PROJ. TECHNOLOGY IMPROVEMENT

PDBAUH45

633-0221

PES 84-10

EXECUTIVE SUMMARY

I. What constraints does this project attempt to overcome and who does it constrain?

This project attempts to relieve the severe bottlenecks in the farming systems of the small-scale, limited resource Botswana farmers.

II. What technology does the project promote to relieve this constraint?

This project uses the interdisciplinary team approach to Farming Systems Research (FSAR) to test existing technologies in the fields of small-scale, limited resource Botswana farmers, and to generate new ones or refine existing recommendations.

III. What technology does the project attempt to replace?

This project begins by examining farmer's practices compared to recommended practices and attempts to make gradual, but unspecifiable, changes either in certain farmer's practices or in research recommendations or both designed to allow improvements to occur in farmer production.

IV. Why do project planners believe that intended beneficiaries will adopt the proposed technology?

Since proposed technolcgies will be developed on or at the very least, tested on, a large sample of potential beneficiaries' farms, the farmers themselves WILL either adopt or reject them, using their own unique set of evaluation criteria.

V. What characteristics do intended beneficiaries exhibit that have relevance to their adopting the proposed technology?

The project assumes the potential beneficiary farm households are headed by either male or female decision-makers who make rational decisions in their acceptance or rejection of proposed technological interventions with respect to costs, returns and risks involved with any specific change in their farming system.

VI. What adoption rate has this project or previous projects achieved in transfering the proposed technology?

The proposed "technolcgy" is a "process" of conducting agricultural research. "Adoption" can be viewed as adoption of the FSR methodology, in some form or another. The adoption rate of the FSR philosophy and some modified version of its methdology in other parts of the world, is at or near 100%. Similarly, the adoption rates of individual components of technology from FSR projects ranges from 0-100%. The rate of adoption of technology components from this project is zero due to two consecutive droughts during the first two years of this project which have meant no farm production was attained by any of the potential beneficiary farmers.

1X

VII. Will the project set in motion forces that will induce further exploration of the constraint and improvements to the technological package proposed to overcome it?

The project will induce further research refinements of some technologies..

VIII. Do private input suppliers have an incentive to examine the constraint addressed by the project and come up with solutions?

Not pertinent - the private agricultural input sector is virtually non-existent in Botswana.

IX. What delivery system does the project employ to transfer the new technology to intended beneficiaries?

The project will utilize the delivery system which is already in place - the Department of Agricultural Field Services (extension) - to deliver the technological innovations which arise. Linkages between the project and extension are in place at the field level and within the Ministry of Agriculture through local extension agents (called agricultural demonstrators) and the Research-Extension Liaison Officer (RELO).

X. What training techniques does the project use to develop the delivery system?

The project will improve upon the extension of agricultural research technologies by involving extension, from the beginning of the project, in the testing and generation of technologies in farmer's fields. Extension agents are more likely to be excited by, and to promote, technology in which they themselves have been involved in developing and verifying.

Training of extension personnel, informally through a series of short-courses or workshops, or more formally through an FSR input into the agricultural college curriculum, is anticipated. Certain extension personnel seconded to the project, may receive long-term BS and MS training.

TELEPHONE: 51177
TELEGRAMS: MINAGRIC
REFERENCE:

REPUBLIC OF BOTSWANA

DIVISION OF PLANNING AND STATISTICS
MINISTRY OF AGRICULTURE
PRIVATE BAG 003
GABORONE
BOTSWANA

Mr. Paul Baudet,
Director,
U.S. Agency for International Development,
P.O. Box 90,
Gaborone.

Dear Paul,

I must apologise for the delay in responding to your letter dated 30th August for our comments on the report of the mid term evaluation of ARIP.

We were generally pleased with the findings of the review group and support, for the most part, their recommendations. We are particularly supportive of the suggestion to expand the training component under the project as a shortage of trained manpower continues to be a pressing problem. Also, we agree that an extension of the project may be desirable and intend to give the issue full consideration at the appropriate time.

The development of effective linkages between the various ARIP components and the Departments of Research, Extension, Planning and the BAC is extremely extremely important if the impact of the ARIP programme on Botswana's agricultural sector is to be maximised. Steps have been taken to strengthen relationships between these agencies and ARIP. A liaison officer in the Planning Unit has been designated to work with the ARIP team as necessary. Likewise, a member of the Sociology Unit has been assigned full time to ARIP and all heads of relevant departments and the BAC have been urged to give attention to the support of the ARIP
programme.

Although we have had occasional differences with various proposals associated with this project, this Ministry has fully supported the farming systems Research efforts. From the outset we have felt that, properly supported and conducted, the programme can make a substantial

3 X

contribution to Botswana's agricultural production and we are grateful for the assistance provided by USAID in the design and implementation of this important work.

Yours sincerely

John P. Larsen
For/Permanent Secretary

CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) — PART I

Report Control Symbol U-447

1. PROJECT TITLE	2. PROJECT NUMBER	3. MISSION/AID/W OFFICE
Agricultural Technology Improvement Project	633-0221	USAID/Botswana

4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) 84-10

☒ REGULAR EVALUATION ☐ SPECIAL EVALUATION

5. KEY PROJECT IMPLEMENTATION DATES	6. ESTIMATED PROJECT FUNDING ('000)	7. PERIOD COVERED BY EVALUATION
A. First PRO-AG or Equivalent FY 81	A. Total $ 12,309	From (month/yr.) 7/82
B. Final Obligation Expected FY 86	B. U.S. $ 9,180	To (month/yr.) 7/84
C. Final Input Delivery FY 87		Date of Evaluation Review 23 July, 1984

8. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
Recommendations:		
1. A. A training schedule be developed that includes the time period of training, the number of individuals involved, the degrees sought, and the positions which may be assumed at the end of training. The training plan should be designed to double the potential for training related to FSR projects in the MOA central staff, DAFS field staff, and DAR research backstopping.	MOA/MIAC	7/85
B. Intensify the effort of training Batswana in B.S. and M.Sc. (and Ph.D. level only when necessary and appropriate), so that trained personnel will be available to work in the ATIP to continue its approach to research and the linkage of research and extension when the project is terminated.		
2. At least two years prior to the PACD (Project Assistance Completion Date), consideration should be given to the extension of the project.	MOA/USAID	7/86
3. A. A short term consultant be assigned a series of three to five month research/training consultancies with ATIP and the Rural Sociology Unit.	MOA/USAID	5/85

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS

- ☐ Project Paper
- ☐ Financial Plan
- ☐ Logical Framework
- ☐ Project Agreement
- ☐ Implementation Plan e.g., CPI Network
- ☐ PIO/T
- ☐ PIO/C
- ☐ PIO/P
- ☐ Other (Specify) _____
- ☐ Other (Specify) _____

10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT

- A. ☒ Continue Project Without Change
- B. ☐ Change Project Design and/or ☐ Change Implementation Plan
- C. ☐ Discontinue Project

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)

Howard Seowele, MOA
Anita Ma[illegible]ie, Proj. Off.
Cornelia Flora
Chuck Frances

12. Mission/AID/W Office Director Approval

Signature: P Guedet

Typed Name: Paul Guedet, Director

Date: 12/6/84

AID 1330-15 (3-78)

5 x

	B. Degree level training be provided for Batswana under ATIP auspices.		
	C. TDY of the ATIP staff include time for interactions with FSR-experienced anthropologists and sociologists.		
4.	The ATIP should continue the use of in-country short courses for specific training of Batswana counterparts and others associated with the project. Whenever appropriate they should be given in Botswana, and when necessary the opportunity to attend courses and workshops outside the country should be taken.	MOA/MIAC	5/85
5.	A. The ATIP Chief of Party, working with his field teams, should consider the policy implications of their field findings in the farming systems process, through the Director of Agricultural Research of MOA to the Policy Committee	MOA/MIAC	4/85
	B. A MOA liaison in DPS with an understanding of farming systems work be named to work with the chief of party and team in identifying policy issues and drafting statements relevant to policy to feed into appropriate MOA channels.		
6.	A. Linkages should be established between the RELO and the Principal and staff of the BAC.	MOA/MIAC	6/85
	B. Consideration should be given to the integration of FSR into the BAC curriculum for ADs, perhaps through short-term consultancies with FSSP personnel.		
7.	A. There should be frequent communication between the scientists based at the central research station and the scientists working in the ATIP villages, including visits of experiment station scientists to the farmers' fields.	MOA/MIAC	6/85
	B. ATIP personnel should be encouraged to participate in any initiative of the Department of Agricultural Research which is designed for testing component technology on station and on farm,		

and which could move new varieties and practices rapidly to the farm for testing.

8.	A.	The team leader should be urged to delegate more of the routine administrative matters to others on the technical assistance team, including the deputy team leader and his counterpart, and the administrative assistant.	MOA/MIAC	3/85
	B.	USAID/B should explore internal mechanisms to better facilitate the handling of forms and other government procedures in a routinized and specified manner. A clearly defined point of contact within USAID is the project officer, and a clear designate is needed if the principal contact person is traveling or otherwise out of the office.		
9.	A.	A Motswana be assigned as interim counterpart to the chief of party, subject to approval of both the ATIP project and the GOB.	MOA/MIAC	5/85
	B.	Thought be given in the MOA to where the ATIP should be institutionalized.		
	C.	The RELO be a senior established post to effect liaison between research and extension groups in MOA.		
10.		Attention needs to be paid to the recommendation in the project paper on the seed requirements of Botswana. Subject to availability of resources from the GOB, this activity should be initiated to solve the current seed crisis and build a long-term potential for quality seed production in the country.	MOA/MIAC	6/85

7X

13. SUMMARY

The evaluation team has found the project to be exceptional in terms of design and implementation. Its complex, though efficient organization is focused on the challenge of implementing a farming systems approach to research, stimulating linkages between experiment station and on-farm research, and catalyzing the communication between research workers in DAR and extension personnel in DAFS. Despite the drought, the evaluation team estimates that most activities in the project are on track in concept and timing. The project has set in motion an approach to agricultural development that will benefit the limited-resource farm family in the harsh and unpredictable environment of Botswana, and has begun the process of institutionalizing this approach. Significant progress toward project goals can be expected by the end of the current contract. In terms of the substantive goals of improving technology that result in increases in small farm production, exogenous conditions have prevented the project from producing measureable, reliable results.

The mid-term evaluation has assessed the organization and team approach followed in the ATIP to address problems of the small farmer. The evaluation team has identified a number of specific procedural questions which should be resolved for more efficient project implementation, as well as a series of larger conceptual issues which are critical to long-term success and institutionalization of the farming systems approach to development. These have been discussed with GOB and USAID/B personnel and detailed in Attachment A. This evaluation also addresses the policy issues which should be assessed as a result of the research findings of this type of FSR project.

