that what will happen, will depend to some extent, on the recommendations arising out of the proposed ISNAR mission, which in February will look at DAR as a whole. Current indications are that FSW-type activities will continue in the Mahalapye and Francistown areas.

11. **The current placement of the RECU under the Crop Production Division of DAFS needs to be reassessed. The positioning and status of the RECU needs to be elevated -- so that it can more realistically perform its research, extension and training coordination role** (3; MOA/AID; 12/86). A formal proposal for the functioning and location of RECU was submitted to the former Director of DAFS (Mr. T. Taukobong) in January 1988. Since then two further developments will likely have an influence on the future location and activities of RECU. The recently completed Agricultural Sector Assessment Study has recommended that the RECU should be relocated under the office of the Deputy Permanent Secretary. Also the former AID-funded technician (B. Hill), due to unforseen personal circumstances, had to leave at the end of his current two-year tour in November, thereby creating a dilemma as to what should be done by ATIP during the remaining few months of ATIP. A meeting is shortly to be held between the Deputy Permanent Secretary (Mr. T. Taukobong), the Directors of DAFS and DAR (Mr. F. Tibi and Dr. L. Gakale), and the COP of ATIP which will hopefully sort out what will happen to the RECU.

12. **Every member of the ATIP team should be responsible for establishing good linkage relationships between research and extension** (4; ATIP; 12/86). A major effort has been made to develop linkages with extension over the last three years. There have been particular successes at the field level in the Mahalapye and Francistown areas.

Linkage activities have included:

Collaboration in Extension-Led Farmer Groups (Francistown)
Collaboration in the National Tillage Trial (Francistown and Mahalapye)
Discussion of proposed work program (Francistown and Mahalapye)
Collaboration in row-planting courses for farmers (Mahalapye)
Collaboration in organizing row-planting competitions at Agricultural Shows (Mahalapye)
Lectures on FSW and collaboration at In-Service Training Courses for Extension Staff (Sebele)
Collaboration with ALDEP in forage trials, and processing forage surveys (Francistown, Mahalapye and Sebele)
Collaboration with ALDEP and FSSR on a row-planter condition survey (Francistown, Mahalapye and Sebele)
Etc.

At the 1989 Farming Systems Workshop hosted by ATIP in Mahalapye and Francistown, the theme was Linkages. At the final session of the workshop, a proposal was made that linkages should be more formalized. A working group was appointed to further develop the recommendations arising out of the workshop, which would then be discussed further with senior officials in MOA. Because of changes taking place in MOA, and The Agricultural Sector Assessment Study which has recently been completed, the working group delayed further action. In fact at the meeting of the working group on 7th December, it was apparent that a number of the major recommendations arising out of the workshop had already independentiy occurred or would occur in the near future. Nevertheless, based on the meeting, proposals on the other recommendations are being prepared for submission to the Directors of DAR and DAFS.

13. **A qualified Motswana should be assigned as counterpart to the ATIP COP** (5; MOA/AID; 12/86). Because so many individuals are currently away on training, it has been impossible for DAR, until very recently, to fulfill this recommendation. With the return of Mr. J. Luzani in July 1989, who was posted back to Mahalapye to work with Dr. J. Siebert, Mr. E. Modiakgotla was transferred to Sebele to work with the ATIP COP.

14. **ATIP should establish better working relationships with on-station researchers** (7; ATIP/MOA; 12/86). This linkage has developed steadily over the years with the result that nearly all of the survey, study and trial work is linked in some way with on-station research. Examples of such linkages are:

Several disciplines	-- National Tillage Trial
INTSORMIL	-- kraal manure
Cowpea researchers	-- cowpea variety trials, bean survey
Groundnut researchers	-- variety, hilling and seed dressing trials, groundnut package trial, planter testing
Cereal researchers	-- variety testing
Weed researchers	-- Dutch hoe testing, inter-row cultivation trial
FMDU	-- equipment testing, planter condition survey
Veterinary laboratory	-- post mortem on goats
Etc.	

Linkages are likely to become even stronger with the creation of the Program Research Teams, proposed by the Acting CARO (Mr. O Mmolawa), and agreed to in principle at the Annual Arable Research Division Meeting held in September, 1989. A working group, of which the ATIP COP is a member, has recently been appointed to develop proposals for the operation of these teams and the proposed revitalized Recommendations Committee.

15. **Remaining GOB long-term training funds should be programmed primarily for professional training of extension staff** (10; MOA/ATIP; 12/86). Efforts have been made to identify suitable extension staff for long-term training. In terms of long-term training it appears that ATIP funds and GOB-matching funds are to be used in the following way:

Complete support:	DAR:	3 BS degrees;	5 MS degrees	
	DPS:	5 BS degrees;	3 MS degrees	
	DAFS:	4 BS degrees;	4 MS degrees;	1 Non-degree
Partial support:	DAR:	--	1 MS degree ;	1 PhD degree
	DPS:	--	1 MS degree	

For further details on training, see later sections in this report (Section 2.3, Chapter 4 and Chapter 10).

On the whole, training funds have been equitably distributed between DAR, DAFS and DPS.

16. **Training in the FS approach to research and extension should be included in the BAC curriculum** (12; MOA/ATIP; 1/87). A number of lectures have been given at BAC, on FSR, by the ATIP COP. In addition, last year the ATIP COP taught an introductory agricultural economics course to the first year BSc agriculture students at the University of Botswana, in which the topic of FSW was introduced. However, beyond these activities little progress has been made in implementing this recommendation. It should be borne in mind that ATIP is located in DAR and consequently has limited influence on what happens in BAC. Some financial support was provided from ATIP funds to provide temporary lecturer support in launching the BSc degree program.

17. **Data gathering, management information systems and computer training should be provided for Batswana counterparts on the FS teams and also appropriate RSU staff** (14; ATIP; 3/87). During the last three years there has been a major change with respect to computing equipment. With the establishment of firms selling IBM-compatible equipment in the Gaborone area, the decision was made to replace the Apple systems with IBM-compatible equipment. This has been done, and as a result a substantial amount of computing equipment now exists. It is being used by many individuals in the department. ATIP has sponsored training in Word Perfect for four clerical staff, while professional staff are slowly developing expertise in the use of DBase 3+, Lotus 123 and MSTAT. Another simple statistical package, ABSTAT, has recently been introduced, while SPSS -- because of its complex nature -- is being used only when necessary. Much data have also been successfully transferred from the Apple to the IBM system with the help of Matchpoint.

Because of instituting a new system and many other commitments, progress on documenting old databases has been very slow.

18. **The DPS should recognize the planning and policy assistance possibilities offered in the FS perspective aspects of the ATIP project, and participate more fully in FS teams' efforts** (22; MOA; 3/87). There have been few developments on this front. Working on the technology front is deemed by GOB to be the dominant mandate of ATIP, with the proviso that any policy issues arising from ATIP's work should be channelled to the Policy Committee through the Director of DAR. However, during the last three years, ATIP staff have been involved in:

(a). Providing background information and papers for The Agricultural Sector Assessment Study.

(b). At the request of the Chief Agricultural Economist, cooperating with FSSR and ADNP, in a survey on the "Impact Assessment of the ARAP and Drought Relief Programmes". (For a summary statement of the findings, see the Executive Summary (EP 88-4).

(c). The COP ATIP has, in the last year or so, been increasingly requested by DPS to comment on DPS documents, proposed consultancies and reports produced by consultants.

19. **The question of expanding FS work into commercial farming areas should be addressed in the upcoming Agricultural Sector Assessment Study** (26; MOA/AID; 6/87). This issue was apparently not addressed in the Agricultural Sector Assessment Study, and as a result nothing has happened.

20. **Institutionalization of Farming Systems should be considered during the upcoming Agricultural Sector Assessment** (9; MOA; 6/87). Progress on this has been made independent of the Agricultural Sector Assessment Study -- see, for example, item 10 above.

21. **ATIP needs to articulate FSW better to decision makers at the senior levels in the MOA** (1; ATIP; 6/87). There has been increased acceptance of FSW at the senior level -- for example, see item 10 above. Other indicators of increased understanding and acceptance of FSW, particularly at the middle level, have been:

(a). A CIMMYT/ATIP sponsored tour of farming systems work in Ethiopia and Zimbabwe by GOB officials and the RELO (see MP 88-19).

(b). The 1989 Farming Systems Workshop hosted by ATIP which was attended by about 70 people with representation from all areas in MOA (see item 12 above).

(c). The considerable amount of progress that has recently been made in developing linkages -- which to date have been based on goodwill rather than being formalized in any way.

22. **Channels should be established for ATIP to provide useful and timely information for DPS planning and policy decision making** (19; MOA/ATIP; 6/87). There is nothing further to report on, over and above that discussed in item 18 above.

23. **The COP should spend more "quality" time interacting with the ATIP FS field teams** (15; COP/MIAC; 6/87).

This has been improved in the last year or so. Relevant points to note are:

(a). The frequency of ATIP meetings has increased to about six per year, with increased emphasis on professional rather than simply administrative matters. Agendas have been circulated to the Director of DAR, CARO, and CAPRO with invitations to attend. The Director has, on occasion, attended for specific items.

(b). Much more time has been spent on professional matters -- thanks in part to the additional administrative support -- in giving advice, help in designing surveys, help in analyzing surveys and trials including the National Tillage Trial, etc. The interaction has been helped through increased visits by ATIP staff to Sebele, and the formation of an advisory group for ATIP Mahalapye.

(c). During the last year, frequency of visits to the field has not been as great as desirable, particularly to Francistown. This is because of other commitments and the feeling that it was not critically important since frequent interaction has been maintained. Whether this is perceived as a problem remains to be determined. Special efforts have been made to keep close contact with Mahalapye which has been faced with greater turnover in professional staff.

24. **In-service FS training should be provided for RSU/DPS and DAFS staff, especially DAOs and ADs** (13; ATIP/MOA; 12/87). Although some invitational talks have been given on FSW at in-service training sessions, this recommendation has not been fulfilled to the degree that is desirable. It is hoped that this can be fulfilled to a better extent once the "Farming Systems Handbook for Botswana" has been completed (see item 25 below).

25. **ATIP should develop an instructional guide on suitable FS methodologies for Botswana's unpredictable and difficult growing conditions** (17; ATIP; 12/87). It is recognized that a farming systems handbook is critically important. It is not intended that this will be a comprehensive handbook since several are already available. Instead, it will concentrate on the approach being used in Botswana. It will also contain references to other manuals where further details on specific methodological issues can be found. Although ATIP is playing a major role in developing the handbook, it is important to develop it in collaboration with other farming system teams in Botswana. Currently, ATIP is placing some emphasis on writing the handbook, a rough draft of which should be completed by the end of January, 1990. Dr. F. Worman, Mrs. J. Snyder and the COP ATIP are expected to play major roles in getting the handbook finalized.

26. **The funding for Bean/Cowpea CRSP participant trainees should be continued until completion of their degree programme** (23; AID; 12/86). The Cowpea Agronomist (Ms. M. Manthe), departed in September, 1989 to study for a PhD at Michigan State University. Obviously, ATIP will not be able to fund her program for more than one year. Consequently, it is likely that the SADCC regional Legume Program will fund the remaining part of her studies.

27. **To assist in the U.S. institutional development in the area of international agriculture, MIAC should consider campus appointment for the highly trained and field experienced ATIP staff upon completion of their Botswana assignments** (28; MIAC/AID; 12/87). It is extremely difficult for MIAC to guarantee long-term employment for AID-funded technicians. However, recently Kansas State University have made a commitment to employ Drs. G. Heinrich, J. Siebert and F. Worman for at least six months after the end of the ATIP contract on September 28th, 1990. This will give them a chance to seek other assignments on their return to the USA, while at the same time providing some short-term assistance in the international activities of MIAC.

28. **The ATIP should consider moving some of its field staff to Sebele to interact with station research and backstop FS field teams** (20; ATIP/MOA/AID; 6/88). GOB did not approve the move of Drs. J. Siebert and D. Baker to Sebele. Dr. D. Baker left Botswana in August, 1988, while Dr. J. Siebert is still stationed in Mahalapye. However, Mr. E. Modiakgotla, formerly stationed as an Agronomist in Mahalapye, was transferred to Sebele in July, 1989 (see item 13 above).

2.3 ATIP PROGRESS AND PLANS WITH RESPECT TO THE LOGFRAME

The following discussion is structured according to the anticipated project outcomes listed in the recently approved logframe, which is given in Table 2.1. Also reference is made, where relevant, to recommendations arising out of the recently completed Internal Review.

2.3.1 FARMING SYSTEMS APPROACH DEVELOPED AND TESTED[2]

1. **Progress made towards localization of farming systems work** (5, 6 and 20). Efforts in this area will continue. There are five Batswana counterparts[3] for the six USAID-funded technicians[4]. Although the future of on-farm work in the Mahalapye and Francistown areas will likely, to some extent, depend on decisions made after the visit made by the ISNAR consultants next February, it is certain that farming systems work will continue in some form. Currently there is a move towards introducing a coordinator for farming systems work, and having one USAID OPEX-funded person who will act probably act as an "advisor" and will be an Agronomist. Tentatively it is planned that this person will take up his/her position in April, 1990, and may be stationed in Francistown. In the meantime, on-the-job and short-term training opportunities will continue to be sought for the Batswana associated with the project. There is also the possibility of a post-contract linkage between MIAC and GOB to provide some continuity and to help in the localization process.

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[2]. The figures in brackets in Section 2.3.1 refer to the relevant recommendations in the Internal Review. They appear on pages 40 to 43 of the Internal Review report.

[3]. A counterpart, according to the Director of DAR, is one who has at least a BS degree.

[4]. One of counterparts, in a sense, could be considered a counterpart to the USAID-funded Agricultural Economist who left in August, 1988. Also with the departure of Dr. Hill, there are now only five USAID-funded technicians. Currently, the Agronomist and Animal Scientist at Francistown, do not have counterparts, although they do work with technician-level colleagues of certificate or diploma level.

2. **Handbook for farming systems work in Botswana prepared** (18). Some priority will be given to the preparation of the handbook during the next few months. The reason for this is that staffing of all the farming systems teams, in Botswana, is changing somewhat frequently, and such a handbook can help provide some continuity in terms of the approach to be used. References have been prepared and the draft is nearing completion. As indicated earlier (see recommendation 25 in Section 2.2) it is not intended to be a comprehensive handbook since several are already available. Instead, it will concentrate on the approach being used in Botswana. It will also contain references to other manuals where further details on specific methodological issues can be found. Although ATIP is playing a major role in developing the handbook, it is important to develop it in collaboration with other farming system teams in Botswana.

3. **Alternative crop and livestock technologies tested on farmers' farms at ATIP locations** (2, 10, 12, 13). Although ATIP as a project will finish in September, 1990, much of the work that it has been undertaking is likely to continue. Therefore work during the next year should not focus only on completing current work. Rather a judicious mix is desirable between ensuring completion of some current work, and continuing other work in such a way to provide a smooth transition into the post-project period. Bearing this in mind, work to fulfill the project outcome outlined above can be divided into three parts.

(a). ***Writing up results of past work.*** It is important that current and past research that involved significant contributions by expatriates is written-up prior to their departure. Inevitably there is some backlog built up over the seven years of ATIP's existence. Also there is a need for consolidating some of the earlier reported results in progress and annual reports in a summarized format. Currently it is anticipated that a major report will be produced summarizing work undertaken, main results achieved -- with cross-references to other papers written -- current state of thinking and related suggestions for future work. Although this will be the major document, supplementing it will be a few other papers on specific topics. A tentative list has been discussed amongst ATIP staff.

(b). ***Closure on some livestock and crop technologies.*** It is hoped that during the next year it will be possible, together with others outside ATIP, to bring about closure on a number of technological research items. Many of these involve building on work by scientists outside ATIP, while others involve fine tuning recommendations already in existence. Items on which it should be possible to effect a degree of closure -- that is involve drawing up a new Agrifact or modifying an existing one -- include:

i. Double plowing
ii. Improving the practicality of row-planting through:
    -- the use of a lightweight cultivater, and
    -- in some cases, use of the hand operated rotary injection planter
iii. Improved donkey harnesses (already produced in conjunction with FMDU)
iv. Organizing and running extension-led farmer groups (it may be more appropriate to publish this as an Extension Bulletin rather than as an Agrifact).

At this time there is less certainty about being able to get a sufficient degree of closure on a number of other technologies such as improved cropping systems to reduce the risk of crop failure, for example, band cropping, growing certain crops in sole stands, etc. However, there is the possibility of reviewing existing Agrifacts to

see whether information can usefully be included that indicates what to do if the recommendation cannot be followed in its entirety (i.e., conditional information) and/or under what type of conditions that recommendation works best (i.e., targeting information).

Obviously any recommendations along the lines proposed above will need to be approved by the Recommendations Committee in DAR. Also, of course, during the coming year ATIP staff will continue to play a supportive role in cooperating with extension/development agency in the extension-led farmer groups, training courses for ADs, farmers, etc.[5]

(c). ***New research work during the coming rainy season.*** During the last year of the project (starting September 1989) it is proposed that the expatriates give the Batswana counterparts major responsibility for implementing the research program, in order to free up some time to undertake other items in the work program. Obviously in connection with this, on-the-job training of local staff will continue, as will the continuing development of linkages between on-farm and station research, and with extension. Simultaneously, some time will need to be spent by all staff in producing the "Farming Systems Handbook for Botswana", in writing the summary report, and analyzing and writing up other results from other trials, studies and surveys for which there is currently no documentation. This plan has the support of the Batswana counterparts, who wish to have one year of trial, study and survey work for which they are primarily responsible, with expatriates available to provide guidance, if so required. Consequently, due to less manpower being available for field work, the size of the field research program is being cut somewhat during the coming year.[6]

4. **Helped DAR in implementing a system for approving recommendations for onward transmission to DAFS.** A Recommendations Committee is in the process of being established which will evaluate possible recommendations. Terms of reference and operation are currently being developed, and hopefully the committee

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[5]. The area of technology transfer is one of the few areas where there may not be complete unanimity in the perceptions of USAID/B and ATIP staff (see recommendation 2 in the Internal Review Report). However, this may be more a question of semantics rather than substance. ATIP staff certainly have a major role in supporting the activities of extension/development staff who have the resources and capabilities to work with the mass of small farmers. This supportive role of ATIP has been well illustrated recently by the ALDEP Reformulation Consultant group spending a considerable amount of time talking with ATIP staff about the extension led farmer groups, farmer training courses, etc.

[6]. The relative time allocation issue is probably the other major difference between the view of the Internal Review team, and the perception of ATIP staff (see recommendation 10 in the Internal Review report). However, it is probably unrealistic to put percent allocations on time to different tasks, since there is considerable overlap between many of the activities. For example, nearly all trial work is linked with on-station research. Hence any time spent on such trials is also time spent on furthering the link. Probably, the most realistic approach is to recognize that staff need to engage in all the activities specified, and that problems will arise if they are not all fulfilled. A personal concern of the ATIP COP is that unless recognition is given to the importance of the final documentation before the end of the contract, the payoff to GOB of the ATIP program will be diminished, and the handing over process will not be smooth.

will be fully operational in early 1990. Complementing the Recommendations Committee is the recent decision to establish Program Research Teams around commodities and subject areas, that will encourage more of a team approach and hence greater integration of research undertaken by individual researchers. Once again terms of reference and operational procedures are currently being developed for them. Thus there does not appear to be much more effort required in this area, apart from submitting for consideration recommendations arising out of activities described under 3(b) above.

2.3.2 INSTITUTIONAL CAPABILITIES DEVELOPED IN MOA

1. **Qualified staff developed in needed specialty areas** (9, 11 and 17). In terms of long-term training, 25 persons are supposed to be trained. Complete support has been given for 25 degrees, and partial support is being given to three others. Because of the end of the ATIP contract in September, 1990, all those due to complete their training under contract funding have been informed that they must return to Botswana at that time. GOB is arranging alternative funding after August 1989 for those who will not have completed their studies by that time. For those being trained with GOB matching funds, there appear to be no constraints on when the funds have to be committed by.

   Twenty-five individuals have received short-term training in farming systems research or closely related topics. Twenty-five were in fact scheduled in the logframe. Thus obligations in this area have been fulfilled, although there is no reason why more training cannot be done. It is anticipated, for example, that participants will, during the coming few months, be sent to the annual farming systems courses sponsored by CIMMYT and the University of Zimbabwe.

   In terms of in-service training, 268 individuals have attended courses of one sort or another, out of 156 that were scheduled in the logframe. Thus, once again, obligations in this area have been fulfilled although there is no reason why more training cannot be done[1]. On-the-job training of ATIP staff will also continue to be emphasized.

   Finally, several ATIP staff members have given seminars, lectures and courses to extension staff, and to students at BAC and the University of Botswana. During the coming year, time permitting, such requests will continue to be fulfilled.

2. **Helped DAR, as requested, in evaluating farming systems work** (19). An offer was made for ATIP funds to be used in partially supporting the proposed visit by ISNAR consultants. However, this not be necessary, since NORAD have agreed to completely fund the visit. The ISNAR consultants will be looking at DAR as a whole, but their terms of reference includes looking at the relationship between on-station and on-farm work. ATIP staff will help the consultants in anyway requested by the Director of DAR.

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[1]. One of the recommendations in the Internal Review report (number 17) is that ATIP staff should encourage and assist the DAFS Training Officer to provide quality in-service training to ADs. The responsibility for the Training the Trainers Program is now that of the DAFS Training Officer. ATIP staff will obviously respond to requests for help, but probably help is more likely to be given via the extension-led farmer groups and farmer training courses in which ADs play major leadership roles.

The MOA in general, and the Director of DAR, in particular, have decided to continue farming systems research after ATIP finishes. FSSR and MDP are to be absorbed under DAR thus placing all the farming systems teams under one department. Also there is likely to be national coordinator for farming systems research who will located in DAR. ATIP will obviously respond positively to any requests from the Director DAR for help in evaluating and institutionalizing farming systems research.

3. **Helped DAR, as requested, in establishing systems for integrating research, extension and planning to maximize the benefits of FSW** (14, 15 and 16). Emphasis on further development of the existing informal links will continue. However, there are two areas which need attention over the next few months:

   (a). Ascertain GOB interest in some formalization of linkages, along the lines discussed at the farming systems workshop. Responsibility for this lies with the group nominated at the 1989 Farming Systems Workshop (hosted by ATIP), which is chaired by the former Coordinator of ALDEP. Because of major changes in MOA during the last few months, some of the recommendations have now been met. The group has met to consider those that still need to be addressed and a proposal is now being developed for submission to the leadership in DAR.

   (b). Ascertain GOB plans for the future of the RECU, and if so desired, what supportive role can be provided by ATIP. This hopefully will arise out of a meeting shortly to be held with the Deputy Permanent Secretary, the Directors of DAR and DAFS, and the COP of ATIP.

   On the related issue of improving communication and information dissemination, additional printing equipment for the desktop publishing system -- set up in the Agricultural Information Section in DAFS with ATIP funds -- has recently been purchased, also with ATIP funds. This has greatly improved the timeliness in the production and distribution of agriculturally-related materials in MOA.

2.3.3 NECESSARY FSW SUPPORT ACTIVITIES STRENGTHENED

1. **Seed Multiplication Unit strengthened and progress made on localization of all positions**. With the departure of the Seed Multiplication Advisor, it is not anticipated that ATIP will provide any further input into the Seed Multiplication Unit.

2. **Training plan implemented for at least six subject matter specialists**. Two have been trained, and four are currently away on training.

3. **On-station agronomic research programs on sorghum, millet and cowpeas strengthened**. Currently plans are as follows:

   (a). ATIP will provide about $40,000 towards the support of the INTSORMIL program in Botswana during the coming year.

   (b). INTSORMIL will fund one position in Botswana starting in September, 1990.

   (c). ATIP are supporting, for one year, the Ph.D training of the Cowpea

Agronomist in DAR.

2.3.4 RESEARCH AND INFORMATION

1. **ATIP data entered on microcomputer to facilitate future data collection and accessibility**. A format for storing data has been developed but very little else has been done. Because it will require a substantial amount of time, and an understanding of the design and implementation of the study, survey or trial itself, to document the data properly, the intention is to only document the more important databases that are potentially useful to other GOB staff.*

2 **ATIP data made available to and used by other GOB personnel.** This outcome can easily fulfilled once activity 1 above has been completed

2.4 OTHER RECOMMENDATIONS IN THE INTERNAL REVIEW REPORT

Six recommendations in the Internal Review report (i.e., recommendations 1, 3, 4, 5, 7, and 8) were not referred to in the preceding section. All of them require an input from USAID/B if they are to implemented. One (recommendation 1) refers to procedures for modifying the baseline, two recommendations (3 and 4) to the procedures for establishing a post-project linkage between MIAC and GOB, and two (recommendations 7 and 8) to the possible plans for post project evaluation. Responsibility for implementation of these recommendations, if they are adopted, is likely to be mainly that of USAID/B, where necessary in conjunction with other involved parties, e.g., ATIP, MIAC, etc.

*. There is some concern within ATIP as to whether, in the light of all the other proposed activities, whether this can be fulfilled satisfactorily. The basic data are available on catalogued disks but in some cases documentation, which is very time consuming, is somewhat deficient.

PART II: SUMMARY OF ACTIVITIES, SEPTEMBER 1988 - AUGUST 1989

Because this year's report was produced late, some material on progress since August has been included.

CHAPTER 3: PERSONNEL AND EQUIPMENT

3.1 PROFESSIONAL STAFF [9.1][1]

Mr. K. Kelemogile (APRU, DAR), a recent Diploma graduate in Animal Health from BAC, joined ATIP in January, 1989, and was posted to Francistown. Mr. J. Luzani returned in August, 1989 with a BS degree in Agronomy, and was posted to Mahalapye. At the same time Mr. E. Modiakgotla was transferred to Sebele to work with the ATIP COP, although he will continue some professional work in Mahalapye.

In terms of expatriate resignations three occurred, two of which, unfortunately, were health-related. Details of these were as follows:

(a). Dr. B. Hill, in the Research Extension Coordinating Unit (RECU) had to leave at the end of his two year contract because of ill health in his family.

(b). ATIP funding has been used until recently to support a technician in the Seed Multiplication Unit, DAR. Unfortunately, Mr C. Bernhardt, the individual employed in this position, was forced to resign due to ill health and sadly, shortly after, died.

(c). Mr. A. Caplan, PCV stationed at Mahalapye, completed his assignment with ATIP in September, 1989, and joined the Peace Corps Headquarter Staff for a one year assignment.

All have made major contributions, and their services will be sorely missed. USAID/B and GOB have agreed that because of the limited time remaining in the project and the limited funds, none of these individuals, or Dr. D. Baker who left earlier, will be replaced. It has also been agreed that all the currently funded American technicians will stay until near the end of the project. Since the staff adjustments have not resulted in any changes in the purpose or goals of the project it is understood that no contract amendment is necessary. The staff adjustments are compatible with the activities outlined in the revised logframe which was recently approved (see Chapter 2 and Table 2.1).

3.2 SUPPORT STAFF [9.2]

Details on staff changes are given in Table 3.1. Four new staff at the T5 level have been seconded from DAFS, while one person has been transferred out of ATIP. Changes have occurred in secretarial help in Mahalapye, and Ms P. Monyane (computer operator, Sebele) resigned from GOB service and is currently paid out of ATIP project funds. A second driver has been hired for Mahalapye bringing it in line with Francistown where there were already two drivers. A number of changes have occurred in the enumerator cadre.

[1]. In this chapter and Chapters 4 to 7, the figures in brackets refer to the section number where it was discussed as part of the work plan, outlined in Annual Report 6.

TABLE 3.1: PERSONNEL ASSOCIATED WITH ATIP SINCE ITS INCEPTION*

(A). CURRENT

Name	Position	Level	Rank	Station	Started
USAID TECHNICIANS:					
Norman, D.W.	Ag. Econ.	Ph.D	-	Sebele	Aug. 1982
Siebert, J.C.	Agronomist	Ph.D		Mahalapye	Sep. 1982
Heinrich, G.	Agronomist	Ph.D	-	Francistown	Aug. 1983
Worman, F.	Ag. Econ	Ph.D	-	Francistown	July 1985
Thedford, T.	An. Scient	DVM	-	Francistown	July 1988
COUNTERPARTS:					
Modhakgotla, E.	Agronomist	MS	C2	Sebele	Aug. 1982
Ramolemana, G.	Agronomist	MS	C2	Gabor[illegible]	Sep. 1983
Tibone, C. (Ms.)	Ag. Econ.	BS	C3	Francistown	Sep. 1983
Luzani, J.	Agronomist	BS	C3	Mahalapye	Jan. 1984
Makhwaje, E.	Ag. Econ.	B.Sc	C3	Mahalapye	July 1988
TECHNICAL STAFF:					
Masikara, S.	Agronomist	CA	C4	Francistown	Sep. 1983
Kelemogile	Animal Health	DA	C4/C3	Francistown	Jan. 1989
ADMINISTRATIVE ASSISTANT:					
Selelo, L. (Ms)	-	-	-	Sebele	Mar. 1983
Snyder, J. (Mrs)	-	-		Sebele	Sep. 1988
OTHERS:					
Mahilo, C.	Enumerator	-	B3/B2	Shoshong	Sep. 1982
Okaile, K.	Enumerator	-	B3/B2	Makoro	Sep. 1982
Dira, D.	Extension	-	B1	Mahalapye	Oct. 1982
Monyane, P. (Ms)	Computing		-	Sebele	Feb. 1983
Monyadzwe, M.	Enumerator	-	B5	Mathangwane	Oct. 1983
Sibanda, C.	Extension	-	B1	Mathangwane	June 1984
Letswetla, T.	Enumerator	-	Ind. C1	Mahalpye	Jun. 1984
Baatlhodi, J.	Enumerator	-	B5	Marapong	Oct. 1984
Bagai, B.	Extension	-	B1	Matobo	Oct. 1984
Nkhutelang, R.	Enumerator	-	B5	Matobo	Oct. 1984
Tsabadira, R.	Driver	-	Ind. C1	Francistown	Oct. 1984
Gaobone, K. (Ms)	Messenger	-	Ind. C1	Francistown	July 1986
Molapisi, M.	Typist	-	B1/B3	Francistown	July 1986
Bani, I.	Enumerator	-	B5	Shoshong	Sep. 1986
Motsokono, O.	Driver	-	Ind. C1	Francistown	Oct. 1986
Batshani, P. (Ms)	Enumerator	-	B5	Marapong	Oct. 1986
Mpaesele, B.	Driver	-	Ind. C1	Mahalapye	June 1988
Tahbona, K.	Enumerator	-	B5	Matobo	Oct. 1988
Seutele, L.	Extension	-	B3	Francistown	Dec. 1988
Kooneeng, K.	Extension	-	B3/B2	Makwate	Nov. 1988
Alesen.g, B.	Driver	-	Ind. C1	Mahalapye	May 1988
Kemotso, R.	Enumerator	-	B5	Makwate	Aug. 1989
Molefhe, S. (Ms)	Typist		B1/B3	Mahalapye	Sep. 1989
Lebese, D.	Extension		B3/B2	Marapong	Sep. 1989
Otsogile, M.	Enumerator	-	B5	Mathangwane	Feb. 1989
Dintho, O.	Extension	-	B3/B2	Shoshong	Nov. 1899

* The table does not include those that were employed as casual labor or as contract workers under Industrial Class. Also, it does not include the students who work with the project for short periods

TABLE 3.1: PERSONNEL ASSOCIATED WITH ATIP SINCE ITS INCEPTION (CONTINUED)*

(B). PAST

Name	Position	Level	Rank	Station	Started	Ended
USAID TECHNICIANS						
Hobbs, A.	Agronomist	PhD	-	Gaborone	Aug. 1982	Aug. 1985
Koch, B.	Animal Sc.	PhD	-	Francistown	Aug. 1983	Aug. 1985
Miller, W.	Ag. Econ.	PhD	-	Francistown	Aug. 1983	Aug. 1985
Trent, C.	Extension	PhD	-	Gaborone	July 1985	Nov. 1987
Gray, R.	Animal Sc.	PhD	-	Francistown	July 1985	Feb. 1988
Baker, D.C.	Ag. Econ.	PhD	-	Mahalapye	Oct. 1982	Aug. 1988
Hill, B.	RELO Adviser	PhD	-	Gaborone	Nov. 1987	Nov. 1989
COUNTERPARTS						
Monyatsi, T.	Ag. Econ.	MS	-	Mahalapye	Aug. 1982	Dec. 1984
Moremedi, G.	Agronomist	BS	-	Gaborone	Dec. 1982	July 1986
Mahabile, W.	Animal Sc.	MS	-	Francistown	Sep. 1983	July 1988
Iprongo, M.	Ag. Econ.	MS	-	Mahalapye	Sep. 1982	July 1988
Mabongo, B.	Ag. Econ.	BS	-	Francistown	Jan. 1986	July 1988
Seleka, T.	Ag. Econ.	BS	-	Francistown	Sep. 1983	Aug. 1988
Lesotlho, J.	Rural Soc.	DA	-	Mahalapye	Sep. 1984	Dec. 1985
Jonas, C. (Ms)	Rural Soc.	Camb	-	Mahalapye	Jan. 1986	July 1987
PEACE CORPS VOLUNTEER						
Bock, S. (Ms)	Ag. Econ.	BS	-	Francistown	Sep. 1986	Aug. 1988
Caplan, A.	Ag. Econ.	MS	-	Mahalapye	Sep. 1986	Sep. 1989
ADMINISTRATIVE ASSISTANT						
Mophuting, N. (Ms)		-	-	Sebele	Sep. 1982	Jan. 1983
OTHERS						
Motlhokodise, B.	Enumerator	-	Trainee	Shoshong	Sep. 1982	Mar. 1984
Kenpetle, W.	Extension	-	T4	Shoshong	Oct. 1982	July 1985
Mmopi, M.	Driver	-	Ind. C1	Francistown	Sep. 1982	July 1985
Moile, P.	Driver	-	Ind. C1	Francistown	July 1985	Sep. 1986
Sibanda, B. (Ms)	Enumerator	-	GA6	Marapong	Oct. 1983	Dec. 1985
Clifford, J. (Ms)	Typist	-	S3	Francistown	Sep. 1983	July 1986
Senumola, R.	Enumerator	-	GA6	Makwate	Oct. 1984	Mar. 1987
Mosojane, R.	Extension	-	T4	Mahalapye	Oct. 1984	May 1987
Temba, M.	Enumerator	-	GA6	Matobo	Oct. 1984	Aug. 1988
Maperia, L. (Ms)	Extension	-	B3/B2	Makwate	Jan. 1986	Dec. 1988
Mogotsi, G.	Driver	-	Ind. C1	Mahalapye	Oct. 1982	June 1988
Alakanam, N. (Ms)	Enumerator	-	B5	Marapong	Dec. 1988	June 1989
Moabi, D. (Ms)	Extension	-	B3/B2	Marapong	Jan. 1987	Sep. 1989
Seleke, K. (Ms)	Typist	-	S4	Mahalapye	Dec. 1983	Sep. 1989

* The table does not include those that were employed as casual labor or as contract workers under Industrial Class. Also, it does not include the students who work with the project for short periods.

* She is currently away on long term training

3.3 CONSULTANCIES AND VISITS [9.3]

In addition to the Internal Review team, discussed in Chapter 2, a number of other trips and assignments were undertaken by individuals on business associated with the ATIP program. These are discussed in the following two sections.

3.3.1 VISITS

In October, at the invitation of President of Kansas State University (Dr. J. Wefald), the former Permanent Secretary of the Ministry of Agriculture (Mr. M. Mokone) visited the university. He was accompanied by the Chief Agricultural Economist (Mr. G. Motsemme), the former Acting Chief Arable Research Officer (Ms. G. Mapanyane) the Director of USAID/Botswana (Dr. J. Hummon), the former ADO, USAID/Botswana (Mr. P. Daly) and the ATIP COP.

Unfortunately, in return, executive visits by President D. Wefald (Kansas State University), and Dr. V. Larsen (Assistant Provost, International Programs, Kansas State University) were cancelled at the last minute due to urgent issues in the State of Kansas. However, Dr. W. Miller (the newly appointed Executive Director of MIAC) was still able to come. His visit was very useful in promoting discussions with GOB and USAID/B officials concerning what ATIP should do between now and the end of the project on September 28th, 1990 in order to ensure a smooth transition to a period when project funding will no longer be available. Specifically, discussions centered around possible modifications to the existing log frame, OPEX support for one person commencing in April, 1990, continuation of existing expatriates in the project until July-September, 1990 and possible short-term assistance for the Seed Multiplication Unit.

3.3.2 CONSULTANCIES AND STRENGTHENING GRANT TRIPS

First of all, four points about completed field assignments are as follows:

(a). ***Farmer Participation and Evaluation of Groups in Agriculture Production Technology.*** The Rural Sociology Unit (Mrs. Y. Merafe and Mrs. P. Ntseane) and Dr. P. Molutsi and Mr. M. Mogalakwe (University of Botswana) were responsible for undertaking the survey in July-September, 1988. Unfortunately due to the departure overseas for further studies of two of the officers (Mrs P. Ntseane and Mr. M. Mogalakwe), and other commitments of the major author (Dr. P. Molutsi) there have been delays in analyzing and writing up the results of the survey. It is hoped that the report will shortly be available.

(b). ***Librarians.*** Ms P. Wetmore (USDA) and Mr. N. Young, (Developing Countries Librarian, Kansas State University) have recently produced reports on their trip to Botswana, which was largely externally-funded. These reports have been forwarded to the Director of Agricultural Research.

(c). ***Range Management and Geographic Information Service (GIS).*** Drs. D. Nellis and C. Bussing (Geography Department, Kansas State University) and Dr. Coleman (Agronomy Department, Alabama A&M) were in Botswana in June, to give a one-day Workshop in Remote Sensing and GIS at the University of Botswana, and to do some ground truthing for satellite pictures in the Mahalapye and Orapa areas. The object of their visit was to assess the feasibility of using satellite pictures for monitoring the effects of drought on the communal range land areas. Most of the

expenses were externally-funded through a KSU/Alabama A&M Strengthening Grant. A brief trip report was produced, and further reports will hopefully be available in the near future.

(d). ***Computer Applications Specialist.*** Ms. S. Hughes (who is locally hired) has been involved in helping the Agricultural Information Section, DAFS, utilize the desktop publishing system more efficiently, through instructing sectional staff in the use of the MacIntosh microcomputer.

Another Strengthening Grant Trip was approved sometime ago but may not now take place. Dr. B. Schurle (Agricultural Economist, Kansas State University), was scheduled to come to Botswana to collect data for use in modelling and risk assessment. However, he now feels that such a trip is probably unnecessary since most of the data required for the exercise is being provided by the ATIP technicians in the fields.

The situation with regard to consultants proposed in Annual Report Number 6, for the current reporting year, is as follows:

(a). ***Study of Farmers' Evaluation Criteria and the Appropriate Decision Making Unit.*** Permission was not granted for a consultant to work with the Rural Sociology Unit to help in designing, and possibly implementing and analyzing the results of studies in these areas. The primary responsibility for undertaking these studies would have been the Rural Sociology Unit of DPS. As a result no work is now planned on these areas.

(b). ***Adoption Study.*** It was anticipated that Mr. J. Lesotlho of the Rural Sociology Unit, DPS, would be primarily responsible for undertaking this study. It was hoped that it would complement the one mentioned above which was supervised by Dr. P. Molutsi of the University of Botswana. However, because of other commitments on the part of the RSU, this study has evolved into a cooperative effort between ATIP and RSU staff.

(c). ***Production and Marketing of Goat Milk Products.*** It was not possible to obtain GOB permission for a short-term consultancy in this area. Therefore no further action will be taken.

(e). ***Agricultural Extension Management (Consulting and Training).*** No action has been taken in using the Mananga Agriculture Management Centre (MAMC) in Swaziland for help in training, with reference to DAFS. DAFS have indicated that it is too expensive and therefore the plan has been dropped.

(f). ***Agro-Forestry.*** No action has been taken by ATIP in this area since the DPS has decided to employ the services of an agro-forestry consultant. It is anticipated that this person will liaise with the Forestry Association of Botswana (FAB) as well as other relevant institutions in MOA. A Ghanian has been identified who will be in Botswana for six months supported with NORAD. The ATIP COP has been involved in several meetings with FAB and MOA officials in helping to identify a suitable consultant, drawing up terms of reference, etc.

Finally, some financial support (totalling approximately $15,000) has been given to paying lecturers in Botswana Agricultural College and the fledgling Faculty of Agriculture. Support was given for teaching of specific courses and to help support the retention of an American Lecturer (Mr. C. Mariner) for a few more months beyond his current contract.

3.4 EQUIPMENT [9.4]

Details on the purchase of major items of equipment during the reporting period are as follows:

(a). The three vehicles that were ordered at the beginning of the reporting period have now arrived. Two have BX number plates and have been allocated to Francistown and Mahalapye, while the third one has been purchased for use by INTSORMIL.

(b). In terms of computing equipment, most of the purchases have involved software although three Zenith laptops have also been purchased: one for use by INTSORMIL, and two for ATIP. The Laser Printer and IT microcomputers are being currently used by many individuals in DAR. In addition, two Elf IBM compatible microcomputers and Epson printers have recently been purchased to meet the increasing microcomputer demands on the part of secretarial and professional staff in DAR. Once again these are available for general use in the department. Finally, another microcomputer plus printer was purchased for the Finance Officer in MOA.

(c). Recently, additional equipment has been purchased to enhance the desktop publishing system, which was also originally financed by ATIP, in the Agricultural Information Section, DAFS.

(d). A fume cupboard has been purchased for use by the soil laboratory at DAR.

CHAPTER 4: TRAINING

Three types of training for Batswana staff continued to be provided through ATIP: long-term and short-term formal training and on-the-job-training (in-service training).

4.1 LONG-TERM TRAINING [10.1]

Long-term training continues to be an important component of the ATIP program.

Only two individuals returned from long-term training during the reporting year: Mr. J. Lesotlho, with a BS degree in Rural Sociology from Ohio State University and Mr. J. Luzani with a BS degree in Agronomy from Kansas State University.

Five long-term training participants were sent to US universities to work on degrees during the last year, despite delays in the approval process caused by more intricate regulations introduced by both the GOB and USAID. Details are as follows:

(a). ***ATIP Funding.*** Mr. B. Moji, Regional Agricultural Officer of the Southern Region, was sent to the University of Missouri for the January semester since his credentials, necessary for graduate school approval, were delayed until after the beginning of the previous fall semester. Preparations for sending Mr. T. Moroke and Ms. M. Manthe to the University of Southern Illinois and to Michigan State University, respectively, were complicated by the additional requirement of a special statement from the DPSM that the GOB would assume all costs for their educational expenses following the termination date for ATIP. Finally, Mr. B. Mogwera, Agricultural Information Section, DAFS, a photographer, was sent to the Ohio Institute of Photography, Dayton, for a one year non-degree training in video production techniques. This is the first video production training for MOA personnel.

(b). ***GOB Matching Funds.*** Mr. P. Mosupi who is attending the University of Arizona, and Mr. P. Ngakane who has gone to Michigan State University, were sent as substitutes for previous candidates nominated by the MOA whose grades were not adequate for graduate work.

The complete list of long-term participants is given in Table 4.1. A total of 23 individuals (25 degrees) have, or are receiving training, directly supported by ATIP (19 degrees), or with GOB matching funds (6 degrees). It is not anticipated that any further individuals will be completely funded under ATIP, although partial support may be given to one individual from DPS for a period of one year. As the results in Table 4.2 indicate, the project has been fairly equitable in training individuals from DAR (8 degrees), DAFS (9 degrees) and DPS (8 degrees), while also equally divided between BS (13) and MS (12) degrees.

In terms of institutional affiliation, the 13 individuals who have completed long-term training have returned to Botswana, and only three have left GOB service -- all joining organizations which have close relationships with GOB. In terms of affiliation with ATIP, before and after training, the picture is less satisfactory. Eleven individuals, who have completed training, worked directly with ATIP prior to their departure on training. Only four of those individuals now work with ATIP, while another three have close working relationships. This situation does of course complicate the task of localizing farming systems research.

TABLE 4.1: LONG-TERM PARTICIPANT TRAINING SINCE INCEPTION OF PROJECT

Participant	Local Affiliation		Training Details			
	Before Training	After Training	Before	Objective	Place	Dates
ATIP Sponsored:						
Gansegelwe, P.	ADNP, DAR	ADNP, DAR	DA 1975	BS (Agronomy)	Kansas SU	1/83- 7/85
			BS 1985	MS (Agronomy)	Kansas SU	8/85- 3/88
Mchive, F.	DAO, DAFS	DAFS	DA 1979	BS (Agronomy)	Kansas SU	1/83- 1/86
Monyatsi, T.	ATIP, DPS	Left GOB (National Dev. Bank)	BS 1981	MS (Ag. Econ.)	Kansas SU	1/83- 1/85
Modiakgotla, E.	ATIP, DAR	ATIP, DAR	BS 1981	MS (Agronomy)	Kansas SU	8/83- 8/85
Moremedi, G.	ATIP, DAFS	RAO, DAFS	DA 1980	BS (Agronomy)	New Mexico SU	8/83- 7/86
Tjirongo, M.	ATIP, DPS	Left GOB (Central Bank)	DA 1982	BS (Ag. Econ.)	Iowa SU	8/83-12/85
			BS 1985	MS (Ag. Econ.)	New Mexico SU	1/86- 3/87
Lesotlho, J.	ATIP, DPS	RSU, DPS	DA 1983	BS (Rural Soc.)	Ohio SU	1/86- 1/89
Luzani, J.	ATIP, DAR	ATIP, DAR	DA 1983	BS (Agronomy)	Kansas SU	1/86- 6/89
Mahabile, W.	ATIP, DAR	APRU, DAR	BS 1984	MS (Animal Sc.)	Kansas SU	1/86- 3/87
Motswasele, P.	ATIP, DAR	Left GOB (Botswana Dev. Corp)	DA 1985	BS (Seed Tech)	Mississipi SU	1/86- 7/88
Seleka, T.	ATIP, DPS	DPS	DA 1983	BS (Ag. Econ.)	Oklahoma SU	1/86- 7/88
Tibone, C.	ATIP, DPS	ATIP, DAR	DA 1983	BS (Ag. Econ.)	Oklahoma SU	1/86- 7/88
Ramolemana, G.	ATIP, DAFS	ATIP, DAFS	BS	MS (Agronomy)	New Mexico SU	8/86- 7/88
Sebinyane, A.	LUO, DAFS		Cert.	BS (Cartography)	SW Missouri U	8/87- 8/90
Ntseane, P.	RSU, MOA		BS 1985	MS (Rural Soc.)	Kansas SU	8/88- 8/90
Masilo, B.	APO, DAR		BS 1984	MS (Animal Sc.)	Kansas SU	8/88- 8/90
Moji, B.	RAO, DAFS		BS 1983	MS (Ext. Educ.)	U of Missouri	1/89- 8/90
Moroke, T.	DAR		BSc 1987	MS (Soils)	S Illinois U	8/89- 8/91
Manthe, M.	DAR		MS 1986	PhD (Agronomy)	Michigan SU	9/89- 8/93
Mogwera, B.	DAFS		Cert	Non-degree (Video)	Ohio Inst. Photog.	9/89- 8/90
GOB Sponsored:						
Jonas, C.	ATIP, DPS		Camb.	BS (Rur. Soc.)	U of Florida	8/87- 8/90
Nkane, D.	DAFS		BS	MS (An. Sci.)	Prairie View U	1/87-12/89
Tabona, L.	DAFS		DA	BS (Agronomy)	Utah SU	1/88- 1/91
Senyatso, E.	AFRU, DAR		BS	MS (An. Sci.)	Iowa SU	8/88- 8/90
Ngakane, S.	DAFS		DA	BS (Range Man)	Michigan SU	8/88- 8/91
Mosupi, P.	DAFS		BSc	MS (An. Sci.)	U of Arizona	8/88-12/90

However, it does not reflect a lack of support for farming systems research on the part of GOB. Rather, it reflects the current shortage of trained personnel in GOB, and that many individuals in government service are away on long-term training. It should also be noted that three other staff (1 certificate, 1 diploma and 1 BS degree holder) who have not received long-term training under ATIP auspices, also work directly in ATIP.

TABLE 4.2: LONG-TERM TRAINING DONE UNDER ATIP AUSPICES[a]

Department	USAID				GOB Matching				Total
	Finished		Still Away		Finished		Still Away		
	BS	MS	BS	MS	BS	MS	BS	MS	
DAR	3	3	--	1	--	--	--	1	8
DPS	4	2	--	1	--	--	1	--	8
DAFS	2	1	1	1	--	--	2	2	9
Total	9	6	1	3	0	0	3	3	25

a. Not included in the table is partial support given for two individuals who recently departed (MS and PhD) from DAR, and a person from DPS who will depart on a MS course in January. It also does not include a person from DAFS who has recently departed on a one year non-degree course.

One issue that is becoming critically important is that all ATIP financed individuals will have to complete their training by September, 1990, but presumably those being trained with GOB matching funds can continue after that date. At the moment it appears one individual financed directly by ATIP, will have trouble completing his studies by September, 1990.

At the request of the Dean of Agriculture, the University of Botswana, the ATIP COP lectured for one term on the principles of agricultural economics to the first year agriculture students. ATIP also provided some salary support for temporary lecturers in the Faculty of Agriculture to help get the BSc degree in agriculture underway.

4.2 SHORT-TERM TRAINING [10.2]

The term, short-term training, includes funding attendance at conferences and workshops that contribute to the professional development of the participants. The reason for these both being combined is because of the way the budget is broken down for the project. In some cases the sponsors of the training courses, such as CIMMYT, shared costs of the training with ATIP.

In terms of short-term training undertaken during the reporting year, the situation is as follows:

(a). Michigan State University. Mr. F. Alidi, Chief Forestry Officer, DAFS, attended the International Seminar on Forest Administration and Management held at Michigan State University.

(b). CIMMYT workshop. Ms. C. Tibone from ATIP, and Ms. T. Ketsitlile and Mr. D. Pilane from FSSR were sent to both the diagnostic phase and the experimental phase of the 1989 Farming Systems Workshop at the University of Zimbabwe. Mr. E. Makhwaje, from ATIP, was approved to attend the experimental phase of the workshop but he elected to take another course and Mr. G. Otisitswe, DAFS Crop Production Officer from Francistown, was sent as an alternate.

(c). IFDC workshop. Mr. E. Lele, agronomist, DAR, was sent to Togo to attend a training course on Statistical and Economic Analysis of Fertilizer Experimental Data.

(d). ILCA/CIMMYT workshops. Mr. E. Makhwaje, ATIP, DAR attended two workshops

on Experimental Data Analysis for Social Scientists in Ethiopia and Kenya.

TABLE 4.3: SHORT-TERM AND IN-SERVICE PARTICIPANT TRAINING SINCE INCEPTION OF PROJECT*

Participant	Local Affiliation	Training Details			
		Current	Objective	Place	Dates
Outside Country:					
Professional Trips:					
Tlale, B.	Dir., DAFS	BS	Visit US Institutions		7/83-8/83
Mmopi, K.K.	DAFS	BSc	Int. FS Tour	CIMMYT	July 1988
Moji, B.	RAO, DAFS	BS	Int. FS Tour	CIMMYT	June 1988
Moremedi, G.	RAO, DAFS	BS	Int. FS Tour	CIMMYT	June 1988
Setshwaelo, L.	CAPRO,DAR	PhD	Int. FS Tour	CIMMYT	June 1988
Modiakgotla, E.	ATIP, DAR	MS	Int. FS Tour	CIMMYT	June 1988
Hill, B.	RELO, DAFS	PhD	Int. FS Tour	CIMMYT	June 1988
Merafe, Y. (Mrs)	RSU, DPS	MS	S Workshop	Philippines	June 1988
Gakale, L.	Dir., DAR	PhD	Dryland Conf.	USA	15/8-19/8
Short-Term Training					
Sigwele, H.	ADNP, DPS	MS	FSR Workshop	U. Zimbabwe	Mar. 1983
Tjirongo, M.	ATIP, DPS	DA	FSR Workshop	U. Zimbabwe	Mar. 1983
Masikara, S.	ATIP, DAR	CA	CIMMYT Workshop	Malawi	May 1984
Monyamane, P.K.	Hort., DAR	BS	Vegetable Course	USDA	1/84- 2/84
Modise, M.	DAFS	BS	Grain Storage	Kansas SU	6/84- 7/84
Lesothlo, J.	ATIP, DPS	DA	CIMMYT Workshop	Zambia	Nov. 1984
Ramolemana, G.	ATIP, DAFS	BS	FSR Workshop	U. Zimbabwe	3/85- 9/85
Masikara, S.	ATIP, DAR	CA	Agronomy Course	ICRISAT	9/85- 3/86
Luzani, J.	ATIP, DAR	DA	MSTAT Workshop	Swaziland	June 1985
Jonas, C.	ATIP, DPS	Camb	FSR Workshop	Gambia	Apr. 1986
Otisitswe, G.	CPO, DAFS	DA	FSR Workshop	U. Zimbabwe	Feb. 1987
Ramanbana, K.	DAO, DAFS	DA	FSR Workshop	U. Zimbabwe	2/87 & 9/87
Jonas, C.	ATIP, DPS	Camb	CIMMYT	Lusaka	May 1987
Mosupi, P.	CPO, DAFS	BS	Quelea Control	Colorado SU	July 1987
Mosarwe, D.	CPO, DAFS	DA	Quelea Control	Colorado SU	July 1987
Masikara, S.	ATIP, DAR	CA	CIMMYT	Harare	July 1987
Modiakgotla, E.	ATIP, DAR	MS	CIMMYT	Harare	July 1987
Mabongo, B.	ATIP, DPS	BS	ILCA	Addis Ababa	Nov. 1987
Mazebedi, M.	Hort., DAFS	DA	Irrigation Training	MAMC, Swaziland	3/88- 4/88
Mpathi, T.	SMU, DAR	DA	Seed Technology	Sweden	8/88-10/88
Masikara, S.	ATIP, DAR	CA	US Workshops and Institutions		9/88-10/88
Alidi, F.S.	DAFS	MS	MSU Seminar	USA	9/89-10/89
Tibone, C.	ATIP, DPS	BS	FSR Workshop	U. Zimbabwe	2/89 & 8/89
Ketsitlile, T.	FSSR, DAFS	DA	FSR Workshop	U. Zimbabwe	2/89 & 8/89
Pilane, D.	FSSR, DAFS	DA	FSR Workshop	U. Zimbabwe	2/89 & 8/89
Otisitswe, G.	CPO, DAFS	DA	FSR Workshop	U. Zimbabwe	2/89 & 8/89
Makhwaje, E.	ATIP, DAR	BSc	ILCA Data Analysis	Ethiopia	Feb. 1989
Lele, E.	DAR	BS	IFDC Workshop	Togo	Apr. 1989
Makhwaje, E.	ATIP, DAR	BSc	CIMMYT Data Analysis	Kenya	June 1989
In Botswana:					
4 Clerical staff	ATIP, DAR		Applewriter IIe	F'town	May 1984
5 Counterparts	ATIP		Daisy Statistics	F'town	May 1984
2 Staff	DAR		Daisy Statistics	F'town	May 1984
18 Staff	DAFS, BAMB		Grain Storage	Sebele	Sep. 1984
25 Enumerators	DPS		Enumerator Workshop	Gaborone	July 1987
25 Enumerators	Farming Systems		Enumerator Workshop	Mahalapye	July 1987
38 Specialists	DAR, DAFS		Writing Workshop	Sebele	July 1987
60 Senior staff	DAR, DAFS		Training Trainers	Sebele	July 1987
5 Ag. Info staff	DAFS		Computer Workshop	Gaborone	Jan. 1988
50 Specialists	DAR, DAFS		Writing Workshop	Gaborone	June 1988
15 Staff	AFS, Vet Serv, ATIP		Writing Seminar	F'town	July 1988
5 Ag. Info staff	DAFS		Computer Workshop	Gaborone	July 1988
3 Clerical staff	ATIP, DAR		Word Perfect	Gaborone	July 1988
1 Clerical staff	DAR		Word Perfect	Gaborone	July 1989

* The table includes professional visits by more senior level officers in GOB.

(c) IDM Word Perfect course. Mrs. J. Clifford, secretary, DAR, attended a Word Perfect

word processing course at the Institute of Development Management, University of Botswana.

Preparations are currently underway to send the DAR librarian, Mr. I. Elifas, for training to the US National Agricultural Library Internship Program and the AID-Washington's Center Training Program.

One problem that has arisen again this year -- and has been mentioned earlier in the project -- is the following. Under the present arrangement, for short-term training, ATIP provides per diem and registration fees while GOB provides airfares. Airfares are generally more expensive than the per diem and registration fees. Thus, the burden of short-term training is usually greater for GOB than for ATIP funds provided through USAID. The problem of the expense and the definition of short-term training as used by GOB, has often created problems in getting GOB approval. For example, the Arkansas Farming Systems Symposium is apparently not considered to be short-term training as far as GOB is concerned. Consequently a recent proposal to send three individuals to this year's symposium (Ms. C. Tibone, Mr. K. Kelemogile and Mr. E. Modiakgotla), followed by visits to other institutions, and possible attendance at short training courses relating to the symposium was turned down by GOB, in spite of approval from USAID/B with respect to other expenses. Consequently, it does constrain the amount of short-term training ATIP can support, where expensive airfares are involved.

4.3 ON THE JOB TRAINING [10.3]

In-service training for the Agricultural Information Section, DAFS, was considerably modified this year. The technical writing workshops sponsored by ATIP in 1987 and repeated in 1988 were discontinued this year as the Agricultural Information Section, DAFS, with the assistance of a Peace Corps Volunteer Journalist, assumed full responsibility for technical writing. Rather than bringing a consultant from the U.S., a local Desktop Publishing System Specialist who is immediately available for emergency consultations, has been utilized for workshops. Special training in printing is being provided by a Peace Corps Volunteer Printer. The in-service training programs for the Department are no longer the responsibility of ATIP staff.

ATIP and other staff have continued to receive hands-on training on IBM compatible computers. Five other staff -- particularly in DAFS -- have learned to use the Apple IIe microcomputer in the REEO's office.

Visiting specialists Patricia A. Wetmore, USDA/USAID Agricultural Literature Research Specialist, and Noel Young, KSU Developing Countries Librarian, provided two lectures to the Botswana University Library Studies Class, two seminars for professional librarians and four library workshops for MOA librarians and supervisors.

Two Pandamatenga Development Project Officers and four commercial farmers at Pandamatenga were instructed in insect survey and monitoring techniques for commercial crop pests. Appropriate extension literature to assist in this endeavor was also delivered to the Pandamatenga Development Project.

ATIP hosted the 1989 Farming Systems Workshop in Francistown and Mahalapye. About 70 individuals attended the workshop which included field visits and a working session on Linkages, the theme of the workshop (see also Chapter 2).

Four farmer field days were held and were well attended. Also two village blacksmiths

were sponsored by ATIP to permit attendance at a blacksmith training course held at RIIC, Kanye.

CHAPTER 5: SEBELE/GABORONE WORK

5.1 TEAM LEADER [11.1]

Agricultural Economist: D. W. Norman

5.1.1 INTRODUCTION

Mr. E. Modiakgotla, Agronomist, was transferred from Mahalapye to Sebele in August, 1989 to become the counterpart to the ATIP COP. However, since this happened near the end of the reporting period, joint activities are only just developing. Consequently most of his activities are presented in Chapter 6 which details the results of the Mahalapye work program. It is also anticipated that he will continue his professional work in the Mahalapye area during the coming year.

5.1.2 ATIP ADMINISTRATION AND OPERATION [11.1.1]

Administration of the project still takes a considerable amount of time. However improvements have taken place with the employment of a second Administrative Assistant. The various papers put out by ATIP have been improved in terms of timely production and dissemination. During the reporting period many meetings were attended, organized by GOB and USAID, and time was spent with a large number of visitors (see Chapter 8 for a partial list). In addition, time was spent in preparing background papers for the Internal Review and helping to facilitate the work of the team members (see Chapter 2).

5.1.3 PROFESSIONAL SUPPORT TO ATIP TEAM MEMBERS [11.1.2]

Efforts have continued in helping to support the other ATIP team members. More time has been spent in professional cooperation, although on occasion visits to the field have not been as regular as would be desirable.

A partial list of professional activities carried in support of ATIP team members during the reporting period included:

(a). Helping in the design and construction of the data collection forms for the National Tillage Trial, designing databases and supervising data entry of the results, and programming DBase III Plus to facilitate analysis of the results.

(b). Designing a study for estimating standard input/output coefficients and units of measurement.

(c). Analyzing and writing up the results of the Mahalapye Cooperators Survey.

(d). Helping in the design, analysis and writing up of the Bean Survey requested by Legume Agronomist in DAR.

(e). Designing and starting analysis of the Row-Planter Condition Survey.

(f). Reading, commenting on, and helping in the editing of a number of manuscripts produced by ATIP staff.

(g). Etc.

5.1.4 MICROCOMPUTER SUPPORT [11.1.3]

Supervision of the SMU data entry on the microcomputers has continued. Much data have been entered from the ATIP field stations including surveys undertaken by ALDEP and studies undertaken by INTSORMIL. Finally, as mentioned above a substantial amount of time has been spent cooperating on the National Tillage Trial in terms of designing data forms, designing the data entry and analysis procedures.

Transfer of data from the Apple to IBM systems has also continued. Much has been learned during the reporting period about the use of the new software packages (i.e., Wordperfect 5, DBase III Plus, Lotus 123, and MSTAT). Recently a new statistical package has been purchased which is much more user friendly than SPSS, and combined with MSTAT will be sufficient for most statistical analysis in farming systems work. It is anticipated now that the main users of SPSS will be the biometric staff in DAR undertaking more complicated statistical analysis.

5.1.5 METHODOLOGICAL MANUAL [11.1.4]

In conjunction with others, some time has been spent on writing sections for the proposed "Farming Systems Handbook for Botswana". A small amount of help was given to Dr. F. Worman and Mrs. J. Snyder in producing an annotated bibliography of the current literature on FSW to help in writing the handbook. This handbook will concentrate on what is being done in Botswana, with substantial cross-referencing to specific methodological issues covered in other manuals (see also Sections 2.2 and 2.3).

5.1.6 PUBLIC PRESENTATIONS [11.1.5]

A semester course has been given at BAC on the Principles of Agricultural Economics, while a number of talks have been given at MOA sponsored meetings and workshops. No visits were made outside the country during the reporting period apart from two to the United States, one for consultation and the other on home leave, where a seminar was given at Kansas State University.

5.1.7 LIAISING AND INFORMATION AVAILABILITY [11.1.6]

Efforts have continued in order to encourage liaison activities with other individuals and institutions in GOB. Much of ATIP's work program now has linkages with individuals and institutions outside ATIP. This year, linkages were a key theme of the Farming Systems Field Workshop (see Section 4.3) hosted by ATIP in Mahalapye and Francistown. It is to be hoped that the results of this workshop will help in furthering the development of linkages, which are recognized as being important by GOB (see Section 2.2 for further discussion on this).

Progress in terms of database documentation has not been as great as would have been

desirable over the last few months. The amount of emphasis to put into this task is currently being re-evaluated.

Recently much time has been spent in terms of thinking about what ATIP should do between now and the end of the project to ensure a smooth transition to the post-project period. This is particularly important since there is an increasing commitment, within GOB, that farming systems work should continue in some form. Discussions with GOB officials have continued and a number of encouraging developments are taking place (see Sections 2.2 and 2.3).

Over the last few months, increasing amounts of time been spent in professional matters relating to the activities of the Division of Planning and Statistics. Examples include; producing materials for the Agricultural Sector Assessment Review, meeting with a large number of consultants and reviewing their terms of reference and provisional reports (e.g., Draught Study, Agro-Forestry Study, Destumping Study, Western Region Study, etc.), participating in reviews and discussions on proposed development activities (MDP extension, ALDEP reformulation, keynote issues for National Development Plan VI), etc.

5.2 RESEARCH-EXTENSION LINKAGE, GABORONE [II.2]

RELO Advisor[1]: B. Hill
RELO: G. Ramolemana

The primary objective of the Research Extension Coordination Unit (RECU) is to increase the cooperation and communication between these two branches of agriculture. The following activities were designed and carried out during 1988-89 to accomplish the unit's objectives.

The three major areas of activity of this unit have been in training, extension publications and assistance to the ATIP team leader in administrative duties. There will be little discussion of the accomplishments in training in this section, as a more detailed presentation appears in Chapter 4 of this report.

5.2.1 ATIP ADMINISTRATION AND OPERATIONS [II.2.1]

Francistown ATIP housing negotiations this year were complicated and involved. These negotiations involved two Francistown landlords and officials from the Department of Surveys and Lands (Ministry of Government and Lands), USAID, and ATIP. Preliminary negotiations began before November 28, 1988 and were only successfully concluded by September 10, 1989. Other activities involving the coordination of many organizations have also been very time consuming.

Visitors this year included many consultants who worked on USAID's Agricultural Sector Assessment Program. The RECU assisted many of these consultants by arranging appointments, making introductions and reading preliminary reports. Other important visitors

[1] The title "RELO Advisor" arises from an official memo written by the DAFS who appointed Mr. G. Ramolemana as RELO and Dr. B. Hill as RELO Advisor. This action was recommended by the ATIP COP and Dr. B. Hill in the belief that it would strengthen Mr. Ramolemana's position. However, Mr. G. Ramolemana objected to this appointment and the matter still awaits clarification.

included the Executive Director of MIAC, Dr. W. Miller. The RELO advisor assisted in arranging his schedule, accompanying him in travel to northern Botswana and serving as his host in Gaborone.

The RELO advisor also served as acting chief of party during Dr. D. Norman's home leave from April 13 until May 16, 1989.

5.2.2 VISITS WITH EXTENSION AND RESEARCH STAFF [11.2.2]

With the return of Mr. G. Ramolemana to the RECU, visits with research and extension staff have increased both in quantity and quality. Visits to regional and district field services were made throughout the year as time was available, while individual and group conferences were held with RAOs, DAOs, ADs, CAPOs and LUOs. Visits with research staff members at Sebele, Maun, Francistown and Mahalapye served to facilitate cooperative efforts in various projects and publications.

5.2.3 MEETINGS AND CONFERENCES [11.2.3]

Both members of the RECU have spent much of their time attending meetings and conferences during the year. Mr. G. Ramolemana has proven to be very effective in these situations and has often played an active or key role (e.g., as organizer or chairperson). The following are a few examples of the RECU's involvement in various meetings and conferences:

(a). Mr. G. Ramolemana represented Botswana at a Managing Agricultural Systems Conference, at the National Institute of Public Administration of Malaysia, from September 11 until October 23, 1989.

(b). Dr. B. Hill organized and planned the 1989 Annual Farm Systems Inter-Project Meeting held in the MOA Main Conference Room, on September 28, 1989.

(c). Dr. B. Hill participated in the Molapo Development Project Workshop held at Maun, from May 31 until June 4, 1989.

5.2.4 AGRINEWS [11.2.4]

Six thousand copies of this 16 page monthly magazine are printed by the Agricultural Information Section, DAFS. New equipment, funded by ATIP, is now being installed which will allow Agrinews to be printed in full color (four color process printing) with better half tone picture reproductions and with less manual labor. Unlike in previous years, articles on farming systems research by ATIP has been reduced in number to allow other farming systems groups to contribute to Agrinews. Such groups, indicated their interest during the 1988 Annual Farm Systems Inter-Project Meeting. However, little has resulted. Efforts are being made to rectify this.

5.2.5 AGRIFACTS [11.2.5]

The number of Agrifacts published last year has greatly increased. All Agrifacts are now published by the MOA in the printing section. The "Print Jobs Book" which lists

chronologically the work published by this section indicates that a total of 45 Agrifacts were printed. This includes new, revised and reprinted Agrifacts for the period beginning April, 1988, when the printing equipment provided by ATIP was installed. However, it does not include those Agrifacts that were awaiting printing at the Government Printer in April, 1988. Records for the latter Agrifacts are not available.

Agrifacts are published in four sections: Land Utilization, Crop Husbandry, Horticulture and Agricultural Organizations. RECU is responsible for the Crop Husbandry Section, and this series of Agrifacts has been extensively revised or rewritten since RECU assumed this responsibility. The only revisions underway at the present time are those on insect control, which are awaiting final editing. An index to Agrifacts on Crop Husbandry lists 49 titles and is kept current at the RECU office. Copies of the latest revision of this index are available upon request.

5.2.6 EXTENSION PUBLICATIONS [11.2.6]

As noted in the above sections on Agrinews and Agrifacts, ATIP's efforts in providing training and equipment for the Agricultural Information Section have paid handsome dividends. Extension publications as well as other agricultural publications are being produced by the MOA. ATIP's input into this effort has been enhanced by two Peace Corps Volunteers. Mr. S. Harle, printer, has, with the assistance of a printer trainee hired by MOA, completed 295 printing jobs during the past 17 months. Mr. Harle estimates that over three million impressions have been run on the printing press which is maintained in excellent condition at MOA's expense. To ensure there is sufficient time available for the trainee printer to complete his training, Mr. Harle has agreed to remain in his present position until January, 1992. The other Peace Corps volunteer, Mr. D. Gately, is an experienced journalist who recently arrived at his post in the Agricultural Information Section. Mr. Gatley's previous experience, and especially his expertise with the desktop publishing system will be a great asset to the department.

Actual numbers of extension publications are easier to obtain this year with the aid of the "Print Jobs Book" described above. This chronological list of jobs indicates that more than 50 percent of the 295 publications are either printed for DAFS, or specifically cover extension material. These print jobs vary from the 247 page "Agricultural Sector Assessment" by USAID to "Bee Keeping Certificates" for the 4-B clubs of Botswana. Annual Reports and other detailed reports by different sections of DAFS constitute a large proportion of these 295 publications.

Extension publications printed by the Government Printer include "A Handbook on the Control of Agricultural Pests in Botswana". The entomological illustrations in this handbook make it valuable for insect identification necessary for insect control work. Reprinting of this rare publication was made possible when ATIP-funded the expenses for producing the color plates.

5.2.7 TRAINING [11.2.7]

See Chapter 4 for details on the role of the RELO advisor in training. Overall, however, the RECU's involvement in training has been limited, and is restricted to assisting the DAFS training officer.

5.2.8 TOURS AND FIELD DAYS [11.2.8]

Attendance at these events, by RECU, has more than doubled over the previous year and are considered to be a good opportunity to further the research-extension linkage.

5.2.9 FARMING SYSTEM INTER-PROJECT ACTIVITIES AND COOPERATION [11.2.9]

As previously mentioned, the RELO advisor was instrumental in organizing this years Annual Farming System Inter-Project meeting. Other activities have included organizing staff training. For example, the RECU was responsible for organizing funding (provided by CIMMYT and ATIP) for staff from FSSR so that they could attend the 1989 Farm Systems Workshops at the University of Zimbabwe. The Molapo Development Project staff were offered the same opportunity. However, communication time between Maun, Moalpo Development Project Headquarters and Gaborone proved too long to meet the application deadline set by the University of Zimbabwe. Other short-term training opportunities in computer training and management have been explored with FSSR staff.

CHAPTER 6: MAHALAPYE ACTIVITIES, SEPT. 1988 - AUG. 1989

USAID:	J. Siebert	(Agronomist)
GOB:	E. Modiakgotla	(Agronomist, DAR)
	E. Makhwaje	(Agronomist, DAR)
PCV:	A. Caplan	(Agricultural Economist)

6.1 CROPPING SYSTEMS [12.2]

6.1.1 SORGHUM/MELON MIX STUDY [12.2.1]

Objective: To assess the impact of the traditional melon component in the sorghum/melon mix through yield.

Justification: This season is to provide a second year's data to this diagnostic study. Previous indications, from an above average rainfall season, are that sorghum yields are not significantly affected by current melon production.

Approach: The same twelve farmers recruited for this trial in 1987-88 were again requested to apply this simple comparison. Treatments are 6kg sorghum seed broadcast/hectare compared with the same seeding rate of sorghum mixed by the farmer, with melon seed at the rate the farmer chooses. An impact assessment of the melon component on the sorghum enterprise was made by measuring overall yields, and melon plant cover of the soil.

Results: Results for this trial are still to be analyzed.

6.1.2 EVALUATION OF AGRO-FORESTRY IMPROVEMENT POTENTIAL [12.2.2]

Objectives: The original objectives of this survey were to:

(a). Ascertain how indigenous trees are managed in village and lands areas throughout Botswana.

(b). Assess farmer attitudes about the various uses of trees and other woody species.

(c). Assist in identifying intervention points for practices such as woodland management, fruit tree establishment, and agro-forestry.

Justification: Although earlier SADCC and Botswana Renewable Energy Team (BRET) reports have documented trends in national tree usage, several questions concerning tree usage and farmer attitudes in the Central Agricultural Region and Tutume District remain unanswered. A survey administered on a national basis would provide the necessary background from which to coordinate future extension and on-farm testing programs.

Approach: Following an exploratory survey in the Mahalapye area during the 1987/88 season, an initial farmer questionnaire was drafted. This questionnaire was presented to the Forestry Association of Botswana (FAB), and discussed among ATIP team members. It was

envisioned that a second draft of the survey would be completed -- possibly with the aid of an outside consultant -- and used for enumerator training. Following a pretest and selection of a sample, it was proposed that the survey, in its final form, be administered in all ATIP villages, including those in Tutume District.

Results: Before the second draft of the survey was completed, the Ministry of Agriculture commissioned a nationwide study of agro-forestry potential in Botswana, with technical assistance provided by NORAD. The study began in June, 1988 and will last until November, 1991. It is expected that if the Mahalapye area is chosen as a research domain, ATIP will be an active collaborator. ATIP also plans to serve as a reference for any agro-forestry research conducted in the Central Agricultural Region.

6.1.3 PHOSPHATE FERTILIZER AND UTILIZATION OF LAB-LAB PURPUREUS [12.2.3]

Objectives: Although the trial format changed from RMFI to FMFI prior to implementation, trial objectives remained the same as those indicated in the work plan section of Annual Report No. 6. The objectives were to:

(a). Test the response of Lab-lab Purpureus fodder yield to phosphate fertilizer applications.
(b). Work with on-going ALDEP and DAFS small stock feeding programs.

Justification: The inclusion of Lab-lab Purpureus in the on-farm testing program, and the wider evaluation of its potential in the farm systems of limited-resource farmers, is justified for three primary reasons:

(a). Previous ATIP research and ALDEP demonstration efforts have indicated that a favorable fodder-crop production potential exists in Botswana, particularly during wet year. Fodder yield and fertilizer responses have been more problematic in dry years. Moreover, enterprise analysis is difficult because of the variable value associated with a unit of the fodder crop.

(b). Before this season, several animal-owning farmers in ATIP villages, who have suffered through repeated drought seasons, indicated a willingness to participate in on-farm testing of several fodder varieties, under various production systems. Of the twenty-two farmers who tested Lab-lab last season, 74 percent constructed fodder storage racks with their own or hired labor, and local materials. Ninety-six percent indicated that they wanted further information on fodder crops.