The GOB is to be congratulated for their participation in the planning and implementation of this project. USAID/B has provided valuable administrative and support services facilitating the efficient operation of the project. The contract team has done a superb job in a short time to organize and implement an exemplary program and to summarize and report their results in a timely manner.

14. EVALUATION METHODOLOGY

This interim project evaluation was conducted in July, 1984 after two years of project implementation. It addresses the relevant issues given in the scopes of work provided by USAID/B. The evaluation was conducted by a team of five members:

Cornelia Flora, Kansas State University, Rural Sociologist
Charles Francis, Rodale Research Center, Agronomist and Team Leader
Dan Galt, Farming Systems Support Project, University of Florida, Agricultural Economist
Howard Sigwele, Division of Planning and Statistics, MOA/GOB, Agricultural Economist
Boyd Whittle, AFR/TR/ARD, AID/W

The team reviewed background and project-related documents including the project paper, first and second annual work plans, first and second annual reports, consultant reports, summaries of project activities in the field, and other materials provided by the team and USAID/B. Field visits to sites where the team is conducting surveys and on-farm activities were made in Mahalapye (villages of Shoshong and Makwate), and Francistown (villages of Matobo, Marapong, and Mathangwane), and to experiment stations in Sebele and Mahalapye. The team interviewed farmers, village headmen, enumerators and counterparts on the ATIP, DAFS field staff, and ATIP scientist team members. The evaluation team was accompanied by the Deputy Mission Director and ATIP Chief of Party during these field visits.

The evaluation team interviewed MOA officials in the Departments of Research, Field Services, and Animal Health as well as the Division of Planning and Statistics. Interviews also included the Deputy Permanent Secretary and the Permanent Secretary of Agriculture. At the Sebele station, the team interviewed the Director of Research, team members of the CRSP support projects, and team members of other farming systems projects in Botswana. Discussions were held with the Planning Officer for Agriculture, Ministry of Finance and Development Planning (MFDP).

Relevant issues were discussed with each of these groups, and the team assembled a list of ten findings and recommendations which were discussed with the Mission Director and staff in USAID/B, the Chief of Party of ATIP, and the Permanent Secretary of the MOA and heads of departments and divisions, as well as a representative of MFDP. Responses from these officials were taken into consideration when preparing the final evaluation report.

15. EXTERNAL FACTORS

1. Drought. The rainfall since project inception has been significantly below the "average", poorly distributed, or both. Farmer's grain yields in the project areas have been between zero and 20% of the long-term average yields during the two cropping seasons the project has been in the field. Thus, the project has not been able to extrapolate from field plots to any meaningful agronomic or livestock production predictions in the region. There is no way the project can make up this time for agronomic results. It is assumed that the project can have a much more meaningful impact only through extension of the current five-year time frame.

2. USAID/B training allocations for Batswana. During the project design, it was assumed that sufficient funds for training existed in the Mission, without specifying positions or years. This assumption is no longer valid. The result will be either that (1) less training will be accomplished if restricted to current project funds, or (2) training as originally envisioned will be carried out by identifying more funds for this critical component of the project. If the former policy is followed, the evaluation team feels this will severely limit the degree to which the project can be expected to become institutionalized within the MOA. The latter course is strongly preferred.

16. INPUTS

Major inputs have been technical assistance and training. The technical staff assigned to the project arrived largely on schedule and were posted at three locations in Botswana. The contractor did an excellent job in recruiting individuals with considerable African experience as well as skill in Farming Systems Research. The Chief of Party has done a commendable job of coordinating the work of the seven professionals on the project staff, located at three sites some distance apart. All members of the technical assistance team adjusted quickly to the new environment and began work on assigned tasks immediately, thus avoiding the usual delays in project implementation.

The training component of the project is ahead of schedule, with six of the ten planned long-term participants already enrolled in U.S. universities studying toward B.S. or M.S. degrees. More total training, both long-term and short-term, will be needed as inputs to assure progress of the project toward institutionalization of the FSR focus.

Commodities purchased under the contract have consisted primarily of micro computers. This purchasing process was done locally to assure warranty servicing and access to parts and expertise in repair if necessary, as well as the proper electrical configuration for local use. This is an efficient route to procure commodities, and should be fully supported by USAID/B and the contracting institution whenever appropriate. USAID/B has aided through the purchase of project vehicles outside the contract.

USAID was to have provided funds to replace worn out equipment and to modernize the seed processing unit now in use and a commercial seed advisor was to be provided. This has not been done because of a decision by the GOB to defer implementation of this aspect of the project.

INPUTS (GOB)

Most of the counterparts to be provided by the GOB have been assigned to the project. One notable exception is the social scientist who will be joining the project in August, 1984. Some of the counterpart positions have remained vacant when the incumbents have been sent for training in the U.S. This is presently the case with the COP counterpart position; however the GOB is aware of the need to fill it and is making an effort to do so. The counterparts are young and inexperienced. They require and are receiving constant training from the U.S. team members with whom they work.

Vehicles for project personnel are provided by the GOB. Transportation does not seem to be a problem - a credit to the GOB since in many projects this is a serious bottleneck.

Funding of participants by the GOB (15 person years) is not scheduled to begin until 1987. GOB funds for training are scarce, but it is assumed that funding will be available in 1987.

For the seed production element of the project, the GOB was to provide a building to house needed seed-processing equipment. The building has not been constructed because the GOB deferred implementation of this activity due to a scarcity of funds.

17. OUTPUTS

This is the midterm evaluation of a five year project now its second year of implementation. The outputs listed in the log frame have not been achieved, but the process is in place to reach these goals. The evaluation team feels that after three more years of project implementation, there will be a significant number of measurable results.

There are a number of accomplishments in terms of establishing an FSR methodology which, once in place, will result in achievement of project targets. A team consisting of an agricultural economist and an agronomist have been established at one site while a a similar team, with the addition of an animal scientist, has been established at a second location. Both teams are skilled in FSR techniques and have established contacts in several villages where various surveys and on-farm trials are under way. Excellent cooperation is being given by village leaders and farmers.

FSR SITE AND ACTIVITY	NUMBER OF SURVEYS OR TRIALS BY CROPPING SEASON	
	1982-83	1983-84
Mahalapye:		
Survey visits	317 (5 survey types)	256 (7 survey types)
Trials	24 (2 trial types)	62 (12 trial types)
Herds	0	7
Francistown:		
Survey visits	(No team in country)	1763 (4 survey types)
Trials	(No team in country)	26 (7 trial types)
Herds	(No team in country)	54 (1 trial type)

Recent acquisition of micro computers in each location has facilitated summary and analysis of data collected and will speed the process of getting results from the FSR team to government colleagues and to the village participants themselves. The teams have tested the appropriateness of a number of agronomic practices and varieties. This baseline data plus the surveys will be used to measure future differences in production and income to small farms as a result of the interventions and the applications of the FSR approach in the field. At that time, care must be used to distinguish environmental factors (especially rainfall) from technological factors. These tools are necessary when individual

farms are used as replications, and there are many confounding factors from one farm to another. The numbers of trials and surveys being carried out are impressive. Interactions of research team members with counterparts and people in the villages are excellent.

The project is also providing a Research-Extension Liaison Officer (RELO) who is responsible for assisting in communication and flow of information between research and extension on FSR at the national level and in the field. This is being done by arranging seminars and workshops which both extension and research personnel are invited to attend, discussing research/extension relationships at monthly AD meetings, and in-service training courses. The RELO will play a leading role in arranging for the dissemination of research results to the DAFS staff.

There have been no outputs at this point from the seed production element of the project because the GOB has chosen to defer implementation, until funds are available.

With the two FSR teams at different locations, the COP at another and the RELO in the capital, project management has been difficult, involving much travel between locations by the COP. This has taken time that might have been spent by the COP in doing more technically oriented work which could have a significant impact on the direction of the project and on the institutionalization of the process. Organization and coordination of the work of personnel at all locations has been excellent, but ways are being sought to relieve the COP of some of these time-consuming activities. No global changes appear to be necessary to achieve most of the project goals in the five years of the current contract. However, if the FSR approach is to fully developed in Botswana, an early project extension and a substantial increase in training funds will be necessary.

18. PURPOSE

"The purpose of this project is to improve the capacity of the Ministry of Agriculture's research and extension programs to develop and effectively extend farming systems recommendations relevant to the needs of the small farmer" in Botswana (Project Paper p.11). The project also has three sub-purposes which should directly contribute to institutionalizing the FSAR in Botswana. These are:

(a) To improve the capacity of the GOB's Ministry of Agriculture's Department of Agricultural Research to develop technologies appropriate for small farmer needs.

(b) To improve the capability of the extension service to transfer technologies which can be utilized by small farmers and strengthen and institutionalize the linkage between the research and extension departments, and

(c) To insure that adequate supplies of needed seed for major agricultural crops are available for distribution to Batswana farmers. (Project Paper, p.12).

Project inputs and outputs effected to date are contributing to the improvements described in sub-purposes (a) and (b). No progress has been made in achieving the sub-purpose (c) due to GOB decision to defer implementation of the seed processing plant.

19. GOAL

"The goal of this project is to improve the welfare of small farmers and increase national food production through the development, extension and adoption of relevant technology" (Project Paper, p.11). In setting this as the project goal, the GOB and USAID/B realize that to achieve this goal, a sustained allocation of funds over a period of time which is considerably longer than this specific project needs to be given to arable agricultural research and extension. A part of this committment must be demonstrated by developing and implementing projects such as ALDEP and ATIP, which are focused on specific farmer needs and problems. A principal method used to meet this goal is training of Batswana to fill important positions in the MOA and to institutionalize this process.

20. BENEFICIARIES

The project works specifically with limited resource Batswana farmers who possess fewer than 40 head of livestock and cultivate fewer than 10 ha. of arable crop land. These are the potential direct beneficiaries:

1. In the Mahalapye area, the project is working intensively with at least 20 such households in agronomic and socioeconomic research, with livestock research affecting about 12 households. During 1984-85, researchers will add a third village and intensive research with approximately 10 more farm households.

2. In the Francistown area, researchers work intensively with approximately 30 such households in three villages in agronomic, socioeconomic, and livestock research.

In addition, the project has had less intensive contact with several hundred farm households in the two research areas. Slightly less than 50% of project households are female-headed. Almost all area households are characterized by significant female management decisions. With the partial exception of the plowing process, most cropping tasks are managed and often performed by women (assisted by their children).

Depending on the unknown magnitude of the multiplier effect and the size of the production increases anticipated by the project in basic grains, it is not unreasonable to expect increases in small-farm, labor-intensive agricultural productivity, promotion of greater income equity, and perhaps a reduction in rural unemployment and underemployment at some time in the future of this project.

The indirect beneficiaries are those farm families with whom the project does not directly work, but who may adopt some of the technology developed by this project through contact with their neighbors or relatives, or through the DAFS extension service. Other indirect beneficiaries include those young adults who currently do not farm the lands but whose children most often dwell on the lands with their farming grandparents. It is not reasonable to estimate numbers of indirect beneficiaries at this time. Women and their children in female-headed households, who make up the majority of limited resource Batswana farmers, will be the largest group of project beneficiaries.