(c). In conjunction with ALDEP and small stock regional officers, ATIP is in a pivotal position to provide the on-farm component to fodder crop testing, particularly where socio-economic assessments are required.

Approach: The approach first proposed was for implementation at five sites in two villages, with superimposed phosphate fertilizer comparisons by ALDEP/ATIP, under an RMFI format. It was also envisioned that the Regional Small Stock Officer would later assist the ten trial farmers, and other farmers who had been provided extra seed by ALDEP, in devising personalized utilization strategies.

The trial format was changed to FMFI before the beginning of this season, primarily because the Regional Small Stock Officer was transferred. Switching to the FMFI mode ensured that the trial would still be implemented across several sites, and that phosphate comparisons

would be made.
Farmers were provided with enough seed to plant one-half hectare plots. They then split the plots, applying phosphate fertilizer to one half (at the rate of 20 units phosphate per hectare), and leaving the other half unfertilized. Shortly before farmers began their fodder harvesting, ATIP researchers collected samples from five two-meter-square quadrants per plot, put the samples in hessian sacks, and left them with the farmers to dry. Enumerators then returned to weigh the samples at thirty-day intervals, until dry weights were reached.

Results: Seven farmers from Makoro and Shoshong agreed to implement the trial. It is assumed that farmer willingness was low due to the high labor requirement for harvesting fodder, and the farmers' lack of experience in utilizing fodder for winter feeding. Also, natural grass cover was profuse enough following last season's rains to convince most farmers that growing fodder crops for their own use would be unnecessary this season.

The lack of farmer willingness demonstrates that fodder production in the traditional farm system is still a sensitive issue. Limited-resource farmers continue to face constraints which make fodder production difficult, both conceptually and practically. It is possible that with research testing and extension demonstrations the practical constraints to fodder production could be overcome. Yet, as the response by farmers to this season's trial indicates, the conceptual problem limited-resource farmers have with introducing wider-scale fodder production into their cropping and livestock systems is perhaps the over-riding constraint.

6.2 COMMODITIES [12.3]

6.2.1 EVALUATION OF MEDIUM MATURITY COWPEA VARIETY TVX3236 [12.3.1]

Objective: The objective of this FMFI was to compare the performance of TVX3236 variety to that of three other varieties i.e., ER7, Blackeye, and Tswana.

Justification: The Cowpea Improvement Program annually identifies new dual and triple-purpose varieties which have performed well on-station, but require on-farm comparisons before wide-scale release. Also on-farm testing is needed to qualify several varietal characteristics such as pest and disease resistance and grain yield response to various growing conditions. Based on last season's results, in which cowpea variety TVX3236 outperformed Blackeye both in terms of grain yield and net returns, a second season of testing TVX3236 in the FMFI format was considered necessary.

Approach: Farmers were selected from each of the three villages. On each farm, a plot of 40m by 40m was sub-divided into four sub-plots of 20m by 20m. Each farmer was given 1.5kg seed of each cowpea variety. In addition, any farmer who was interested in setting-up his/her own comparison was given 1.5kg of ER7, Blackeye, Tswana and TVX3236, but no data were collected from these farmers.

Results: Overall, yields were lower than average mainly due to the low and erratic rainfall. TVX had the highest yield (190kg/ha.) and Blackeye the lowest (121kg/ha.). However, the actual yield differences between TVX, ER7 and Tswana were insignificant.

6.2.2 EVALUATION OF DROUGHT RESISTANT GROUNDNUT VARIETY [12.3.2]

Objective: To compare the performance of a new drought resistent variety (55-437), obtained from Senegal, with Sellie, which is a local variety.

Justification: Due to the endemic risk of drought in Botswana, drought resistance in any crop variety is an essential and attractive characteristic. Groundnut (v.Sellie), though adapted to semi-arid conditions, does not perform well in more severe conditions, particularly when planted at high populations. The new variety has performed well on-station during the three previous seasons, thus researchers are keen to test it under on-farm conditions. They expect that, with all things being equal, this new variety can/will outclass the local check.

Approach: Farmers were to implement this FMFI comparison. Four sites per village were selected for data gathering purposes. These farmers, and other farmers who were interested in making their own comparison, were provided with seed. However, only data collected form the experimental trails were collected and analyzed. At the beginning of the cropping season, plots measuring 40m by 40m were prepared. These plots were then broadcast planted at 25kg/ha (i.e., 2kg of each variety, per farmer). Data on emergence stand count and grain yield were collected.

Results: The data are still to be analyzed.

6.2.3 MUNG BEAN VARIETY TRIAL[1]

Objective: Identify bean varieties for release to farmers.

Justification: On-station researchers, involved in a Cowpea/Bean Improvement Program, were interested in testing several bean varieties under on-farm conditions.

Approach: RMFI trials were conducted at two separate sites in Makoro village.

Results: The trials were established. However, the data have not yet been analyzed.

6.3 TILLAGE AND PLANTING PRACTICES [12.4]

6.3.1 NATIONAL TILLAGE TRIAL [12.4.1]

Objectives, Justification and Approach for this trial were written by Dr. N. Persaud and are presented along with a useful introduction in Section 7.2.2 in this report.

Results: Five tillage systems are under test at three sites in the Mahalapye lands area. These sites are part of a multi-location (nine sites) two replications per site trial that has been organized by the working group on tillage at Sebele. The tillage comparisons are primarily concerned with water conservation/harvesting. The most important effect observed to date in this trial has been the tillage effect on plant establishment. Early plowing has resulted in better establishment. Considerable technical data on soil moisture and bulk density, as well as economic data, are being collected. Several technical and logistical problems have been encountered in this trial activity; this could be expected in the first season of such a widespread undertaking. Two of the Mahalapye sites were affected by water run-on and water logging following heavy storms this past season. The trial is to be abandoned at these two sites, however another site will be selected for the coming season. The future plans for this trial are to continue and expand the activity during the coming season.

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[1] This trial was not in the work plan.

6.3.2 ROW-PLANTER CONDITION SURVEY [12.4.2]

Objective: The objective of this survey was to assess the condition of row-planters currently owned by farmers; and to determine how this condition is affected by use and care of the machine, and by the availability of spare parts and repair facilities.

Justification: Previous work in ATIP villages with farmers owning row-planters has shown that many parts of the machines are not working correctly (i.e., fertilizer hoppers, seed metering plates, etc.) MOA (ALDEP) is undertaking a large investment to supply row-planters to farmers, but not enough is known about deterioration of the planter, or about what type of advice/training should be given to protect the farmer's and government's investments. This survey should also provide information on the constraints imposed by the lack of spare parts or qualified repairmen.

Approach: The ATIP team leader produced an initial copy of the survey and circulated it to ATIP team members and FMDU personnel for their comments. After modifying the survey according to team member and FMDU feedback, the team leader provided ATIP Mahalapye and Francistown with copies for administration in their villages. FMDU provided ATIP with technical assistance during the survey phase, by visiting farmers with ATIP researchers and assessing planter conditions. The survey was also administered in other areas of Botswana in order to increase the area covered by the survey.

Results: A final version of the survey has been completed and has been administered to 84 farmers, owning row-planters, in six villages, in the Central Agricultural Region. FMDU personnel spent two weeks in Mahalapye in order to assess the condition of the planters being surveyed. The same survey has also been conducted by FSSR and in the ATIP Francistown villages. A final report will be published by ATIP and FMDU sometime during 1990.

6.3.3 CULTIVATOR EVALUATION TRIAL [12.4.3]

Objectives: The objectives were to:

(a). Compare the operation of different cultivators that are currently available or are under test on-farm.

(b). Assess weed levels on row-planted fields before and after inter-row cultivation to measure relative effectiveness.

Justification: With the current emphasis on early plowing and row-planting, weed control can be a major issue. Good inter-row cultivation is considered critical. The Mahon cultivator appears to be effective for weed control, but is somewhat heavy. Lighter and more maneuverable cultivators are now being introduced.

Approach: This trial is similar to the one conducted during the previous seasons at Kanye. It had been hypothesized that different cultivators will perform differently in terms of ease and speed of operation, and in terms of effectiveness on weed control. A total of five farmers were to be selected by the AD on the willingness to test different cultivators.

Results: Different cultivators were not effectively evaluated because of late implementation of this trial. The factor most limiting in implementing the comparisons is original site selection. In some cases, the areas selected for inter-row cultivation had limited turning

space which interferes with other row-planted or broadcasted plots. During future seasons, site selection will have to take into account needed turning space for donkey teams.

6.3.4 ROW-PLANT FERTILIZER TRIAL [12.4.4]

Objective: The objective was to compare, under row-planting, sorghum grain yield response to banded 2.3.2 fertilizer at two rates, and farmer's assessment of it, with a broadcast application.

Justification: The trial was designed to support the promotion of row-planting. Fertilizer (2.3.2) has generally been available in recent years through the introduction of the ARAP scheme. Most farmers had been broadcasting fertilizer. However, there has been a strong interest among row-planting farmers to know more about applying the fertilizer with a planter. It had been suggested that a phosphate fertilizer application, much below the standard 20 units P/ha (e.g., 6 units P/ha) should provide as much as 75 percent of the 20 units P response.

Approach: Although more farmers showed interest in row-plant fertilizer application, only five farmers effectively implemented the trial. Low implementation rates were as a result of poor distribution of rainfall, and dependency on traction.

The following four treatments were imposed:

(a). A control -- row-planted without fertilizer
(b). Banded -- 2.3.2 equivalent to 6 units P/ha
(c). Banded -- 2.3.2 equivalent to 20 units P/ha
(d). Broadcast -- 2.3.2 equivalent to 20 units P/ha

Results: Fifteen farmers in three villages were originally selected to host this RMFI trial; however, only eight farmers were able to implement the trial. Late planting rains prevented some farmers from plowing the sites selected for the trial. Data for this trial are still to be analyzed.

6.4 SOIL AND WATER MANAGEMENT [12.5]

6.4.1 MANURE RESOURCE ASSESSMENT STUDY [12.5.1]

Objective: The objective was to assess the availability of kraal manure and farmers' perceptions of its use.

Justification: A successful recommendation on the use of kraal manure not only depends on achieving technical and economical responses at the plot level, but also on whether manure is available, and farmers' perceptions about the use of manure. Project experience with using manure in the fields indicated the possibility of major logistical and labor problems for many, if not most farmers.

Approach: A survey was undertaken, in three ATIP research villages, on the availability of manure, transport, labor and interests in the research area. A total of thirty farmers, who own kraals and could conceivably utilize their manure resources, were interviewed. Distances between fields and kraals, and the quantity of manure in selected kraals were measured in order to provide an estimate of how much manure was available at the farm and village levels.

Results: Seventy-two percent of farmers had ready access to sources of manure other than what they produced themselves (i.e., from relatives and friends). However, twenty-eight percent of farmers were solely dependent on their own sources. Therefore, not only was access a constraint, but the quantity farmers were able to provide themselves fell short of their needs.

The most available and easily accessible transport type, at village level, was found to be the four-wheel donkey cart compared to a two-wheel donkey cart or a four-wheel tractor trailer. Neither labor nor draft power were considered a constraint to the use of kraal manure.

Farmers perceived kraal manure as being a superior soil building option to other alternatives, e.g., inorganic fertilizers and straw incorporation. However, they did prefer old cattle manure to fresh goat and/or cattle manure because of the possible weed introduction associated with these latter types.

6.4.2 EVALUATION OF MANURE APPLICATION [12.5.2]

Objectives: The objectives of this study were to:

(a). Assess yield differences between kraal manure and control; N and P fertilizer and no fertilizer.
(b). Assess the residual effect of kraal manure through yield.
(c). Assess the interaction of manure benefit with season.
(d). Assess the change in effect of manure application when moving from upland to lower slopes in a topo-sequence.
(e). Assess the economic benefits from the use of kraal manure.

Justification: A historical background study notes that Shoshong fields were first tilled around 1900, while those around Makwate and Makoro were tilled in 1920 and 1942, respectively. The nine farmers who participated in this agronomic study had their fields allocated to them, and had tilled them for over a period of sixty years.

Most farmers in these villages had never used any form of soil building options since they had farmed the piece of land allocated to them. Although fertilizers are available at cooperatives or BAMB, farmers don't buy them. Hence, this trial was designed to assess whether manure was an attractive option for adding nutrients to the soil. As a result of its application, it is assumed that bulk density is likely to decrease, while water content increases.

Previous on-station work on kraal manure, tested over a period of nine seasons, has generally produced mixed results. However, the response pattern indicates that best yield results were obtained during high rainfall years, and when manure is applied to sandy soils.

Approach: This trial is a multi-season trial and is treated as an RMFI with the hope that it will eventually be under the farmer's control. In conducting the trial, three sites were selected in each of the three villages (Shoshong, Makwate and Makoro) through the farmer's committee. In each village, selected fields had to be either on the upper slope, middle slope or lower slope. Each plot was one hectare. The trial consisted of two replications, and it was all row-planted. The following treatments were imposed:

(a). Control
(b). Ten tons/ha kraal manure every second year, beginning year one
(c). Ten tons/ha kraal manure every second year, beginning year two

(d). Twenty units P/ha plus 60kg LAN/ha every year

Results: In this first season, six farmers in three villages have implemented this RMFI trial. In all cases, manure and fertilizer were hauled by ATIP to the farmers' fields. However, it was noted that farmers have demonstrated a resistance to hauling manure from their kraals, due to the high labor requirement involved in transporting and spreading the manure.

This years on-farm trials didn't show any significant yield advantage to manure application (Table 6.1), nor did topo-sequence appear to be of any agronomic importance. Since this is a multi-season trial, assessments on residual effect will be done during the following season. Mean yields are generally low due to both late planting and low rainfall.

TABLE 6.1 SORGHUM GRAIN YIELDS FOR MANURE, CHEMICAL FERTILIZER AND CONTROL TREATMENTS

Treatment	Yield (kg/ha)
10 tons manure	336
Fertilizer	357
Control	287
	ns

In conjunction with previous on-station research, extension recommendations, and the on-going manure resource assessment study (see Section 6.4.1), this trial was designed to verify the agro-economic response of sorghum grain yield to manure application, under farmer implemented (FI) conditions. A break-even analysis was conducted and costs were calculated for users and non-users of manure. This seasons results showed no significant yield differences between treatments. Within the context of this study, it could be said that there was no economic benefit from the use of kraal manure. However, it should also be noted that as kraal manure has a long-term residual effect, with high initial costs, an economic advantage is unlikely in the first year of study. As such, it is desirable to continue economic assessments for the subsequent years, before drawing any conclusions.

6.4.3 EVALUATION OF RUN-OFF MANAGEMENT SYSTEMS TRIAL [12.5.3]

Objective: To evaluate at three levels (design criteria, soil moisture benefit, and crop production outcomes) several run-off management systems. Production outcomes can be evaluated both agronomically and economically.

Justification: Observations of rainfall run-off, and the potential for increased water storage in many soil profiles indicates that yields could be dramatically raised in drought with effective control of run-off. Permanent structures and tillage systems can both be employed to reduce run-off. Permanent structures have an important advantage over tillage systems in that they do not need to be re-implemented every season during the bottleneck tillage-planting period. A benefit/cost assessment of such systems is required.

A second season of testing for run-off control systems is necessary. Last season, with its higher than normal rainfall, produced no measurable agronomic differences between the systems tested. However, several design problems were identified. These include the need for better control of plant populations and plant placement in systems with micro-level water concentration effects, and more attention be given to plowing patterns within systems because water readily moves along the plowing lines. The most important design problem related to flood water from off the field or above the trial block. Storm protection is required before shallow bunds within fields can work (these are discussed in Section 6.7.2).

Testing of the redesigned systems is required. Testing in another rainfall pattern is also important.

Approach: Six treatments were compared. These included four from last season which were placed on precisely the same plot areas as before. These four included single plowing, double plowing, strip cultivation and level terracing. All plots were row-planted in 1988-89. A macro-catchment water harvesting area was not included. Added to these four treatments were a massive ridge and furrow system that was designed to completely eliminate run-off and optimize water concentration and plant placement. This design was not practical for area farmers, but was constructed by the SACCAR Land and Water Management Project (LWMP) at Shoshong and elsewhere in an attempt to assess grain yield potential, given only rainfall and soil profile factors as variables. Use of the Mahon cultivator for tied ridge making was also compared. Tied ridges are achieved with the unit set for groundnut hilling. ALDEP staff have recommended this operation and the resulting soil shaping looks to be beneficial, but the operation is laborious. The Land and Water Management Project continued to monitor soil moisture on these plots.

Results: Six rainfall run-off management (RRM) technologies have been implemented on four different fields in Shoshong. The four fields represent sandier textured land with upland slopes of greater than one percent, and heavier textured land on the lower slopes of less than one percent. Both land types are commonly found in the Mahalapye area. This trial focuses on technology design (i.e., modification of technologies that are not yet in a form that would be useful to farmers). The selected on farm sites have been found to be very suitable for this work. Technologies in place for two or more years include single plowing on the contour, double plowing on the contour, strip cultivation (alternating fallow and cultivation which achieves a level of water harvesting) on the contour, and water conservation terraces. A semi-permanent ridge and furrow with planting on the flank of the ridge has been added for the first time this season.

Progress to date is promising for three RRM systems: strip, terrace and semi-permanent furrow and ridge systems.

Strip cultivation will provide greater return to plowing input, but the issue of weed control in the fallow is not fully resolved. Additional weed control input such as use of herbicide or a light cultivation in the fallow is sometimes required to achieve the desired benefit. This system holds particular promise for seasons with average or below average rainfall, and for households with limited access to plowing resources.

Water conservation terraces involving land shaping cannot be fully implemented in a single season, using equipment generally available to farmers. A consistent plowing pattern over several seasons can achieve a high potential deep soil bench at the base of each otherwise level terrace. This base provides a high potential production zone for a wide range of seasonal rainfall situations. After two seasons, the effect of a plowing pattern is only beginning to show in the terrace plots. Because this system does not rely on additional tillage input during the regular plowing/planting period (i.e., as with double plowing), and is semi permanent, the water conservation benefits could extend to households without reliable access to plowing resources.

A semi permanent ridge and furrow is somewhat costly and will require considerable annual maintenance. However, water conservation and harvesting is highly effective with the ridges, and the possibilities of reliably producing maize under this system, on even small areas

within the field, makes the system attractive.

The Land and Water Management Project has made a large investment in technical monitoring of plots in this trial. ATIP and LWMP are presently discussing how the precision of plot work required for this technical monitoring can be appropriately balanced with the scale of implementation required for farming systems research or farm level evaluation of technologies.

6.4.4 WHOLE FIELD RUN-OFF CONTROL [12.5.4]

Objective: The objective was to implement and evaluate simple storm drainage followed by contoured ridges on portions of fields above the Rainfall Run-off Management Trial.

Justification: For fields with large upland watersheds, water control structures that prevent flooding would be of value. At least one 24 hour rainfall event of more than 65mm is expected in 70 percent of all seasons for farms in the Mahalapye area. Flooding has been observed as a major problem on many fields in both drought and wet years, and farmers indicate that this is a serious problem

Approach: The construction of a massive graded bund at the upslope side of a field. By taking soil from the upslope side, a diversion drainage channel is created. Construction was to be done with a tractor and grader provided by DAR. Below the bund, smaller contoured ridges were to be spaced at 15m 20m intervals creating a series of level terraces. These were to be placed on four fields. Two of these fields are lighter textured with 1.2 to 2.0 percent slope, and two are heavier textured, with less slope.

Results: Separate storm drainage systems have not yet been built on any of the proposed field sites. This is due, in part, to difficulties in reaching agreement with host farmers on the design of these systems. Host farmers propose construction of massive diversion bunds that would channel large volumes of water onto neighboring land areas. ATIP, in consultation with the Soil Conservation Unit, propose that the drainage center around the development of natural, major flow lines that run through the field itself. The latter approach would tend to pose less hazard to the host field as well as to the neighboring landscape, but would involve sacrificing a portion of the field that could safely carry flood water. This issue will be further discussed by Shoshong farmers during formal end of season assessments.

6.5 FARM EQUIPMENT [12.6]

6.5.1 EVALUATION OF ROTARY INJECTION PLANTER [12.6.1]

Objectives: The objectives of this trial were to:

(a). Test the operation of the improved injection planter manufactured by RHC.
(b). Evaluate the operation over light and heavy texture soils, and over cloddy and fine seed beds
(c). Measure cropping outcomes.

Justification: The rotary injection planter was originally identified as a technology which could give farmers more control over row-planting operations. Because it is designed to be pushed or pulled by humans, reliance on animal draught and tractor power for timely row-

planting is effectively eliminated.

Last season, several design and manufacturing faults were identified with locally produced models. Corrections made prior to this season by RHC required further on-farm testing. Other groups interested in testing the planter include: ATIP Francistown; Palapye Development Trust Dryland Farm; Molapo Development Project; FSSR; FMDU and ALDEP.

The rotary injection planter was originally designed for no-till planting, but information is scarce on how well it will do on poor seed beds, in Botswana. Previous use, in a dry year, has indicated that the planter performs better on sandy rather than heavier-textured soils. In the Mahalapye area, net gains associated with using the injection planter to plant a hectare of secondary crops, rather than broadcasting them, indicate that positive returns per unit of land can be expected. Seed savings obtained by using the planter outweigh the extra planting labor required to pull it.

Approach: The trial format changed from RMFI to FMFI prior to implementation. It was originally envisioned that various soil types and conditions (e.g., differing soil moisture and clod size conditions) would be monitored on fields which would permit planting comparisons on poor versus good seedbed conditions. It was proposed that INTSORMIL provide field monitoring, and ATIP recruit farmers who could plow early.

Planting rains arrived late this season, thus discouraging farmers from plowing early. Moreover, farmer interest in using the rotary injection planter was surprisingly low, making the proposed field monitoring impossible. There were too few farmers to chose from, and therefore a limited variety of soil types and conditions.

Farmers in Makoro and Shoshong were provided with enough sorghum seed to plant quarter-hectare plots, in the FMFI mode. Plant stand and grain yield measurements were made at each site, and, where possible, compared with neighboring broadcasted plots. The broadcast plots were near the injection planted plots, and planted on approximately the same days.

Results: Prior to the planting season, nine improved rotary injection planters were delivered to ATIP Mahalapye. One planter was later sent to the Molapo Development Project (MDP), in Maun, for testing on Molapo soils. A second planter was sent to the Palapye Development Trust (PDT) for testing on their dryland farm. The planter sent to PDT was found to be defective, therefore no testing was performed on the dryland farm. Two of the remaining seven planters were also found to be defective, and could not be used for planting sorghum.

Five farmers (one in Makoro and four in Shoshong village) used the rotary injection planters to plant sorghum. No farmers in Makwate village were interested in using the planter. The low number of farmers interested in using the planter was surprising. However, lack of farmer interest points to several issues which might help to predict wider-scale farmer acceptance (or rejection) of the injection planter system.

One reason for this low interest might be due to the fact that only sorghum seed was offered by ATIP, rather than locally scarce, higher-value seed such as groundnut or cowpea. Last season, groundnut and cowpea seed were offered for use with the planter. Therefore farmers might have agreed to use the planter in order to obtain the seed.

Another reason might be that plot sizes were enlarged relative to those used last season. Last season's plot sizes were held to 10 by 20 meters. This season, plot sizes were enlarged to one-quarter hectare. Although one-quarter hectare plots are probably best suited for the injection planter, farmers might still believe it is too large an area to devote to a

new, as yet unproven technology.

A third reason might be that the planter used last season had several manufacturing and design faults, which contributed to poor plantings on some of the sites. It was the first time many of the farmers had ever seen such a machine, and when it failed to operate properly they gave up on the technology altogether.

A final reason might be that farmers were not properly trained last season in how to repair and adjust the planter. When breakdowns occurred, or when they wished to change the seed wheels but could not figure out how, many farmers became discouraged and returned to the traditional broadcast system, giving up on the injection planting technology
Despite the lack of farmer interest in using the planter this season, results based on four of the five farmers (all from Shoshong) who used the rotary injection planter indicate that respectable sorghum yields are obtainable, and seed savings are possible. In most cases, the rotary injection planter will reduce and even-out plant stands relative to broadcasted plats.

The mean planting date was January 26th (standard deviation of 5 days). On average, 20 days elapsed between plowing and planting (standard deviation of 8 days). This elapsed time includes two plots which were replanted due to poor emergence associated with the initial planting. The plots were planted on sandy soil, but on various slopes within fields. The mean seeding rate was 2.23kg/ha. (standard deviation of 0.38kg/ha.). This represents a large seed savings when compared with 8kgs/ha. for traditional broadcast. The mean planting time was 8.89 person hours per hectare (standard deviation of 2.52 person hours per hectare).

Table 6.2 presents emergence standcount results. The rotary-injection planted plots were compared with neighboring broadcast fields plowed and planted at approximately the same time.

TABLE 6.2 EMERGENCE STANDCOUNT RESULTS FOR ROTARY INJECTION PLANTED PLOTS, MAHALAPYE AREA, 1988/89

Treatment	Emergence Standcounts* (1000 plants/ha)	
Neighboring Broadcast	52.74	(30.66)
Rotary Injection Planted	25.79	(19.66)

* Standard deviations are in brackets beside their respective mean values. The means are significantly different at the five percent level of significance

As indicated in Table 6.2, significantly fewer plants emerged (per hectare) on rotary injection planted plots than on neighboring broadcasted plots. Surprisingly, emergence stands were more variable on the rotary injection planted plots than on the neighboring broadcasted plots. The mean grain yield, based on two plots was 6kgs. per hectare.

A newly designed version of the rotary injection planter has been designed and manufactured for testing during the next cropping year.

6.5.2 EVALUATION OF IMPROVED DONKEY HARNESSES [12.6.2]

Objective: The objective was to evaluate the Kenya donkey harnesses under farmer-managed conditions.

Justification: Previous ATIP research conducted with the improved Kenyan donkey harness

indicates a problem with the hame strap, which has now been strengthened. Tests undertaken by RHC indicated increased efficiency of donkeys using the harnesses.

Approach: Harnesses were given to a selected group of farmers who planned to plow/plant, inter-row cultivate, and/or transport firewood and water with their donkeys. Following harvest, these farmers were surveyed using a questionnaire developed by ATIP Francistown.

Results: Eight farmers (in Makoro and Makwate villages) were provided with the improved harnesses. Six of the eight were surveyed following harvest. Their responses to the survey have been sent to Francistown for combined analysis with Francistown data. A report, detailing the combined outcome of the survey, will be produced at a later date.

For five of the six Mahalapye farmers, it was the first full season that they had used the improved harness. The remaining farmer reported using an improved harness during previous seasons. Two farmers used the harnesses for plowing, planting, and carting; one for plowing and planting; one for planting and cultivating; and two solely for planting. All six farmers reported that the harnesses did not cause any sores on their donkeys.

Table 6.3 summarizes information specific to the harnesses' performance, based on farmer assessments. As indicated, farmers were almost unanimous in praising the performance of the improved harnesses, in terms of the wooden hames, straps, and pads. No other problems were reported concerning the performance of the harnesses.

TABLE 6.3 FARMER ASSESSMENTS OF THE PERFORMANCE OF THE IMPROVED DONKEY HARNESS, MAHALAPYE AREA, 1988/89

Questions	Percentage of Farmers Responding	
	Yes	No
Did wooden hames break?	16.67	83.33
Straps easily adjustable?	100.00	0.00
Pads hard enough?	83.33	16.67
Hame strap strong enough?	100.00	0.00
Neck strap strong enough?	100.00	0.00

The six farmers unanimously reported that padding was the harnesses' most effective component, because of the protection it provided their donkeys. Recommended improvements to the harness included:

(a). Make the wooden hames of a harder wood (1 response)
(b). Reduce the size of the wooden hames (1 response)
(c). Add padding to the straps (2 responses)
(d). Make the straps more adjustable (1 response)
(e) Thicken the straps (1 response)
(f) No improvements recommended (1 response)

At the end of this season, ATIP will transfer its supply of improved harnesses to ALDEP. ALDEP has agreed to include improved donkey harnesses in its general extension package for the coming season.

6.5.3 EVALUATION OF GROUNDNUT PLANTER [12.6.3]

Objective: To assess the performance of a planter especially designed for groundnut against that of the Selvle standard planter.

Justification: Because groundnuts are a soft seed prone to cracking, the need for an appropriate planter is evident. Most planters currently used in Botswana, were not originally designed for groundnut seeds. It is not certain, however, that an appropriate planter would be more attractive to area farmers than the traditional planter. The economic benefit for farmers to use such a planter is also unknown.

Approach: In an FMFI format, the use of the groundnut planter was compared to that of the Sebele planter (i.e., a side-by-side comparison). Initially four farmers selected this trial, but only three implemented it. A 50 by 20m. plot/farm was divided into two equal sub-plots for each planter. Each farmer was given an equal amount of seed for each sub-plot/planter.

Performance measurements included amount of seed used/given area, stand counts, grain yield and farmer's preference.

Results: There were no significant differences between yields, but plant populations for the groundnut planter were significantly higher than those for the Sebele standard planter. This was accounted for by the higher seeding rate of the groundnut planter. Overall, however, the farmers expressed a greater interest in the Sebele standard planter. They considered the specialized planter an unnecessary costly addition since the Sebele standard planter could perform the same operation.

It would, however, be inappropriate to draw any major conclusions based only on a sample of three. Therefore, further assessment is necessary.

6.5.4 EVALUATION OF DUTCH HOE

Objective: To compare the performance of the dutch hoe and the traditional hand-hoe across a variety of locations and dates.

Justification: Previous research in the Mahalapye area has shown that traditional hand-hoeing requires 37.4 person hours per hectare weeded (ATIP Research Paper No. 1). If household labor is used, then weeding requirements consume valuable labor time, which could be used for other productive purposes. If household weeding labor is unavailable, then non-household labor can be hired, but at a considerable cash cost to the household. If weeding is not performed, then the expected grain crops' yields are adversely affected, thus reducing net farm income. Therefore, weeding labor using the traditional hand-hoe is a considerable constraint for limited-resource farmers, no matter which type of labor is used (or ultimately not used). A weeding tool which can reduce the hand-weeding requirement will positively impact on the profitability of the traditional farm system.

Also, as more farmers switch from traditional broadcast to row-planting systems, they will need a weeding tool which removes weeds from within rows without damaging the growing crops. The traditional hand-hoe cannot be used effectively to remove within-row weeds. Due to its design -- a slicing blade attached to a long handle -- the Dutch Hoe might be an effective within-row weeding tool.

Approach: At the beginning of the weeding season, Dr. M. Phillips, Sebele Weed Scientist, distributed 10 Laser Dutch Hoes to Mahalapye. The hoes were distributed to farmers in each Mahalapye research village at the end of February, and demonstrations were provided during March farmer group meetings. A follow-up survey, designed jointly by ATIP Mahalapye and Francistown, was administered shortly before harvesting began.

Results: A total of 11 farmers in the Francistown and Mahalapye areas were provided with Dutch hoes. Their responses to the survey were combined in order to increase the number of observations for statistical analysis.

The hoes were used by the respondents (or their spouses), and in over 50 percent of the cases by the respondents and other household or non-household members. Of the 11 farmers, seven used the Dutch hoe on an area less than one-quarter of a hectare; one used it over one-quarter to one-half hectare; and three used it on an area greater than three-quarters of a hectare. In terms of when the Dutch hoe was used, the farmers were almost equally divided between middle of and late in the season.

When asked if the Dutch hoe was easier to use than the traditional hand-hoe, approximately 55 percent said yes, 36 percent said they did not know, and 9 percent (one farmer) said no. All but one farmer said they would purchase a Dutch hoe if it were locally available. However, when asked if they would pay between P15.00 and P20.00, approximately 55 percent said yes, 27 percent said they did not know, and 18 percent said no.

Summary statistics for specific comparisons between the Dutch hoe and traditional hand-hoe are presented in Table 6.4.

TABLE 6.4 SUMMARY STATISTICS FOR COMPARISON OF DUTCH HOE AND TRADITIONAL HAND HOE, MAHALAPYE AND FRANCISTOWN AREAS, 1988-89*

Description	Dutch Hoe	Traditional Hand Hoe	No Diff	Don't Know
	(Percentage of Farmers)			
1. Severs stem from roots more completely	18	64	18	0
2. Removes wider variety of weeds	55	36	9	0
3. Removes same weeds with less effort	36	45	9	9
4. Removes weeds more quickly	45	36	18	0
5. More durable implement	18	45	9	27
6. Can weed closer to plants	20	40	20	10

* Categories whose cumulative percentages do not sum to 100% are caused by rounding error

From this study, it is hypothesized that the farmers' evaluation of the Dutch hoe is functionally related (contingent upon) when they used it. In other words, farmers who used it during the middle of the season might be more likely to positively evaluate the Dutch hoe than those who used it late in the season.

6.6 HOUSEHOLD CIRCUMSTANCES [12.7]

6.6.1 COOPERATING FARMERS STUDY [12.7.1]

Objectives: The objectives of this diagnostic study were to:

(a). Provide a whole-farm production assessment with which to compare specific trial and intervention results.
(b). Identify trends in the farming systems of cooperating farmers.

Justification: Since arable agricultural production in Botswana fluctuates greatly from year to year, due in large part to changes in the climatic environment and government policies, several seasons' information are required to adequately describe crop production activities of cooperating farmers. Livestock enterprises also fluctuate with climatic conditions and government policies, although to a lesser extent. A continual monitoring program provides information on responses to the fluctuations, and allows for the identification of trends

among cooperating farmers, such as shifts from one traction source to another. This information assists in the identification of economically feasible technologies, which can lead to increased incomes without substantially increasing business risk.

Approach: A post-harvest, single-visit survey was administered to cooperating farmers in each research village. Cooperating farmers included those who implemented trials and/or responded to any surveys conducted during the season.

Results: Approximately 70 farmers were interviewed following harvest. They were questioned about: crops planted, lands plowed and planted, weeding, harvesting, new crop variety assessments, new cropping practices, and major problems identified during the current cropping season. Detailed results are presented elsewhere (PR M89-2). The cropping year was, in general, poor. 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 draft, but also hiring tractors (partially dependent draft households). Intuitively, a two-pronged subsidization approach -- combined with availability of tractors to hire -- may be the best solution to attaining the dual national goals of equitability and food security.

It is expected that the same survey will be administered next season, and all seasons thereafter, thus enabling the identification of trends in the farming systems of cooperating farmers.

6.7 ENVIRONMENTAL MONITORING [12.8]

6.7.1 RAINFALL AND TEMPERATURE MONITORING [12.8.1]

Objective: The objective of this RMRI study was to measure rainfall and temperature for all research sites.

Justification: Large temporal and spatial variation in rainfall and temperature accounts for a large part of the variation in agricultural production. From a research perspective, not only should the effect of these climatic factors be measured, but different technologies must be evaluated on the basis of how well they do under different climatic conditions.

Approach: Rainfall and temperature have been monitored as in previous seasons. A few adjustments have been made this season, however, in the distribution of rain gauges in two of the ATIP village areas. Seven gauges have been added in Makoro providing a total of 14 gauges, thus adjusting the gauge density so that it is comparable to that of the other villages. In Shoshong, three remote gauges have been abandoned because of the small amount of research presently carried out in those areas. A single gauge has been added in another area of the Shoshong lands. No changes were necessary in the rain gauge distribution of Mahwate.

6.7.2 RAINFALL RUN-OFF MEASUREMENT STUDY [12.8.2]

Objective: This is an RMRI descriptive/diagnostic study to define relationships between rainfall, soil type, slope, land use and run-off.

Justification: Data on expected run-off in the traditional lands area are not available for Botswana. Such data are useful in designing or evaluating the potential of run-off

management structures or systems for agricultural purposes.

Approach: Three bunded plots of 50m by 100m were built last season in one field of the Shoshong area. Land use patterns in the plots are (a) uncleared bush, (b) cleared fallow and (c) cultivated. Run-off and soil moisture were monitored with automatic flow recorders and neutron probe readings. Stream flow, for important flows in the lands area, were also calculated using the Manning Equation.

Results: Three run-off plots each measuring 40m by 100m have been monitored in Shoshong. These three plots are part of a much larger 27 plot study conducted by the Land and Water Management Project Hydrologist. Interesting data were collected following rainfall events in January and early February. A maximum of 20 percent run-off occurred from land planted with sorghum following a heavy storm with 60mm rain falling in less than one hour. Land that was left in grass or shrub bush generated insignificant amounts of run-off during the same storm. Storms of lesser intensity produced little run-off on any of the plots.

6.8 METHODOLOGY [12.9]

6.8.1 STANDARDIZATION OF MEASUREMENT UNITS [12.9.1]

Objective: The objective of this study was to standardize weights and labor times for more accurate local costing, especially of locally-scarce, high-value crops sold in small quantities.

Justification: Precise economic valuation of crops and labor times are contingent on local prices, especially when local prices for high-value crops differ from official BAMB prices. High-value crop seed and grain is often traded in small quantities, making weight conversions to common units difficult. If units are standardized, then more accurate conversions are possible; conversions which reflect actual, local conditions.

Approach: Two approaches were taken in order to obtain all of the information pertinent to standardization of measurement units. To obtain labor coefficient and unit weight information, survey forms were designed by the ATIP COP, and distributed to the Mahalapye and Francistown teams. Labor coefficient information included: destumping, fencing, plowing, broadcast and row-planting, fertilizer application, weeding, harvesting, threshing, and transporting of harvest. Unit weight information pertained to all seed types sold locally, and traditional units of measure, such as coffee mugs and donkey cart loads. Labor coefficient and unit weight information was to be obtained from related secondary sources, and any formalized field studies initiated by ATIP Mahalapye and Francistown.

Local prices were obtained using a form developed by ATIP Francistown. Individual farmers and local traders were interviewed, at random, in each research village.

Results: The labor coefficient and unit weight study designed by the ATIP COP was completed in Mahalapye shortly following harvest. Several secondary sources were researched, primarily reports from previous on-farm research projects in Botswana. Where unit weight information was lacking, weight measurements were performed in the research villages. After the study is completed at Francistown and Sebele, the results will be published in a separate progress report.

Local prices were also obtained from the ATIP villages shortly following harvest. A total of 26 and 13 individuals and local traders, respectively, were interviewed in Shoshong, Makoro, and Makwate villages. Table 6.5 summarizes the local price results which must be

considered very tentative in nature since there are also no established prices.

As Table 6.5 indicates, deviations associated with cowpea and groundnut seed/grain prices are markedly higher than deviations for other seed/grain types. This is probably due to the fact that groundnuts and cowpeas are scarcer, and farmers who sell seeds and grains are less certain of how to price them.

Compared with local prices for the Mahalapye area presented in Annual Report Number 6 (May - July, 1988), seed/grain prices are lower this season than last, except for sorghum and groundnut, which are approximately the same as last harvest season. Given anticipated inflationary pressure in the general economy of Botswana, such an outcome is theoretically unexpected. However, Mahalapye village traders were included in the Annual Report Number 6 price survey, thus higher prices found in a larger village were factored into the overall mean price values. This season's survey was confined to ATIP villages in an effort to isolate current, post-harvest prices existing solely in rural areas.

It is expected that as the local price survey is conducted each season before planting and shortly following harvest, seasonal price trends will be identified, thus allowing comparisons with theoretical expectations.

TABLE 6.5 AGRICULTURAL PRICES, MAHALAPYE AREA, APRIL, 1989

	Commodity	Unit	Price/Unit*	
Seed:	Sorghum	Kg	0.12	(0.09)
	Maize	Kg	0.33	(0.10)
	Millet	Kg	0.58	(0.12)
	Cowpea	Kg	1.08	(0.69)
	Groundnut	Kg	1.30	(0.75)
Grain:	Sorghum	Kg	0.39	(0.08)
	Maize	Kg	0.34	(0.08)
	Millet	Kg	0.56	(0.14)
	Cowpea	Kg	1.33	(0.70)
	Groundnut	Kg	1.22	(0.67)
Other:	Watermelons	Each	0.66	(0.36)
	Pumpkins	Each	2.11	(0.83)
	Morogo	Cup	0.42	(0.20)
	Sweet reed	Each	0.17	(0.08)
Animals and Products:				
	Goats	Each	54.81	(19.29)
	Madilla	Cup	0.20	(0.09)
	Cattle	Each	357.27	(176.80)

* Local prices represent the mean values across villages. Standard deviations are in brackets beside the mean values. In most cases, farmers and traders reported lowest, most common, and highest prices. These prices were lumped together to find overall means and standard deviations. The following conversions were used, unless otherwise indicated by the enumerator: 1 phonsane (bucket) = 12.0kgs; 1 cup/coffee mug = 0.3kg.

6.8.2 RESEARCH GROUP METHODOLOGY [12.9.2]

Objective: The objective is to iterate on previous group methodology and set a framework for the Mahalapye team's future use of farmer groups.

Justification: As past ATIP work and studies have shown, use of groups is an effective strategy for trials management and dissemination. The group strategy facilitates message

delivery, and allows for immediate farmer interaction on points of mutual interest. Group formats also utilize research resources more efficiently.

Stages throughout the season may be reached when farmer groups no longer contribute to the efficient use of research resources, and continued meetings for the sake of group cohesion inhibit trials progress. Therefore, it is important to identify how groups can be structured so that this point of diminishing returns is never reached.

Approach: As soon as the trials program was decided upon, field enumerators were to attend a comprehensive trials training session(s). During November and December, general farmer group meetings were to be held in each village for FMFI and RMFI trials management purposes. Each field enumerator will then be responsible for visiting farmers individually during the implementation process to ensure that mistakes are minimized.

Beginning with the month of January, group meetings were to be held in each village, but these would resemble mini-farmer field days, more than structured meetings. All ATIP staff were to be encouraged to attend the meetings cum field days, as general farmer problems and successes, both specific and non-specific to trials work, were to be discussed and observed. This meeting format was to be continued throughout the season. Sebele researchers and area extension agents were to be encouraged to attend selected meetings.
A separate farmer group, consisting of Shoshong farmers who participated in RRM work (section 6.4.3), and interested neighbors of these farmers, were to meet following harvest in order to assess this season's RRM results, and the potential for water harvesting in the Shoshong area. The Rural Sociology Unit of MOA was to monitor the group meeting, and design a follow-up questionnaire seeking to understand the overriding issues of RRM work in the Shoshong area.

Results: In keeping with the need to rationalize the Mahalapye team's use of farmer groups, the farmer group strategy was slightly modified to make more efficient use of the Mahalapye team's resources.

During October, the field staff attended a comprehensive trials' training session. New standardized data forms were reviewed and all trials chosen for this season were discussed.

During November, general farmer group meetings were held in each village for the purpose of FMFI and RMFI trials management. Each field enumerator then visited farmers individually during the implementation process. Follow-up farmer group meetings were held in each village during March in order to discuss the progress of trials work, and to plan for farmer field days scheduled for April and May. Field days were held in each research village, concentrating on the themes of maintaining soil fertility and row-planting.

ATIP staff visited farmers individually throughout the season to personally assess the trial results, and for trial management purposes in cases where RMFI trials necessitated researcher involvement. Group outings (e.g., mini-farmer field days) were not possible, due primarily to the demands of each individual's work load. Finding time to visit farmers together proved to be too difficult for research staff.

End-of-season FMFI farmer group meetings were held in each village following harvest. Village field staff set the agenda and led these meetings. RRM farmers in Shoshong met with ATIP staff and representatives from the Rural Sociology Unit, before harvest, in order to assess this season's RRM results. Several issues pertaining to design modifications and the potential of water harvesting in Shoshong were discussed. The Rural Sociology Unit followed up the group meeting with a survey, which was administered during June and July.

6.9 OTHER PROFESSIONAL ACTIVITIES [12.10]

6.9.1 LINKAGES WITH FARMERS [12.10.1]

Linkages with farmers have been accomplished in the following ways:

(a). Farmer group meetings have continued for the purpose of FMFI trials management and technology assessment.

(b). Farmer participation in technology screening and design has been increased through the use of farmer assessment groups in RMRI land and water management work. The Rural Sociology Unit of MOA has participated in interviewing farmers and designing a follow-up questionnaire.

(c). Farmer participation in RMFI testing of farm equipment has been increased due to an increase in the variety of equipment being tested. Post-season questionnaires concerning the donkey harnesses and dutch hoes should allow farmers to more actively participate in equipment assessment.

(d). An annual research report on ATIP activities is given at kgotla meetings in each ATIP village.

(e). The format for farmer field days has been modified to enhance the focus of the messages given during the days. Also the focus on farmer related issues has been increased by limiting participation of extension and research staff.

6.9.2 LINKAGES WITH ON-STATION RESEARCH [12.10.2]

Linkages with on-station research has been maintained and improved by:

(a). Providing on-farm research support/feedback to commodity programs such as cowpea, groundnut, sorghum, and FMDU research.

(b). Providing on-farm research input into Sebele research working groups based on themes.

(c). Providing on-farm research management for three locations of the National Tillage Trial.

(d). Providing on-farm research management for four locations of the Land and Water Management Unit's Rainfall Run-off Management Study.

(e). Providing on-farm research sites and historical yield data for further technology research.

6.9.3 LINKAGES WITH EXTENSION [12.10.3]

In an effort to formalize linkages between research and extension at the regional level the following, joint activities have been, or will be initiated by ATIP:

(a). ***Row-Planting Field Course Impact Assessment Study.*** Thirty-three farmers who participated in last season's row-planting field courses in Machaneng and Palapye Districts have been interviewed jointly by ATIP staff and the respective ADs. The survey assessed the impact that the field courses had on individual farmer operations, and perhaps more importantly, brought researchers, extension agents, and farmers in contact with one another. A report on the survey is forthcoming.

(b). ***Machaneng Agricultural District.*** Based on last season's successful row-planting field course, the DAO Machaneng has decided to hold two field courses in his district at the conclusion of this season. ATIP will collaborate with the DAO, RTC, and ALDEP, but will not play the lead role in organizing the field courses. A row-planting contest during this season's agricultural fair was also jointly sponsored by the DAO Machaneng, RTC, ATIP, and ALDEP.

(c). ***Machaneng West Agricultural Districts.*** ATIP plans to collaborate with the DAO Machaneng, Mahalapye RTC, and ALDEP in organizing two row-planting field courses. A row-planting contest during the season's Mahalapye agricultural fair was jointly sponsored by DAOs Mahalapye, Mahalapye RTC, ATIP, and ALDEP. This competition was repeated at Serowe and Machaneng.

(d). ***Palapye Development Trust/Palapye Agricultural District.*** Following the row-planting field course held in Palapye, it was decided not to administer the impact assessment survey to the five "pioneer" farmers from the PDT Tswapong Hills extension area. The pioneer farmers were not devoting time to their own operations this season. Instead, PDT was paying them a salary to remain at PDT and study sustainable agricultural techniques.

A meeting will soon be arranged between PDT and ATIP staff in order to assess the progress of farmer group formation in the Tswapong Hills area, organized and led by the PDT AD staff.

6.9.4 LINKAGES WITH POLICY/PLANNING [12.10.4]

Documentation of Mahalapye data sets is currently being undertaken at Sebele.

6.9.5 VISITS OUTSIDE THE COUNTRY

The following conferences and workshops held outside the country, were attended:

(a). Mr. E. Modiakgotla attended a SIDA sponsored FSW/Workshop in Tanzania during February.

(b). Mr. E. Makhwaje attended CIMMYT/ILCA sponsored Experimental Data Analysis Workshops in Ethiopia and Kenya, during February - July, 1989 (see Section 4.2).

CHAPTER 7: ATIP FRANCISTOWN ACTIVITIES, SEPT. 1988 - AUG. 1989

USAID:	G. Heinrich	(Agronomist)
	T. Thedford	(Animal Scientist)
	F. Worman	(Agricultural Economist)
GOB:	S. Masikara	(Agronomist, DAR)
	C. Tibone	(Agricultural Economist, DPS)
	K. Kelemogile	(Animal Scientist, DAR)

7.1 CROPPING SYSTEMS [13.2]

7.1.1 SORGHUM/COWPEA INTERCROPPING STUDY [13.2.1]

Objectives: The objectives of this RMRI testing stage trial were:

(a). To examine whether a sorghum-cowpea intercropping system can reduce the risk of crop failure relative to sole crop sorghum production.

(b). To examine whether an intercrop system is actually more productive than a sole crop system under farmers' field conditions.

Justification: Intercropping has been shown to reduce the risk of crop failures in some countries. The rate of crop failures, under the drought conditions now prevailing in Botswana has been very high in recent years (e.g., up to 80 percent failure of plots planted in 1983-84). Any technology which reduces the rate of crop failures should be of benefit to farmers. Further, published reports from other countries indicate that, in some cases, a cowpea/sorghum association can actually increase sorghum yields over that of sole sorghum.

In their final report, the DLFRS team concluded that adding a cowpea component to a sole sorghum system actually increased the probability of failure of the sorghum crop in dry years. However, this effect was most severe in sorghum stands of 40,000 plants per hectare and above. The effect was less severe with lower sorghum densities. In the experiment described below, plant populations were held at 20,000 and 10,000 plants per hectare for sorghum and cowpeas, respectively. Further, the between-row spacing was increased from the usual 75cm to 100cm, reducing the between row and between species competition still further.

It was hoped, the added legume crop in this cropping system would:

(a). Provide farmers with increased food (and possibly income) through the use of cowpea leaves during the growing season.
(b). Provide a buffer crop in case of failure of the sorghum or destruction of the sorghum by birds.
(c). Add to the long-term productivity of the soil by increasing nitrogen content to some extent.

Approach: The intercropping system tested consisted of two rows of sorghum (v. Segaolane) followed by one row of cowpeas (v. ER7). Rows were on one meter spacing,

and were planted with the rotary injection hand row-planter. All plants within rows were on 33.3 cm spacing. Comparisons were made against sole stands of both sorghum and cowpeas, planted in the same row arrangements, and against a traditional broadcast mix of the same plant populations.

The trials were conducted with two farmers per village, with two replications per field, giving a total of 12 replications overall. Plot size was 15 meters by 20 meters. Trials were planted in randomized complete block designs, with four treatments and two replications per field.

The economic focus for these trials was to collect sufficient labor use, input cost, and yield information from the individual trials to allow the formulation of budgets for each proposed intervention. The budgets were used in comparing potential interventions with traditional technologies, in order to determine which interventions may be economically feasible.

Results: This trial was conducted for three years from the 1986/87 to the 1988/89 seasons. In general, the yields were low due to low rainfall with poor distribution. During the first season -- 1986/87 -- the trial was badly hit by drought with little harvest from cowpea, and very little or zero harvest from sorghum. The last seasons -- 1987/88 and 1988/89 -- had better rains and yields were better than the first season. However, the yields were still low due to poor rainfall distribution. For the 1987/88 and 1988/89 seasons only, the average yield for sorghum was 244 kgs/ha and for cowpeas was 81 kg/ha. There were no significant differences between treatments, mainly due to drought, but the differences between locations were highly significant, primarily due to the influence of rainfall distribution.

Conclusions: There was no yield increase on the intercropping system over sole cropping. However, it was observed that over years some crops did better than others due to weather or environmental changes. For example, in 1986/87 cowpeas did better than sorghum due to the timing of drought conditions, and in 1988/89 sorghum did better because aphid and rat damage on cowpeas reduced yield. It might therefore be advisable to intercrop to avoid the risk of total crop failure, especially under limited resource farmer conditions. The purpose of the intercrop system was to improve the traditional broadcast mix cropping, but it can only work for farmers who practice row planting. The combination of main and minor crops should be carefully selected to avoid plant nutrient competition and farm labor constraints.

7.1.2 CROP MIX STUDY [13.2.2]

Objective: The purpose of this FMH testing stage study was to determine the degree of crop yield stabilization that can be achieved by planting a mix of different crops -- and/or varieties with different maturity lengths -- at different times of the year.

Justification: At present, farmers tend to plant one or two sorghum genotypes throughout the planting season -- this may be due to lack of seeds of different varieties or lack of strategy. The same is true of millet. Yet the length of the growing season and the distribution of rainfall in a given year are both highly variable. By planting a planned mix of different crops and crop varieties throughout the season -- mostly long season crops at the beginning, mostly short season crops near the end, it is possible that farmers could improve the reliability of their grain production.

Farmers already do this to some extent, but it would be useful to develop guidelines for farmers, extension agents, and policy planners who make seed available for farmers.

Approach: As in the past, these trials were handled through the farmer groups, in an FMFI mode (see Section 7.9.1). Much data are required to examine stability effects, so it was expected that this activity would continue for several years -- particularly given the low number of volunteer participants. Farmers were encouraged to plant mixes of 75 percent long season cereal and legume crops -- 25 percent short season ones -- in any plantings prior to January 15, and to plant a mix of 75 percent short season crops/varieties and 25 percent long season ones after that date. Records were kept on planting dates, crop varieties and plot grain yields.

Results: This was not a popular option for testing. Only one farmer planted a trial. This trial was planted January 18th and compared sorghum varieties Segaolane and 65D, and cowpea variety TVX. The top yielder was 65D with 390 kg/ha. The TVX failed to produce any grain due to insect pests.

The results of this years trial will be added to those from previous years for analysis. It is not clear why farmers are not particularly interested in testing this concept.

7.1.3 ESTABLISHMENT OF PERENNIAL FORAGE SPECIES [12.2.3]

Objectives: The objectives of this RMRI testing work were to:

(a). Identify problems associated with the establishment of agro-forestry/perennial forage species.
(b). Evaluate cultivars of leucaena and pigeon peas for local adaptation.

Justification: Hedge rows have been shown to prevent wind and water erosion. Leguminous plants such as leucaena and pigeon peas also fix appreciable amounts of nitrogen in the soil. In addition, such agro-forestry/perennial forage species can supply valuable feed for livestock as well as firewood and building materials.

Approach: Leucaena, pigeon pea and other plants suitable for hedge rows were planted in pots for later transplanting to test sites in ATIP compounds, and on farmers' fields/or at their compounds. Plants were distributed to farmers through the farmer testing groups and on request.

Results: Table 7.1 provides a summary of the plants grown in the nursery and their disposition.

TABLE 7.1 PERENNIAL PLANTS STARTED IN MATOBO NURSERY

Variety	No. Planted	Disposition
Papaw	160	90 given to farmers
Luceana	1000	800 given to farmers & 3 schools
Pepper tree	150	110 given to farmers
Hage	200	None distributed
Hot pepper	450	200 given to farmers
Moroja	30	All given to farmers
Mophane	25	Taken by individuals from southern Botswana
Mosetha	25	No farmer interest, thrown away

7.2 TILLAGE AND PLANTING PRACTICES [13.3]

7.2.1 DOUBLE PLOWING SYSTEMS TRIALS [13.3.1]

Objectives: The objectives of this RMFI testing stage work were:

(a). To test three different double plowing (DP) systems on a large scale, and to assess their feasibility and profitability in practice.

(b). To collect labor and input data on operational scale plots, to clarify the relationship between small plot labor data, and actual requirements from large scale plots.

Justification: Plot level studies in Tutume Agricultural District indicated that DP could profitably boost per hectare grain yields as long as the opportunity cost of the first plowing was minimized (ATIP PR F87-5). Also, economic analysis indicated that it would be beneficial to switch from 2 hectares single plowed (SP2) to 1 hectare DP on farm units with a weeding labor constraint, and/or with limited plowing opportunities.

Theoretically, several practical systems were envisioned which could minimize the cost of the first plowing, and allow farmers with different resource constraints to implement DP. However, these have never been tested on a large scale to verify the theory. In order to round out the work to date on DP, it was proposed that these systems be subject to a full scale test.

Approach: The three systems tested applied to farmers in different traction categories. These categories and the appropriate systems are described below.

(a). ***For Farmers Who Own Their Own Draft Power (Largely Cattle).*** With the first rains when the animals were ready to plough, the farmer plough/ planted an area of 50 meters by 25 meters. This required about one day. When the soil dried slightly below a reasonable moisture level for planting, an area of 50 meters by 25 meters was plowed in preparation for DP with the next rain.

When the next rain occurred, the prepared plot was planted, together with an adjacent 5 meters by 50 meters strip, to act as a traditional check. As the soil moisture dropped below the optimum for planting, another 50 meters by 25 meters strip was prepared. This system continued on subsequent rains into January, with the farmer planting on good moisture and preparing more land as the soil dried. Each DP plot had an adjacent check plot 5 meters wide.

It was hoped that this trial would help determine the feasibility of using drying soil moisture periods for land preparation, and provide some estimate of the potential benefits on a whole farm level.

(b). ***For Farmers Who Share Animal Draft.*** This assumed a government subsidy on tractor tillage, and that tractors were available. In this case, a tractor was hired to plough the land, either before the rains or during the early rains, before animals were in condition for plowing. The tractor plowed a quarter hectare strip, 25 meters by 100 meters. With the first planting rain that animals were available, the farmer planted half of this area (50m by 25m), plus an adjacent unplowed area of 50 meters by 25 meters. All of this land -- 0.25 hectare total -- was either row-planted or broadcast planted in the traditional manner at the farmer's discretion. With the second rain, the process was repeated using the second half of the prepared land.

As long as there is a subsidy on tractor plowing, this system allows farmers, with limited access to cattle draft, to double plow without increasing their direct costs. The double plowing should allow them to increase their production and profit from a limited plowed area.

(c). ***For Farmers Without Access to Animal Draft.*** This trial also assumed a government subsidy on tractor plowing. Before the rains, or with the first rains, a tractor was hired to plough an area of 50 meters by 200 meters. With the next rain, half of the area was re-plowed by tractor (50m by 100m), along with an adjacent unplowed area of equal size. Both areas -- adjacent prepared and unprepared plots -- were planted on the same day with the same planting method. This procedure was repeated on the second half of the plowed area, plus on an equal adjacent area, with the next rain. As well as allowing assessment of the double plowing system on a large scale, this system shed some light on the relative merit of DP using tractors.

Each of these three systems was implemented by two farmers in different villages. All labor and input data were collected to allow budgets to be constructed, and to provide comparative data on labor requirements for large and small plots.

Results:

(a). ***For Farmers Who Own Their Own Draft Power:*** The two farmers involved in this study had problems, this year, that affected their draft management systems. At location 1, a lack of labor to help in the field resulted in a late start in bringing the animals to the village. Then, in order to get labor, the farmer entered into a draft-sharing arrangement -- draft power in return for labor. This meant that she could only use her animals to plow her own land during alternate planting opportunities.

At location 2, the couple delayed in getting started. Then the husband died in a traffic accident early in the new year. This tragic accident naturally caused a hiatus in planting activities in late January.

Thus neither of the farmers was completely able to use their draft animals as they might have chosen for the whole of the season, and so did not really fit into the category of farmers to whom this system should apply. However, as they had been involved in the study the previous year, and the problems they encountered were not entirely predictable, no switch was made to other locations.

Adding to the difficulties of the season, there were no planting opportunities in November (i.e., no rainfall events of 10 mm or above) at these two locations. Preliminary plowing and plow/planting were initiated in December for both locations, but the first planting of the DP plots did not occur until early January. This was unfortunate, as it restricted the number of plots that could be subsequently planted. In the latter part of January and the early part of February, rains were very poor. March and the first three weeks of April were also very dry. This drought period delayed maturity in millet and sorghum, at both locations, particularly in crops planted in February. April was also unseasonably cool, which delayed maturity even further. As a result of these environmental factors, crops planted in February generally gave very low yields.

Nonetheless, the trials did help to address the two primary objectives, i.e., the feasibility and profitability of the system.

Information on daily rainfall, and the dates of all field operations will be given in a forthcoming progress report. Plant densities for the DP and TC plots averaged 18,261 and 8,344 plants/ha, respectively, while grain yields were 283 kg/ha for the DP plots and 129 kg/ha for the TC plots.

Regarding the feasibility of using good soil moisture for planting and using the drying soil moisture period for preparing more land, it was found that:

(i) Plowing with animal draft power was feasible for at least 5 days following a rainfall of 15 to 20mm, with an opportunity cost near zero for plowing on the last two of those days.

(ii) Following heavier rains (38-80mm), plowing was possible at least 8 days.

Thus the data support the hypothesis that following rains of 15mm or more, it should be possible for farmers, who control their own animal draft power, to use the first few days for plow/planting and still have time to prepare the land for DP on drying soil moisture.

Profitability: On a per hectare basis, the double plowing system produced a slightly higher (P18/ha) net return. The net return to labor for TC was five thebe per hour greater than for the DP system. Partial budget analysis indicates that there is a slight advantage (P13.68/ha) in shifting from the traditional system to the double plowed system. This analysis is not made on a total five hectare system as the average number of the farmers were able to plant the total trial. Hence, the analysis is based on four hectares for one farmer, and three for the other.

(b). ***For Farmers Who Share Draft Power:*** At both locations, the initial land preparation on the DP plot was done somewhat later than optimal. The first plantings were done in early January, and subsequent poor rainfall in January and early February delayed plantings of the second replications into the second half of February. Late planting coupled with an early on-set of cold weather severely limited yields in those replications. Plant densities were 12,438 and 500 plants/ha for the DP and TC plots, respectively. DP plots yielded 305 kg/ha while TC plots yielded 10 kg/ha -- only data from plots that yielded. A full data set will be presented in a forthcoming progress report.

At both locations, the system of tractor plowing followed by animal plowing on DP plots appeared both practical, and in this year, beneficial. In the first replication at both locations, planting was followed by a long drought period. During this period it appeared that the extra soil moisture stored in the DP plot, before planting, made all the difference to both stand establishment and eventual grain yield. This was similar to results from the tractor/tractor DP systems trials for plots planted during this period.

Additionally, an incident occurred during the planting of one plot that has implications regarding the limited planting opportunities faced by animal draft power users. After the rain on the 12th February, 1989 the farmer wanted to plant the second replication. However she was delayed until 17th February, 1989 because she could not find her animals. On the 17th February, 1989 the DP plot still had

sufficient moisture for plow/planting (there was a 7mm rain on 16th February, 1989), but the TC plot was too hard to till. Hence the TC plot had to be planted some days later after the next heavy rain. This experience highlighted a phenomenon that has been observed previously i.e., that preliminary preparation of the land often has the effect of extending the time when planting can be done effectively on subsequent rains, and can sometimes enable farmers to plant effectively on smaller rainfall events. Taking advantage of this effect might be of significant benefit to farmers who share animal draft power, and often gain access to the animals during non-optimal planting times for other farmers. One scenario might be for draft dependent farmers to tractor-plow an area early in the season on drying soil moisture. Then they might be able to capitalize on the extended planting period effect, to employ the animals of other farmers after the optimal single plowing period had passed on the other farms.

Profitability: The double plough system yielded a net return of slightly over P80/ha more than the traditional system, if only plots producing a yield were included. If all plots were included, the DP system provided a net return of approximately P10/ha more than the traditional system. Net returns to labor were only two thebe/hour more for the DP system if all plots were included, but were almost 40 thebe/hour more if only plots yielding a crop, were included.

(c). ***For Farmers Without Access to Animal Draft:*** At one location, the preliminary plowing was done on the 15th December, 1988. All plowing was by tractor and mouldboard plow. The first double plowed plot and the traditional check plot were planted on the 5th January, 1989. Maize was planted by hand in the furrow behind the plow. It was planted in rows, 1 meter between rows, and every third row was left empty -- skip row-planting. Seedling emergence was reasonable on the DP plot; poor on the TC plot. The seedlings were later thinned on the DP plot.

There were no further planting opportunities until late February. Planting of the second DP and TC plots was attempted on the 24th February, 1989. However, the soil was too wet and the tractor became mired in the mud. By the time conditions were acceptable for planting, it was March, and too late to plant. Hence only one planting date was applied at this location. The dates of all field operations, rainfall data, etc. will be included in a forthcoming progress report.

For the first six weeks after planting, rainfall was very poor, with only one shower of 10 mm or above. Plants in the TC plot withered and died. Plants in the DP plot showed signs of stress, but largely survived.

Plant stands were 6,667 and 3,250 for the DP and TC treatments, respectively. Grain yields were 422 and 0 kg/ha for the DP and TC treatments, respectively. The DP treatment allowed the maize seedlings to survive a 6 week post-planting drought, and produced a yield on subsequent rainfall.

At the second location all plowing was by tractor, using a 3 furrow disk plow. In the first replication, sorghum seed was broadcast and plowed down. After planting the first replications, there were only two showers, of less than 10mm each, during the following 6 weeks. Emergence and seedling establishment were good on the double plowed plot, poor on the traditional check plot. Plant stands in the first replication were 30,000 plants per hectare for DP versus 2,250 for TC. Grain yield was 563 kg/ha for DP versus 46 kg/ha for TC.

Due to the 6 week drought in January-February, the second replication could not be planted until 14th February, 1989. This was a dry-planting. The late planting date also meant that a short season sorghum was planted. The crops planted in January survived to produce some yield. The crops planted in mid-February did survive, but were overtaken by cold weather in April. The cold weather slowed down the growth process to the extent that the crops never produced grain.

At both locations, the long drought period following early January rains prevented the timely planting of the second replications. Regarding the results of the first replications, it was clear that the preliminary tillage was beneficial for both stand establishment and the survival of seedlings through the long post-planting dry period. The effects of DP on seedling establishment and survival through the drought were probably due to the existence of a greater amount of stored soil moisture at planting in DP plots. Greater soil moisture at planting is the expected result of preliminary plowing and improved moisture infiltration on that area between the first and second plowings.

Profitability: For all plots, the net return per hectare for the double plowing system was almost P9/ha, while the net return for the traditional system was minus P47/ha. This was because only one of the traditional plots yielded, and that yield was approximately one-tenth of the yield of either of the DP plots which yielded. The net return to labor for the DP system was slightly positive (P0.16/hour), while it was a negative P7/hour for the traditional system.

7.2.2 NATIONAL TILLAGE TRIAL [13.3.2]

Introduction: These trials were a collaborative effort between DAR, MDEP, ATIP, and INTSORMIL and the SACCAR Land and Water Management Project. They were similar to the collaborative tillage trials performed by ATIP and DAR in 1985-87. The main differences between the current trials and previous ones, within the Francistown region, were that the recent trials:

(a). Included a modified deep-ripping treatment
(b). Were truly national in scope
(c). Included participation by more research and extension groups
(d). A soil physicist assisted in quantifying the physical effects of the different tillage practices on soil characteristics.

The trial design was agreed to by representatives of all the groups involved, in a meeting at Sebele on 1st August, 1988. Objectives, justification and approach were written by Dr. N. Persaud and are included below. The only variation that occurred in the Francistown region was that, at one location, a sixth treatment was included. This treatment was "skip row-planting". Skip row-planting is planting two rows of sorghum on 75cm between-row spacing, and then leaving an adjacent area of 1.5m empty.

Objectives: The objectives of this RMS Testing stage work were:

(a) To evaluate the performance of the deep-ripping system on seed-bed and root-bed preparation, on yields, on soil moisture conservation, and use on various soils, and for different rainfall conditions.

(b). To evaluate the effects of several possible improved tillage options on sorghum yields, seedbed and root-bed conditions during the growing season, and use on various soils, and for different rainfall conditions.

Justification: Primary and secondary tillage are essential operations to ensure proper physical seedbed and root-bed conditions for sorghum establishment and growth, and for weed control on soils of Eastern Botswana. Previous studies on sorghum yield response to tillage -- mainly on-station by the DLFRS and on-farm by ATIP -- have shown:

(a). All else remaining equal, the deeper the tillage, the higher the yield.

(b). Response to tillage is governed by the seasonal rainfall pattern.

(c). Response to tillage is influenced by any soil management factor such as weed control operations that directly affect soil profile moisture content.

(d). That over several years, the deep-ripping tillage system may have potential to increase yields.

(e). That two primary plowing operations, the first early in summer and the second at a later date, depending on the rainfall, may provide economic yield benefits over the conventional single plow/plant operation.

More tillage studies were needed to develop a fundamental understanding of the sorghum crop responses to tillage. Specifically the following needed to be evaluated:

(a). The direct influence of various tillage practices on soil physical properties over time.
(b). Sorghum yield response to these tillage practices for various soil types and seasonal rainfall patterns.

Approach:

Treatments: Proposed treatments were as follows:

(a). Conventional tillage: single plow/row-planting operation.
(b). Double plowing: a first plowing done as early as possible, followed by a plow/row-planting operation simultaneously with treatment (a).
(c). Deep-ripping: deep-ripping when soil was dry followed by a discing/row-planting operation simultaneously with treatments (a) and (b).
(d). Conventional tillage with wide row spacing: same as in treatment (a), but with rows spaced as for the deep-ripping treatment.
(e). Plowing and cultivation: as in treatment (b), but with the second tillage replaced with a cultivation/row-planting operation.

Design and field layout: Experimental plots were laid out in randomized, complete blocks with at least two blocks at each location. Experimental plots were at least 40 meters long by 15 meters wide, with a 10 meter allowance at each end to allow for turning.

Locations: Locations were as follows:

(a). Sebele: one site
(b). Mahalapye: three sites.
(c). Francistown: two sites at Mathangwane.

Measurements:

(a). Site characterization: location and landscape characteristics of each site using 9x9 panchromatic 1:50000 aerial photographs. Profile description of each site using the guidelines for soil profile description developed for Botswana by the FAO/UNDP/GOB Soil Mapping and Advisory Services Project. In situ bulk density measurements, sampling and chemical analyses on samples from all horizons to 125cm. Infiltration rate versus time curves and surface bulk density samples for 0-5, 0-10, and 0-15cm depth intervals for each elementary plot for all sites.

(b). Physical measurements: profile soil moisture, bulk density at 0-5, 0-10, and 0-15cm depths, and infiltration rate versus time curves, and where possible penetrometer measurements on each elementary plot at regular intervals from the beginning to the end of the season.

(c). Meteorological measurements: non-recording rain gauges installed at each site.

(d). Crop measurements: observations on plant stands, weed counts, rooting pattern, and crop yields made at appropriate times during the growth of the crop.

(e). All labor and input data was collected so that economic comparisons could be made between the different technologies.

Results: This trial was performed at one location in Mathangwane village, Tutume Agricultural District. A second trial was planted twice. The first time it was destroyed by rats. The second time it was destroyed by drought immediately following planting. After that it was abandoned, due to the lateness of the season. The daily rainfall amounts for the surviving location and the dates of all field operations, by treatment, will be given in a forthcoming progress report. During implementation of the treatments there were some deviations from the original plan. These are described below.

Preliminary Tillage. The first tillage operation was deep-ripping. There were some logistical problems involved with this. First was the problem of finding a tractor with sufficient horse power to perform the operation and sufficient height to lift the ripper. Normally tractors are hired in the village. However, the largest tractors for hire in the Mathangwane village were 185's, and these did not have sufficient height or power. Finally, a large tractor was secured from the local CTO in Francistown. Even this tractor (ca. 250) had to make two passes over each rip-line in order to achieve a ripping depth greater than 40cm. The point here is that if ripping is to be recommended for this area, there must be some mechanism to account for the small size of tractors in the village. At the time of planting, these plots were to be machine weeded in such a way that the rip lines would remain visible. However, the proper equipment was not available at planting. As there was considerable weed growth on the plot, the decision was made to plow the plot instead. The ends of the rip lines were marked before plowing so that planting could be done on the rip lines after plowing. Hence the "deep-ripped" plots were first ripped and molded, then later plowed on the date of planting.

Another problem occurred with the plow-cultivate operation. Because equipment had to be borrowed or hired, there was no cultivator available at planting time. In order to destroy weeds and leave these plots bare, these treatments were simply replowed and row-planted, exactly like the double-plowing treatment plots. Thus the "plow-cultivate" treatment cannot be considered as different from the double plowing treatment.

Plant Density and Grain Yield Results: Plant stand densities and grain yields for each plot are presented in Table 7.2. Analysis of variance was performed. These analysis showed no significant differences between treatments or replications for either plant stand densities or grain yield. The lack of significant differences was possibly due to the high variability within treatments, and the low number of replications.

TABLE 7.2: PLANT POPULATION, YIELD, TOTAL LABOR, NET RETURN PER HECTARE, AND NET RETURNS TO LABOR, NATIONAL TILLAGE TRIAL, FRANCISTOWN AREA, 1988-89

Treatment[a]	Plants Per ha	Yield per ha Kg	Total labor Hours	Net Ret per Ha[b] Pula	Net Ret/ Hour Lab Pula
Single Plow-rp	25605	810	128.4	310.78	2.42
Double Plow-rp	24239	1033	161.3	361.26	2.24
Deep Rip-rp	22564	729	142.2	224.67	1.58
Plow/Cultiv-rp	27219	976	151.3	335.77	2.22
Sp-Wide Row-rp	12945	522	94.0	181.28	1.93
Dp-Skip Row-rp	16791	798	123.6	255.53	2.07

a. rp equals row-planted.

b. Net return per ha = net total value product - (yield kg/ha x p45/kg) - costs, where tractor time was valued at P50/ha, seed at P2/ha, and equipment at P1 50/ha.

Regarding the effects of plant stand densities on grain yield, it was true that the two highest yielding plots also had the highest plant stand densities. However, plant stand densities alone could not explain all of the variations among treatment mean grain yields. For example, the deep-ripping treatment had a mean stand density of 22,565 plants per hectare, and a mean grain yield of 731.5 kg/ha. When this was compared with the means for the skip row treatment (16,792 plants/ha and 752.1 kg/ha of grain) and the double plow treatment (24,329 plants/ha and 1067.5 kg/ha of grain), it was clear that something other than plant stand density was affecting treatment mean yields. Presumably the other factors were treatment effects and possibly soil physical factors.

Economic factors: Table 7.2 contains data on total labor time, net returns per hectare (net total value product), and net returns to hour of labor. Double plowed plots required the most labor, while single plowed plots, on wide rows, required the least. However, the net return per hectare of land was greatest for double plowing -- 50 percent greater than for single plowing on wide rows. The conventional single plow system produced the highest net returns to labor, P2.84/hour, with the deep-ripping system producing the least -- over 30 percent less than the single plowed system. All systems produced good returns under the prevailing conditions.

Conclusions. This experiment was part of a set of experiments nationwide. Specific conclusions regarding treatment effects cannot be drawn from this one location in one year. More so since there were no statistical differences detected between treatments. Specific conclusions should await a combined analysis of the complete data set over all eight locations.

However, some specific recommendations can be made regarding the conduct of this trial in the coming year. These are as follows:

(a). A careful analysis should be made of the soil data, by plot, in this trial to determine whether there is a gradient across the experiment in terms of soil moisture holding capacity, soil texture and/or soil fertility. Variations in soil fertility could be corrected by applying varying amounts of fertilizer (by plot) in the coming season.

(b). Plant stand densities will need to be more closely controlled to avoid confounding effects.

(c). The proper equipment for implementing treatments will need to be on-site, well before implementation begins, in order to avoid the problems that occurred this year.

(d). Adding a third replication might be necessary to improve local precision, though this might complicate the logistics of trial implementation considerably.

7.3 FARM EQUIPMENT [13.4]

7.3.1 EVALUATION OF IMPROVED DONKEY HARNESSES [13.4.1]

Objectives: The objectives of this FMFI testing stage work were to

(a). Continue evaluating the durability of the locally produced Kenya donkey harness, as reinforced, under farm conditions.
(b). Evaluate farmer acceptance of the Kenya donkey harness.