21. UNPLANNED EFFECTS

Not pertinent at this time.

22. LESSONS LEARNED

1. Future FSR design teams for other projects and countries should be encouraged to read this project's PP. It could serve as a model for future FSR projects.

2. The following key elements have come together in this project: (a) the Collaborative Assistance Mode (CAM) of project contracting, (b) selection of contractor based on expected high expertise of the technical assistance, (c) careful selection of project staff with prior experience in the region, (d) excellent relations between the project and the ADO, and (e) commitment of most of the project staff to extending from two to four year contracts, which promotes continuity and minimizes the effect of the "learning curve" during the first year in country. Since all of these events rarely occur together, this "package" of administrative and implementation components should be used by AID/W and the FSSF in assisting future contractors and USAID Missions to plan, design, and implement FSR projects. When new staff is rotated in, sufficient overlap time should be planned.

23. SPECIAL COMMENTS OR REMARKS

Unique Elements in the ATIP and Evaluation Process

The evaluation team has observed several elements which are unique to this project and its implementation and to the evaluation process. These findings are listed because the evaluation team feels strongly that both USAID/B and AID/W should encourage projects to seek these key elements and assure that they are considered in on-going and future FSR projects and their evaluations.

A. Unique to the project:

This project was well conceived and planned from the PID through the PP stages. Selection of MIAC as the contractor was made primarily on the strength of the Chief of Party designate. The Chief of Party and KSU backstops in turn went to extensive lengths to induce the best candidates available to join the project, regardless of the short-term strains this put on MIAC and KSU vis-a-vis the commitment to staff with consortium personnel.

The project has been able to develop and/or utilize an impressive array of agronomic and economic tools, survey and data collection forms designed to explore and use the data necessary to allow measurement of quantitative differences in yields which are expected to emerge from the methodological process of FSAR as applied in the two field locations of Mahalapye and Francistown. Project staff have explicitly incorporated these detailed measurement techniques in order to determine the impact of proposed technological improvements. The project seems to be poised on the brink of determining those parts of existing technology which are superior to current practices of the farmers in the two areas. Together with the Sebele researchers and those on other FSR projects the team will examine areas in the total research agendas which should be modified or fine-tuned to address priority needs of the farmers. The two-way flow infrastructure is in place -- all that is needed is a "normal" rainfall cropping season!

It is apparent that cutting edge state-of-the-art FSR methodological developments are taking place in Botswana. This project is already viewed by the Farming Systems Support Project (FSSP) as a prime candidate project for a case study in FSR.

Implementation of the project has gone remarkably well. Availability of micro computers at project headquarters and at the field sites has led to an efficient use of project staff time. The Agricultural Development Officer assigned to facilitate the implementation of the project has done an outstanding job in meeting the needs of the project. The decision by the Chief of Party and the rest of the team to use a flexible FSR implementation methodology in the two agricultural regions because of the limited environmental buffer -- that is, the very small difference in rainfall amount and distribution which allows subsistence in some years and which leads to massive sub-subsistence in others -- which constantly confronts the Batswana farmers is a positive and unique feature of this project. This demonstrates the advantage of the FSAR and the need for leadership with technical experience in FSR practice.

B. Unique to the Evaluation:

USAID/B is to be commended for providing excellent physical work conditions for the TDY evaluation team. Cooperation and willingness to facilitate the job was encountered at every level within the Mission, from the director to his support staff. The micro computers in the Mission were used during evenings, weekends and holidays, greatly adding to the evaluation team's efficiency. Secretarial help was excellent.

The logistics of facilitating the team's trip up-country and setting up necessary appointments with contacts in the GOB, USAID, and the project were outstanding. The flexibility of the Mission and ATIP in allowing the team to occupy the guest house promoted a maximum degree of intra-team communication which in turn led to a minimum of disagreement and rewrite. The team would not draw attention to this degree of cooperation if it were the norm during project evaluations. This is a model for cooperation. The evaluation team wishes that it be known to AID/W that this evaluation received excellent logistical support from USAID/B and the Project personnel.

C. Unique to FSR projects:

There is also a general concern about the relevance of FSR evaluations. FSP projects in particular are part of overall programs, or strategies, for modifying agricultural research paradigms. Such modifications themselves are long-term in nature. Results - tangible results - from such paradigm shifts are even longer-term. Most FSR practioners believe FSR time-frames should be 10-20 years. However, AID generally puts a five-year maximum on projects. The PES format makes it extremely awkward to evaluate a project, or research strategy, which everyone implicitly acknowledges to be 10-20 years in length, in an explicit, five-year time frame. Agreement should be reached on some practical suggestions for conducting FSR project evaluations which will be more satisfactory to USAID Missions, AID/W, and project contractors.

ATTACHMENT A.

Narrative Responses to Scopes of Work.

Note: The scopes of work were defined in the ATIP external evaluation schedule for July, 1984; these are presented here in narrative form following the outline provided in the "scope" document from the mission. Preparation of each section represents a team activity, and does not present a sole opinion or authorship from the designated specialist on the team. The outline follows:

I. GENERAL AGRICULTURE:

A. Review of documents: (see reference list, Attachment B)

I.A.1. General Project Process

B. Assess the quantity and quality of technical assistance by contractor

I.B.1. Professional Research Qualifications of TA Team

I.B.2. Ability to Conduct Research Under Local Conditions

I.B.3. Ability to Develop Skills of Batswana Counterparts

I.B.4. Ability to Conduct Interdisciplinary Research

I.B.5. Support to Project by GOB and USAID/B

C. Evaluate progress made by the project to date:

I.C.1. Institutionalizing the Farming Systems Approach to Research

I.C.2. Improving Capacity of DAR to Develop Appropriate Technology

I.C.3. Improving Capacity of DAFS for Technology Transfer

I.C.4. Strengthening Linkages between Research and Extension

D. Assess training plans and their implementation:

I.D.1. Adequacy and Appropriateness of Training of Batswana

E. Evaluate project against the log frame and measure progress expected in years 2 and 3.

I.E.1. Evaluation of Project against Log Frame and Progress Expected in Years Two and Three

F. Assess balance of emphasis in project given to cropping and livestock systems.

I.F.1. Balance of Emphasis in Project: Cropping and Livestock Systems

II. AGRICULTURAL ECONOMICS;

A. Review of documents: (see reference list, Attachment B).

B. Assess the adequacy of the project in a number of critical areas

II.B.1. Identifcation of Problems and Opportunities in the Context of Batswana Farmers.

II.B.2. Development of a Research Base, including Collecting, Assembling, and Managing Data

II.B.3. Disaggregation of Data for Identifying Recommendation Domains and Measuring Project Impact.

C. Review planning, implementation, and analysis of on-farm research

II.C.1. Planning, Implementation, and Analysis of On-Farm Research

D. Assess relevance of project results to small farmers

II.D.1. Relevance of Project Results to Small Farmers

E. Assess the consistency of project activities with national policy goals.

II.E.1. Consistency of Project Activities with National Policy Goals

F. Assess the project emphasis to agricultural policy and recommend changes if warranted

II.F.1. Project Emphasis on Agricultural Policy Considerations and Recommended Changes.

III. SOCIAL SCIENCE:

A. Review of documents: (see reference list, Attachment B)

B. Assist in Agricultural Economics area (see section above)

C. Review GOB inputs in social science training and technical assistance

III.C.1. GOB Inputs in Social Science Training and Technical Assistance

D. Assessment by project of endogenous aspects including household labor, cropping choices, livestock access, and off-farm employment

III.D.1. Endogenous Farm Factors including Household Labor and Off-Farm Employment Cropping Choices, and Livestock Access

E. Review degree to which teams function as interdisciplinary units

III.E.1. Functioning of Interdisciplinary Teams

F. Review the adequacy with which team members are training and supervising interviewers

III.F.1. Training and Supervising of Interviewers

IV. AGRONOMY

A. Review of documents: (see reference list, Attachment B)

B. Assess target and research area selection, problem identification, and potential for finding solutions

IV.B.1. Target Area and Research Area Selection

C. Review data collection forms and field designs for experiments

IV.C.1. Data Collection Forms and Field Designs

I.A.1 General Project Process

This project is exceptional in design and implementation. The conditions for arable agriculture in Botswana are among the most difficult in the world yet the need to provide employment for the majority of Batswana who live in rural areas requires that the difficult issue of small farm agriculture be addressed for both production and equity reasons.

The design has already had important multiplier effects toward achieving those goals. Strong linkages have been formed among MOA units, project counterparts, the Cooperative Research Support Projects (CRSPs), International Agricultural Research Centers (IARCs), and the centrally-funded Farming Systems Support Project (FSSP) The major goal of this farming systems approach to research (FSAR) has been to link research and extension in a joint effort to most effectively meet the needs of small farmers' arable agriculture by (1) determining the farmers' constraints according to their socio-economic and environmental conditions and by (2) determining the technology necessary to overcome those specific constraints. Those technological recommendations will include the judicious application of existing technology that has both proven effective on farmers' fields and acceptable to farmers, and the generation of new technology that meets the same criteria.

In order to meet these goals, the project has made maximum use of AID resources, through the complementary mobilization of funds from both the Africa Bureau and the Bureau of Science and Technology. The USAID/Botswana funded project provides the basic institutional structure, supported by Government of Botswana (GOB) funds, personnel and infrastructure, as the basis for linking research and extension. These linkages have been bolstered by ties to CIMMYT, through short term training and networking, and to the FSSP, through evaluation and networking; thus supporting and strengthening the farming systems approach to technology

19X

approach by exposing Batswana personnel to the implementation of ATIP in various settings and by training project counterparts in specific aspects of its implementation.

Component research has been strengthened not only through linkages to the IARCs as a source of technology, but through personnel and training provided by the Bean and Cowpea CRSP and the INTSORMIL (Sorghum and Millet) CRSP. In both cases, crop breeders have come to the Sebele Agricultural Experiment Station and carried out research that otherwise would have been done elsewhere. Both the research results and the training of agricultural researchers who will later be available to carry out crucial component research relevant to the harsh and unpredictable Botswana conditions are important contributions stimulated by the ATIP project. The linkages with the CRSPs were designed into the Project from the beginning, while the linkages with the FSSP and the IARCs developed as the project was implemented. This kind of coordination and piggybacking appear to be a particularly efficient use of USAID resources, focusing multi-bureau resources on a difficult but key food production/employment generation problem. The mission is to be complimented on its support of these unique networking activities. The COP has used these resources to good advantage in bringing relevant methodology and appropriate technology to the Motswana farmer.

Recommendation.

Continued coordination and cooperation between ATIP and centrally funded projects continue to be sought, particularly in the areas of short term and long term training and of component research.