Justification: A significant percentage of arable agriculture depends on donkey power for plowing, cultivating and planting. Little improvement has been made in the traditional donkey harnesses which have been used for centuries. Improved harnesses have been shown to increase the efficiency of draft animal utilization by as much as 30 percent. This study continued the testing of an improved design which was initially tested in 1986-87.

Approach: Fifty Kenya donkey harnesses were manufactured and later modified (reinforced) by the Rural Industries Innovation Center, in Kanye. Farmers who tested the equipment last season continued testing the harnesses during the 1988-89 crop season. ALDEP Francistown has ordered 66 harnesses for sale to farmers in their participatory trials program.

Results: At the end of the season, all harnesses were collected and farmers who had used the harnesses were interviewed to obtain their assessment of the harnesses. Generally, farmers were pleased with their experience with the harnesses. A few suggestions concerning reinforcement of specific points on the harness were made and will be forwarded to RHC. A brief final report will be prepared on the donkey harness assessment.

7.3.2 EVALUATION OF ROTARY INJECTION HAND ROW-PLANTER [13.4.2]

Objectives: The objective of this FMFI testing stage trial was to test the modified rotary injection planter to ascertain its durability, and improved acceptability under farm conditions.

Justification: The rotary injection planter may enable farmers with little or no control over traction resources to obtain increased production and farm income through better control over seed depth placement, and the timing of planting vis-a-vis rains.

Approach: The improved rotary injection planter was tested through the farmer assessment groups, as a tool for row-planting in terms of its practicability and performance. Modified units were also tested in Mahalapye and by other farming system projects.

Results: The rotary injection planter was tested by some members of the researcher managed farmer testing groups as part of other group trials they conducted. Farmer

evaluations of the planter were collected as part of the End-of-Season Survey, and will be reported in a forthcoming progress report. The planters had numerous problems and have been discontinued. However, an improved version has been manufactured for the 1989-90 cropping season and included in the ALDEP program.

7.4 LIVESTOCK [13.5]

7.4.1 IMPROVED PRODUCTION OF GOAT MILK [13.5.1]

Objectives: The objectives of this RMFI design trial were to:

(a). Select one or two outstanding female goats from each cooperating farmer's herd.

(b). Determine the maximum production possible from these does by manipulating nutrition, in the form of supplemental feeding and management, by removing kids from these does -- transplanting to does of lesser milk production who have lost kids or had single births, and milking twice per day.

(c). Intensify production of kids by allowing them complete milk production from all other does on the farm.

(d). Initiate permanent identification (via tattoo) of all goats on the farm, so selection processes can be started.

(e). Develop a record keeping system tied to the permanent identification system.

(f). Establish a working relationship with DAFS.

Justification: Most subsistence farmers keep goats, and 90 percent of those who do keep goats, milk them. There is, however, a potential market for fresh liquid milk, and a market for milk products which could possibly be developed. If animals of a dairy type were kept under improved management and a selection program was initiated, it should be possible to increase family cash flow as well as provide a rapid return on investment through small stock.

Malnutrition appears to be a cause of young goat mortality. This is partially because too much milk is taken from the doe by the farmer for home use and to sell, and is not being replaced with supplemental feed. Development of a fodder production and storage program utilized to increase milk production from two or three does for home use and sale would allow all other does to be devoted to raising kids. The kids should be allowed to go with the adults to graze and browse, thereby offering them better quality forage as well as additional milk.

Approach: Two farmers, in each of the three ATIP villages, were invited to participate in this trial. These individuals were selected because of their interest in cooperating, and because of their exceptional managerial capability. As designed, the two or three highest milk producers were to be selected from their herds, and at kidding or soon thereafter their kids were to be transferred to other does so that the complete supply of milk would be available for human use. These animals were to have grazed during the day, but during milking both in the morning and afternoon were to have been fed a supplemental feed calculated to be that amount required for lactation above maintenance. These animals were

to be housed separately from other goats at night and fed free choice, either green chopped or dried fodder raised on the farm. The milk off-take was to be measured and recorded on a record book provided by ATIP. Data was also to be collected on how the product was used, and price received. Analysis of feed versus return was to have been determined from farm records. This was to have allowed all other kids the complete supply from their dams, reducing malnutrition

Cooperating goat farmers were asked to plant 0.1 ha of triple purpose cowpea (B005C) and 0.4 ha of Dolichos lab-lab. Single superphosphate was to have been applied at the rate of 200 kg/ha to one-half of the area. An evaluation was to have been made of the cowpeas for leaves picked for feeding to milk goats. Data on grain yields and forage residue yields was to have been collected. Similar information was to be obtained on the Dolichos lab lab leaves picked for green feeding and estimates forage yields were also to have been obtained

Results: Farmers were selected, the project was explained and all participants agreed to the protocol. Of the six farmers only two constructed kraals or made modification to existing kraals. Only four planted any fodder, two of these did not build kraals, and in the end sold their fodder to ATIP. The other two did not plant until late January, never weeded the crop and after a much reduced harvest, fed all the feed to all the goats in their kraal and exhausted the feed resource in less than four weeks, thereby making the objectives of the project impossible to accomplish.

7.4.2 DIAGNOSIS OF KID MORTALITY [13.5.2]

Objectives: The objectives of this RMRI descriptive and diagnostic study were:

(a). Arrive at the most common causes of kid mortality from birth to weaning
(b). Design management strategies, including housing, to prevent this mortality.
(c). Devise methods of management, including housing, to decrease morbidity
(d). If immunization would be a deterrent, then develop recommendations for immunizing against specific diseases.
(e). Develop working relationships and linkages with Veterinary Services Department and DAFS.

Justification: Death losses in kids vary in severity from year to year, and has been reported from 9 percent to 62 percent by both APRU and ATIP. This loss of income potential, as well as future breeding potential, is of great concern to farmers and government officials alike

Approach: Some kids that died were collected and stored in a cooler or transported to Francistown for a post mortem exam. A post mortem report form was developed. This was completed at time of examination and submitted with those tissue samples that were to be submitted to the Veterinary Diagnostic Laboratory in Gaborone for work-up.

Results: This project will be on-going into April of 1990 to increase the amount of data available. Seasonal evaluation is not important in this instance as identifying causes, with possible corrective recommendations, is the objective. This project has been expanded to look at any sick or dead goat that is presented for evaluation. This should give a more comprehensive view of disease and death as it occurs at the village level, and affects the farmer.

Initial impressions of the disease status in young goats include the following:

(a). Malnutrition is very common -- most likely related to heavy off-take of milk for human consumption, and overgrazing close to village communal areas.

(b). External parasite infestations -- especially sucking lice - appear to be common and severe. Severe anemia associated with lice and malnutrition appears to be a common cause of death.

(c). Colostrum intake and value of dipping navels is currently being evaluated.

(d). Internal parasite infection with helminths of the gastro-intestinal type appears to be of limited severity.

(e). High levels of coccidia counts are common, but evidence of clinical disease is rare.

(f). Pinkeye and contagious Ecthyma are both very common.

Disease status in older goats was as follows:

(a). Heartwater appears to be very common in small stock after about six months of age. Many of these animals respond to treatment if treated early.

(b). Tick and lice infestation is prevalent and severe in all herds.

(c). Caseous lymphadenitis is common in the villages. Some herds are more highly affected than others. This probably relates to kraal environment.

(d). Clinical intestinal parasite infection (stomach and intestinal trichostrongylus) do not appear to be very common. When it does appear, it tends to be seasonal and affects some kraals more than others. Animals so infested respond well to therapy.

Some of the problems identified were:

(a). There is great resistance on the part of villagers to present animals for a post mortem exam. These animals are butchered and eaten and they do not want the meat spoiled by having it examined.

(b). The Small stock Associations are not working properly. Consistent treatment and proper timing is not occurring. Part of this is due to overwork of small stock officers, but a good deal of it is because many of the small stock owners will not spend money on goats, and expect the government or some donor to do everything for them -- including all labor. This resistance to self-help and change is very difficult to work around. Those that have cooperated, have seen extraordinary results and have been very pleased. The extension type contact here could be very beneficial.

(c). The ATIP villages are far apart and require a good deal of driving time. This, coupled with the poor condition of our vehicles and the number of people using them, with only two drivers, limits visits to a maximum of about two per week. Daily visits would be much superior.

7.5 HOUSEHOLD CIRCUMSTANCES [13.6]

7.5.1 COOPERATING FARMERS STUDY [13.6.1]

Objective: This is an RMRI descriptive and diagnostic study. The objective of collecting economic and technical data on a continuing basis was to identify major changes and trends over time in the farming systems in Tutume Agricultural District. Of particular interest were data on:

(a). Crop environments, crops planted, cropping systems used, and harvested yields.
(b). Animal traction used, livestock inventory, and management changes.
(c). Market participation - both input and output.
(d). Timing of labor activities, particularly plowing activities to establish labor coefficients for cropping activities.

Justification: Since arable agricultural production in Botswana fluctuates greatly from year to year, due in large part to the harsh climatic environment and changing government policies, several years are required to adequately describe crop production activities. Livestock enterprises also fluctuate with climatic conditions, although to a lesser extent. A continuing monitoring program provides information on the fluctuations in the system over time and allows the identification of trends, such as shifts from one source of traction to another. This information assists in the identification of economically feasible technologies which can lead to increased incomes without substantially increasing risk or investment.

Approach: To provide system monitoring information, several approaches were combined. For environmental information (Section 7.8), daily readings of rainfall and temperature were continued. Cropping and animal management practices, livestock inventories and market participation were assessed using an annual questionnaire administered to the households which participated in the Multiple Visit Study of 1983-84. Timings for plowing activities under farmers' field conditions were collected for animal and tractor traction.

Results: Twenty-seven of the original Multiple Visit Study farmers were still living in the research villages, and participated in the 1988-89 Cooperators Survey. Three of the 27 farmers did not plow due to lack of draft. The average area plowed was 5.96 hectares, of which 5.33 hectares was plowed with ARAP assistance. The average first plowing date was the third week in November, with plowing being completed the third week of January. Sorghum, millet and maize were the most important crops planted. Approximately 21 percent of the farmers destumped new land, while 8 percent fenced land. All but one of those planting applied for ARAP plowing assistance, but no one received weeding assistance from ARAP. Cattle were the major source of traction. Fifty-eight percent of the farmers used only animals, while 42 percent used some tractor traction. More than half owned their own traction. For those hiring, tractors were the most common source of hired draft, and the going rate for tractor hire was P60 per hectare. Seventy percent of the farmers harvested more than three-quarters of the land planted. Average total grain yields per family harvesting a crop were: sorghum 383 kg, millet 300 kg, maize 207 kg, cowpeas 41 kg, and groundnuts 36 kg. Thirty-nine percent of the farmers sold an average of 47 kg of grains. One-third of the farmers row-planted at least some of their crop, while one-half practiced double plowing on at least some of their land. Twenty-two percent used a new crop variety, and 8 percent used fertilizer. For those who did not use fertilizer, lack of transportation was the biggest problem. Drought, insects, birds, and labor constraints were the most frequently listed problems. Complete results of this survey will be presented in a forthcoming progress report.

Over a period of three years, plowing labor data were collected on farmers plowing their own plots in their traditional way. A total of 91 observations were made. Average plowing labor time with donkeys was 32 hours per hectare. For cattle, the labor time was 21 hours per hectare, and it was 4 hours per hectare for tractors. Additional analysis will be reported in a working paper.

7.6 MARKETS [13.7]

7.6.1 SMALL STOCK AND GRAIN TRADING AND PRICES [13.7.1]

Objective: The objective of this RMRI descriptive and diagnostic study was to ascertain the extent of within village formal marketing opportunities and the prevailing prices, both formal and informal.

Justification: Formal marketing channels are not well established, and most local sales by village farmers are inter-household sales. Some limited opportunities exist to sell small stock to local restaurants, and in one village the cooperative will purchase grain. A monitoring of the number of animals purchased and the price gives some indication of the local market opportunities. There has been little formal trading in grain due to the drought, but the monitoring of local informal prices for grain is useful data for an economic analysis of crop production technologies.

Approach: Monthly surveys of local restaurants were used to monitor small stock trade and prices. One informal survey was used to estimate the local informal price for grain.

Results: Monthly surveys of local restaurants were discontinued due to the lack of sales through these sources, and the lack of cooperation by proprietors. A price survey was conducted during farmer group meetings in four villages (two ATIP villages and two extension villages in North East District) during March, 1989 to attempt to establish prices during the planting season. Table 7.3 shows the range of prices reported by farmers during group meetings. The prices between villages were similar, with only one village reporting slightly lower prices for many items.

The low village prices for sorghum, maize and millet grain were approximately double the Botswana Agricultural Marketing Board prices, while the low village price for cowpeas was slightly lower (3 thebe) than the BAMB price. The BAMB price for unshelled groundnuts was P1.15/k_g 43 percent above the low village price.

7.7 EXTENSION LINKAGES [13.8]

7.7.1 FMFI OPTIONS TESTING WITH EXTENSION LED FARMER ASSESSMENT GROUPS [13.8.1.]

Objectives: The objectives of the extension managed farmer (FMFI) testing groups were to:

(a). Provide a method for ADs to increase their efficiency by addressing a large number of farmers on technical issues at once, rather than having to make numerous individual visits to households and fields. The group format allows the AD to perform a teaching function at the beginning of the year, and a backup function throughout the cropping season through monthly meetings.

TABLE 7.3: AGRICULTURAL PRICES REPORTED DURING FARMER GROUP MEETINGS, FRANCISTOWN AREA, MARCH, 1989

Commodity	Low price	High price
	(Prices pula per kg unless marked for different unit)	
Seeds		
Sorghum seed	1.00	1.76
Maize seed	1.25	1.50
Millet seed	1.17	1.70
Cowpea seed	0.25/Cup*	1.00/Cup*
Groundnut seed	0.40/Cup*	1.00/Cup*
Grains		
Sorghum grain	0.42	0.86
Maize grain	0.42	0.71
Millet grain	0.58	1.00
Cowpeas	0.42	1.18
Groundnuts (unshelled)	0.80	2.50
Other		
Watermelons	0.10 Each	2.00 Each
Pumpkins	0.50 Each	2.00 Each
Morogo	0.30	1.00
Sweet reed	0.10 Each	0.50 Each
Animals		
Goats	30/Animal	100/Animal
Madila	0.20/Cup	0.50/Cup
Cattle (grown)	300/Animal	500/Animal

* Size of cup varies greatly.

(b). Provide a forum for researcher backup in extension activities.

(c). Provide a test to see if farmer groups are practical under extension conditions.

Justification: The extension service in Botswana, to date, has been committed to administering drought relief programs. Thus, the traditional role of extending recommended agricultural technologies has been greatly reduced. The 1987-88 annual report from extension, in the Francistown Region, states that virtually no extension was done that year and that 95 percent of the ADs' time was taken up with administration of government relief programs. Further, a single AD may have well over 500 households under his/her responsibility. Without a good communication system, many of the constraints these households face may go unaddressed. The farmer group approach offers a means of working with a number of farmers at one time, thus improving the efficiency of the AD. ADs are officially encouraged to work with groups of farmers, but, to date, the system has not been employed for the testing and teaching of extension recommended technologies in the Francistown Region.

Approach: Prior to the cropping season, ATIP staff met with regional agricultural officers and CFDA coordinators to discuss the extension managed options testing farmer group. With the RAO's approval, the DAO identified two extension areas for the groups. The DAO and the ADs from the areas met with ATIP staff to discuss the group work. The regional CPO and the ALDEP manager were also included in the discussions. This group decided on a limited number of technologies, including types of equipment provided through the ALDEP program, which might be made available for testing. Logistical details were also arranged.

Just prior to the usual beginning of the cropping season, the ADs asked the village headman to call a traditional village meeting at which he/she, and the ATIP Francistown staff, described the farmer group work in other villages and invited interested farmers to attend the initial group meeting to be held two weeks later. At the initial group meeting, farmers were

asked to indicate what areas of technology they were interested in learning about. The AD and ATIP staff then presented options available for testing -- within the areas indicated), and discussed a few other options as well.

At subsequent monthly meetings the implementation of trials was discussed. The farmers were asked to decide, on their own, how large to make the test plots, and to stak. the plots accordingly. Side-by-side comparisons were recommended but rejected by the farmers. A field assistant was hired to assist the AD in working with farmers to collect data, provide seeds and equipment, monitor the location of the equipment, etc.

Monthly meetings were held to discuss the trials. Farmers were asked to described their trial experiences, identify problems, and report their observations on the trial to the group. The farmer group meetings were chaired by the AD. All meetings were attended by ATIP and district level extension staff. ATIP and extension staff visited all trials at least once during the season.

A field day was held in one village near the end of the season. Farmers from other villages, extension staff and research staff were invited to participate. Following harvest, the ATIP staff conducted a formal End-of-Season Survey of participating farmers to obtain farmer assessment of the trials they participated in, and the group activities. This information will be included, with extension and researcher evaluations of the group activity, in a progress report.

Results: A second extension led farmers testing group, at Musojane, was added to the group at Mapoka which was started during the 1987-88 cropping season. These groups were led by the local Agricultural Demonstrators, with support from other DAFS and ATIP staff. The Safim planter was the most popular option tested. Table 7.4 provides information on participation and trials. As in the previous year, farmers did not do side-by-side trials.

Attendance at farmer group meetings was good, although there was a general concern among farmer group members that inputs did not arrive on time. Twelve trials failed (see Table 7.4). From farmer's observations, row-planted areas did better than broadcasted areas. Farmers reported that row-planted crops looked healthy, were vigorous and established well. In addition weeding was easier for row-planted crops.

TABLE 7.4: PARTICIPANTS AND TRIALS DATA, EXTENSION LED FARMER TESTING GROUP, FRANCISTOWN AREA, 1988-89

	Mapoka	Musojane
Number of participants	23	14
Number of trials implemented		
Sebele planter	3	3
Master hand row planter	4	-
Safim planter	12	3
Forage/fodder trial	1	1
Trials that failed before:		
Plowing	1 -Lack of draft	
Planting	2 -Planters late	2 -Planters
Weeding	-	-
Harvesting	3 -Sickness -Wild animals -Late planting	2 -Late planting -Late inputs -Too much heat -Wild animals
Trials that failed during or after harvest	-	2 -Aphids -Fodder harvest late Palatability lost

7.8 ENVIRONMENTAL MONITORING [13.9]

7.8.1 RAINFALL AND TEMPERATURE MONITORING [13.9.1]

Objective: The objective of this RMRI descriptive and diagnostic activity was to obtain daily rainfall and temperature data from experimental sites for use in agronomic and economic evaluations of trials.

Justification: Rainfall and temperature are two important parameters in crop production, and to a lesser extent in animal production. Over the past several years, rainfall has been a major limiting factor in determining the amount of area planted, the quality of seedling emergence, and the quantity of grains and forage harvested. Because of high variability in rainfall within village areas, monitoring must be done on a plot-by-plot basis. Temperature is more constant within an area, so can be monitored at a central location.

Approach: Daily rainfall readings were taken on rain gauges located on experimental plots. Rainfall amounts, and maximum and minimum temperatures were recorded at the ATIP compounds. At the ATIP compounds in each village, the equipment used complied with recognized meteorological standards.

TABLE 7.5: MONTHLY RAINFALL (MM), FRANCISTOWN AREA, 1983-89

Month*	1983-84 Mean	1984-85 Mean	1985-86 Mean	1986-87 Mean	1987-88 Mean	1988-89 Mean
Matobo						
September	NA	0	0	18	1	0
October	NA	17	12	11	4	46
November	NA	119	0	63	39	29
December	31	36	77	51	209	60
January	29	114	38	95	58	149
February	53	126	34	18	212	102
March	74	43	52	10	92	18
April	0	0	74	0	0	45
June	0	0	0	0	20	0
Total Matobo	187	455	317	296	635	449
Mathangwane						
September	NA	0	0	9	0	0
October	NA	42	29	66	9	58
November	NA	44	31	91	45	8
December	15	63	24	83	249	53
January	24	185	28	41	36	45
February	25	142	33	27	198	222
March	77	0	67	5	128	6
April	16	0	146	0	5	50
June	0	0	0	0	20	0
Total Mathangwane	156	476	358	325	690	442
Marapong						
September	0	0	0	10	0	0
October	NA	43	17	91	7	68
November	NA	64	1	57	78	10
December	20	48	37	50	256	114
January	39	112	28	69	30	32
February	73	133	31	48	354	174
March	70	12	54	7	123	0
April	22	0	124	0	30	58
June	0	0	0	0	21	0
Total Marapong	224	412	292	332	899	456
Overall Average	189	448	322	318	741	449

* Months not indicated had insignificant rainfall

* Data collection began in December, 1983

Results: Monthly rainfall information for the 1988-89 cropping season is shown in Table 7.5, along with data for the other years during which ATIP has worked in the Francistown area. Total rainfall in 1988-89 was slightly below the 30 year average (464mm). There was much less variability in total rainfall between villages than had been observed previously, but on a monthly basis there was considerable variability between villages. Only Mathangwane had significant amounts of rainfall prior to January. This occurred in the last week of December. Hence, most planting did not begin until early January, with many later plantings not maturing due to an early cool period in April.

7.9 METHODOLOGY [13.10]

7.9.1 FMFI OPTIONS TESTING WITH RESEARCHER LED FARMER ASSESSMENT GROUPS [13.10.1]

The work with farmer groups in 1987-88 was very popular among farmers and was continued in the three study villages in Tutume Agricultural District with only a few minor changes.

Objectives: The objectives of this FMFI testing activity were:

(a). To test a broad range of innovations under farmer managed conditions for increased productivity and grain yield dependability.
(b). To involve farmers and ADs directly in the farming systems development process.
(c). To determine what types of innovations are most appealing to different types of farmers.
(d). To determine the extent of adoption of technologies tested by participants in the 1986-88 farmer trials.

Justification: Numerous technological innovations have been developed in Botswana, and elsewhere, which may be relevant to subsistence farmers in Tutume Agricultural District. However, due to time constraints, it is difficult to evaluate a very wide range of these innovations under researcher managed conditions in on-farm tests. Further, it is often difficult to assess which innovations might be most relevant to specific farmers. It was therefore decided to present a wide range of technological options to a group of farmers. Farmers could then select innovations that seemed most relevant to their situation, and test those with some researcher guidance and provision of inputs. Monthly meetings were held with the groups to discuss problems and progress. In this way, farmers demonstrated which types of innovations seemed most appropriate to them, and researchers were able to observe the effectiveness of those innovations and work with farmers towards development of improved production systems. By including ADs in the group monthly meetings, the ADs also become part of the systems development process.

Approach: In late September, an open kgotla meeting was held for all participating farmers, members of village Farmers' Committees and the local ADs in the three villages where ATIP has been working. At this meeting ATIP staff presented:

(a). The results from last year's research.

(b). An invitation to all interested farmers, to attend a special meeting where technical options were reviewed which included both new technologies and currently recommended ones.

At this meeting, a wide range of technology options were discussed. Farmers were then asked to select any innovation or package of innovations they wished to test in the coming year. Those farmers electing to perform a test/s formed the farmer groups that met monthly. The ADs were also invited to attend these meetings where progress and problems were discussed.

The types of innovations introduced included:

(a). Tillage/water conservation techniques
(b). Planting method options -- with some emphasis on evaluating hand row-planters
(c). Crop varieties
(d). Manure and fertilizer possibilities
(e). Forage and fodder production options
(f). Seed protection options

Depending on the degree of interest, and availability of equipment, some or all of the farmers wishing to test a specific innovation were supplied with the necessary inputs and machinery by ATIP. Trials were laid out side-by-side with a traditional control. A record was kept by ATIP staff regarding the dates of all operations, and grain yield. An End-of-Season Survey was administered, in order to get the assessment of farmers.

Some of the changes that were made for this year included the following:

(a). Farmer comparisons were slightly more controlled. For example, a farmer who wished to test double plowing with fertilizer, versus double plowing/row-planted was encouraged to separate her/his trials into double plowing with and without fertilizer, double plowing with and without row-planting, and to include traditional checks in each.

(b). Where farmer feedback on a new technology was required, or where requests had been made by other researchers for tests on items like variety trials, if insufficient farmers elected to test them, ATIP actively sought farmers in the group to take on these tests in addition to tests they had selected themselves.

Results: A total of 128 farmers in three villages participated in the trials, conducting over 140 valid comparisons of various technology options.

There was a total of about 450mm of rainfall across Tutume Agricultural District, but there were wide variations in both geographic and seasonal distribution. Generally, there was very little rain during November and December. There were also extended dry periods in January, and from late February to early April. Thus considerable moisture stress occurred on most crops, regardless of the planting date.

Groundnut seed dressing with insecticide and fungicide and a new variety of groundnut (55-437) showed no benefit in this season. Groundnut yields were very low, and treatment effects largely masked by the effects of moisture stress and predation by rats and rabbits. Treatments did not address the major yield constraints.

In cowpea variety trials, the one indeterminate genotype, Tswana yielded consistently higher than the determinate types Blackeye, TVX, and ER7 (400 kg/ha range versus 100 to 250 kg/ha range). Most cowpea variety trials suffered stress during the reproductive period, either from drought or aphid infestations or both. The indeterminate genotype survived these periods to produce grain in more favorable periods. The determinate types generally could

not recover. This same result was observed the previous year. It seemed likely that indeterminate types would generally offer more yield security under low-management conditions, but there may still be an important role for determinate types as a buffer against early termination of the rains, or as a late-planting option.

Phosphate fertilizer trials (ca. 20 kg of P_2O_5/ha versus zero fertilizer) were implemented with both determinate cowpea varieties and cereal crops. Yield benefits on cowpeas were masked by within season stress. Maize showed some benefit from fertilizer application. Variable results from fertilizer trials have previously been noted in Botswana, and are not unusual.

Double plowing (DP) increased per hectare yields of cowpeas by an amount similar to previous years -- about 70%. The effect was, as always, somewhat suppressed by insect pests. The effect of DP on cereals was more pronounced than usual -- about 140% -- possibly because drought stress was a major yield limiting factor this season.

Effects of technology options over years: Of the technologies tested by farmers over the last three years, DP has given the most consistent yield increases -- 60% to 100% depending on crop and year. This may be because DP addresses the soil moisture constraint, which is probably the most common yield limiting factor over seasons in Botswana. Phosphate fertilizer gave the next highest average, though there was considerable variation across seasons -- over 90% in wet years, 20% in a year of drought stress, and about 50% overall. Row-planting and groundnut seed treatments have given lower, and more variable yield increases. Over the past two seasons, indeterminate cowpea genotypes (BOO5C and Tswana) have given better yields than determinate types due to their capacity to survive stress periods, and reproduce during less stressful periods.

From the very simplistic viewpoint of increasing per hectare grain yields, these data suggest that the most important technologies for extensive management conditions would be improved soil/water management followed by fertilizer applications, though numerous other technologies also show merit.

Spontaneous adoption of technologies: The 1989 Adoption Study was based on a survey of 158 farmers who had participated in the researcher managed farmer options testing groups. The purpose of the survey was to determine the extent of spontaneous technology adoption by members of the groups. Forty-one (26 percent) of the farmers interviewed used a "new technology" during the 1988-89 season. New technologies were used on 14 percent of the land planted by the interviewees. The most popular technology was double plowing, either alone or in combination with other technologies -- usually row-planting. A complete report is contained in a forthcoming working paper.

7.10 OTHER PROFESSIONAL ACTIVITIES [13.11]

In order to promote the acceptance of farming systems work, it is important to continue and increase contacts between the team, farmers and other agencies, in terms of conducting joint research, the inclusion of extension and research staff in farmer group work, field days and joint visits to fields. Linkages and collaboration were strengthened through the following activities:

7.10.1 LINKAGES WITH FARMERS [13.11.1]

(a). Continued activities with researcher managed farmer testing groups.

(b). Expanded activities with extension managed farmer testing groups.
(c). Continued active involvement of farmers in RMFI trials implementation.
(d). Annual report on ATIP activities presented at a kgotla meeting in each village where ATIP is working.

7.10.2 LINKAGES WITH EXTENSION [13.11.2]

(a). Participated in a regional review of ATIP work plans.

(b). Worked with the RAO to establish an annual coordination meeting for the coordination of regional research and extension activities with regional DAFS personnel, research personnel, CFDA coordinators, and representatives from non-governmental organizations operating in the region.

(c). Continued to involve DAFS in the FMFI design and testing of systems' options through involvement of local ADs, and district and regional DAFS officers, in researcher managed farmer testing groups monthly meetings and field days.

(d). Assisted in the continued testing of an accelerated extension procedure -- extension managed farmer testing groups. The two active groups were located in the CFDA in Northeast District.

(e). Collaborated with ALDEP on tillage trials, and fodder trials -- as part of the Goat Milk Study.

(f). Cooperated with the Regional Agricultural Office, actively sought their suggestions concerning the identification of research problems and the Francistown ATIP work plan, and kept them fully informed of ATIP's activities.

(g). Collaborated with the Regional Small Stock Officer on goat management studies.

(h). Prepared articles on agricultural activities, with pictures, for inclusion in extension publications.

(i). ATIP technical officers regularly attended DAFS Monthly Management Meetings and discussed ATIP activities.

(j). Assisted ALDEP in the design of their Participatory Trials Program and District Demonstration Farms.

7.10.3 LINKAGES WITH ON-STATION RESEARCH [13.11.3]

Collaborated with DAR on tillage systems research, crop variety testing (sorghum and cowpeas), equipment development, small stock research, and other activities, including theme group meetings for planning research strategies. Assisted in the design of one DAR survey, and administered that survey and another DAR-requested survey, in the Francistown area.

7.10.4 LINKAGES WITH VETERINARY SERVICES [13.11.4]

Continued to work in conjunction with the Veterinary Services field staff and Central

Diagnostic Laboratory in the investigation of goat diseases and mortality, and methods of control using management, nutrition and husbandry.

7.10.5 LINKAGES WITH POLICY/PLANNING [13.11.6]

Cooperated with the Rural Sociology Unit on several studies. ATIP staff, particularly the agricultural economist assigned to ATIP Francistown by the Department of Planning and Statistics (DPS), met regularly with DPS personnel. Some data sets were reviewed and documented. These data sets are available to the DPS, DAR, other Botswana governmental bodies, and to other interested groups for their use in research.

7.10.6 METHODOLOGY DEVELOPMENT

The Francistown ATIP team continued to work with other members of ATIP in the preparation and dissemination of methodological materials. Emphasis was placed on the preparation of a draft of a "Farming Systems Manual for Botswana".

7.10.7 VISITS OUTSIDE THE COUNTRY

(a). During September and October, Mr. S. Masikara spent six weeks in the USA working with INTSORMIL personnel, attending two short microcomputer courses, and presenting a paper at the Annual Farming Systems Symposium in Arkansas.

(b). Dr. G. Heinrich presented a paper and a poster session at the American Society of Agronomy Annual Meeting, Anaheim, California, November 28-December 2.

(c). Ms. C. Tibone participated in a one month training program on the Diagnostic Phase of FSR hosted by CIMMYT and the University of Zimbabwe, in Harare.

(d). Dr. G. Heinrich served as a resource person for a workshop in the Gambia where he presented material on the ATIP approach to on-farm technology testing based on farmer-groups.

CHAPTER 8: VISITORS

The following is a partial list of visitors to ATIP during the reporting year. Often they came for purposes other than simply visiting ATIP. It is not a complete record since, for some, a record was not kept.

8.1 NAMES RECORDED

D. Anderson, AID Consultant, USA
R. Bernsten, University of Zimbabwe
W. Bollinger, Africa Bureau, Washington DC, USA
P. English, IDRC, Canada
A. Geddes and C. Davis, ODNRI, UK
D. Hildebrand and L. Hansen, South Dakota State University, USA
H. Matteson, New Mexico State University, USA
R. Mbonika, MOA, Tanzania
P. Mowbray, Horticulture Consultant
W. Miller, MIAC, University of Nebraska
D. McClaren, MOA, Zimbabwe
D. Nellis, C. Bussing and J. Coleman, KSU and Alabama A&M, USA
D. Nyack, SACCAR Consultant
C. Perrings, University of Botswana
R. Purcell and E. Poulsen, Draft Power Consultants
T. O'Sullivan and C. Ward, Snowy Mountain Consultants
D. Sisler and M. Levine, Cornell University, USA
P. Turner, W. S. Atkins International, UK
T. Wilcox, AFRC, UK
A. Willems, Minster Agricultural Consultants, UK
R. Vanderlip and M. Clegg, INTSORMIL, USA
T. Wood and M. O'Reilly, ODNRI, UK
Etc.

8.2 NAMES NOT RECORDED

ALDEP Reformulation Team Members
Two Consultants for MDP
Etc.

PART III: WORK PLAN, SEPTEMBER 1989 - AUGUST 1990

CHAPTER 9: PERSONNEL AND EQUIPMENT

9.1 PROFESSIONAL STAFF

With reference to Batswana staff, only one possible change in staffing might occur during the remaining part of the project. Discussions are underway on a possible replacement if this takes place. Efforts will be made during the next few months to ensure that the personnel remaining after the expatriates leave in September, 1990 are as well trained as possible. Staffing is, however, likely to be a problem given the current shortage of trained staff within the MOA. Hard trade-off decisions on allocation of staff will need to be made by senior officials in the MOA during the next year or so, especially since many staff are currently away on long-term training.

In recognition of this, USAID/B will help support one OPEX position starting in April, 1990. This person will be an Agronomist who has expertise in farming systems work. This individual, who will probably be located in Francistown will help continue to provide expertise in FSW. The position is currently being advertised by AED in conjunction with MIAC. In the light of a possible post-project linkage between MIAC and MOA, Botswana, it is hoped that this person can be linked to MIAC to enhance continuity.

The responsibilities of DAR with respect to FSW will increase over the next year with the planned transfer of FSSR and MDP to the department. Along with the GOB decision to institutionalize farming systems type activities, it is likely that a national coordinator for farming systems work will be appointed. This will be a citizen of Botswana. It is possible the OPEX appointee will act as an adviser to the national coordinator.

It is anticipated that no changes will occur in expatriate staffing between now and September, 1990. All have indicated an intention to stay until the end of the project. In addition, Drs. G. Heinrich, J. Siebert and F. Worman have been offered short-term appointments at KSU -- six months to one year -- after the end of the project.

With reference to the INTSORMIL personnel, ATIP will provide about $40,000 to help fund their continued presence until the end of the ATIP contract. After that, INTSORMIL plan to continue funding the Soil Management Specialist position occupied by Dr. N. Persaud, who currently plans to stay in Botswana after September, 1990.

9.2 SUPPORT STAFF

Currently the support staffing position is reasonably satisfactory. Plans will need to be made over the next few months about the optimal situation after the expatriate personnel depart and contract funds are withdrawn. Obviously the quantity of field work will decrease because of the smaller teams. Therefore the numbers of full-time field level support staff that are required may well decrease, but this may be offset to some extent by extra support in two areas where ATIP contract funding will no longer be available, namely:

(a). Office support -- secretarial and computing -- for the proposed national coordinator for FSW. The three support staff associated with the ATIP COP are all funded out of project funds.

(b). A substantial amount of the casual labour employed for seasonal field work is also currently paid out of contract funds.

9.3 CONSULTANTS AND EXECUTIVE VISITS

Currently it is anticipated there will be not be a major use of consultants over the remaining life of the project. This reflects, in part, the anticipated needs of the project and the increasing reluctance for GOB to approve consultancies that are not critically important. Many consultants are employed by GOB, which is becoming more selective concerning the roles they can play.

However, there is a need for Dr. Jorns, KSU Campus Coordinator of ATIP, to visit Botswana to settle administrative details with reference to ensuring an orderly close out of the ATIP contract. Currently, it is anticipated he will be in Botswana in February, 1990.

Also in connection with close out of the ATIP contract and the possible development of post-project linkages between MIAC and MOA, Botswana, there may be a need to organize an executive visit by a senior MIAC official. A request for this will be submitted later if such a visit is considered desirable.

Another area which may receive some ATIP support is for two individuals from the International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) to visit Botswana to discuss potential future cooperation.

9.4 EQUIPMENT

It is anticipated there will be no further purchases of major items with ATIP contract funds, except for 25 rotary injection planters which have been made in Botswana. Agreement on this was obtained several months ago.

One issue to bear in mind over the next few months is ensure that funds are available in DAR to take over responsibility for purchasing many small items that are currently purchased with project funds. DAR has already taken action with reference to some of these, such as budgeting for maintenance and licencing of the radios located in the ATIP villages and Francistown and Mahalapye.

CHAPTER 10: TRAINING

10.1 LONG-TERM TRAINING

Long-term training can be divided into two classes based on funding source:

(a). ***ATIP-Funded Support.*** In Table 4.1 there are seven people who are currently away on long-term training. Because of the PACD date of September 28th, 1990, the contract cannot fund training beyond that date. Alternatively, if they are not finished by that time, it will be necessary to establish an agreement from GOB, that they will fund the remaining part of the training program. The current situation with reference to the seven individuals is as follows:

i. It is anticipated that Mrs. P. Ntseane, Mr. B. Masilo, Mr. B. Moji and Mr. B Mogwera will all complete their studies in August, 1990. All have been informed of the importance of doing this. These individuals are administered via Kansas State University.

ii. There appears to be a delay in Mr. A. Sebinyane completing his studies. As a result, GOB is currently in the process of identifying alternative funding sources to enable him to complete his degree. He is administered via AED.

iii. Mr. T. Moroke and Ms. M. Manthe went on long-term training as a result of GOB assurances that alternative funding sources would be identified to support them after August, 1990. These individuals are administered via Kansas State University.

The only possible further support to be provided out of contract funds for long-term training is $5000 towards the maintenance of a person, in DPS, who is to receive most of his support from other sources.

(b). ***Matching Funds From GOB.*** Under the original ATIP agreement, GOB agreed to fund 15 person years of long-term training. All these have now been funded. Therefore, there will be no additional persons trained with these matching funds. Since these funds are not tied to the end of the ATIP contract, there appears to be no problem in them not returning by September, 1990.

10.2 SHORT-TERM TRAINING

Possibilities for short-term training often arise at relatively little notice. Therefore it is difficult to make specific plans for sending people on short-term training. When opportunities arise, they will be considered on their merits.

However, it is planned that efforts will be made to ensure that people will attend the CIMMYT Workshop on FSW. The short course they offer is divided into two parts, so that individuals that will attend each workshop. ATIP will help fund the attendance, if other sources of funds are not forthcoming.

10.3 ON-THE-JOB TRAINING

In-service training opportunities, also, often arise at relatively short notice. Therefore, there needs to be some flexibility in planning activities in this area. However, those that will definitely occur, include the following:

(a). ***Training ATIP Staff.*** This training, which is on-going, will continue to receive emphasis during the coming year. The proposed completion of the "Farming Systems Handbook for Botswana" will help in this effort and will also be useful for staff on other farming systems teams in Botswana.

(b). ***Other Training.*** When called upon to do so, ATIP personnel will also help in implementing other training activities, such as talks to DAFS staff, and BAC and University of Botswana students.

(c). ***Farmer Groups and Training Workshops.*** Currently, there are several activities where ATIP personnel either train farmers directly through groups or via workshops, held in conjunction with DAFS and other agencies. It is anticipated that these activities will continue. Some details on these can be found in other parts of the work plan.

(d). ***Farmer Field Days.*** As in previous years, farmer field days will continue this coming year. The nature of the cropping season will partially determine how many will be held. Any number up to six could be held.

CHAPTER 11: SEBELE/GABORONE WORK PLANS, SEPT. 1989 - AUG. 1990

11.1 TEAM LEADER'S OFFICE

D. W. Norman (Team Leader)
E. Modiakgotla (Agronomist)

11.1.1 HANDING OVER OPERATIONS

Mr. Modiakgotla was transferred to Sebele in August, 1988 in anticipation that he will take over many of the duties of the ATIP COP, on departure of the latter in September, 1990. Therefore, time will be spent by the ATIP COP during the coming months in acquainting Mr. Modiakgotla on both relevant administrative and professional matters to ensure a smooth transition in September, 1990. Therefore, some of the activities discussed in the work plan involve joint efforts, although it is anticipated Mr. Modiakgotla will continue to be involved to some extent in the research program at Mahalapye.[1]

Important in the smooth transition to the post-ATIP contract era, is an appropriate institutional framework for the continuation of farming system type activities. Since the decision to institutionalize farming system type activities, in Botswana, has already been taken, efforts will be directed to supporting initiatives taken by the Director DAR, and to engaging in developing strategies requested and/or approved by him. Currently a number of these are underway.

11.1.2 ATIP ADMINISTRATION AND OPERATION

The ATIP COP will continue to have the major responsibility for the administration and day-to day operation of ATIP. Every effort will be made to ensure that this is undertaken in a way that is compatible with the operations of the Ministry of Agriculture. Continuing efforts will be made to liaise with other staff in the Ministry of Agriculture, and with the other institutions -- GOB, USAID/B, MIAC and KSU. Additionally, throughout the next year the project will maintain the timely production and dissemination of papers, and the Monthly Activity Newsletter.

11.1.3 PROFESSIONAL SUPPORT TO ATIP TEAM MEMBERS

Efforts will continue to emphasize visiting team members in the field, and organizing ATIP meetings on a regular basis to discuss professional matters. At least six will be held during the coming year. Also cooperative work with other ATIP team members will continue.

Among immediate plans are to finalize the results of the Bean Survey, Row-Planter Condition Survey, and the Coefficient/Standard Study.

Efforts will be made, with others, to obtain approval for finalizing or modifying a number of

[1]. Work planned in Mahalapye is discussed in Chapter 12.

technological recommendations, through producing new Agrifacts or modifying existing ones (see Section 2.3.1 for details).

Also in conjunction with other staff, two important documents that will be finalized are:

(a). The "Farming Systems Handbook for Botswana". This will not be a comprehensive manual on how to conduct FSW, but rather will concentrate on what is done in Botswana. Cross-references on specific methodological topics will be included in the handbook.

(b). A report summarizing research work and other professional activities undertaken by ATIP. This report will include the main results achieved -- with cross-references to other papers written by ATIP staff -- current state of thinking, and related suggestions on future work.[2]

11.1.4 MICROCOMPUTER SUPPORT

Activities in this area will include the following:

(a). Supervision of the SMU data entry on the ATIP microcomputers will continue for the first few months. During that period, in cooperation with one of the Sebele biometricians (Mrs. B. Sebolai), the system will be redesigned to fit the IBM compatible system, after which responsibility for data entry of SMU records will be transferred.

(b). When requested, data from ATIP field stations will be entered on the microcomputers at Sebele, under the supervision of the ATIP COP.

(c). Transfer of data from the Apple to the IBM compatible systems will continue, although it is anticipated that because of other demands on time, documentation of the databases is likely to be more limited than originally anticipated.

(d). Where necessary, help will be provided in the use of the main software packages currently used by ATIP and DAR as a whole, namely; Word Perfect, Lotus 123, DBase III Plus, MSTAT, and ABSTAT. It is anticipated that the use of the complicated SPSS statistical package will be mainly limited to the biometric staff.

11.1.5 PUBLIC PRESENTATIONS

When requested to do so, lectures will be given at the Botswana Agricultural College (BAC) and the University of Botswana, and talks will be given at MOA sponsored meetings, workshops, conferences, etc.

11.1.6 LIAISING AND INFORMATION AVAILABILITY

Efforts will continue in order to encourage liaison activities with other institutions in GOB. Along with other ATIP staff, time will be spent documenting the project's ideas and

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[2]. It is uncertain, at the moment, whether this would be the same as the one that is usually produced at the end of a contract, by the contractor.

activities, and arranging to have them disseminated. Also time will be spent, as requested, in meeting with consultants, and reviewing and commenting on GOB and consultant documents and plans.

11.1.7 FULFILLING CLOSING OUT REQUIREMENTS OF USAID

Efforts will be made to meet the administrative requirements of USAID in closing out a contract, such as transferring contract purchased equipment to the GOB inventory, etc.

11.2 RESEARCH EXTENSION COORDINATION UNIT

G. Ramolemana (RELO)

With the departure of Dr. B. Hill, no USAID-financed technician exists in the RECU. Therefore, no work plan is presented for the unit since ATIP no longer has a direct input into its activities. However, every effort will continue to provide support to Mr. G. Ramolemana and the activities of the unit. The support that is desirable will become clearer once the current negotiations on the future of the unit become clearer (see Section 2.3).

CHAPTER 12: ATIP MAHALAPYE WORK PLAN, SEPT. 1989 - AUG. 1990

USAID:	J.Siebert	(Agronomist)
GOB:	E.Makhwaje	(Agricultural Economist)
	J.Luzani	(Agronomist)
	E.Modiakgotla	(Agronomist)

12.1 OVERVIEW

Proposals in this work plan emphasize continuation of many research activities from the past year. Examples of continued work include the kraal manure work, the rainfall run-off management work, and the commodity support testing. Even though closure on investigations into specific technologies is desirable and maybe possible in some cases (i.e., new varieties, some farm equipment, etc.), many of the trial activities should be viewed as "pipelines" linking commodity or program units of DAR with on-farm work. In this pipeline context, research could continue in the future on similar or related technologies.

Emphasis is also put on developing standard research methods that can be readily used in future work. In this regard, attention is given to completing standard data forms and data handling procedures and to developing protocols, within the team, on how to manage RMFI and RMRI trials, and farmer group activities.

Research-extension linkages will continue to focus on promotion of a basic row-planting and inter-row cultivation package. The RELO should become increasingly involved in this activity.

Emphasis will also be placed on writing a series of papers summarizing work carried out on various topics during the life of ATIP, and in finalizing the Farming Systems Handbook for Botswana.

12.2 COMMODITIES

12.2.1 EVALUATION OF EARLY-MATURITY COWPEA VARIETY

Objectives: The objectives of this FMFI trial are to:

(a). Provide general performance testing under farmer management of a new early-maturity cowpea variety screened through the cowpea commodity program on-station.
(b). Evaluate farmer acceptance of the new early-maturity cowpea variety.
(c). Provide a wide range of production environments for the new early-maturity variety to permit effective evaluation of its resistance or tolerance to disease and pests.

Justification: Information on the performance, acceptance and resistance characteristics of the new early-maturity cowpea variety has been requested by the cowpea commodity program.

Cowpea is an important crop grown on a small to medium scale by a majority of farmers in the research area. An early-maturity variety (similar to ER-7) provides several options to farmers. The harvest work can be more effectively staggered with early-maturity varieties. With early planting, double cropping is possible with this variety. An early-maturity cowpea can be planted during late planting opportunities in the season.

It is important to determine if this early-maturity variety performs better than ER-7. ER-7 is appreciated by farmers as a complement to medium maturity and indeterminate varieties. ER-7 has shown some problems with disease, pests and with stand establishment under farmer management.

Approach: On-farm testing is for verification of station results. In order for this information to be most useful to the commodity program of DAR, testing by household resource categories, land types and so forth is important. Farmer assessment is obtained from farmer group meetings during the season.

The trial will be conducted in a FMFI format with a single comparison of the improved variety with a standard variety per farm. Trial implementation is managed through the farmer group format. A relatively large number of comparisons are made. Farmers will be selected to include contrasts of household resources and farmer interests as is pertinent for technology. For cowpea varieties, a contrast between households that grow for home consumption only versus those that grow in order to process and sell in towns, may touch on one of the significant issues.

In this trial, seed types, seeding rates are prescribed. Only varieties are compared. Plowing and planting dates, plowing rates, weeding and other post-establishment management are not part of the comparison but are left to the farmer. Measurements are made on crop establishment, grain yield, and leaf yields. Farmers will make general observations and will be asked to assess preference. Information collected will be reported back to the cowpea commodity program of DAR.

12.2.2 EVALUATION OF GROUNDNUT PRODUCTION PACKAGE

Objectives: The purpose of this RMFI trial is to:

(a). Evaluate a package of options related to groundnut production.
(b). Obtain subjective farmer assessment on the relative benefits of elements of this package.

Justification: To date, five options in groundnut production have been tested separately by Sebele and on-farm research. These include: new variety, seed treatment, higher than traditional plant populations, row-planting (with RIP), and elimination of hilling. In the Mahalapye program, these have never been proposed to farmers as a single package. However, interest is good among participating farmers in intensification, on a small scale, of groundnut production.

The package evaluation will permit a consolidation of previous research findings. It will also add RMFI package testing as part of the on-farm research methodology in the Mahalapye area.

Approach: In this study, the package is compared as a whole with some level of traditional production determined by the farmer. This type of approach depends largely on farmer

assessment of implementation constraints. The experiment is RMFI with a single replication per farm. The target will be three farms in each of the three research villages.

Farmers will be selected on the basis of interest (probably including participation in previous groundnut trials work), availability of animal draft and/or equipment, and labor to do row-planting, and availability of sandy soil. Some of the fields selected should also be located to permit easy demonstration of the plots to visiting farmers, and Ministry of Agriculture personnel.

Only the elements of the package are prescribed. These include the variety 55-437 (seed for v. Sellie will be provided to farmers), seed treatment with fungicide and pesticide, row planting, target plant population of 80-100,000 plants/ha., and elimination of hilling. Other practices, including weeding, will be left to the control of the host farmer.

Direct measurements will be secondary to farmer assessment. Measurements will be made, however, on plant stands and harvest yields.

To facilitate trial management, a type of farmer activity record keeping maybe useful. Interviews (questionnaires) will be conducted with farmers during the course of the season. Information gathered will be reported back to the groundnut commodity program at DAR.

12.3 TILLAGE AND PLANTING PRACTICES

12.3.1 NATIONAL TILLAGE TRIAL

Objectives: Objectives of this RMRI trial are to:

(a). Evaluate the ability of tillage systems to conserve or harvest rainfall and to make this water available to crop growth.
(b). Evaluate tillage treatment by environment (soil and rainfall) interactions.
(c). Evaluate the effects of traction, crop type, and fertilizer and their interactions with the tillage systems under test.
(d). Estimate the economic return of shifting to various tillage options.

Justification: The National Tillage Trial provides a good focal point for scattered research efforts on tillage in DAR and ALDEP. This type of multi-location (environment) testing requires multiple seasons. It is anticipated that such a trial will continue, with appropriate modifications, into future seasons.

Meetings of the tillage working group, that manages this trial, provide an opportunity for the presentation and the discussion of on-farm research findings on tillage and of the farming systems perspective.

Several things were learned in the first year of this trial. This type of trial format can provide useful information on tillage systems and their interaction with environmental factors, however, managing such a large national effort is difficult.

Approach: This is a RMRI multi-location, replicated trial with tillage systems, traction type and fertilizer as treatments. Because the position of plots is permanent between seasons, comparisons of traction type (added only for this season) are not part of the randomized within replication structuring. There will be nine locations in eastern Botswana. Two of these are in the Mahalapye area. Management of the Mahalapye trial sites will be carried

out in collaboration with the manager of the DAR sub-station at Mahalapye.

Farm selection is based on soil type, land availability, field protection factors and on the willingness of the farmer to allow DAR to conduct the trial on the farm.

The tillage systems compared in both animal and tractor implemented plots are basically the same and include the following:

(a). Standard plowing and row-planting on the same planting day.
(b). Early plowing with double plowing and row-planting on the planting day.
(c). Early plowing with cultivation and row-planting on the planting day.
(d). Precision deep-ripping on 1.5 m. spacing in winter, with planting on the rip lines. (for animal draft, tillage is with a chisel and work is done in the spring following the first rains)
(e). Standard plowing and row-planting on 1.5 m. spacing on the same planting day.
(f). Broadcast seeding and single plowing on the same planting day.

Each tillage plot is split with one-half receiving a complete fertilizer (2:3:2 plus 0.05% Zn).

Members of the tillage working group determine which measurements are to be made. These measurements include weeding labor, weed level assessment, soil moisture and soil bulk density, and harvest outcomes.

Training courses for technicians involved with data collection in this trial will be organized by DAR and the working group.

Data collected from this trial are handled by the members of the working group. This is a high profile trial within MoA, and trial results should be well noticed regardless of the trial outcome.

12.3.2 CULTIVATOR EVALUATION TRIAL

Objectives: The objectives of this RMFI trial are to:

(a). Compare the operation of different recommended or experimental cultivators.
(b). Assess the effectiveness of different cultivators by measuring weed levels before and after inter-row cultivation.

Justification: With early plowing and row-planting, weed control can be a major issue. In this type of tillage-planting system, good inter-row cultivation is critical. Because of the current campaign by research and extension to promote early plowing and row-planting, evaluation of cultivator options could be useful

The Mahon cultivator, which is currently available, appears to be effective for weed control but is somewhat heavy and a little difficult to manage if rows are irregular. Lighter, more maneuverable cultivators may do a better job. It is hypothesized that different cultivators will perform differently in terms of ease and speed of operation, and in terms of effectiveness on weed control

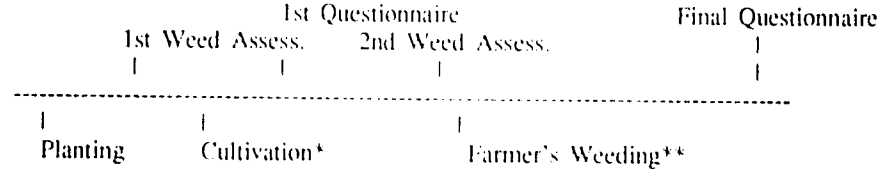
Approach: This trial is designed in collaboration with the weed agronomist of DAR Sebele. It is anticipated that a similar trial design will be adopted at other on-farm research locations.

With the aid of extension personnel, 4-5 farmers who row-plant and who are interested in inter-row cultivation will be recruited for this trial. Each farmer will be asked to compare the following:

(a). Uncultivated check (hand hoe weeding)
(b). Maun cultivator
(c). Mahon cultivator
(d). Scraper cultivator

All operations will be performed by the farmers hosting the trial. Following cultivation, each of the plots can be split with one-half receiving no additional hand hoe weeding, while the other will be hand hoe weeded at the farmer's normal weeding schedule (see time frame below). The split plot comparison provides an estimate of the need, or benefit, of follow-up hand weeding. Weed levels, weed species and weed growth stages will be assessed, in conjunction with the DAR weed agronomist, before and after cultivation. Crop plant stands and grain yields will be measured. A farmer questionnaire will be administered in two parts. The first will look at the operational aspects of the planters and the immediate impressions of effectiveness following the cultivation work. The second part will ask the farmers to evaluate outcomes towards the end of the season.

Proposed Cultivator Research Time Frame



* 35-40 days after emergence
** generally 45-60 days after emergence

12.4 SOIL AND WATER MANAGEMENT

12.4.1 EVALUATION OF MANURE APPLICATION TRIAL

Objective: The objectives of this RMH study are to:

(a). Assess yield differences between kraal manure and two controls; N and P fertilizer and no fertilizer/manure.
(b). Assess the residual effect of kraal manure through yield.
(c). Assess the interaction of manure benefit with season.
(d). Assess the change in effect of manure application when moving from upland to lower slopes in a topo-sequence.

Justification: Most soils on farmers' fields are deficient in nutrients. Although fertilizers are available at cooperatives or at BAMB, farmers don't buy them. This trial intends looking at manure as an option for adding nutrients to the soil. Manure should be more

affordable to most farmers than are chemical fertilizers. In addition to the nutrient benefits with manure use, bulk density of soils should decrease and total and available soil water holding capacity of the soils increase. Questions about manure (e.g., on which land types is the benefit most reliable and how does the residual effect compare with the effect of fresh additions of manure?) relate to the existing general recommendation for small farmers.

Of additional concern is the reliability (across wet and dry seasons) of benefit and profitability from this recommendation for small farmers, and their generally low input style of crop production.

Approach: This is a RMFI multi-season trial with nine farmers on representative soil types from different positions on a topo-sequence. Positions include upper, middle and well-drained lower parts of the slope. Sites within the village were selected in consultation with the Farmer's Committee. There are three trial sites within each of the three ATIP villages. Even though some of manure hauling and spreading is organized by research, host farmers are asked to plow and row-plant the trial area.

This trial is in its second season and will, beginning this season, look at residual effects of manure applied the previous year. The treatments in this trial are:

(a). Control
(b). Twelve tons manure/ha. every second year beginning year one
(c). Twelve tons manure/ha. every second year beginning year two
(d). Twenty units P/ha. plus 60 kg LAN/ha. every year

The trial is in a RCBD with two replications per farm.

Labor and animal draft use data will be collected for a second season to confirm the economic analysis on manure use. Plant stand and harvest data will be collected for the agronomic analysis.

12.4.2 EVALUATION OF RUN-OFF MANAGEMENT SYSTEMS TRIAL

Objectives: To evaluate at four levels (design criteria, farmer acceptance, soil moisture benefit and crop production outcomes) several runoff management systems. Outcomes are evaluated both agronomically and economically.

Justification: Observations on rainfall run-off and on the potential to increase the amount of water stored in many of the arable soils, indicate that yields could be dramatically raised in drought with the effective control of run-off. Permanent structures and tillage systems can both be employed to reduce run-off. Permanent structures have an important advantage over tillage systems in that they do not need to be re-implemented every season during the bottleneck tillage-planting period. A cost-benefit assessment of such systems is required.

A third season of testing these systems is necessary. The past two seasons have not produced the rainfall pattern for which these systems are designed (heavy storm followed at some point by drought). In addition, a number of design flaws have been identified in some of the test systems and need correcting. Assessment of the systems by a group of Shoshong farmers aided in determining the most appropriate modifications to correct these flaws.

Approach: Continue work under an RMRI format. Tillage and planting operations are with tractor and row-planter. Ridges, furrows, tillage and planting follow the contour of the field.

Sub-plot comparisons include with or without 200 kg/ha. of 2:3:2 plus 0.05% Zn fertilizer. This comparison is included in order to evaluate water management treatments with the effect of soil fertility removed. Rainfall run-off management (RRM) treatments and changes that are being made for this season include:

(a). Standard plowing on day of row-planting -- no change.
(b). Double plowing plus row-planting -- no change.
(c). Strip cultivation -- plowing pattern changed in order to increase the crop planted per area plowed. Plowing pattern also changed in order to correct drift of soil from repeated plowing in the same pattern over several seasons. Width of cultivation strip is to be increased and width of fallow (watershed) strip is be reduced.
(d). Conservation terraces -- change by moving soil to build-up terraces with tractor and plow before the plowing and planting season.
(e). Ridge and furrow made with a inter-row cultivation -- use Mann cultivator instead of heavier Mahon cultivator.
(f). Semi-permanent ridge and furrow -- reshape and plant with rotary injection planter.

In order to serve both the interests of L&WMP (SACCAR) and farming systems research, plots will be split so that one portion can be intensively managed to achieve precision in plant stands. Soil moisture monitoring will be carried out on this intensively managed sub-plot. Systems' assessments will be made on the extensively managed portion of the plot.

12.4.3 WHOLE FIELD RUN-OFF CONTROL

Objective: The objective is to implement and evaluate simple storm drainage followed by contoured ridges on portions of fields above the rainfall run-off management trial.

Justification: For fields with large upland watersheds, water control structures that prevent flooding would be of value. At least one 24 hour rainfall event of more than 65 mm. is expected in 70 percent of all seasons, for farms in the Mahalapye area. Flooding has been observed as a major problem on many fields in both drought and wet years. Farmers indicate that flooding is a serious problem.

Approach: This work will be implemented in collaboration with the L&WMP. Plans include: (a) surveying the four fields involved, (b) building protection bunds and channels on two of the fields, and (c) further assessing the issue of flood protection, protection versus water harvesting, etc., with farmers in the research area.

12.4.4 HISTORY OF CULTIVATION STUDY

Objectives: This study will serve two purposes:

(a). Quantify changes occurring in cultivation in the research areas over the past 25-30 years.
(b). Enumerate fields (on aerial photos) along with the stratification boundaries that can provide a sample frame for research in the future.

Justification: An historical and geographical framework is useful: in evaluating cultivation patterns if trial sites are representative, and in developing a sampling frame for a range of issues with potential for research. These issues include: soil building, intensification of cropping, interventions bound by logistical constraints, etc.

Approach: Aerial photos from 1963, 1975 and 1982 for Shoshong and Makwate and for 1971, 1981 and 1988 in Makoro will be used to evaluate the changes in the pattern of cultivation in the three research village areas. Combined with the assessment of the photos, information is also gathered from discussions with village elders about the history of the development of the lands, history of land allocation, land type preferences, and so forth. Information from these discussions is used to stratify lands areas on the basis of family/ward origin, age of cultivation, and agro-ecology.

12.5 FARM EQUIPMENT

12.5.1 EVALUATION OF ROTARY INJECTION PLANTER

Objectives: Objectives of this RMRI and RMFI evaluation are to:

(a). Test the operation of the most recent modification of the injection planter.
(b). Evaluate the operation over light and heavy textured soils (RMRI trials).
(c). Measure cropping outcomes.

Justification: The rotary injection planter is identified as a means for farmers, without good control of traction, to row-plant and to have reliable control over the timeliness of planting relative to soil moisture. Models of the planter tested in the two previous seasons have not performed in a satisfactory manner. Modified versions of the planter need to be tested for their technical performance to gain a large scale assessment of farmer acceptance of such a machine that is performing adequately.

Approach: FMFI testing of the machine will be organized through farmer groups. In this testing format, farmers will be offered a choice of seed types to use with the planter. For each seed type chosen, the farmer is asked to broadcast one-half the seed during plowing. An equal sized area is plowed but not broadcast seeded. This area is planted, using the rotary injection planter, with the other half of the seed on the same or any subsequent day in which soil moisture is judged by the farmer to be appropriate.

Even though measurements on plant stand and grain yield will be made, farmer's comments and researcher's observations on the operation of the machines will be the critical part of the rotary injection planter assessment.

12.5.2 EVALUATION OF DUTCH HOE

Objective: The objective of this FMFI trial is to elicit farmers' evaluations of the efficiency of the Dutch hoe for intra-row weeding and for weeding before traditional weeding time.

Justification: Information on the efficacy of this hoe, when used by farmers, has been requested by the weed agronomist of DAR Sebele. During research this past season, it was indicated that the hoe is liked by farmers but that it is not as effective on large weeds as the commonly used hoe. It is hypothesized that this hoe, which is easier to used and to use with more precision than the common hoe, could find a niche for intra-row weeding and for weeding early while most weeds are still small.

Approach: A number of Dutch hoes will be given to interested farmers in each of the research villages. Farmers will be instructed on when and where it should be used. A

small questionnaire will be administered to farmers who have used the hoe to find out how it was used, and to get a qualitative assessment of its performance.

12.5.3 EVALUATION OF GROUNDNUT PLANTER

Objectives: To assess the performance of a planter especially designed for groundnuts.

Justification: Because groundnut seed is soft and prone to cracking, the need for an appropriate planter is evident. Most planters, currently used in Botswana, were not originally designed for oblong seeds. Sebele researchers have identified a planter which may solve the seed cracking problem. It is not certain, however, that an appropriate planter would be more attractive to area farmers than the traditional planting methods of broadcasting or hand planting. The economic benefit for farmers to use such a planter is also not known.

Approach: In an RMFI format, use of the groundnut planter will be compared with broadcast and hand planting (hoe or stick) by three or four farmers. Planting dates should be the same or nearly the same for all treatments within each comparison.

Performance measures include plant stand, grain yield, and seed quality (estimated from sub-samples). Handling characteristics of the planter will also be evaluated.

Time for labor and draft use in planting, weeding and harvesting will be monitored. From these data and from the harvest results, cost/benefit analysis on the shift to use of this planter can be made.

12.6 ENVIRONMENTAL MONITORING

12.6.1 RAINFALL AND TEMPERATURE MONITORING

Objective: The objective of this RMRI study is to measure rainfall and temperature for all research sites.

Justification: Large temporal and spatial variation in rainfall and temperature accounts for a large part of the variation in agricultural production. From a research perspective, not only should the effect of these climatic factors be measured, but different technologies must be evaluated on the basis of how well they do under different climatic situations.

Approach: Approximately 40 rain gauges are distributed throughout three research areas. Most of these have been in place since the beginning of the season. In many cases, more than one neighbor participating in the project will be grouped with a single gauge reading. The distribution of rain gauges will be again be studied during this season and repositioning of some gauges maybe made. A single maximum/minimum thermometer is read in each village area.

12.7 HOUSEHOLD CIRCUMSTANCES

12.7.1 COOPERATING FARMERS STUDY

Objectives: The objectives of this RMRI descriptive and diagnostic study would be to:

(a). Identify changes overtime in the farming system.

(b). Provide a whole farm production assessment with which to compare specific trial or intervention results.

Justification: This is the same as given in Section 13.8.1.

Approach: A single visit survey is administered to approximately five core farms per season. The 1988-89 survey must be evaluated and revised to better address issues of concern.

12.8 OTHER PROFESSIONAL ACTIVITIES

12.8.1 LINKAGES WITH FARMERS

This will be accomplished in the following ways:

(a). Continue farmer research groups for the purpose of FMFI trial management and technology assessment.
(b). Increase farmer participation in technology screening and design by expanding the use of farmer assessment groups in RMRI land and water management work, and possibly also in the National Tillage Trial work.
(c). Increase farmer participation in RMFI testing of farm equipment.
(d). Give annual research report on ATIP activities at kgotla meeting in each ATIP village.
(e). Modify the format used for farmer field days to (i) increase the focus and number of field days and (ii) increase focus on farmer-related issues by limiting participation of extension and research staff.

12.8.2 LINKAGES WITH ON-STATION RESEARCH

Linkages will be maintained or improved by:

(a). Providing on-farm research support/feedback to commodity programs such as cowpea, groundnut, and FMDU research.
(b). Providing on-farm research input into research working groups based on themes.
(c). Providing on-farm research management for locations of National Tillage trial.
(d). Providing on-farm research support and management for technology screening related to land and water management.
(e). Providing on-farm research sites and historical yield data for further technology by rainfall, by land type, and by management analyses.

12.8.3 LINKAGES WITH EXTENSION

Continued improvement of linkages with extension will involve:

(a). Working with the Machaneng Agricultural District Office to organize the second annual farming training course on row-planting and inter-row cultivating.
(b). Working with the Machaneng Agricultural District Office to plan a long-term expansion of the farmer training course program.
(c). Working with six Agricultural Districts of Central Region to improve the row-planting and inter-row cultivating contests held at the District Agricultural Shows.

(d). Presenting the proposed ATIP work plan to the annual planning session of all DAOs and the RAO of Central Agricultural Region.
(e). Co-sponsoring a special meeting between research and extension to evaluate the current status of the research-extension linkage in Central Agricultural Region.
(f). Requesting ADs in the research villages to be participate in farmer groups and review other trial activities.
(g). Preparing articles on ATIP activities for extension publications.
(h). Having ATIP Technical Officers attend selected DAFS Monthly Management Meetings in three Districts to discuss ATIP activities.
(i). Providing assistance to the Palapye Development Trust in evaluating their outreach work to five villages located in the Tswapong Hills.

12.8.4 LINKAGE WITH PLANNING AND POLICY

Participate, as needed, in the administration of an agro-forestry needs assessment survey. This survey will be developed through a NORAD-funded consultancy, and will have a nation-wide scope.

12.8.5 DATA DOCUMENTATION

Prepare documentation of Mahalapye data sets. Provide duplicate sets of these data sets for Sebele.

12.8.6 METHODOLOGY

The structure of team activities will be reviewed and revised to assess the effectiveness of the work, and the appropriateness of methods for future teams which could be inexperienced to on-farm research. Activities that are receiving major attention in this respect include:

(a). Standardization of data collection books.
(b). Standardization of certain data collection and data handling procedures.
(c). Team meeting formats with outside support persons included.
(d). Protocols for participation of professional disciplines, on the team, in the farmer group activities and in researcher managed research.

The description of many methods used or found appropriate will be included in the Handbook for Farming Systems Work in Botswana.

12.8.7 PRODUCTION OF PAPERS

Since this will be the last year for many ATIP staff, a series of definitive working papers will be produced summarizing work carried out on specific topics, together with suggestions for future work. In addition, all team members will cooperate in the production of the "Farming Systems Handbook for Botswana".

CHAPTER 13: ATIP FRANCISTOWN WORK PLAN, SEPT. 1989 - AUG. 1990

USAID:	G. Heinrich	(Agronomist)
	T. Thedford	(Animal Scientist)
	F. Worman	(Agricultural Economist)
GOB:	S. Masikara	(Agronomist, DAR)
	C. Tibone	(Agricultural Economist, DPS)
	K. Kelemogile	(Animal Scientist, DAR)

13.1 OVERVIEW

The ATIP Francistown team collected much descriptive technical and socio-economic data during the first two years of its work. At the beginning of the third year, the team shifted its emphasis away from descriptive/diagnostic research, except for analyzing existing data, and placed more emphasis on design/testing research. The team continued the same basic research thrust during the 1988-89 year. During the 1989-90 year, the research program will be conducted primarily by GOB personnel with back-up provided by the USAID scientists, who will spend the majority of their time completing analyses and writing up the research work which has been completed. Selected databases created over the last six years will be documented. The entire team will participate in finalizing the Farming Systems Handbook for Botswana. For continuity, most research activities will remain concentrated in the villages of Matobo, Marapong, and Mathangwane.

Within this framework, specific disciplines will have different, but interlinked focuses:

Agronomy: In the 1989-90 season, the agronomy research in Tutume Agricultural District will focus on the same primary issues as last season. That is, it will continue to focus on water conservation and improved tillage/planting systems, largely in collaborative trials with ALDEP. Further, examination of the potential of other useful interventions will be continued through farmer group activities. Highlights of this year's research program include:

(a). Continued work with an improved, easy to use, modified hand row-planter (rotary injection planter) to assist non-draft power owners and others with timely row planting, and testing of a light weight inter-row cultivator to assist with more timely weeding;

(b). Continued collaboration with extension in the area of technology testing, adaptation and dissemination through work with two farmer groups in the Communal First Development Area, NE District. Extension takes the lead role in this work.

Animal Production: Work will continue in collaboration with the socio-economists and agronomists at ATIP Francistown and Mahalapye, the livestock extension personnel, the personnel at the National Veterinary Laboratory, and the Francistown Veterinary Services Division with the objectives of investigating small stock losses, especially as they relate to management-related problems.

Descriptive work will continue on the identification of production parameters of goats in the

smallholder sector. The focus of the testing stage will center on the management systems for goats, purpose grown fodder and its intensive usage. In the dissemination stage, emphasis will continue on the introduction of fodder crops into the farming system and harvesting, and storing crop residues for feeding during the latter part of the dry season.

Day-to-day management and data collection for the projects will be completely localized by the end of the year. Current structure of the project and status of the animals will be maintained so that all data currently being collected can be completed. The facilities and livestock will be maintained in such a manner that research can be continued without interruption when complete localization occurs, and the expatriate technical staff leave.

Farm Management: The 1989-90 season will complete the localization of the farm management section, with all of the trial-related activities supervised by the Motswana agricultural economist assigned to the team. Activities will be in four major areas:

(a). There will be analysis and documentation of descriptive/diagnostic and trials data already collected, with preparation of final reports on most trials and surveys.
(b). A priority for 1989-90 will be the continued collaboration in the agronomy and animal production trials to collect data, and to provide an economic analysis of the trials.
(c). A related area is to participate in farmer groups. The purpose of the groups is to promote interaction and the exchange of information between farmers, extension, and the ATIP team; to obtain farmer assessment of trials during the year; and to increase team understanding of farmers' attitudes. Assistance will be provided to DAFS staff who are working with similar groups in non-ATIP villages.
(d). In order to promote the acceptance of the farming systems approach to research, emphasis will be placed on improving channels of communication with other organizations, providing information on ATIP for dissemination in extension publications, and addressing methodological issues with the entire ATIP team.

13.2 CROPPING SYSTEMS

13.2.1 ESTABLISHMENT OF PERENNIAL FORAGE SPECIES

Objectives: The objectives of this RMRI testing work are to:

(a). Identify problems associated with the establishment of agro-forestry/establishment of perennial forage species.
(b). Evaluate cultivars of leucaena and pigeon peas for their acceptability.

Justification: Hedge rows have been shown to prevent wind and water erosion. Leguminous plants such as leucaena and pigeon peas also fix appreciable amounts of nitrogen in the soil. In addition, such agro-forestry/establishment of perennial forage species can supply valuable feed for livestock as well as firewood and building materials.

Approach: To a limited extent, leucaena, pigeon pea and other plants suitable for hedge rows will be planted in pots for later transplanting to test sites in ATIP compounds, and on farmers' fields. Problems associated with plant establishment will be identified with the aim of developing a system which can be recommended to smallholder farmers.

13.3 TILLAGE AND PLANTING PRACTICES

13.3.1 NATIONAL TILLAGE TRIAL

Introduction: These trials are a collaborative effort between DAR, ALDEP, ATIP, and INTSORMIL and the SACCAR Land and Water Management Project. They are similar to the collaborative tillage trials performed by ATIP and DAR in 1985-87. The main differences between the current trials and previous ones within the Francistown region are:

(a). They will include a modified deep-ripping treatment;
(b). They will be truly national in scope;
(c). They include participation by more research and extension groups;
(d). A soil physicist is assisting in quantifying the physical effects of the different tillage practice on soil characteristics.

The trial will be similar to the ones conducted in 1988-89, with a few alterations. These include:

(a). A possible third replication in one tractor implemented trial;
(b). The second location will be implemented using animal draft power.

Objectives, justification, and approach are written by Dr. N. Persaud and are given below:

Objectives: The objectives of this PMSI testing stage work are:

(a). To evaluate the performance of the deep-ripping system on seedbed and root bed preparation, on yields, on soil moistare conservation, and use on various soils and for different rainfall conditions.
(b). To evaluate the effects of several possible improved tillage options on sorghum yields, seedbed and root-bed conditions during the growing season, and use on various soils and for different rainfall conditions.

Justification: Primary and secondary tillage are essential operations to ensure proper physical seedbed and root bed conditions for sorghum establishment and growth, and for weed control on soils of eastern Botswana. Previous studies on sorghum yield response to tillage (mainly on station by the DLFRS and on-farm by ATIP) have shown:

(a). All else remaining equal, the deeper the tillage, the higher the yield.
(b). Response to tillage is governed by the seasonal rainfall pattern.
(c). Response to tillage is influenced by any soil management factor, such as weed control operations that directly affect soil profile moisture content.
(d). That over several years, the deep-ripping tillage system may have potential to increase yields.
(e). That two primary plowing operations, the first early in summer and the second at a later date, depending on the rainfall, may provide economic yield benefits over the conventional single plow/plant operation.

More tillage studies are needed to develop a more fundamental understanding of the sorghum crop responses to tillage. Specifically the following need to be evaluated:

(a). The direct influence of various tillage practices on soil physical properties over time.
(b). Sorghum yield response to these tillage practices for various soil types and seasonal

rainfall patterns.

Approach:

Treatments: Proposed treatments are as follows:

(a). Conventional tillage: single plowing/row-planting operation.
(b). Double plowing: a first plowing done as early as possible, followed by a plow/row-planting operation simultaneously with treatment (a).
(c). Deep-ripping: deep-ripping when soil is dry followed by a discing/row-planting operation simultaneously with treatments (a) and (b).
(d). Conventional tillage with wide row spacing: same as in treatment (a) but with rows spaced as for the deep-ripping treatment.
(e). Plowing and cultivation: as in treatment (b) but with the second tillage replaced with a cultivation/row-planting operation.