I.B.1 Professional Research Qualifications of TA Team

A. Chief of Party: The COP has a PhD in agricultural economics from Oregon State University and is a full professor of agricultural economics at Kansas State University. This individual, who lives in Gaborone and works out of the Sebele research station, is one of the pioneer developers and practitioners of FSR methodology, with extensive experience in the implementation of FSR projects in the field. Additionally, almost all of his field experience has been in Africa, particularly Nigeria, where he was posted for eleven years. A partial listing of his publications (refer to the REFERENCES Annex) includes more than a dozen papers and publications written on the theory and state-of-the-art of FSR. The quality and recognition of his work is exemplified by several prominent papers in the FSSP Annual One Hundred Most Important FSR Documents listings.

B. Assistant COP: This senior individual, an agronomist, has a PhD. from Purdue University and is a full professor of agronomy at Kansas State University. He has extensive experience in Africa, having worked in Nigeria six years, and in Cooperative Extension in Canada. As the RELO stationed in Gaborone in the MOA, he seems ideally qualified and situated to stimulate liaison between DAR and DAFS (research and extension). His selected scientific publications are listed in the REFERENCE appendix, and focus on soil

C. Agricultural Economist, Mahalapye: This individual has a MA degree in economics from Michigan State University and is in the process of completing his PhD at Michigan State University (MSU). Again he has a good deal of African experience, in Upper Volta and Cameroon. He is the co-author of a major African agricultural strategy monograph of the MSU international publication series (refer to the REFERENCES Annex), as well as several other relevant monographs and working papers.

D. Agronomist, Mahalapye: This individual has a PhD from the University of Georgia and has served as millet breeder at the Coastal Plains Experiment Station in Tifton, Georgia. He also has previous experience in Africa, serving five years in Zaire. He has a number of scientific papers under review.

E. Agricultural Economist, Francistown: This individual has a PhD in agricultural economics from the University of Wisconsin. He also has had relatively long experience in Botswana, where he spent three years working for the Mennonite Central Committee. He also coordinated programs of the Mennonite Central Committee's agricultural activities with research and extension of the Bangladesh Ministry of Agriculture. He has prepared a number of professional papers.

F. Agronomist, Francistown: This individual has a PhD in agronomy from the University of Nebraska. He has spent a substantial portion of his life in Africa, having been born in what is now Zimbabwe and raised in Zambia to age 12. He was in the Peace Corps in Kenya, and has also lived in India, working for ICRISAT coordinating their on-farm testing of technology for vertisol areas. He has published in Crop Science and has another publication out for review.

G. Livestock Expert, Francistown: This individual has a PhD in Animal Nutrition from the University of California at Davis. He is a full professor of animal science at Kansas State University. He has experience in Africa, having spent 4 years working in Nigeria with an institution-building project. He also spent two years working in the Philippines. He has published on animal nutrition, most recently on swine production.

Assessment: The evaluation team believes the total complement of personnel implementing this project to be better prepared than any other team of technical assistance personnel which has been assigned to FSR projects during the last five years, in terms of education, experience and publications relevant to FSR. Each person has had long-term experience in Africa, a major qualification for the project activities. It is significant to note that every member of the technical assistance team who is completing a two-year contract has been asked and has agreed to continue on the project. Equally important is the fact that the contractor and USAID/B are anxious to have each person continue on the team. This reflects the quality of scientists, their commitment to development, and an appreciation of their efforts by USAID/B and by the GOB. Despite building on a solid foundation of professional competence, there is a need for all the professionals on the team to have continuing interaction with their disciplinary peers.

21X

Recommendation.
Bi-annual attendance at professional meetings, supported by the project, is crucial to the maintenance of professional accuracy and should be included in future contract negotiations. It is also critical to include a minimum two month overlap period for senior technical staff positions to provide continuity in the ATIP.

I.B.2. Ability to Conduct Research Under Local Conditions

The evaluation team feels that the entire technical assistance team is quite capable and oriented to conduct research under local conditions. All team members have prior experience working in Africa, and all seem to be able to work well with both their GOB counterparts (when available) and the RD farmers and village headmen. All team members seem to possess very high degrees of cultural sensitivity, and several are progressing with language study.

A impressive demonstration of the group's commitment to conducting local research lies in the fact that the FSR-implementing teams live in either Mahalapye or Francistown. It is important to recognize the logistical challenges of a project spread over this area. The COP, MIAC, and USAID must be acutely aware of the added burden to support these teams and make their work as efficient as possible.

Recommendation.

Continued attention be given to the logistical support of the field teams.

I.B.3. Ability to Develop Skills of Batswana Counterparts

The COP has shown sensitivity and concern about the career lines and the formal training needs of Batswana counterparts. Several of those counterparts are now studying at the BS and MS level at U.S. universities. The counterparts are also included in all formal meetings of the project teams, as well as assigned their own areas of research within the overall scope of the project. Their task assignment has tended to emphasize directing the collection of field data. The data collection emphasis seems to have resulted in increased skills on the part of the agronomist counterparts, who have had rather straight-forward tasks to oversee, and fairly easy to observe relation between treatments and responses, despite the unfavorable drought conditions. The methodologies they are to oversee consist of both relatively standard agronomic measurements, supplemented by adaptive and team-developed measurements, making their jobs broader than typically encountered at the experiment station.

In the case of the agricultural economists and animal science counterparts, the project contractor seems less able to develop relevant skills, although working relationships seem quite good. This is a more complex area. The TA team agricultural economists themselves have limited experience with complex survey research techniques. Although the counterparts are included in the discussion of questionnaire formats, at their level of academic

preparation it is difficult to gain skills in the research design phases of the project. Indeed, there is a direct contradiction between the MIAC researchers devoting time to teaching research methods and time to project design and analysis. As a result, the counterparts have been given tasks to perform in order to free the researchers from performing them, but less attention has been given to systematic training in how to carry out such tasks effectively. The training course in micro computer use was an excellent step toward skill building, but the counterparts found little chance to apply what they had learned when they returned to post, as the researchers and secretaries tend to use the micros extensively in the course of their daily activities. Further, training in computer technology must be supplemented with disciplinary training on the ways to formulate and interpret data. On the job training of the counterparts must include purchase of equipment such as more micro-computers that can help them hone their data analysis skills, as well as their data gathering skills. The purchase of such equipment might be justified as part of short term training.

ATIP is fortunate to have counterparts with native language ability in both Kalanga and Setswana. The stationing of the Kalanga-speaking agricultural economics counterpart in the Setswana speaking area, and vice versa, while in line with national policy to avoid tribal factionalism, means that the counterparts may not be fully able to oversee field work effectively. Creative use of cross team training, particularly in data gathering operations, might allow for more complete discussion of local language terms and expressions, as well as local ways of defining reality that impact the farming system and ultimately agronomic practices and crop yields. Even if it is possible for the two counterparts to switch areas, interdisciplinary training, although requiring an extra effort by the COP and staff, will have important payoffs. Such short term field training will be particularly effective if the counterparts know that effective performance results in long-term advanced training in their disciplines. Since much of the next round of data collection involves areas of data collection expertise of rural sociologists and anthropologists, the use of a short-term consultant, already included in the terms of the contract, might be appropriate for training both the counterparts and the agricultural economists. The FSSP might be an appropriate vehicle for locating such a trainer.

Recommendations.

More attention should be paid to the formal short-term training of the counterparts in field situations. When necessary, consultants should be used. Disciplinary training as well as training in FSR theory and practice should be offered. Cross team training should occur more regularly. The COP should increase his contacts with the MOA on substantive matters to make clear how such postings of MOA staff will serve to further the goals of the Botswana government, the MOA, and the divisions from which the counterparts are seconded.

I.B.4 Ability to Conduct Interdisciplinary Research

The evaluation team feels that while both teams began FSR in some degree of disciplinary isolation, the level of interdisciplinarity in evidence now indicates that each team member obviously places a great degree of importance on this key factor of integration. The more individualistic paths begun by the agricultural economist and the agronomist in the Mahalapye area have been converging steadily. The evaluation team finds evidence that the FSR team is developing and demonstrating to the Batswana counterparts and other more casual contacts a strong interdisciplinary approach and team spirit.

In Francistown, partly because of the experience of the project in Mahalapye during the first year of implementation, a more common approach has been taken to FSR by the team members. Use of the Multiple Visit Resource Use Survey (MVRU), which was developed in Mahalapye, and general agreement on agronomic trials has led to a quicker convergence on the interdisciplinary approach in this area.

Some of the other FSR projects in Botswana provide good models of interdisciplinary teams. The linkages to those projects can thus heighten awareness and appreciation of an interdisciplinary approach to agricultural research.

Recommendations.

Discussions on team building should be held with other FSR teams in Botswana in order to share experiences, and, if possible, derive lessons for future institutionalization efforts.

I.B.5 Support to Project by GOB and USAID

Unlike other FSR projects in Botswana, ATIP has from the beginning placed fairly extensive demands on the GOB in terms of provision of personnel and infrastructure. Other projects have been located squarely within a single MOA division and often staffed by expatriates. This policy of close involvement was initiated consciously as one mechanism to help promote institutionalization of a FSAR, relevant to harsh climatic conditions of the small farm, that could feed directly into and receive feedback from the Botswana extension system.

The GOB, despite staff shortages at all levels within the MOA, has responded with the provision of the required person or item, although not always as rapidly or with as well-trained personnel as at first envisioned by the project. The one exception has been the delayed assignment of the rural sociologist approved in the project. An individual is now in the process of being seconded from the Rural Sociology Unit of the DPS. However, that individual has no formal sociological training. Hopefully, ATIP can in the future provide training for rural sociologists at the BS and MS level, as well as provide opportunities for higher level sociological/anthropological input in the project. This may require an amendment to the contract. In the meantime, short-term consultancies of FSR anthroplogists/sociologists should be coordinated with the DPS.

Because of the complexity of the project and the large number of demands project implementation has made on the MOA, liaison between the COP and the MOA have been more related to administrative problems than to project content and policy implications. Hopefully the next phase of the project will allow for more focus on professional issues of the role of FSR within the context of Botswana agricultural development, addressing the critical issues of how to institutionalize the farming systems approach to development and agricultural policy issues raised by the research.

Another challenge has occurred in the provision of services by USAID/Botswana. USAID/B developed an innovative project paper that has allowed the implementation of one of the most comprehensive farming systems research and extension projects in Africa. The rapport between the COP and the past and current agricultural officers has been exceptional. The field support office of USAID/Botswana has provided an excellent service by meeting day to day needs of the expatriates.

However, provision of administrative support has suffered from problems of communication. For example, home leave forms have required multiple filings and multiple visits between the COP and the Mission. This is one example of excessive professional time being devoted to procedural matters. Such incidents have required the COP to devote a great deal of his time to determining proper AID procedures, from housing to home leave, rather than to the pressing technical implementation issues that would make better use of his unique FSR expertise.