Design and field layout: Experimental plots will be laid out in randomized, complete blocks with at least two blocks at each location. Experimental plots will be at least 40 meters long by 25 meters wide, with a 10 meter allowance at each end to allow for turning.

Locations: Locations are as follows:

(a). Sebele: one site
(b). Mahalapye: three sites at Mahalapye.
(c). Francistown: two sites at Mathangwane.

Measurements:
(a). Site characterization: location and landscape characteristics of each site using 9x9 panchromatic 1:50000 aerial photographs. Profile description of each site using the guidelines for soil profile description developed for Botswana by the FAO/UNDP/GOB Soil Mapping and Advisory Services Project. In situ bulk density measurements, sampling and chemical analyses on samples from all horizons to 125cm. Infiltration rate versus time curves and surface bulk density samples for 0-5, 0-10, and 0-15cm depth intervals for each elementary plot for all sites.
(b). Physical measurements: profile soil moisture, bulk density at 0-5, 0-10, and 0-15cm depths, and infiltration rate versus time curves, and if possible penetrometer measurements on each elementary plot at regular intervals from the beginning to the end of the season
(c). Meteorological measurements: non recording rain gauges installed at each site.
(d). Crop measurements: observations on plant stands, weed counts, rooting pattern, and crop yields made at appropriate times during the growth of the crop.
(e). Some labor and all other input data will be collected so that economic comparisons can be made between the different technologies.

13.4 LIVESTOCK

13.4.1 IMPROVED PRODUCTION OF GOAT MILK

Objectives: The objectives of this RMFI design trial have been changed to eliminate the FI portion, and will be continued as an RMRI trial with the following objectives:

(a). Assess milk production by traditional and improved goats under total confinement production, utilizing different feed types and levels of management.

(b). Collect production and economic data in order to evaluate the potential of goats as a small dairy industry

(c). Determine feasibility of planting and utilization of forage crops and fodder from crop residue for confined goat milk production.

Justification: Most subsistence farmers keep goats, and 90 percent of those who do keep goats, milk them at least part of the year. There is a potential market for fresh liquid milk, and a market for milk products which could possibly be developed. If animals of a dairy type were kept under improved management and a selection program was initiated, it should be possible to increase family cash flow as well as provide a rapid return on investment through small stock. This is an attempt to evaluate the potential of goats as a small dairy industry.

Approach: Four goats have been placed in research-demonstration kraals located in each village compound. Each kraal contains two Tswana goats, one Tswana x Boer cross and one pure Saanen. They will continue to be fed variable rations and milk yield, time involved in management and costs for feed, etc., will be recorded. Comparisons will be made with production under the traditional method of goat milking based on milking records obtained periodically from cooperating farmers, and, if any data are realized, then compared with production under the modified management method attempted by cooperating farmers during 1988-89.

The planting and utilization of forage crop and fodder from crop residues will be promoted through the purchase for use in feeding project goats. Additional feed will be purchased from other sources as necessary.

13.4.2 DIAGNOSIS OF KID MORTALITY

Objectives: The objectives of this RMRI descriptive and diagnostic study are:

(a). Arrive at the most common causes of goat mortality from birth to weaning, to one year old, and in adult goats.

(b). Design management strategies, including housing if appropriate, to prevent this mortality.

(c). Devise methods of management, including housing if appropriate, to decrease morbidity.

(d). If immunization would be a deterrent, then develop recommendations for immunizing against those specific diseases.

(e). Develop working relationships and linkages with Veterinary Services Department and DAFS.

(f). At the end of this year, the observations will be evaluated in the light of:

  (i). Recommendations to be made to Veterinary Services and DAFS to reduce mortality.

  (ii). Suggestions for future work in small stock research.

Justification: Death losses in kids vary in severity from year to year, and has been reported from 9 percent to 62 percent by both APRU and ATIP. This loss of income potential, as well as future breeding potential, is of great concern to farmers and government officials alike. Inventory changes could have an effect on management procedures and result in returns to the farmers.

Approach: All kids that die will be collected and stored in a cooler or transported to Francistown for a post mortem exam. A post mortem report form will be developed. This is to be completed at time of examination and submitted with those tissue samples that are to be submitted to the Veterinary Diagnostic Laboratory in Gaborone for work up.

13.5 MARKETS

13.5.1 SMALL STOCK TRADING AND PRICES

Objective: The objective of this RMRI descriptive and diagnostic study is to monitor the impact of the BMC abattoir on small stock prices, and to examine resulting trends in small stock inventories.

Justification: For a long time small stock purchases and sales around Francistown have been through informal markets. Prices averaged as low as P38 per head. The number of goats sold to local restaurants ranged between 16 in Mathangwane and 30 in Matobo. With the opening of the BMC abattoir in Francistown next year, there may be an improvement in small stock prices. Livestock inventories may also be affected by the new market.

Approach: Monthly surveys of a selected number of farmers and restaurants will be conducted. The BMC abattoir will also be visited periodically to administer a questionnaire more or less the same as that for farmers and restaurants. This will provide a cross-check on small stock trade and prices.

13.5.2 GRAIN TRADING AND PRICES

Objective: The objective of this RMRI descriptive and diagnostic study is to ascertain the within village prevailing prices for basic grains.

Justification: Formal marketing channels for grains are not well established, and most local sales by village farmers are inter-household sales. There has been little formal trading in grain due to the drought, but the monitoring of local informal prices for grain is useful data for economic analysis of crop production technologies.

Approach: One or two informal surveys will be used to estimate the local informal price for grain.

13.6 FARMER PARTICIPATORY RESEARCH

13.6.1 FMFI OPTIONS TESTING WITH RESEARCHER LED FARMER ASSESSMENT GROUPS

The work with farmer groups in 1988/89 was very popular among farmers and will be continued in the three study villages in Tutume Agricultural District.

Objectives: The objectives of this FMFI testing activity are:

(a). To test a broad range of innovations under farmer managed conditions for increased productivity and grain yield dependability.
(b). To involve farmers and ADs directly in the farming systems development process.

(c). To determine what types of innovations are most appealing to different types of farmers.

Justification: Numerous technological innovations have been developed in Botswana (and elsewhere) which may be relevant to subsistence farmers in Tutume Agricultural District. However, it is difficult to evaluate a very wide range of these innovations under researcher managed conditions in on-farm tests (due to time constraints). Further, it is often difficult to assess which innovations might be most relevant to specific farmers. It was therefore decided to present to a group of farmers a wide range of technological options. Farmers can then select innovations that seem most relevant to their situation, and test those with some researcher guidance (and provision of inputs). Monthly meetings are held with the groups to discuss problems and progress. In this way, farmers demonstrate which types of innovations seem most appropriate to them, and researchers are able to observe the effectiveness of those innovations and work with farmers towards the development of improved production systems. By including ADs in the group monthly meetings, the ADs also become part of the systems development process.

Approach: In late September, an open kgotla meeting will be held for all participating farmers, members of village Farmers' Committees, and the local ADs in the three villages where ATIP has been working. At this meeting ATIP staff will present:

(a). The results from last year's research.
(b) An invitation to all interested farmers, to attend a special meeting where technical options are reviewed (these will include both new technologies and currently recommended ones).

At this meeting, a wide range of technology options will be discussed (see list in Table 13.1). Farmers will then be asked to select any innovation or package of innovations they wish to test in the coming year. Those farmers electing to perform a test (or tests) will then form the farmer groups that will meet monthly. The ADs will also be invited to attend these meetings, where progress and problems can be discussed.

The types of innovations introduced will include:

(a). Tillage/water conservation techniques.
(b). Planting method options (with some emphasis on evaluating hand row planters).
(c). Crop varieties.
(d). Manure and fertilizer possibilities.
(e) Forage and fodder production options.
(f). Seed protection options

Depending on the degree of interest, and availability of equipment, some or all of the farmers wishing to test a specific innovation will be supplied with the necessary inputs and machinery by ATIP. Trials will be laid out side-by-side with a traditional control. Generally a record will be kept by ATIP staff regarding the dates of all operations, and grain yield. An end-of-season farmer assessment survey will be administered and, where possible, economic interpretations will be made.

Field days will be held in one or two villages. At these field days, selected participating farmers will have the chance to show off their trials to the rest of the group, as well as to farmers from outside the group and to regional extension staff. They will describe the trial, their observations and opinions, and answer questions from the group of visitors. This will be primarily an extension activity.

13.6.2 FMFI OPTIONS TESTING WITH EXTENSION LED FARMER ASSESSMENT GROUPS

Objectives: The objectives of the extension managed farmer (FMFI) testing groups are:

(a). Test a method for ADs to increase their efficiency by addressing a large number of farmers (on technical issues) at once, rather than having to make numerous individual visits to households and fields. (The group format allows the AD to perform a teaching function at the beginning of the year, and a backup function throughout the cropping season, through monthly meetings.)
(b). Provide a forum for researcher backup in extension activities.
(c). Provide a test to see if farmer groups are practical under extension conditions.

Justification: The extension service in Botswana, to date, has been very committed to administering drought relief programs. Thus, the traditional role of extending recommended agricultural technologies has been greatly reduced. Further, a single AD may have well over 500 households under his/her responsibility. Without a good communication system, many of the constraints these households face may go unaddressed. The farmer group approach offers a means of working with a number of farmers at one time, thus improving the efficiency of the AD. ADs are officially encouraged to work with groups of farmers, but to date, the system has not been employed for the testing and teaching of extension recommended technologies in the Francistown Region.

Approach: These activities have been implemented for two years now. While the methodology seems practical and popular with farmers, there remain some problems with logistics. These problems are largely in the area of input preparation and supply, early in the season. At a recent organizational meeting between ALDEP, ATIP, and District extension staff, it was decided not to expand these activities -- particularly since several extension staff are about to be transferred. The following approach has been used in previous years, and will be used again this season.

Prior to the cropping season, ATIP staff will meet with regional agricultural officers and CFDA coordinators to discuss the extension managed options testing farmer group. The DAO and the ADs from the areas will meet with ATIP staff to discuss the group work. The regional CPO and the ALDEP manager will also be included in the discussions. This group will decide on a limited number of technologies, including types of equipment provided through the ALDEP program, which are to be presented for testing. Logistical details will also be arranged.

Just prior to the normal beginning of the cropping season, the ADs will ask the village headman to call a traditional village meeting at which he, and the ATIP Francistown staff, will describe the farmer group work in other villages and invite interested farmers to attend the initial group meeting to be held two weeks later. At the initial group meeting the AD and ATIP staff will discuss the technologies available for testing (see Table 13.1) and how tests are to be conducted. Farmers will be asked to indicate which tests they wish to implement.

At subsequent monthly meetings the implementation of trials will be discussed. The farmers will be asked to decide on their own how large to make the test plots, and to stake the plots accordingly. Side-by-side comparisons will be recommended. A field assistant will be

TABLE 13.1: TECHNOLOGIES TO BE OFFERED FOR TESTING TO FARMER GROUPS, FRANCISTOWN AREA, 1989-90*

Technology	Uses	Conditions for Applications (and Timing)	Resources and Inputs Required (Labor, Cash)
Subject: Water Conservation			
A) Double plowing	Reduce run-off & erosion, conserve water.	Preliminary tillage to be done a) on very early season rains(S/O) b) on dryer periods between rains NB: Not to be done after mid Jan	Non restricted access to draft power. Will increase plowing labor and draft use where animal draft only is used.
B) Contour plowing	Reduce run-off & erosion. Conserve water	Field contours should be marked before onset of rains	Nothing extra (contouring done free by SCS (GOB)
C) Fallow	Conserve water between years	Field not planted, weed control	Chemical or mechanical weed control
Subject: Crop Mixtures			
A) Mixing long and short crops and varieties	Reduce risk of total crop failure due to early termination of rain	Suggested mixes through season 1) Before Dec 1 - 75% LS, 25% SS 2) Dec 1 - Jan 15 - 50% LS, 50% SS 3) Jan 15 onwards - 25% LS, 75% SS	Labor available for harvesting, drying from early Mar onwards Purchase seed? Bird scaring may be necessary earlier than usual.
B) Annual forage crops	Provide supplemental dry season feed of good quality	Livestock needs (e.g., early feeding of draft animals, fattening for sale, milk production)	Planting labor in Feb,weeding in Mar. Seeds (free from MLDEP). Harvesting May-June.
Subject: Planting Methods			
A) Hand row planter	Plough on poor soil water, plant on good moisture (for farmers without draft) - ensures good plant stand.	Anytime, best on good moisture or completely dry soils Good soil preparation required	Well tilled seed bed. Sanitas hand row planter or RIP Extra labor at planting. (RIP to be emphasized)
B) Sebele row planter and plow planter	Ensure good plant stand	Requires good soil water condition for effective use. Also requires understanding of mechanics. Use anytime before Jan 15 (plough/plant same time there after). Well trained draft power	Sebele planter Planting labor Well trained draft power
C) Improved harnesses, yokes, and animal care. Proper plough adjustment	Improve efficiency of plowing operations, improved animal well being	Throughout plowing operations	Improved equip. Knowledge of animal husbandry (small?). Cost of equipment.
Subject: Weeding			
A) Inter row weeder (modified Indian design and Zimplow design)	Reduce weeding time. Increase timeliness of weeding	Row-planting situation	Donkeys, weeder. Depending on availability from Sebele.

TABLE 13.1: TECHNOLOGIES TO BE OFFERED FOR TESTING TO FARMER GROUPS, FRANCISTOWN AREA, 1989-90* (CONTINUED)

Technology	Uses	Conditions for Applications (and Timing)	Resources and Inputs Required (Labor, Cash)
Subject: Forages			
A) Annual forages Babala millet and lab lab	Provide supplemental dry season feed of good quality for early feeding of draft animals.	Anytime but only on good moisture or completely dry soils. Good soil preparation required.	Well tilled seed bed. Broadcast and plow down or use Sebele row planter. March weeding? May-June harvesting.
B) Perennial forages Buffel grass and Siratro	Draft animals, stall feeding, supplemental feeding selected livestock.	Land available for permanent pasture. Seed before Feb.15. Good soil preparation required.	Broadcast on well tilled seed bed cover with brush harrow. Seeds (free from ALDEP). Draft power, weeding labor (late season), harvest labor.
Subject: Manure/Chemicals			
A) Animal manure spread on fields	Increase soil fertility and moisture holding capacity.	Use on all soils in TAD.	Donkey cart, considerable labor for transport to fields and increased weeding.
B) Chemical fertilizer	Increase soil fertility	Use P on all soils, use N on poor soils under higher rainfall conditions.	Transport for fertilizer to field, labor for broadcasting, and cash to purchase fertilizer.
C) Captan	Seed treatment for groundnuts. Protect expensive seed. Improve germination percentage.	Availability of Captan and G. nut seed. Farmer must understand basics of toxic chemical use.	Cost of Captan.
Subject: Crop Variety Testing			
A) Advanced selection of genotypes	Farmer evaluation of potentially improved sorghum and cowpea genotypes.	Availability of seed	None extra.

*. LS = Long Season, SS = Short Season, TAD = Tutume Agricultural District

hired to assist the AD in working with farmers to collect data, provide seeds and equipment etc.

Monthly meetings to discuss trials will be held. Farmers will be asked to describe their trial experiences, identify problems, and report their observations on the trial to the group. The farmer group meetings will be chaired by the AD. All meetings will be attended by ATIP and district level extension staff. ATIP and extension staff will visit all trials at least once during the season.

A field day will be held near the end of the season. Farmers from other villages, extension staff and research staff will be invited to participate.

Following harvest, the ATIP staff will conduct a formal end-of-season survey of participating farmers to obtain farmer assessment of the trials they participated in, and the group activities. This information will be included with extension and researcher evaluations of the group activity in a progress report, and will help measure farmer adoption rates.

13.7 ENVIRONMENTAL MONITORING

13.7.1 RAINFALL AND TEMPERATURE MONITORING

Objective: The objective of this RMRI descriptive and diagnostic activity is to obtain daily rainfall and temperature data from experimental sites for use in agronomic and economic evaluations of trials.

Justification: Rainfall and temperature are two important parameters in crop production, and to a lesser extent in animal production. Over the past several years rainfall has been a major limiting factor in determining the amount of area planted, the quality of stand emergence and the quantity of grains and forage harvested. Because of high variability in rainfall within village areas, monitoring must be done on a plot by plot basis. Temperature is more constant within an area, so can be monitored at a central location.

Approach: Daily rainfall readings will be taken on rain gauges located on experimental plots. Maximum and minimum temperatures will be recorded at the ATIP compounds.

13.8 HOUSEHOLD CIRCUMSTANCES

13.8.1 COOPERATING FARMERS STUDY

Objective: This is an RMRI descriptive and diagnostic study. The objective of collecting economic and technical data on a continuing basis is to identify major changes and trends over time in the farming systems in Tutume Agricultural District. Of particular interest are data on crop environments, crops planted, cropping systems used, and harvested yields.

Justification: Since arable agricultural production in Botswana fluctuates greatly from year to year, due in large part to the harsh climatic environment and changing government policies, several years are required to adequately describe crop production activities. A continuing monitoring program provides information on the fluctuations in the system over time, and allows the identification of trends, such as shifts from one source of traction to another. This information will assist in the identification of economically feasible technologies which can lead to increased incomes without substantially increasing risk or

investment.

Approach: To provide system monitoring information, several approaches will be combined. For environmental information (Section 13.7), daily readings of rainfall and temperature will be continued. Cropping and traction animal management practices will be assessed using an annual questionnaire administered to the households which participated in the multiple visit survey (MVRQ) near the beginning of the project.

13.9 OTHER PROFESSIONAL ACTIVITIES

In order to promote the acceptance of farming systems work, it is important to continue and increase contacts between the team, farmers and other agencies, both in terms of conducting joint research and in the inclusion of extension and research staff in farmer group work, field days and joint visits to fields. Linkages and collaboration will be strengthened through the following activities.

13.9.1 LINKAGES WITH FARMERS

(a). Continue activities with researcher managed farmer testing groups.
(b). Continue activities with extension managed farmer testing groups.
(c). Present an annual report on ATIP activities at a kgotla meeting in each ATIP village.

13.9.2 LINKAGES WITH EXTENSION

(a). Have a regional review of work plans, and coordination of regional activities with regional DAFS personnel.
(b). Continue to involve DAFS in the FMFI design and testing of systems' options through involvement of local ADs, and district and regional DAFS officers, in researcher managed farmer testing groups monthly meetings and field days.
(c). Assist in the continuation of the existing extension managed farmer testing groups located in the CFDA in Northeast District.
(d). Collaborate with ALDEP on tillage trials, and forage trials.
(e). Cooperate with the Regional Agricultural Office, actively seek their suggestions concerning the identification of research problems and the Francistown ATIP work plan, and keep them fully informed of ATIP's activities.
(f). Collaborate with the Regional Small Stock Officer on goat management studies.
(g). Prepare articles on ATIP activities, with pictures, for inclusion in extension publications.
(h). ATIP senior technical officers will continue to regularly attend DAFS Monthly Management Meetings and discuss ATIP activities.
(i). Assist ALDEP with their Participatory Trials Program and District Demonstration Farms.

13.9.3 LINKAGES WITH ON-STATION RESEARCH

Collaborate with DAR on tillage systems research, crop variety testing, equipment development, and other activities, including theme group meetings for planning research strategies, and presenting seminars.

13.9.4 LINKAGES WITH VETERINARY SERVICES

With the addition of an animal scientist/veterinary scientist there has developed work in conjunction with the Veterinary Services field staff and Central Diagnostic Laboratory in the investigation of goat diseases and mortality, and methods of control using management, nutrition and husbandry

13.9.5 LINKAGES WITH POLICY/PLANNING

Relevant data sets will be reviewed and documented. These data sets will be made available to the DPS DAR other Botswana governmental bodies, and to other interested groups for their use in research Support for the MOA agro forestry study will be provided as requested

13.9.6 METHODOLOGY DEVELOPMENT

The Francistown ATIP team will continue to work with other members of ATIP in the preparation and dissemination of methodological materials. Emphasis will be placed on the completion of a Farming Systems Handbook for Botswana. The Francistown agricultural economist will continue to coordinate team efforts to further develop and utilize the sequential decision system framework.

13.9.7 PRODUCTION OF PAPERS

Since this will be the last year for many ATIP staff, a series of definitive working papers will be produced summarizing work carried out on specific topics, together with suggestions for future work In addition, all team members will cooperate in the production of the "Farming Systems Handbook for Botswana"

PART IV: FINANCIAL PLAN, SEPTEMBER 1989 - AUGUST 1990

CHAPTER 14: FINANCIAL PLAN

One of the main objectives of presenting a financial plan in the Annual Report was to give some idea of the costs that GOB will have to incur if ATIP type and related (INTSORMIL) activities are to continue at the same level after the end of the project on September 28th, 1990. This is of course not entirely reasonable, as it is doubtful if all the expatriates will be replaced by nationals. Thus, activitities and hence support costs are likely to be reduced to some extent. However, at the moment it is too difficult to make projections about this. Therefore an attempt is made to give some idea of the costs that currently are being met by GOB and ATIP. To address this, commitments required have been broken into two components:

(a). Fixed or overhead costs which cannot easily be costed.
(b). Recurrent costs which have to be met on an annual basis.

Commitments currently made, that will not likely be necessary after donor funding ceases, have been listed separately. GOB commitments with respect to these have been costed in this report. Commitments not likely to continue have been divided into two parts:

(a). GOB commitments.
(b). USAID commitments.

No attempt is made to separate GOB commitments into individual departments in MOA. The costs given should be considered very tentative in nature. Also, in the tables it is assumed that ATIP and ATIP related activities (i.e., INTSORMIL) will continue in the future in much the same way as they are now.

14.1 CONTINUING GOB COMMITMENTS

These are the commitments that will need to continue to be made by GOB, under the somewhat unrealistic assumption that the current level of commitment in terms of staff is maintained.

14.1.1 FIXED

These are given in Table 14.1. No attempt is made to put a value on these components.

TABLE 14.1 OVERHEAD FOR ATIP AND ATIP RELATED ACTIVITIES, SEPT 1987 - AUG 1988*

Unit	Place	Number	
		Offices	Houses
ATIP	Gaborone	1	1
	Sebele	5	4
	Mahalapye	3	3
	Francistown	1	6
INTSORMIL	Sebele	2	2

* This list includes houses for professional staff only. It does not include houses for the support staff in Gaborone, Sebele, Mahalapye and Francistown, or the 12 rondavels in the ATIP villages.

14.1.2 RECURRENT

The following assumptions were made in drawing up the recurrent estimates for the coming year.

(a). ***GOB (i.e., BX) Vehicles.*** A few years ago the Central Transport Organization (CTO) were planning to rent vehicles to governmental departments. However, this has now been abandoned. Nevertheless for want of better estimates, the same figures are used as last year, plus 10% allowance for inflation. Table 14.2 gives some details. The costs in Table 14.2 seem rather low indicating that funds are channelled directly to CTO, therefore heavily subsidizing vehicles. However the degree to which this done is impossible to determine. Thus vehicle costs are underestimated as far as GOB is concerned, especially as some of the vehicles are in the process of being replaced

TABLE 14.2 COSTS OF RUNNING GOB VEHICLES

Toyota Type	Number	Cost/Vehicle/Year (Pula)	
		Hire Cost	Running cost[1]
Landcruiser Station Wagon	1	3,595	4,920
Landcruiser	2[2]	3,096	4,920

[1] Assumes vehicle travels 30,000 kms per year, and at rate of five kilometers per liter. Cost of petrol per liter is P0.82.

[2] This also includes three vehicles for Mahalapye, three for Francistown, and one for the RECO.

(b). ***Salaries of Staff.*** In order to simplify the calculations, the median salary in each rank is used. Also there are allowances or support costs that are budgeted for transport, travelling and subsistence. Assumptions used are given in Table 14.3.

TABLE 14.3 MEDIAN SALARIES AND ALLOWANCES OF GOB STAFF, SEPT 1989-AUG 1990

Rank	Numbers in Activity		Cost/Person/Year (Pula)	
	ATIP	INTSORMIL	Salary	Allowances[1]
C2	2		16,884	2,195
C3	3	1	13,728	1,785
C4/3	1	1	12,936	1,682
C4	1		11,160	1,450
B1	3		8,820	1,147
B3/2	5	2	6,972	906
B3	1		6,012	782
B1/3	2		5,946	773
B5	8		3,852	500
Industrial Class	6		3,000	390

[1] These have been estimated to be 13% of the salary.

Estimated recurrent costs for running the ATIP and ATIP related activities in the form that might exist after donor-funded support finishes are given in Table 14.4.

TABLE 14.4 ESTIMATED RECURRENT COSTS FOR UNDERTAKING ATIP AND ATIP RELATED ACTIVITIES, SEPT 1989 - AUG 1990[1]

Item	Amount (Pula) By Whom Is Currently Paying For ATIP		INTSORMIL Related[2]	
	GOB	Project	GOB	Project
Salaries and Allowances				
Other than Industrial Class	236,264		43,879	
Industrial Class	20,340			
Casual Labor	15,000	15,000	4,000	1,000
Vehicles	64,628	15,000		8,016
Miscellaneous[3]		80,000		20,000
Total	336,232	113,000	47,879	29,016

[1] This table includes recurrent expenditure that will need to be continued by GOB in the long run after donor funding is withdrawn. Some of the entries in the table are based on figures in Tables 14.2 and 14.3.

[2] Includes purchase of equipment such as implements, consumable stores, etc.

14.2 CURRENT COMMITMENTS THAT WILL NOT CONTINUE

This section includes estimates of commitments that will not be necessary when the project is over.

14.2.1 GOB COMMITMENTS

These commitments are listed in Table 14.5. They include houses, allowances, and short and long-term training.

TABLE 14.5 CURRENT COMMITMENTS OF GOB THAT WILL NOT CONTINUE AFTER DONOR FUNDED SUPPORT IS WITHDRAWN

Item	ATIP		INTSORMIL Related	
	Number	Cost	Number	Cost
Houses: Sebele	1	Unknown	2	Unknown
Mahalapye	1	Unknown		
Francistown	3	Unknown		
Allowances for Technicians[a]	5	10,975	2	5,390
Short Term Training[b]		25,000		
Long-Term Training[c]	6	240,000		
Partial Total Cost		175,975		5,390

[a] Assumed to be at a rate equivalent to C2 (P2,195) in Table 14.3.
[b] This is rough estimate. Individuals sent on short-term training can use ATIP funds for per diem and tuition, but airfares have to paid by GOB.
[c] Expressed in person years, and estimated at a cost of P40,000 per year

14.2.2 DONOR-FUNDED COMMITMENTS

Table 14.6 gives the commitments planned by ATIP and ATIP-related activities that are being met through funds originating from USAID. It is anticipated that these commitments will not need to be assumed by GOB once donor-funding is withdrawn.

TABLE 14.6 COMMITMENTS TO BE MADE WITH DONOR FUNDS THAT WILL NOT NEED TO BE ABSORBED BY GOB IN THE LONG RUN, SEPT. 1987 - AUG. 1988

Item	Unit	ATIP	INTSORMIL
Staff			
Long-Term	Person years	7	2
Consultants	Person months	7[a]	1
Training:			
Long-Term	Person years	3	
Short-Term[b]	Person months	5	
Support Staff[c]	Person years	3	
Vehicle Support[d]	Vehicles	3	

[a] This is a rough estimate.
[b] It does not include those who will receive in service training.
[c] Including allowances estimated at 13% of the the salary, total cost is P63,000.
[d] Estimating costs at P7,000 per year (three of the vehicles are very old) the total cost is estimated to be about P35,000

These commitments are satisfied from a number of places: ATIP under the MIAC contract, ATIP under USAID/B, and INTSORMIL.

14.3 CONCLUSIONS

It is anticipated that on the basis of the data presented above, which must be considered very tentative in nature, the recurrent cost to GOB of ATIP and ATIP-related activities for the period September 1989 to August 1990 will be in the region of P660,086 (see Tables 14.4 and 14.5), of which P275,975 (Table 14.5) is a short-run commitment that GOB should not have to incur in the long-run.

As far as USAID support is concerned, costs that will eventually have to be absorbed by GOB are estimated to be around P142,016 for the period September, 1989 to August, 1990 (see Table 14.4); while commitments they are currently making, that will not have to be absorbed by GOB in the long run after USAID funding is withdrawn, are given in Table 14.6.

APPENDIX: PAPERS PRODUCED BY ATIP

APPENDIX: ATIP DOCUMENTATION

A.1 POLICY

Papers written by ATIP staff are disseminated in the following manner.

A.1.1 EXTERNALLY PUBLISHED PAPERS (EP SERIES)

Copies of articles and papers on ATIP work that are externally published are kept in limited quantities. Many of these are likely to have earlier been produced as Progress Reports, Miscellaneous Papers, etc. Likely audience: national and international.

A.1.2 RESEARCH PAPERS (RP SERIES)

Research Reports are published by the Government of Botswana and are submitted to external review (review by individuals outside ATIP). This generally means approval by the Chief Arable Research Officer and the Director of Agricultural Research. These consist of comprehensive summaries of ATIP work plus detailed reports on specific topics. Likely audience: local and international.

A.1.3 WORKING PAPERS (WP SERIES)

These are papers that deserve wide circulation, and have particular methodological or empirical value. They are submitted to internal review amongst ATIP members. They have a standard designed cover, with a hole in the middle of the front page showing the title. They are numbered ATIP WP-1, ATIP WP-2, etc. Likely audience: local and other people interested in farming systems work, both nationally and internationally.

A.1.4 MISCELLANEOUS PAPERS (MP SERIES)

These consist of conference papers, trip reports, etc, and are not generally subject to review. They are numbered with the year followed by the number in that year (e.g., ATIP MP 84-1, ATIP MP 84-2, etc.). Likely audience: mainly ATIP and other interested individuals inside and outside of Botswana.

A.1.5 PROGRESS REPORTS (PR REPORTS)

These are primarily papers written by staff members in ATIP, are not reviewed, and consist of research results, methodological issues, etc. They can be drafts of material to be published in another form. The idea is to systematize the way in which information is produced and circulated. Each location produces its own series. Therefore each area Mahalapye, Francistown and Gaborone identify their papers with M, F or G., followed by the year (e.g. 84), followed by the number of the Progress Report in that year (e.g., 1, 2, etc.). An example might be ATIP PR F84-3. No cover is produced for these Progress Reports, and circulation of the information is limited. Likely audience: ATIP staff and other interested individuals in Botswana.

A.1.6 REPORTING DOCUMENTS (RD SERIES)

These are reporting documents required by USAID. They consist of an annual report containing material not only on professional matters, but also covering staffing, training and administrative matters, and an annual work plan. Likely audience: primarily ATIP staff, USAID and MIAC, and institutions within Botswana.

A.2 PAPERS WRITTEN BY ATIP

Copies of most of the papers listed below are available on request. This is a cumulative list and includes all papers written since the inception of ATIP.

A.2.1 EXTERNALLY PUBLISHED PAPERS

1983

ATIP EP 83-1. Baker, D., E. Modiakgotla, D. Norman, J. Siebert and M. Tjirongo. "Helping the Limited Resource Farmer through the Farming Systems Approach to Research". Culture and Agriculture 19: 1-8

1984

ATIP EP 84-1. Norman, D., D. Baker and J. Siebert. "The Challenge of Developing Agriculture in the 400-600mm Rainfall Zone within the SADCC Countries". Zimbabwe Agricultural Journal 81(6):205-214.

1985

ATIP EP 85-1. Norman, D.W. "Some Problems in the Implementation of Agricultural Research Projects with a Farming Systems Perspective". FSSP Networking Paper No. 3. Gainesville: International Programs, University of Florida, 1985.

ATIP EP 85-2. Norman, D.W. "The Limited Resource Farmer and Africa's Food Production Crisis". In IFDC (Ed.), Fertilizer Efficiency Research and Technology Transfer Workshop for Africa South of the Sahara. Muscle Shoals: International Fertilizer Center, 1985. pp. 23-67.

1986

ATIP EP 86-1. Baker, D.C. and J. A. Hobbs. "Institutionalization of FSR and E in Botswana: Current Programmes and Issues". In C. Flora and M. Tomecek (Eds.), Selected Proceedings of KSU's 1984 Farming Systems Research Symposium. Farming Systems Research and Extension: Implementation and Monitoring, Farming Systems Research Paper No. 9. Manhattan: Kansas State University, 1986. pp. 110-134.

ATIP EP 86-2. Koch, B.A. "Farming Systems Research on Animal Husbandry Problems in Tutume Agricultural District of Botswana". In C. Flora and M. Tomecek (Eds.), Selected Proceedings of KSU's 1984 Farming Systems Research Symposium. Farming Systems Research and Extension: Implementation and Monitoring, Farming Systems Research Paper No. 9. Manhattan: Kansas State University, 1986. pp. 258-268.

ATIP EP 86-3. Norman, D. and M. Collinson. "Farming Systems Research in Theory and Practice". In J. Remenyi (Ed.), Agricultural Systems Research for Developing Countries, ACIAR Proceedings No. 11. Canberra: Australian Council for International Agricultural Research, 1986. pp. 16-30.

ATIP EP 86-4. Norman, D. and D. Baker. "FSR Credibility and Experiences in Botswana". In Moock, J. (Ed.), Understanding Africa's Rural Households and Farming Systems. Boulder: Westview Press, 1986. pp. 36-57.

ATIP EP 86-5. Trent, C., Monyatsi, T. and E. Modiakgotla. "Progress and Needs in On-Farm Research in Botswana". In CIMMYT (Ed.), Report of a Networkshop of Eastern and Southern African Senior Agricultural Administrators on Issues in Systems Based On-Farm Research. Nairobi: CIMMYT, July 1986. pp. 13-16.

ATIP EP 86-6. Merafe, Y., D. Baker, and D. Norman. "Socio-Economic Constraints to Farm Equipment Innovations in Botswana". In ILO (Eds.), Initiatives for Farm Equipment Programmes in Botswana: Improving Coordination. Geneva, Switzerland: ILO, 1986. pp. 41-49.

ATIP EP 86-7. Baker, D.C. and D.W. Norman. "Farming Systems Research and Extension in Harsh Environments: Development of a Farmer Cooperator Approach in Botswana". In C. Flora and M. Tomecek (Eds.), Selected Proceedings of KSU's 1985 Farming Systems Research Symposium, Farming Systems Research and Extension: Management and Methodology, Farming Systems Research Paper No. 11. Manhattan: Kansas State University, 1986. pp. 535-555.

ATIP EP 86-8. Koch B., Masikara, S., G. Heinrich, and W. Matlho. "Draught Animal Management and Early Ploughing". In C. Flora and M. Tomecek (Eds.), Selected Proceedings of KSU's 1985 Farming Systems Research Symposium, Farming Systems Research and Extension: Management and Methodology, Farming Systems Research Paper No. 11. Manhattan: Kansas State University, 1986. pp. 467-474.

1987

ATIP EP 87-1. Gray R., and D. Horspool. "Using Donkeys for Draught Power". Four Parts. Agrifacts. B/28/1-4. Gaborone: Department of Agricultural Field Services, Ministry of Agriculture.

ATIP EP 87-2. Heinrich, G., F. Worman, S. Masikara, and R. Gray. "Link Among Farmers, Extension and Research for Agricultural Development". Agrinews, 18 (April 1987): 8-9.

ATIP EP 87-3. Gray, R. C. "Donkeys". Northern Advertiser. 107:11 and 110:11. July/August, 1987.

ATIP EP 87-4. Worman, F. "ATIP Project in Tutume District". Northern Advertiser 125: 14-15. 27 November 1987.

ATIP EP 87-5. Norman, D.W., Baker D.C. and J.D. Siebert. "The Challenge of Developing Agriculture in the 400-600 mm Rainfall Zone within the SADCC Countries". In Boyle, P.J. (Ed), Agronomic Adjustment to Environment of the 400-600 mm Rainfall Zone of Southern Africa. SACCAR Workshop Series No.1, 1987. Gaborone: SACCAR. pp. 17-36.

1988

ATIP EP 88-1. Baker, D.C. and D.W. Norman. "A Framework for Assessing Farming System Activities in National Settings in West Africa with Special Reference to Senegal, Nigeria, and Mali". In Abalu, G.O.I. et. al. (Ed), Farming Systems Research in West Africa. Proceedings of the West African Farming Systems Research Network Workshop, Dakar, Senegal, 10-14 March 1986. February 1988. pp. 62-87.

ATIP EP 88-2. Norman, D., Baker, D., Heinrich, G., and F. Worman. "Technology Development and Farmer Group Experience from Botswana". Experimental Agriculture. 24 (3):321-331.

ATIP EP 88-3. Ketsitlile, T., Caplan, C., Modidi, L., and P. Bacon. "Estimated Tractor Costs for Ploughing in the Southern Region of Botswana". Kanye: FSSR, DAFS, Botswana.

ATIP EP 88-4. ATIP, ADNP and FSSR. "Impact Assessment of the Accelerated Rainfall Arable Production (ARAP) and Drought Relief(DR) Programmes: Executive Summary". Gaborone: DAR and DAFS.

ATIP EP 88-5. Worman, F., Merafe, Y., and D. Norman. "Increasing Farmer Participation in FSR/E: the ATIP Experience with Farmer Testing Groups". In Ty, T., and F. Balina (Eds), Philippine Upland Research and Extension Training Workshop. Proceedings of Workshop held 19-24 June, 1988, at Visca, Baybay, Leyte. Visca: Farming Systems Development Project, Eastern Visayas. pp. 177-192.