Recommendation: Mechananisms should be found to ease the COP's administrative burden. The current project Administrative Assistant has a good understanding of the GOB bureaucracy. USAID/B should review procedures for dealing with the contractor on administrative matters and devise ways to improve understanding and efficiency in this regard.

I.C.1 Institutionalizing the Farming System Approach to Research

Institutionalizing the FSR approach to research and development is a complex and difficult challenge. The ability of an organization to accept change and especially to reorient programs toward different or redefined goals often depends on the availability of more trained personnel and additional resources. Assuming that everyone in a government agency is fully employed and is working within an established set of priorities, the potential to change to an approach which requires an entirely new conceptualization and mode of operation is difficult. Any reallocation of resources or personpower in response to changes in direction or philosophy can be perceived as threatening to the status quo and to persons in crucial positions in the organization. That resource allocation has already occurred within the MOA suggests that there is potential to institutionalize the Farming Systems Approach to Development (FSAD) in Botswana.

There are also two major constraints to widespread understanding and adoption of the approach. First is the perceived threat of loss of position with any change or realignment of policy, and the effects that this will have on individuals in the departments of the MOA. Second, as with many other findings of the evaluation team reviewing the ATIP, a major constraint would appear to be a need for more trained personnel in the MOA, specifically in the areas of agricultural research and extension. Not only is there a need for more people, but there is a shortage of technical people both in the research and extension areas who are oriented in the FSAD.

A major conceptual difficulty in the institutionalizing of the FSAD is the orientation of activities starting with a "bottom-up" approach in an organization which has an essentially a "top-down" operating mode and decision-making structure. The people in specific positions at all levels in the MOA are accustomed to setting priorities and allocating resources in a traditional top-down manner. Any change which leads to more responsibility from the lower echelons which disturbs these channels and operating procedures would lead to an unsettled situation, even if this change were possible. Thus, the FSAD is a difficult concept to introduce, to understand, and to implement in an established organization in which many years of cultural and educational experience dictate that decisions be made in the more traditional manner. Nevertheless, it is apparent that leaders in the GOB and the MOA are willing to consider new ideas and approaches to problem-solving in the agricultural sector.

The implementation of several projects with a farming systems approach to development has occurred over the past several years. Examples of these projects include the Evaluation of Farming Systems and Implements Project (EFSAIP), Integrated Farming Pilot Project (IFPP), Ngamiland Agricultural Development Project (NADP), and Molapo Development Project (MDP). These projects have tended to be research projects, with expatriate scientists carrying out the activities and analyzing the results. As the projects near termination expatriates are expected to return home, and FSR activities may end as well. However, recent activity of IFPP, located in DAFS, and the increased linkages among the projects in which ATIP has participated have been moves toward institutionalization. As the projects learn from each other, the commonality of approach can be better achieved and demonstrated.

It is crucial that a long term training plan be implemented within the ATIP to provide master's level training for counterparts, two for each position, who would rotate between field work and long term training.

To be more effective in institutionalizing the FSAD, the training of ADs at BAC should include an FSR component. A number of course syllabi are available through the FSSP. It might be possible to send a teaching team to the U.S. or an IARC to take such a course or receive other short-term FSR training.

It is to the credit of the administration of the MOA that it has supported and implemented these several farming systems projects over the past decade. This must be especially difficult given the newness of the approach and the lack of training in complex

methodology common to scientists who have studied in conventional university programs. Specific difficulties in implementing an FSR approach are the lack of familiarity with holistic systems approaches to problem solving in the field and lack of understanding of this new methodology at the administrative levels within the MOA. Continuation and formalization of FSR project linkages with DPS, DAR and DAFS, hopefully including field site visits, should help coordinate and demonstrate the implementation of an FS approach.

Every effort should be made to orient other people in the BAC and the research and extension services toward the FSAR. The RELO person on the team could work toward this, expanding his/her contacts to include the BAC Principal, ALDEP representatives as well as the cowpea and sorghum/millet scientists working in conjunction with the team.

As ATIP more directly addresses policy issues, linkages to ALDEP and the Ministry of Finance become even more crucial, expanding even more the role of the RELO in achieving and maintaining those contacts. Individuals in each entity should receive project documents and be invited to RELO-instituted project related meetings. In particular, individuals in the GOB, MOF and MOA Departments of Planning should be invited to the field to observe the project at work. Such trips are costly in terms of researchers time. However, the payoff in terms of institutionalization is high.

When it is to their advantage to become involved, the researchers will be interested in the variety, tillage, fertility and systems trials which are also of interest to the project. More frequent communication with extension personnel in the areas of the project villages could lead to greater interest by them in the trials and demonstrations of the project. This would hopefully add to the multiplier effect of the activities of the project technicians. All these activities would lead to a greater probability of institutionalization of the FSAR.

Recommendations: It is a priority activity to develop a long-term strategy and plan for training. For this to be reasonably accomplished, the Ministry of Finance should be included in deliberations regarding the proposed changes in the training program. As proposed by the evaluation, it attempts to meet the identified need for increased numbers of trained individuals and the financial contraints of the GOB, which is concerned that training be given to individuals who already have posts within a ministry, rather than creating new posts that require recurring government expenditures to maintain. The RELO should establish a linkage with the Planning Officer for Agriculture and include her and her counterpart in meetings and discussions regarding the project. This educational and communication function is key in institutionalization efforts.

There should be a formal coordination and linkage of the FSR projects in Botswana through the MOA. Although an informal meeting format exists currently, it is not functioning well. A Motswana coordinator should be designated by the GOB to guide the issues to be addressed at regular meetings that could include rotating site visits.

27X

The training of ADs at BAC should include an FSR component. BAC faculty could utilize FSSP and CIMMYT to develop course syllabi for regular and refresher courses for ADs. B.S. and Masters level training should be provided for counterparts and the rural sociologist, two for each position, who would rotate between field work and long-term training.

The RELO should expand contacts and regular meetings to include the BAC principal and ALDEP representatives.

I.C.2 Improving Capacity of DAR to Develop Appropriate Technology

The need for appropriate technology for the limited resource farmer is a common theme in projects in the developing world. There is also a growing appreciation of the lack of scale neutrality for many of the practices developed on experiment stations. These stations are often found in more favorable areas, with better soils and access to machinery and other inputs not easily obtained by small farmers. In Botswana, there is a long tradition of agricultural research. There is also a body of information and certain varieties of crops which are available from nearby countries with similar climatic and soil conditions. In spite of several decades of research and past efforts in extension, many practices have not been accepted by limited resource farmers.

What are some of these practices? Research on the stations has led to recommendations on early plowing and planting with the first rains. Seeds of uniform varieties have been increased by the government or have been imported from neighboring countries. The practice of row planting as an alternative to broadcast seeding has been promoted. Only the large farmers have accepted the recommendations on chemical fertilizers, pest control with chemicals, and mechanization of harvest. Although we did not visit large farms, there is every indication that much of the technology developed on the stations has served these farmers in the past, and the current projects will continue to meet their needs. How are small farms different?

There is an obvious difference in resource base between large and small farms. Smaller farms have less potential and incentive to purchase equipment to further mechanize a marginal activity. There is a concentration on animals in the system even with small farmers who own a small herd of cattle and/or goats. Most important for most small farm households is the need to minimize risk. Any technology which increases the investment of either time or resources in planting and caring for the crops, or which increases potential for greater yields but increases risk of harvesting nothing from the plots in some years, would not be a viable alternative to these farmers.

In our limited exposure to several villages in the Mahalapye and Francistown areas, it was apparent that only a few of the farmers were practicing the components of technology listed above. Some of their reasons gave us food for thought about the whole idea of appropriate technology. If plowing and planting were accomplished early with the first rains, this could provide a good crop <u>if</u> that rain continued for several months. The farmers with traditional methods plant one or several plots each time there are good

conditions for seeding that is, following a rain. By the time all plots are planted, there may be a spread of several months in planting dates. This effectively spreads risk of loss over the entire season, and generally guarantees some harvest from at least one of the planting dates.

Planting in rows at a uniform depth can provide uniform germination, good stand, and acceptable production if rains continue after planting. If the rains stop, however, the traditional method of spreading seeds through several inches of topsoil may give a sequential germination of seeds from different depths, and thus is another drought-avoiding technique.

The use of uniform varieties of sorghum and millet is essential in a system which includes mechanized harvesting. Where the crop is harvested by hand, this is not needed. As an alternative, a non-uniform variety flowering over a period of several weeks can provide buffering against a drought which occurs near flowering time. In any given year, some of the early plants may produce while the late ones run out of water before setting seed. In another year, the early varieties may die or experience floral abortion before reaching maturity, while a late variety in the same mixture may go dormant while there is drought, or may tiller with late rains and produce something to give the farm family food until the next year. These are all possible solutions in a program for a dryland area which experiences unpredictable rainfall, both in time and space dimensions.

Such a risk-spreading approach is also the key to developing appropriate technologies for the limited resource farmer. The researcher must become familiar with the current cropping system of the farmer, understand the principal constraints to production, and design alternative technologies which will solve constraints perceived by the farmer within the range of his or her resources. This approach will require some creative thinking by those in the experiment stations, and will probably result in some non-conventional solutions. It is not enough to apply the same technology or even the same method of breeding crops or improving soils used in other countries, but rather the researcher needs to understand what the farmer is doing and why, and then develop a technology or set of practices which is consistent with the objectives and limitations found on these farms. It may not be easy to explain this approach to research directors or planners, but the long-term results will show that the methodology is valid. This is now called the Farming Systems Approach to Research (FSAR), a methodology and focus which is likely to become increasingly familiar as it is put into practice and demonstrates success in other parts of the world. However, like all research undertakings, concrete results take a decade or more to achieve.

The capacity of the DAR to develop this appropriate technology is limited by the lack of trained people in research. It is difficult to expect capable and motivated young scientists to carry out independent research without some graduate training in research methodology and priorities. It is necessary to identify these talented young researchers and find the resources to help them study in country or outside, whichever is most appropriate. The ATIP is

an appropriate vehicle for channeling such training in order to provide a critical mass of well-trained, well oriented scientists directing their efforts toward the needs of the majority of the Batswana.

The other major constraint to progress is the lack of orientation in most graduate training programs to provide these kinds of problem-solving skills to each generation of students. There is a preoccupation with the transplanting of technology which has already been developed in one environment to a new environment and set of socio-economic conditions, where it is supposed to solve all the food production problems. Training in the setting of priorities and the design of strategies to identify the most important limiting problems and setting out to solve them within the context of the farmers in the country or region of interest is more appropriate.

Recommendations:
Disciplinary training and FSR orientation should be increased to improve the capacity of DAR to develop appropriate technology. As technology is appropriate only as it meets farmers' needs and is made available to them, establishing two way linkages between DAR and DAFS must be part of the process.

I.C.3 Improving Capacity of DAFS for Technology Transfer

The capacity of the extension division -- DAFS -- to work with farmers is limited in several respects. One is the lack of trained people to occupy the positions which are already established for the country. This may result in vacancies in as many as twenty percent of the positions at any one time, as detailed above. Another constraint is the appropriateness of training and preparation of personnel for the posts in the field. Many of the ADs do not have the practical experience which is only developed over time to be able to understand easily what the farmers are doing and to recommend something better. Finally, the technology available to recommend may not be appropriate to the specific farm conditions in their zone, especially the resource-poor farmers. This leads to difficulties and frustrations for the ADs.

Extension capacity can be improved in several ways. First is orientation toward more relevant programs and components of technology, which should be developed by the experiment stations, responding to constraints identified by ADs. A more relevant training of students by the Botswana Agricultural College (BAC) could lead to more available young persons to fill the positions as they become vacant. As mentioned above, there needs to be a recognition of the importance of these ADs and their supervisors in the regions, and attention given to including FSR in their initial preparation and follow-through training. Professionals do not quit learning after they finish the certificate, diploma, or Ph.D. programs. The post-degree period is the time to accelerate learning about the real problems which confront farmers and devise methods to solve them.

Training of people is at once the key to solving agricultural research and extension challenges, and at the same time one of the most long-range of the components of a development strategy. The process has already begun. The time to accelerate its implementation is now.

Recommendations:
Include FSR courses and field orientations for students in the BAC, coordinating field visits to all Botswana's FSR projects, continued student particpation in data gathering during vacation periods, and special courses. Utilize the BAC for in-service training in the FSR approach for ADs currently in the field.

I.C.4 Strengthening Linkages between Research and Extension

Problems of linking research and extension are not unique to Botswana. The differences in objectives, orientation, and methods of operating in the field present challenges in any culture or climatic zone. What is unique in the ATIP is the level of concern about that linkage and the assignment of a Research and Extension Liason Officer (RELO) to work with the MOA in this critical area. Although that job has its frustrations, the RELO and his counterpart have made progress toward solving some of the technical constraints listed above. Through seminars and joint workshops, extensive travel and enthusiastic dialogue with both groups, these two persons have focussed on the key linkage which can help to bridge these disciplinary and adminstrative gaps which, in many countries, prevent appropriate results from ever reaching the farmer.

It is difficult to conceive of large strides toward linkage of research and extension at the local level without (1) serious concern about linkage and integration of activities at administrative levels and (2) solving the severe problem of the shortage of trained persons in the field. Nevertheless, some things can be done at the field level. There is a growing appreciation by those in FSR programs of the need for integration of station research and activities on the farm. The linkages between research and extension can be strengthened at the village level by a concerted effort to bring people together and demonstrate how the FSR approach is beneficial to both. This integration of activities also can serve as a demonstration of what is possible when people cooperate and each contribute something unique to solve a production problem. It appears that little pressure moves up or down through the government channels to bring about greater integration of this type. It is necessary to consider how this integration can be encouraged and institutionalized at the higher levels of decision-making.

A part of the solution is further education of those in positions of decision-making, although not necessarily a matter of further formal study. Executive visits to field plots where this approach has been successful, including the opportunities to visit informally with farmers, would be an appropriate approach. This is a policy level aspect of FSAR which is addressed by the evaluation report in another section. It is unlikely that much will become institutionalized at the field level without this concurrence and tangible support from the administration.

Recommendations:
To further strengthen linkages between research and extension there is a need for executive orientation sessions where special tours or presentations could be prepared for decision makers to show or

describe a certain type of field activity where research and extension are integrated. The RELO position should be permanently established within MOA.

I.D.1. Adequacy and Appropriateness of Training of Batswana

The adequacy and appropriateness of training currently being provided to Batswana students is difficult to assess. In discussions with professionals in the MOA, it appears that the theoretical training received at the University in Swaziland is good but not excellent. There is a concern about the quality of basic courses in sciences and the basis that this provides for further courses in agriculture. The adequacy of the training at the BAC appears to have improved as a result of the recent USAID-financed project to upgrade the level of instruction there. The graduates who are assigned to work in the rural areas have from adequate to outstanding preparation. There is a lack of practical preparation at all levels, and there is a need to follow formal training with practical orientation through in-service workshops or direct work with a more experienced counterpart. The addition of some FSR training in BAC might have important field implications.

It is difficult to assess the specific staffing patterns and training plans of the DAR, DAFS, and the MOA overall because we have not seen the details of this plan. From the series of conversations with government officials, field technicians, and project personnel. it is apparent that a shortage of trained professionals is a major constraint.

Linking training to the project helps insure the selection of key individuals already in MOA posts, particularly in DAFS and DAR, who can form a critical mass in the institutionalization process. Once the needed numbers of profesionally trained technicians can be determined, as the evaluation team has attempted to do in Table 1, it will be possible to developed a phased plan for sending people out for more education, organizing courses in country to meet some needs, and pursuing the resources necessary to accomplish these objectives. This should be a priority for GOB and USAID/B. The estimate is that 16 people should be trained through ATIP to the M.S. level, including two rural sociologists, six agronomists, six agricultural economists and two animal scientists. We also recommend PhD level training for four Batswana. This training should be staggered with field experience under team direction, and accountability to MOA. That will require 35 person years to be added in the first period, 13 more than in the PP. If the ATIP is extended, 41 person years of training should be included.

The counterparts have been identified, and field apprenticeship to team scientists helps screen them as to interest and ability. Qualified individuals are being found in this way. ATIP is assigned individuals already having positions within the MOA. Training in no way includes the creation of new posts which is contrary to the budget policy of the Ministry of Finance. Training, including regional agricultural officers of DAFS, and linkages to the FSR teams seem a particularly fruitful way to prepare technicians. Rotation of two individuals between in service training with the ATIP team and long term training abroad provides continuity. By

selecting individuals with posts, the recurrent costs to the GOB are reduced. They are responsible only for the one-time costs associated with their contribution to training. A more complete training/staffing plan needs to be designed.
Several counterparts already have been sent out for advanced training, and the project is ahead of schedule in the implementation of the long-term training plan.

In-service training is a major component of in-country training and includes close working relationships with project counterparts in the field. This association should be considered a training activity rather than being considered a typical situation of counterparts at similar technical levels.

A serious limitation in training the lower cadre Batswana is the difficulty in implementation when people are assigned to the project by the government more slowly than anticipated initially. Assistance in enumerator training by the sociologist should help in retention of enumerators and improvement of the quality of their work.

The appropriateness of training people on the job appears good for both counterparts and lower level technicians and trainees. However, often explicit training is sacrificed because of the mass of field work. More formalized short-term training should be continued. Motivation for short course participation for counterparts could be increased if the option of U.S. college credit were available. MIAC should investigate mechanisms for instituting this important training mechanism.

The evaluation team estimates that sixteen Batswana should be trained to the M.S. level through ATIP over the next eight years (Table 1). The suggested training allows rotation of two Batswana in each field slot, interspersing three years for the B.S. with two years in the field, two years for an M.S., returning to the field as an apprentice in line to take over project implementation. The disciplinary breakdown is: two rural sociologists, two animal scientists, six agronomists and six agricultural economists. Explicit efforts should be made to insure that all long-term trainees are exposed to formal FSR training as part of their graduate programs, either as part of a regular program or as special short courses or workshops on another campus. The FSSP is working on a catalogue of institutions offering FSR training, both short and long term, and should be used as a resource when considering students for training opportunities.

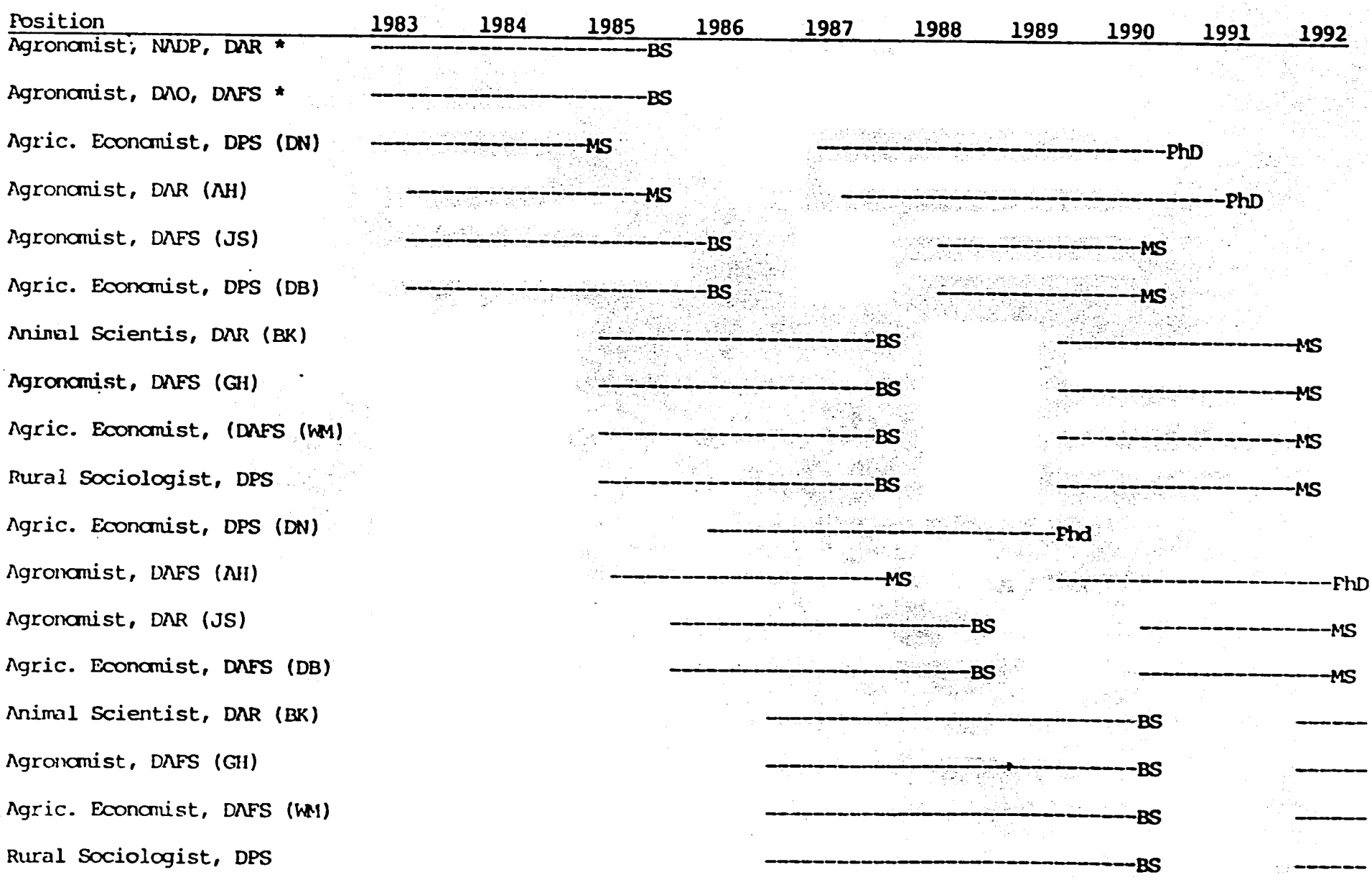
Recommendations:
A training plan should be prepared within the next 12 months to rationalize both the GOB training input called for under the project, as well as the desired level of training to achieve project goals and the amount of funding required.