ATIP EP 88-6. Norman, D., Sigwele, H., and D. Baker. "Reflections on Two Decades of Research on Sorghum-Based Farming Systems in Northern Nigeria and Botswana". In Rukuni, M., and R. Bernsten (Eds), Southern Africa: Food Security Policy Options. Harare, Zimbabwe: UZ/MSU Food Security Research in Southern Africa Project, Department of Agricultural Economics and Extension, University of Zimbabwe. 1988. pp. 235-254.

1989

ATIP EP 89-1. Norman, D. "Communication and Information Systems in Farming Systems Work: an Overview." In University of Arkansas (Ed), Proceedings of Farming Systems Research Symposium 1987: How Systems Work, Farming Systems Research Paper No. 15. Fayetteville: University of Arkansas and Winrock International Institute for Agricultural Development, 1989, pp. 287-303.

ATIP EP 89-2. Baker, D. "Adaptive Research: it has been Implemented in SADCC Countries." In Namponya (Ed), Integration of Agricultural Research, Training and Extension in SADCC Countries. Proceedings of a SACCAR Workshop, Arusha, Tanzania, 22-28 March, 1988. Gaborone: SACCAR. pp. 13-22.

ATIP EP 89-3. Modiakgotla, E. "The Effect of Tillage and Fertilizer on Sorghum Production Under High Potential Sites." The Bulletin of Agricultural Research in Botswana, 6(1987):12-15.

ATIP EP 89-4. Siebert, J. and E. Modiakgotla. "Evaluation of Factors Affecting Sorghum Yield On-Farm During Drought in Botswana and Potential for Improvement Using Conventional Tillage-Planting Options." In IGADD (Ed), Forum on On-Farm Research in Arid and Semi-Arid Areas of IGADD Member Countries, Djibouti, 23-27 May, 1988. Djibouti: Intergovernmental Authority on Drought and Development. pp. 172-188.

ATIP EP 89-5. Norman, D. "Accountability: a Dilemma in Farming Systems Research." Culture and Agriculture, 38 (Spring/Summer): 2-8.

ATIP EP 89-6. Norman, D., D. Baker, G. Heinrich, S. Mastkara, and F. Worman. "Farmer Groups for Technology Development: Experiences from Botswana". In R. Chambers, A. Pacey and L. Thrupp (Eds.). Farmer First: Farmer Innovation and Agricultural Research. London: Intermediate Technology Publications, 1989. pp. 136-146.

A.2.2 RESEARCH PAPERS

1986

ATIP RP 1. ATIP. "Farming System Research Activities at Mahalapye: Summary of Activities, 1982-85". 1986.

ATIP RP 2. ATIP. "Farming System Research Activities at Francistown: Summary of Activities, 1983-85". 1986.

A.2.3 WORKING PAPERS

1983

ATIP WP 2. Hobbs, A. (Ed.). "Report on Farming Systems Workshop, Denman Rural Training Centre, 28th - 29th June, 1983".

1985

ATIP WP 1. Ramolemana, G. and A. Hobbs. "Relative Importance of Factors that Influence Extension Efficiency and Crop Production Improvement". July 1985.

ATIP WP 3. Miller, W. and T. Seleka. "Agricultural Baseline Survey of Tutume District". October 1985.

1986

ATIP WP 4. Miller, S. "Agricultural Markets for Crops, Small Stock and Animal Products in Tutume District". (Forthcoming)

ATIP WP 5. Heinrich, G. and S. Masikara. "Performance of the Extension Package for Cereal Production, and its Components, in Tutume District, 1983-85". May 1986.

ATIP WP 6. Trent, C., D. Styles, and G. Ramolemana. "An Assessment of Subject Matter Competencies of Agricultural Demonstrators in Botswana". June 1986.

ATIP WP 7. Gray, R. (Ed.) "Cattle Post-Lands Interaction Study". Two Parts: Text and Appendices. September 1986.

1987

ATIP WP 8. Gray, R., C. Berg, B. Koch, R. Windsor, W. Mahabile and A. Holmes. "Blood Parameters of Donkeys, Mathangwane Village, Tutume Agricultural District, Botswana". July 1987.

ATIP WP 9. Gray, R., C. Berg, B. Koch, R. Windsor, W. Mahabile and A. Holmes. "Blood Parameters of Goats, Mathangwane Village, Tutume Agricultural District, Botswana". July 1987.

1988

ATIP WP 10. Gray, R., C. Berg, and R. Windsor. "Blood Parameters of Goats, Artesia Village, Kgatleng Agricultural District, Botswana". January 1988.

ATIP WP 11. Niseane, P.G. "ATIP Groups Report". May 1988.

ATIP WP 12. Baker, D. "ATIP Mahalapye Trial Participation: Participant Characteristics, Implementation Patterns and Direct Farmer Benefits, 1982-87". May 1988.

ATIP WP 13. Baker, D. "Village Groups in Shoshong and Makwate". May 1988.

ATIP WP 14. Baker, D. "Agricultural Extension in the Central Region: AD Performance and Research-Extension Linkages". June 1988.

ATIP WP 15. Baker, D. "Agricultural Development Setting in Botswana". July 1988.

ATIP WP 16. Baker, D. "Draught Arrangements in Shoshong and Makwate". July 1988.

ATIP WP 17. Baker, D. "Household Circumstances and Farming Practices in Shoshong and Makwate". July 1988.

ATIP WP 18. Baker, D. "Trading Establishments in the Central Agricultural Region: Findings on Agricultural Inputs and Commodities Trade". August 1988.

ATIP WP 19. Baker, D. "Food Consumption in Shoshong and Makwate". August 1988.

ATIP WP 20. Baker, D. "Livestock Management in Shoshong and Makwate". August 1988

ATIP WP 21. Baker, D. "Arable Farming Research and Planning Issues". (Forthcoming).

ATIP WP 22. Baker, D. "Traction Use in Shoshong and Makwate". August 1988.

1989

ATIP WP 23. Styles, D. and C. Trent. "An Analysis of Job Attitudes of Agricultural Demonstrators in Botswana." June 1989.

A.2.4 MISCELLANEOUS PAPERS

1983

ATIP MP 83-1. Norman, D.W. "Some Problems in the Implementation of Agricultural Research Projects with a Farming Systems Perspective". Paper presented at a seminar on Introduction of On-Farm

Research with a Farming Systems Perspective, CIMMYT, Nairobi, Kenya, 18th - 20th April, 1983. Now published, see ATIP EP 85-1.

ATIP MP 83-2. Norman, D.W. "Helping Resource Poor Farmers: the Agricultural Technology Improvement Project, Botswana". Paper given at Workshop for US Technicians Preparing for Overseas Assignments, Manhattan, Kansas, 10th - 14th May, 1983.

ATIP MP 83-3. Baker, D., E. Modhakgotla, J. Siebert, and M. Tjirongo. "Agricultural Technology Improvement Project". Paper presented to the Farming System Workshop, Denman Rural Training Centre, Sebele, 28th - 29th June, 1983.

ATIP MP 83-4. Norman, D.W. "The Farming Systems Approach". Paper presented to the Farming System Workshop, Denman Rural Training Centre, Sebele, 28th -29th June, 1983.

ATIP MP 83-5. Baker, D., and D. Norman. "Relevance of the Farming Systems Approach to Agricultural Demonstrations". Paper presented at ALDEP In Service Training Course, Mahalapye RTC, August, 1983.

ATIP MP 83-6. Norman, D.W., D.C. Baker, and J. D. Siebert. "The Challenge of Developing Agriculture in the 400-600 mm. Rainfall Zone Within the SADCC Countries". Paper presented to the SADCC seminar on Agronomic Adjustment to the Environment of 400 to 600 mm. Rainfall Zone, 14th-16th Sept. 1983, Harare, Zimbabwe. Now published, see ATIP EP 84-1

1984

ATIP MP 84-1. Norman, D.W. and D.C. Baker. "Components of Farming Systems Research: FSR Credibility and Experiences in Botswana". Paper presented at ADC sponsored conference on Intra Household Processes and Farming Systems Analysis, Bellagio, Italy, 5th-9th March, 1984. Now published, see ATIP EP 86-4.

ATIP MP 84-2. Norman, D.W. "Institutionalizing the Farming Systems Approach to Research". Seminar given at INAT, Tunis, Tunisia, 12th March, 1984.

ATIP MP 84-3. Norman, D.W. "Consultancy to Tunisia". March 1984.

ATIP MP 84-4. Hobbs, J.A. "Report on a Visit to the Farming Systems Research Project, Department of Agricultural Research, Maseru, Lesotho," May 1984.

ATIP MP 84-5. Baker, D.C. and J.A. Hobbs. "Farming Systems Research and Extension in Botswana: Current Programmes and Issues Facing the Ministry of Agriculture". Paper presented at the KSU Farming Systems Research Symposium on Farming Systems Research and Extension: Implementation and Monitoring, 7th - 10th Oct. 1984, Manhattan, Kansas, USA. Now published, see ATIP EP 86-1.

ATIP MP 84-6. Koch, B.A. and W. Matlho. "Farming Systems Research on Animal Husbandry Problems in Tutume Agricultural District of Botswana". Abstract of paper accepted at the KSU Farming Systems Research Symposium on Farming Systems Research and Extension: Implementation and Monitoring, 7th - 10th Oct. 1984, Manhattan, Kansas, USA. Now published, see ATIP EP 86-2.

ATIP MP 84-7. Koch, B.A. "Animal Science Input in ATIP Poster Presentation". Paper accompanying poster presented at the KSU Farming Systems Research Symposium on Farming Systems Research and Extension: Implementation and Monitoring, 7th - 10th Oct. 1984, Manhattan, Kansas, USA.

ATIP MP 84-8. Miller, W. and S. Miller. "Agricultural Pricing Policy and its Effect on Production and Equity with Special Emphasis on Botswana Farming Systems". Invited paper presented at Botswana Agricultural Society Meeting, 12th December, 1984.

ATIP MP 84-9. Baker, D.C. and J. Lesotlho. "A Methodology for Farm Management Research in Botswana". Invited paper presented at ARPT/CIMMYT Networkshop on The Role of the Rural Sociologist in FSR and Technology Generation and Adoption, Lusaka, 26th - 28th November

1984.

ATIP MP 84-10. Baker, D.C. "FSR Credibility: Experiences in Botswana". Paper presented at Michigan State University, March, 1984.

1985

ATIP MP 85-1. Norman, D.W. "The Limited Resource Farmer and Africa's Food Production Crisis". Invited paper presented at IFDC/IRA workshop on Fertilizer Efficiency Research and Technology Transfer, Douala, Cameroon, 21st - 25th January, 1985. Now published, see ATIP EP 85-2.

ATIP MP 85-2. Norman, D. and M. Collinson. "The Concept of FSR in Theory and Practice". Invited paper presented at Australian Centre for International Agricultural Research sponsored Workshop on Farming Systems Research (FSR), Hawkesbury Agricultural College, Sydney, Australia, 12th - 15th May, 1985. Now published, see ATIP EP 85-3.

ATIP MP 85-3. Baker, D.C. "Population Council/FSSP Case Studies Project: Training Workshop Trip Report". Arising out POPCO/FSSP Case Studies Project Workshop, Boston, USA, 9th-12th June, 1985.

ATIP MP 85-4. Baker, D.C. "Farming Systems Development Project - Eastern Visayas: Philippine Trip Report and Implications for ATIP". Report on USAID consultancy trip to Philippines, May 1985.

ATIP MP 85-5. Miller, S., T. Farrington and D. Norman. "Selecting a Microcomputer System for Farming Systems Research: A Framework for Decision-Making". Paper presented at CIMMYT/GOB sponsored Regional Workshop on Socio-Economics and Microcomputers in Farming Systems Research, Gaborone, Botswana, 2nd-4th July, 1985.

ATIP MP 85-6. Baker, D.C. and J. Lesotlho. "The Place of Sociology/ Anthropology in FSR and E in Botswana". [In Press].

ATIP MP 85-7. Baker, D.C., M. Hunt and N. Hunter. "Contributions of Farm Management Economists to FSR and E in Botswana". Paper presented at CIMMYT/GOB sponsored Regional Workshop on Socio-Economics and Microcomputers in Farming Systems Research, Gaborone, Botswana, 2nd-4th July, 1985.

ATIP MP 85-8. Siebert, J.D. "Use of a Spreadsheet in FSR and E". Paper presented at CIMMYT/GOB sponsored Regional Workshop on Socio-Economics and Microcomputers in Farming Systems Research, 2nd-4th July, 1985.

ATIP MP 85-9. Baker, D.C. "Labour Productivity in Traditional Agriculture". Invited paper given at The National Seminar on Labour Productivity in Botswana, Gaborone, 8th-11th July, 1985.

ATIP MP 85-10. Hobbs, J.A. "Research/Farming Systems Teams/Extension Relationships and Agricultural Development in Botswana". Prepared for Agricultural Staff Relations Seminar, Pelotsetlha, 6th-8th March, 1985.

ATIP MP 85-11. Norman, D.W. "Farming Systems Research in Africa -- An Overview". Invited paper given at The Farming Systems and Extension Seminar, Nhlangano, Swaziland, 22nd-23rd April, 1985.

ATIP MP 85-12. Masikara, S., G. Heinrich, W. Matlho, and B. Koch. "Draught Animal Management for Early Ploughing". Paper presented at the KSU Farming Systems Research Symposium on Farming Systems Research and Extension: Management and Methodology, 13th - 16th Oct. 1985, Manhattan, Kansas, USA. Now published, see ATIP EP 86-8.

ATIP MP 85-13. Baker, D.C. and D.W. Norman. "Farming Systems Research and Extension in Harsh Environments: Development of a Farmer Cooperator Approach in Botswana". Paper presented at the KSU Farming Systems Research Symposium on Farming Systems Research and Extension: Management and Methodology, 13th - 16th Oct. 1985, Manhattan, Kansas, USA. Now published, see ATIP EP 86-7.

ATIP MP 85-14. Trent, C., Monyatsi, T., and E. Modiakgotla. "Progress and Needs in On-Farm Research in Botswana". Paper presented at CIMMYT sponsored Networkshop of Senior Agricultural Research, Extension, and Teaching Personnel of Eastern and Southern Africa, Maseru, Lesotho, 25th-28th November, 1985. Now published, see ATIP EP 86-5.

ATIP MP 85-15. Merafe, Y., D. Baker, and D. Norman. "Socio-Economic Constraints to Farm Equipment Innovations in Botswana". Paper invited for ILO sponsored Workshop on Farm Tools and Equipment Technology: Basic Needs and Employment, Gaborone, Botswana, 3rd-5th December, 1985. Now published, see ATIP EP 86-6.

ATIP MP 85-16. Nygaard, D. and D. Norman. "The Potential Use of Farming Systems Research in Madagascar". Report submitted to FOFIFA, Madagascar, as a result of a consultancy trip to Madagascar, 8th-15th November, 1985. [Also in French]

1986

ATIP MP 86-1. Baker, D. and D. Norman. "A Framework for Assessing Farming System Activities in National Settings in West Africa With Special Reference to Mali, Nigeria and Senegal". Invited paper given at West African Farming Systems Networkshop, Dakar, Senegal, 10th-14th March, 1986.

ATIP MP 86-2. Baker, D. and E. Modiakgotla. "Training of Non-Professionals in FS Work". Invited paper given CIMMYT Regional Review of OFR, 1986, Mbabane, Swaziland, 12th-16th May, 1986.

ATIP MP 86-3. Heinrich, G.M., Modiakgotla, E. and D.W. Norman. "Enhancing the Productivity of National Agricultural Research Programmes Through Farming Systems Research, the Case of the Semi-Arid Areas of Sub-Saharan Africa". Invited paper given at International Drought Symposium sponsored by SAFGRAD, OAU, Nairobi, Kenya, 19th-23rd May 1986.

ATIP MP 86-4. Baker, D. "Botswana Agricultural Technology Improvement Project. Mahalapye Farming System Team". Produced for IFPRI/OFCOR-ESSP Case Studies Project, Boston, July 1986.

ATIP MP 86-5. Gray, R. "Goat Production in Botswana". Paper given at the SR-CRSP Fifth Annual Scientist Workshop, Nairobi, Kenya, 4th-6th November, 1986.

ATIP MP 86-6. Gray, R. "Farming Systems Work". Invited paper given at the Animal Production Division 1986 Senior Staff Meeting, Denham Rural Training Centre, 9th October 1986.

ATIP MP 86-7. Norman, D. "Farming Systems Work and Extension". Paper given at the Extension Crop Officers Meeting, Denham Rural Training Centre, 18th-19th December, 1986.

ATIP MP 86-8. Siebert, J. "On Farm Trials and Demonstrations". Paper given at the Extension Crop Officers Meeting, Denham Rural Training Centre, 18th-19th December, 1986.

ATIP MP 86-9. Makwaie, E. "Goat Management, Milk and Meat Production, Tutume District, Botswana". Project Paper for Scale Hayne College, UK, December 1986.

ATIP MP 86-10. Trent, C. "Research/Extension Linkages". Paper presented at SADCC Extension Study Visit, Gaborone, Botswana, 1st-5th December, 1986.

1987

ATIP MP 87-1. Gray, R., and D. Horspool. "Using Donkeys for Draught Power". Four Parts. Prepared for publication as Agrifacts. Now published, see ATIP EP 87-1.

ATIP MP 87-2. Norman, D., and D. Baker. "Incentives for the Development of the Arable (Cereal) Sub-Sector: The Small-Scale Farmer". Prepared for Panel Discussion hosted by BOSAD on Crop Incentives for the Development of the Arable Sub-Sector (Cereals) in Botswana, Gaborone, 18th March, 1987.

ATIP MP 87-3. Siebert, J.D., and E. Modiakgotla. "Water Harvesting and Soil Moisture Conservation in Dryland Farming'. Presented at National Training Course on Reclamation and Management of Deteriorated Soils, Gaborone, 10th March 1987.

ATIP MP 87-4. Norman, D., D. Baker, G. Heinrich, S. Masikara, and F. Worman. "Farmer Groups for Technology Development: Experiences from Botswana". Prepared for Workshop on Farmers and Agricultural Research: Complementary Methods, IDS, University of Sussex, England, 27th-31st July, 1987. (Now published, see ATIP EP 89-6).

ATIP MP 87-5. Norman, D.W. "Communication and Information Systems in Farming Systems Work: An Overview of the Past and Present". Plenary address given at the 7th Annual Farming Systems Symposium at the University of Arkansas. Fayetteville, Arkansas, USA, October 18th-22nd, 1987. Now published, see ATIP EP 89-1.

ATIP MP 87-6. Worman, F. "Economic Analysis of the ATIP Double Ploughing Trials, 1983-87". Presented at Department of Agricultural Research Seminar on Double Ploughing. Sebele, Botswana, September 7th, 1987.

ATIP MP 87-7. Heinrich, G., S. Masikara, F. Worman, and D.C. Carter. "Effects of Tillage Systems on Weed Growth and Weeding Labour Requirements". Presented at Department of Agricultural Research Weeds Workshop, Botswana Agricultural College, Sebele, Botswana, June 19th, 1987.

ATIP MP 87-8. D. Baker. "Trip Report: UZ/MSU Food Security Research Methodology Workshop". Harare, Zimbabwe, 23-25 March, 1987.

ATIP MP 87-9. Siebert, J.D., and E. Modiakgotla. "Tillage-Planting Method Effects on Weed Development". Presented at Department of Agricultural Research Weeds Workshop, Botswana Agricultural College, Sebele, Botswana, June 19th, 1987.

ATIP MP 87-10. Norman, D., D. Baker, G. Heinrich, and F. Worman. "Technology Development Farmer Groups: Experiences from Botswana". Now published, see ATIP EP 88-2.

ATIP MP 87-11. Baker, D.C. and D.W. Norman. "The Farming Systems Research and Extension Approach to Small Farmer Development". October, 1987 (Forthcoming)

ATIP MP 87-12. Norman, D.W., H. Sigwele and D. Baker. "Reflections on Two Decades of Research on Sorghum-Based Farming Systems in Northern Nigeria and Botswana". Presented at the 3rd Annual Conference on Food Security Research in Southern Africa. Harare, Zimbabwe, 1st - 5th November, 1987. Now published, see ATIP EP 88-6.

ATIP MP 87-13. Baker, D. "Trip report University of Zimbabwe Third Annual Conference on Food Security in Southern Africa". Harare, Zimbabwe 1st - 5th November, 1987.

ATIP MP 87-14. Baker, D. "Weed Control During Drought, a Fact Sheet". Presented at Department of Agricultural Research Weeds Workshop, Botswana Agricultural College, Sebele, Botswana, June 19th, 1987.

ATIP MP 87-15. Jonas, C. "Zambia Trip Report: Intra - Household Dynamics and FSR/E". Lusaka, Zambia, 26th - 29th March, 1987.

ATIP MP 87-16. Baker, D. "Research Relating to Household Food Security Analysis Carried Out by an On-Farm Research Team of the ATIP Project in the Mahalapye Area, Botswana". Presented at the UZ/MSU Food Security Research Methodology Workshop, University of Zimbabwe, Harare, Zimbabwe, 23rd - 25th March, 1987.

1988

ATIP MP 88-1. Worman, F., G. Heinrich and S. Masikara. " Strengthening the link Among Farmers Extension and Research for Agricultural Development in Botswana". Submitted for publication in the Information Centre for Low External Input Agriculture Newsletter.

ATIP MP 88-2. Baker, D. "Adaptive Research: How it has been Implemented in the SADCC Countries". Invited for SACCAR Conference, Arusha, Tanzania, 22nd - 26th February, 1988.

ATIP MP 88-3. Baker, D. "Women and Trials Management in Botswana: Experiences with Farmer Groups". Presented at the 6th Annual Farming Systems Symposium at Kansas State University, Manhattan, Kansas, USA, October 5th-8th, 1986.

ATIP MP 88-4. Molutsi, P. and D. Norman. "Methodologies for Development Research in Rural Areas". Presented at Workshop on Development Research, NIR, University of Botswana, May 27th, 1988.

ATIP MP 88-5. Worman, F. and G. Heinrich. "Two Operational Approaches to Participative Technology Development Used by the Agricultural Technology Improvement Project, Francistown, Botswana". March 1988. Submitted for use in Conference on Participative Technology Development hosted by Information Center for Low External Input Agriculture, April 11-12, 1988, The Netherlands.

ATIP MP 88-6. Siebert, J. and F. Modiakgotla. "Water Conservation and Use Patterns in the Traditional Cropping System of Botswana" Prepared for International Dryland Conference, Bushland, Texas, August 1988.

ATIP MP 88-7. Worman, F., Y. Merafe and D. Norman. "Increasing Farmer Participation in FSR/E: the ATIP Experience with Farmer Groups". Invited for Philippines Upland Research and Extension and Training, Visca, Leyte, June 19-24th, 1988. Now published, see ATIP EP 88-5.

ATIP MP 88-8. Siebert, J. and F. Modiakgotla. "Evaluation of Factors Affecting Sorghum Yield On-Farm During Drought in Botswana and Potential for Yield Improvement for Yield Improvement Using Conventional Tillage-Planting Options". Invited for Forum on On-Farm Research in Arid and Semi-Arid Countries, hosted by CIMMYT, Djibouti, May 23rd-27th, 1988. Now published, see ATIP EP 89-4.

ATIP MP 88-9. Worman, F.D. "Trip Report: Philippines Upland Research and Extension Training/Workshop, Visca, Leyte, Philippines, June 19-24th, 1988.

ATIP MP 88-10. Seleka, T. Establishing Formal Markets for Small Livestock in Tutume Agricultural District of Botswana. September, 1988.

ATIP MP 88-11. Masikara, S., F. Worman and G. Heinrich. "The Role of Farmer Testing Groups in Research and Extension: Some Experiences in Botswana". Paper given at the 8th Annual Farming Systems Symposium at the University of Arkansas, Fayetteville, Arkansas, USA, October 9th-12th, 1988. Accepted for publication.

ATIP MP 88-12. Siebert, J. "Soil and Water Management at the Farm Level". Invited paper given at SADCC/SACCAR Workshop on Objectives, Strategies and Techniques and Applied Research on Soil and Water Management, Gaborone, September 26th-29th September, 1988.

ATIP MP 88-13. Gray, R., Koch, B., Mahabile, W., Windsor, R., Holmes, A., and C. Berg. "Blood Parameters of Donkeys in Botswana". Submitted to Tropical Agriculture.

ATIP MP 88-14. Gray, R., Koch, B., Mahabile, W., Windsor, R., Holmes, A., and C. Berg. "Blood Parameters of Goats in Botswana". Submitted to Tropical Agriculture.

ATIP MP 88-15. Gray, R., and W. Mahabile. "Production Parameters of Tswana Goats". Submitted to Tropical Agriculture.

ATIP MP 88-16. Heinrich, G., Worman, F., and S. Masikara. "Improving the Efficiency of On-Farm Research and Ensuring Direct Farmer Participation in Technology Development, with Farmer Testing Groups". Paper given at the Annual ASA Meeting, Anaheim, California, USA, 27th Nov.-2nd Dec. 1988. To be published in Agronomy Abstracts.

ATIP MP 88-17. Heinrich, G. and F. Worman. "Double Plowing: a Low-External Input Technology for Increasing Grain Production on Hardveld Soils in Eastern Botswana". Paper given at the Annual

ASA Meeting, Anaheim, California, USA, 27th Nov.-2nd Dec., 1988. To be published in Agronomy Abstracts.

ATIP MP 88-18. Siebert, J., Modiakgotla, E., Caplan, A., and E. Makhwaje. "Farmers' Decision Making in Relation to Access to Resources and Climatic Uncertainty". Paper given at Seminar on Sustainable Dryland Management, Palapye, Palapye Development Trust, 7th-10th Nov., 1988.

ATIP MP 88-19. Hill, B., Mmopi, K., Modiakgotla, E., Moji, G., Moremedi, G., and L. Setshwawelo. "A Tour of African Farming System Projects by Botswana Agricultural Officials, 19th-27th April, 1988". A Trip Report.

ATIP MP 88-20. Norman, D., and S. Bock. "Some Notes on Policy Trade-Offs." Prepared as a background paper for The Agricultural Sector Review.

1989

ATIP MP 89-1. Tibone, C. "Women's Arable Agriculture in Relation to the Main Factors of Production: The ATIP Experience." Paper presented at the Molapo Development Project Workshop on Constraints in Agricultural Development, Maun, 10th-12th April, 1989.

ATIP MP 89-2. Makhwaje, E. "Animal Traction in Mahalapye Area." Paper presented at the Molapo Development Project Workshop on Constraints in Agricultural Development, Maun, 10th-12th April, 1989.

ATIP MP 89-3. Modiakgotla, E. "The Effect of Tillage and Fertilizer on Sorghum Production Under High Potential Sites." Now published, see ATIP EP 89-3.

ATIP MP 89-4. Tibone, C. "A Critical Analysis of Health Hazards Associated with Agricultural Activities in Botswana and How They Affect Women." Paper presented at Workshop on the Health and Safety of Women at the Work Place in Botswana, Gaborone, 26th-28th June, 1989.

ATIP MP 89-5. Norman, D. "Accountability: a Dilemma in Farming Systems Research." Now published, see ATIP EP 89-5.

ATIP MP 89-6. Worman, F., G. Heinrich, C. Tibone and P. Ntseane. "Is Farmer Input into FSR/E Sustainable? The ATIP Experience in Botswana". Paper given at the 9th Annual Farming Systems Symposium at the University of Arkansas. Fayetteville, Arkansas, USA, October, 1988.

ATIP MP 89-7. Heinrich, G. "Trip Report: Workshop on Farmer Innovation and Technology Testing, Yundum, The Gambia, 29-30th May, 1989".

ATIP MP 89-8. Thedford, T., F. Worman and K. Kelmogile. "Causes of Disease Among Goats in Three Villages in the Tutume District of Botswana." Prepared for the Botswana Veterinary Association Annual Meeting, Gaborone, November 16th-17th.

ATIP MP 89-9. Modiakgotla, E., and D. Norman. "Planning, Management and Evaluation of On-Farm Experiments: Issues in Botswana". Invited for CIMMYT Workshop on Issues Related to Planning, Management and Evaluation of On-Farm Experiments, Arusha, Tanzania, December 4th-8th, 1989.

A.2.5 PROGRESS REPORTS

GABORONE

1983

ATIP PR G83-1. Hobbs, A. "Report on Visits to Agricultural Extension and Research Officers by the REL O", May 1983.

ATIP PR G83-2. Hobbs, A. and G. Moremedi. "Report on Problems Raised by Southern Region ADs and DAOs and Solutions Proposed by Research Officers". June 1983.

MAHALAPYE

1983

ATIP PR M83-1. Baker, D., Tjirongo, M., and T. Monyatsi. "Household Characteristics in Shoshong East and Makwate: November 1982 Sample Frame Census Summary Results". October 1983.

ATIP PR M83-2. Baker, D.C. "Early Season Cropping Plans of ATIP Mahalapye Farmers". December 1983.

1984

ATIP PR M84-1. Baker, D.C. "ATIP Makwate Farmer Workshop, 18th April,1984". June 1984.

ATIP PR M84-2. Baker, D.C. "1983 Agricultural Demonstrator Survey: Tables and Summary Findings. Part One: Extension Area Characteristics in the Central Agricultural Region". September 1984.

ATIP PR M84-3. Baker, D.C. "1983 Agricultural Demonstrator Survey: Tables and Summary Findings. Part Two: AD Activities and Constraints on Effectiveness in the Central Agricultural Region". September 1984.

ATIP PR M84-4. Baker, D.C. "1983 Crop Management Survey: Tables and Summary Findings. Part One: Household Characteristics and Practices of Farmers Cooperating with ATIP Mahalapye". September 1984.

ATIP PR M84-5. Baker, D.C. "1983 Cowpea Baseline Survey: Tables and Summary Findings from ATIP Mahalapye Farmers". September 1984.

1985

ATIP PR M85-1. Siebert, J.D. "A Portable Quadrate Sampling Method for Measuring Plant Stand Establishment and Harvest Outcomes".

ATIP PR M85-2. Lesotlho, J. and D. Baker. "Decision Unit-Management Information Study: Exploratory Study". December 1985.

1986

ATIP PR M86-1. ATIP, Mahalapye. "Progress on Work Planned for 1985-1986". May 1986.

1987

ATIP PR M87-1. Baker, D. "Observations on Gender Issues in Botswana Farming Systems Research". February 1988.

ATIP PR M87-2. Caplan, A., D. Baker and S. Bock. "Options and Improved Chicken Management: Findings from an Informal Study". April 1988.

ATIP PR M87-3. Baker, D. "Prediction of Sorghum and Millet Processing Time for Use in the Economic Analysis of On Farm trials". February 1988.

ATIP PR M87-4. Baker, D. "Types of FS work: a Terminology Update". February 1988.

1988

ATIP PR M88-1. Baker, D. "Farm Population Characteristics in Shoshong and Makwate: the MVRU Survey Households, 1984". July 1988.

ATIP PR M88-2. Baker, D. "Frequencies of Cash Transaction in Shoshong and Makwate". August 1988.

1989

ATIP PR M89-1. Modiakgotla, E. "Custom-Hire Row-Planting Scheme, 1987/88". March 1989.

ATIP PR M89-2. Caplan, A., E. Makhwaje and D. Norman. "Cooperators Baseline Survey, Mahalapye, 1988/89."

FRANCISTOWN

1983

ATIP PR F83-1. Miller, W. "ATIP Selection of Villages and Participating Households in Tutume Agricultural District". November 1983.

1984

ATIP PR F84-1. Miller, W. and T. Seleka. "Cowpea Baseline Survey: Implementation and Findings in Tutume District". September 1984.

ATIP PR F84-2. Koch, B. and W. Matlho. "Livestock Practices Survey". November 1984.

ATIP PR F84-3. Koch, B. and W. Matlho. "Draught Management for Early Ploughing". November 1984.

ATIP PR F84-4. Koch, B. and W. Matlho. "Plough Condition Survey and Observations Concerning Harnesses and Yokes". November 1984.

ATIP PR F84-5. Koch, B. and W. Matlho. "Supplemental Mineral-Mix for Animals". November 1984.

1985

ATIP PR F85-1. Miller, W. "Analysis of Census Frame Survey in Matobo, Mathangwane and Marapong Villages in the Tutume Agricultural District of Botswana, October 1983". March 1985.

ATIP PR F85-2. Koch, B.A. and W. Matlho. "Livestock Inventory Changes on ATIP Farms in 1984".

ATIP PR F85-3. Koch, B.A. and W. Matlho. "Dry-Season Supplemental Feed for Draught Animals". May 1985.

ATIP PR F85-4. Seleka, T. "Tonota Smallstock Market Study". December 1985.

ATIP PR F85-5. Worman, F.D. "Government Subsidized Ploughing Programme Participation and Demand for Tractor Ploughing". November 1985.

ATIP PR F85-6. Koch, B., Mahabile, W., and R. Gray. "Dry-Season Supplemental Feed for Draught Animals in the Central and Tutume Districts of Botswana". December 1985.

1986

ATIP PR F86-1. ATIP, Francistown. "Progress on Work Planned for 1985-1986". May 1986.

ATIP PR F86-2. Heinrich, G., F. Worman, S. Masikara, and B. Mabongo. "1986 Double Ploughing/Broadcast Planting System Trial (Farmer Managed and Implemented)". November 1986.

ATIP PR F86-3. Heinrich, G., F. Worman, S. Masikara and R. Gray. "1986 Draught Management and Early Ploughing Trial (Researcher Managed and Farmer Implemented)". December 1986 (revised August 1987).

ATIP PR F86-4. Heinrich, G., F. Worman, and S. Masikara. "1986 Hand Planter Trial (Farmer Managed/Farmer Implemented)". December 1986.

ATIP PR F86-5. Heinrich, G., S. Masikara, and F. Worman. "Tillage Systems Trial (Researcher Managed/Researcher Implemented)". December 1986.

1987

ATIP PR F87-1. Bock, S., F. Worman, and B. Mabongo. "1985-86 Cooperators' Cropping Practices Survey". January, 1987.

ATIP PR F87-1. (Supplement) Bock, S., F. Worman, and B. Mabongo. "1985-86 Cooperators' Cropping Practices Survey" Contains survey form only. January 1987.

ATIP PP F87-2. Gray, R. C. "Goat Production by ATIP Farmers during 1986 in Tutume District, Botswana". February, 1987.

ATIP PR F87-3. Gray, R. C. "Livestock Inventory Changes on ATIP Farms, Tutume District, Botswana, 1984-86". May, 1987.

ATIP PR F87-4. Bock, S., F. Worman, and B. Mabongo. "Ploughing Labour Study". May, 1987.

ATIP PR F87-5. Heinrich, G., F. Worman, S. Masikara, and R. Gray. "1987 Double Ploughing Trial (Researcher Managed/Farmer Implemented)". September 1987

ATIP PR F87-6. Worman, F., G. Heinrich, S. Masikara, B. Mabongo, and S. Bock. "1986 Farmer's Groups Technology Options Testing Trial". October 1987.

ATIP PR F87-7. Masikara, S., and B. Mabongo. "1987 Cropping Systems Trials (Researcher Managed/Farmer Implemented)". September 1987.

ATIP PR F87-8. Heinrich, G., F. Worman and S. Masikara. "1986-87 Tillage Systems Trial (Researcher Managed/Researcher Implemented". October 1987.

1988

ATIP PR F88-1. Gray, R.C. and J. A. Baathodi. "Goat Production by ATIP Farmers During 1987 in Tutume Agricultural District, Botswana". February 1988.

ATIP PR F88-2. Bock, S. "1986-87 Cooperator's Cropping Practices Survey". March 1988.

ATIP PR F88-3. Worman, F. and B. Mabongo. "Matsitama/Mokubilo Communal Grazing Pilot Project: Baseline Census Data". April 1988.

ATIP PR F88-4. Bock, S., Heinrich, G., and A. Caplan. "Rotary Injection Planter Survey". July 1988.

ATIP PR F88-5. Bock, S. "Donkey Harness Informal Survey". July 1988.

ATIP PR F88-6. Heinrich, G., F. Worman and S. Masikara. "1987-88 Water Harvesting Trial (Researcher Managed/Researcher Implemented)." November 1988.

1989

ATIP PR F89-1. Heinrich, G., F. Worman and S. Masikara. "1987-88 Double Ploughing Systems Trials (Researcher Managed/Farmer Implemented)". January 1989.

ATIP PR F89-2. Worman, F. "Brief Report on Testing of Low Lift Hand Water Pumps (Researcher Managed/Farmer Implemented)". March 1989.

A.2.6 REPORTING DOCUMENTS

These are documents produced to fulfill requirements of USAID and written by the ATIP team as a whole.

ATIP RD 82-1. ATIP, ATIP Annual Work Plan Number 1, December 1982.

ATIP RD 83-1. ATIP, ATIP Annual Work Report Number 1, December 1983.

ATIP RD 83-2. ATIP, ATIP Annual Work Plan Number 2, December 1983.

ATIP RD 84-1. ATIP, ATIP Annual Work Report Number 2, October 1984.

ATIP RD 84-2. ATIP, ATIP Annual Work Plan Number 3, December 1984.

ATIP RD 85-1. ATIP, ATIP Annual Report Number 3, September 1985.

ATIP RD 86-1. ATIP, ATIP Annual Report Number 4, October 1986.

ATIP RD 87-1. ATIP, ATIP Annual Report Number 5, November 1987.

ATIP RD 87-2. A Plain Language Summary of ATIP Research Findings, December 1987.

ATIP RD 88-1. ATIP, ATIP Semi-Annual Report Number 5, April 1988.

ATIP RD 88-2. ATIP, ATIP Annual Report Number 6, October 1988.

ATIP RD 89-1. ATIP, ATIP Semi-Annual Report Number 6, May 1988.