More formalized short term courses should be offered by ATIP staff and consultants. MIAC should investigate mechanisms for offering college credit for such courses.

When Batswana are sent abroad for training, careful choice of

institution for disciplinary strength at the appropriate level should be sought. FSR training, in addition to and never in place of disciplinary training should supplement training.

TABLE 1: Long-term participant training in ATIP; initials indicated ATIP TA counterpart.



I.E.1. Evaluation of Project against Log Frame and Progress Expected in Years Two and Three

Note: This section is organized using the same headings and topics found in the Annex IIA, Logical Framework (pages 1-4) of the Project Paper, Botswana Agriculture Technology Improvement, 633-0221

Program or Sector Goal (A-1): Improve welfare of small farmers and increase national production.

Measure of Achievement: National grain production increases by 10%.

One of the assumptions for achieving this sector goal was that there would be no significant drop in rainfall. A severe drought in Botswana has been experienced during the first two years of project implementation. Although total rainfall figures appear near normal for the season just concluded, an extremely abnormal distribution of this rainfall has created severe reductions in crop production on both small and large farms. The net result has been a drastic decrease -- to about 20% of normal -- in national grain production. If the drought continues, there can be no expectation other than continued low levels of production.

The low rainfall affects project implementation to a degree, but much has been done in the project areas in spite of these conditions. Since the activities and training planned in the project can be carried out even in the poor rainfall years, the FSR system will be in place and the process should show a greater impact when rainfall is more normal. Even in these drought years, some indication of successful yields as a result of introduction of appropriate technology have been shown by the project team in a few sites. The project will contribute to this sector goal through improving the relevance of available technology, and demonstrating what can be done on the farm when these improvements are introduced. Baseline project data, particularly relating technologies to rainfall and yield, should help assess this measure of sector achievement.

Measure of Achievement: Per capita income increases by 10%.
Per capita income, taken on a national level, obscures rather than clarifies what is happening to small farmers. Most of farm income comes from cattle (for a large minority) and wage labor or informal sector businesses such as beer breweing. Since little of the grain raised by small farmers is marketed even in good years, this project will have little direct impact on per capita income, even in the rural sector. It will, however potentially decrease the amount of grain purchased for home consumption thus freeing income for other purposes and raising level of living.

Project Purpose (B-1): Improve capacity of MOA to develop and extend technology

New technological packages will have been developed and will be extended to Batswana farmers.

Technological packages are being tested and on occasion developed by the teams at Mahalapye and Francistown. They have not yet been

extended to any degree to Batswana farmers, although the research process with on-farm experimentation and a large number of researcher- and farmer-managed trials does lead to a potential for demonstration in the on-going research process. The method of extension will be through the Department of Agricultural Field Services, and is being worked out. It appears that this aspect of the project is on schedule, in spite of the drought, and a number of packages will be tested, developed and extended during the remaining years of the project.

An FSR Program will be on-going in Botswana and posts will have been localized for established positions; research at the MOA's DAR will be structured to emphasize a commodity approach

With the cereals and the legumes researchers from the CRSPs working with counterpart scientists at Sebele, it is likely that more emphasis is being given to the commodity approach to research, but it is still too early in project implementation to determine this. The researcher from the bean/cowpea CRSP has established an ambitious program in his area of interest, and the recent arrival of a senior and a junior scientist from INTSORMIL should provide the same input from the cereal side.

Counterparts now working with ATIP project personnel are seconded to the DAR from established posts to which they are assigned in various departments in the MOA. It is likely that there will not be new FSR posts established since this would mean losing the posts which already exist. This is probably a practical way to handle the assignment of Batswana FSR technicians. FSR needs to be integrated into existing posts and linkages formed between research and extension through channels for increased two way communcation.

DAR will be emphasizing cereals and legumes and conducting this research along commodity lines; most positions in these areas will be localized.

It is too early in project implementation for this to have been accomplished. The project agronomists have been in the field for one year in Francistown and two years in Mahalapye. Their contacts with the regional and central stations have helped to stimulate thought about the organization and orientation of the commodity-specific research on component technology. Cooperation with the station staff is reflected in collaborative experiments both on station and on farms. In addition, the INTSORMIL cereal agronomist arrived in Sebele in February of this year. In the project paper, this person was scheduled to arrive in July, 1984. He is becoming well established at the experiment station and will be assisting the cereals research group. A short-term legume consultant spent 15 days on the project in April, 1984. INTSORMIL has also supplied a junior agronomist to work for two years with the cereals program, and he arrived in April, 1984. The inputs of these technicians and other agronomists in ATIP will become apparent at some later time in project implementation.

DAR will be responsive to the extension service and will be conducting trials based on requests from field services (DAFS).

The ATIP RELO reports that the lack of contact between research and extension has been perceived as a major problem. In an effort to bring the two groups together, attempts have been made to organize six monthly meetings of the regional Crop Production Officers at which contact with DAR personnel will be emphasized. The ATIP team in Mahalapye reported their interest in involving ADs in their work. However they recognize that this had to be undertaken with considerable tact, since the ADs feel that they are already overburdened with various tasks and would not welcome additional responsibilities assigned by individuals associated with a new and little-known project activity. It is apparent that considerable continuing effort must be given to build a relationship between DAR and DAFS which has not existed in the past. The ATIP teams, however, are doing all that can be expected to bring about a closer relationship between DAR and DAFS at all levels. The field scientists work with local and regional DAFS staff and relay their concerns to DAR. The RELO has facilitated an update of the extension handbook, Agrifacts, by soliciting input from DAR technicians.

The RELO position will be functioning effectively.

The ATIP RELO is doing an excellent job of assisting in communications flow between research and extension on FSR at the national level and in the field where the FSR teams are located. This has been implemented through his attendance at monthly DAFS planning meetings, arranging seminars and training meetings, and through membership on key committees where both research and extension personnel are represented. As mentioned in other sections of this report, there is much to be done to bring research and extension closer together, and even though the team member occupying this position is doing an excellent job, the effectiveness of his work can be determined only after more years of project activity.

The extension service will have new technologies to disseminate.

New technology packages are being developed to the degree that would be expected by the teams at Mahalapye and Francistown, in collaboration with the scientists at the research stations. They are building on the information which is available from long years of research on the stations and are attempting to determine which of the recommended practices are really appropriate to the situation of the small farmer with limited resources and a high-risk economic situation. Although some of the on-farm research has been used as demonstrations, as yet there are no packages from the teams which have been given to the extension service. The manner in which this will be handled is under consideration by the ATIP team and is expected to be worked out in a way that will be understood and accepted by the DAFS. The transfer of this knowledge from DAR to DAFS for dissemination will require careful planning and discussions between the parties concerned. It is important to note that the FSAD includes the validation and dissemination activities as an integral part of the process, and this will assure that anything

which is relevant from the research will be implemented rapidly in the villages where the project is operating.

BAMB's seed production unit will be producing and distributing 2000 metric tons of seed per annum.

At the time the project was planned, the GOB specifically requested that support for the Botswana commercial seed activity be included as an element of the ATIP. USAID was to supply funds to replace worn out equipment and to modernize the processing unit now in use. A commercial seed production advisor was to be provided to assist both the Seed Multiplication Unit (SMU) and the Botswana Agricultural Marketing Board (BAMB) in the development of a total seed program.

This element of the project has been deferred by the GOB. A building to house the planned new equipment has not been built and no technical assistance has been provided. USAID/B currently supports the seed industry by supplying an OPEX technician located at Sebele who is not included in the ATIP project. It should be understood that responsibility for this plant does not lie with ATIP. If the seed component is strenthened, there will be an OPEX position in Pitsane.

Recommendations:
More information needs to flow between DAR and DAFS, particularly at the field level. New FSR posts, generally should not be established. Rather, the FSAR should teach personnel already in research and extension posts. The goal of ATIP should continue to be to establish links between them. The RELO position is the one new post required to facilitate those contacts. The post needs to be formalized within the MOA.

The GOB should review its plans for a seed processing plant and consider whether or not this will continue to be a project component. It should be made clear that constructing the seed processing facility does not lie with the ATIP contractor.

Project Outputs (C-1):

Research strategy will be developed.

There is no doubt about either the strategy evolving through the ATIP or the farming systems approach which this team has used in implementation of the field activities. This strategy has been formed through the surveys with farmers and observations and trials on farmer's fields. It has been articulated in the work plans and summarized in the first report and the preliminary draft of the second annual report.

The development of a relevant strategy by the GOB which is appropriate to the realities of risk and the low resource base of the small farmer is a more complex process. This challenge is a part of the institutionalization of the FSAD, a continuing concern of the COP and others on the ATIP team. Only when this strategy is developed and internalized in the Ministry of Agriculture will there be some assurance of continuity of effort and long-term emphasis on this type of participatory research and extension.

New technologies will be tested, technological packages developed, and these packages disseminated to farmers.

These several activities are grouped for discussion. A number of technologies are being observed and tested in farmer's fields in Mahalapye and Francistown areas. During the course of the project the number of alternative components of technology tested in the project villages will greatly exceed the numbers listed in the log frame, especially if varieties of the several crops to be tested are included.

The teams at the two sites have lost no time in getting under way in the field. They are conducting surveys at the same time that they are carrying out researcher-managed trials and others managed by farmers. The researchers at the two sites have extensive plans for testing and developing new technologies, and these are well described in the plan of work. An attempt to count varieties, tillage alternatives, and other seeding practices at this early stage in project implementation would be difficult and serve little purpose. The important thing to note is that the process outlined in the log frame is being followed, with testing and observation of a large number of possibilities in the farmer's fields, followed by a narrowing of the options to those which appear to have some chance of success, and then putting these practices into packages which can be tested more widely and then disseminated through DAFS.

Project Inputs (D-1):

(a). AID

Technical assistance team: As described in other sections of this report, the contractor has carefully selected an unusually high quality group of professional persons for posting to the ATIP. These individuals are committed to the specific goals and objectives of the project and are performing extremely well in their roles. Emphasis has been placed on African experience in selecting technicians for the project, and this has paid dividends in enabling team members to begin work immediately on assigned responsibilities. The usual period of adjustment required by the professional taking a first assignment overseas has been avoided. It was obvious from contacts with the team member families that adjustment to a new culture and unusual living conditions has been handled with very little difficulty. Arrival of technicians at post has been largely on schedule. The only member who has not been recruited for the team is the seed production specialist, and the reasons for this were given above. Further, that specialist lies outside the USAID/MIAC contract. The team was recruited and oriented according to the schedule in the contract, and every member of the initial team who has completed the contract has asked to extend for further time in the ATIP.

Commodities: Equipment required to supplement that supplied by the GOB has been provided, but with the usual delays caused by bureaucratic procedures and shipping distance. Acquisition of microcomputers has facilitated processing/writing and summarizing data which has improved the productivity of the ATIP team at all three project locations. The seed equipment has not been purchased for the reasons given above; other agricultural inputs as required by the team, as well as micro computers and other incidental items have been purchased according to the plan and the budget.

Vehicles: Two additional vehicles were purchased by USAID/B from project funds outside the contract.

Consultants: The selection of short term consultants has been good, evidencing response to a need to provide special assistance in areas where expertise or time was not available among the resident professional staff. There have been roughly nine person months of short term consultants utilized by the project to date of the 55 person months in the budget and project paper. These specialists have come in for specific purposes with the ATIP, and are listed in detail in the accompanying Table 2.

Recommendation:
It is recommended that more use be made of consultants when there is a specific need in the project. For example, the lack of local backstopping for the rural sociologist can be achieved through the use of consultants. Selection of consultants must be coordinated through the COP, as well as approved by the GOB and USAID/B. The COP might want to utilize the FSSP roster to provide short lists of available consultants with appropriate expertise and experience.

Batswana Training (long-term): Sixteen person-years of long-term training of the twenty-two indicated in the project paper have been committed . Six participants left for overseas long-term training in 1983. Two of the six are studying for M.S. degrees and four are working toward B.S. degrees. Of the participants, two each were sent from DAR, DPS, and DAFS. The project is two person years ahead of the planned training objective. There is concern that the levels of training planned are not sufficient to train the people necessary to fill all the counterpart positions with persons who can do a professional job in the field and help to effect the institutionalization which is so critical to future program functioning within government agencies. An additional 64 person-years of long term training will be needed to adequately prepare appropriate numbers of Batswana to assist with institutionalization. If effected this would require a minimum of five additional project years.

Recommendation:
Additional person years of long-term training be added to the current contract and included in any project extension that is negotiated.

Batswana Training (short-term): Numerous individuals have received short-term training in the U.S. at special courses as well as workshops in third countries. Ten persons received a two week course on Apple IIe micro computers in Botswana. A good example of in-country training is the on-farm storage short course planned for September of this year. Leadership in this course will be given by the recently appointed MOA post-harvest officer, who will have received his training at Kansas State University/USAID's Food and Feed Grain Institute short course on grain storage and marketing. Invited to attend this course will be regional CPO's and warehousemen from BAMB and the cooperatives.

Recommendations:
Short-term training of counterparts and other MOA personnel should continue to be integrated into yearly plans of work.

4/X

(b). Government of Botswana (GOB):

Counterparts: Most of the GOB counterparts have been assigned to the project, coming from established posts in DAR. One notable exception is the social scientist who is just joining the project in August of this year. Some of the positions have been empty when counterparts have been sent for advanced training to the U.S., and there has been a delay in naming replacements. In general, DAR, DAFS and DPS are to be complemented in providing these motivated young technicians.

Vehicles: Most vehicles for project personnel are provided by the GOB. In our discussions with ATIP personnel we gained the impression that transportation was not a problem.

Batswana Training: The positions to be provided by the GOB to support this project have not all materialized. Funding of participants by the GOB is not scheduled to occur until 1987. It is understood that GOB funds for training are scarce, but it is assumed that funding by the GOB will be accomplished as now scheduled in 1987. The fact that there is a limited training budget in the MOA, and that these positions must be spread over a number of departments, makes it difficult for the government to fulfill this obligation according to the original schedule.

Housing:
The GOB has provided the housing for technicians.

Technicians/enumerators:
Through the DAFS, GOB has provided all but two of the village level T-4s and about half of the enumerators.

Recommendation:
The GOB should continue in its efforts to provide the personnel necessary for adequate project implementation. The GOB and USAID/B should work out an implementation plan for the GOB portion of the long-term training.

TABLE 2.

SHORT TERM CONSULTANTS TO ATIP

NAME	DISCIPLINE/POSITION	ARRIVAL	DEPARTURE
J.Sjo	Ag Econ	9/9/82	10/4/82
M.Collinson	Ag Econ	10/17/82	10/20/82
C.Lightfoot	Agronomy	11/1/82	11/26/82
J.Jorns	Campus Coordinator(KSU)	10/30/82	11/12/82
A.Barnaby	Microcomputers	3/8/83	5/1/83
G.Hamm	Agronomy (Dept. Head)	3/27/84	4/12/84
R.Johnson	Extension	5/6/84	7/3/84
S.Miller	Microcomputers	5/1/84	5/15/84
D.Rees	Soils	6/84	Selected days
J.Sinclair	Soils	7/84	Selected days

In addition to the above consultancies, Dr. D. Acker, president of KSU, visited Botswana in the early stages of the Project. Dr. J. Dunbar, Dean of Agriculture at KSU also made an executive visit to the project in March, 1984.

I.F.1. Balance of Emphasis in Project: Cropping and Livestock Systems

The principal focus of the ATIP is on increasing agricultural productivity and improving incomes for limited resource farmers in Botswana. These farmers are defined as those having between one and ten hectares of arable land and 40 or fewer head of cattle. There are undoubtedly more practices that can be measurably improved on the cultivated land than is possible with livestock, although this is clearly a livestock-driven system. Acquisition of livestock, rather than crop production seems to be the primary goal of small farm families. Indeed, livestock activities and off-farm work often subsidize crop production, particularly in drought years. Under the conditions of livestock management in Botswana, it is difficult to determine exactly what deficiencies could be corrected by improved practices on an individual level. This complicates the application of FSR methods in diagnosing problems and attempting to find solutions. Even so, the need for including livestock owners in the scope of work of the ATIP is logical, since all recommendation domains determined through the surveys include livestock as a part of the total farming systems. These farmers have cattle, goats, chickens, and donkeys, either some or all of these species. The areas where livestock and crops impinge on each other are particularly appropriate areas for FSR analysis. An addition to traditional thought about the farming system contributed by ATIP is explicit consideration of the importance of the "minor" animals - goats and sheep - to the limited-resource farmers with whom ATIP is working.

Oxen and donkeys are used for draft purposes. These should be a principal focus for FSAR because the condition or strength of these animals at planting time is critical for arable agriculture. Since most of the farmers use oxen or donkeys for plowing, it is important that some means be found to maintain the condition of the animals before and through the planting season. Farmer's concerns, in contrast, may be related to increasing herd size.

Because of the need for healthy and strong livestock on the small farm at planting time, the project should attempt to introduce practices which will assure a healthy condition in the animals at this critical time of the year. However, as of yet, farmers in the project have evidenced little selective concern for their draft animals. Farmer's interests are herd oriented, with agriculture one of several supplemental activities.

Low-resource management strategies characterize both animal and crop strategies of small farm families. Because cropping is problematic, and because government policies de facto favor the cattle sub-sector, emphasis on cropping is proportionally greater in ATIP in order to balance the current situation. Emphasis on crops is also practical, as livestock intervention strategies generally involve pasture management and must take place at a group rather than on individual farm family level.

The animal husbandry specialist on the FSR team in Francistown is working with the Regional Livestock Officer and ALDEP livestock specialists in testing a simple supplemental mineral and salt mix fed to all livestock on the farm (cattle, goats, donkeys). This is

one of the potentially appropriate individual level interventions. There is evidence based on earlier tests inthe area that cattle having access to a mineral mix produce more calves and are heavier at the end of a trial period. This improved condition of the animals also appears to make them more tolerant to a period of drought and reduced feed supply. The mineral supplement may also cut down on botulism, a disease caused by phosphorous-deficient cattle licking cattle bones as a self-sought supplement.

Planned tests in the animal area include draft management for early plowing, improved harnesses and yokes for draft animals, adequate drinking water for working animals, and crop residue and forage preservation. These tests must be carefully evaluated for their competition for farmer resources with arable agriculture and on- and off-farm income generation activities. Their relation to herd increase versus crop increase must be carefully evaluated from the farm families' points of view.

These animal trials are consistent with needed improved practices and are appropriate for farmers with limited resources. Measurement of results of the tests will be difficult because of rather primitive management conditions and many confounding factors, but some positive changes should result.

The dedication of the livestock specialist at Francistown and his interest in the people and their activities on more than 60 farms, -- working with 29 goat herds, 13 cattle herds and 12 donkey herds, in the two project areas were noted by the team. This close communication with a large sample of farmers helps the team to better understand the livestock component of the total farming system, and especially how the condition of animals can affect the success of the crop production activities.

Recommendation:
ATIP should continue its present research concern of the linkages between the animal and crop systems. This includes the direct contribution of cattle and donkeys as draft animals, as well as the indirect contributions of goats and other small stock to the cropping systems through the provision of cash. Conflicting labor demands of herding versus crop raising need to continue to be examined, as well as methods of limited resource farmers in preventing animal damage to crops.

II.B.1 Identification of Problems and Opportunities in the Context of Botswana Farmers

The conditions in Botswana for arable agriculture are historically difficult and unpredictable. The experience of the ATIP teams during the first two years in the field has been quite representative of those conditions. Rainfall has been sparse and unpredictable, making planting difficult and harvesting a crop almost impossible. Attempting to work with scarce resources -- particularly limited traction power that is the key to capturing moisture with timely plowing and planting -- has helped the team fine-tune their appreciation and documentation of the high risk conditions that define the situation of the Batswana small farmers.

45X

The team has been outstanding in the two years in the field (one year for the Francistown team) in specifying the constraints which the small farmers face within their complex and uncertain farming systems and the relatively small areas within which technological innovations are possible. They have come to the conclusion that they must focus on resolving bottlenecks in the production process, rather than taking advantage of the flexibility which usually exists in small-holder agricultural systems. Such flexibility is almost non-existent under rainfed conditions in Botswana.

In Botswana almost all agricultural activities revolve around unpredictable rainfall. Plowing, planting and weeding may all have to be carried out in the relatively short time when the ground is wet, requiring more labor than is normally available, followed predictably by periods when little labor can be utlitized. Such conditions require different solutions than when there is a longer period of time for each activity to be carried out sequentially.

While the drought has been poor for production and for demonstrating agricultural technology innovations, it has contributed to the researchers' appreciation of the restrictive parameters under which the small farmer operates. It has helped them identify the multitude of problems and the limited number of opportunities as a series of decisions relating farmer to potential technological innovation. They have been careful to separate constraint from perceived problem and from problem solution, which has allowed them to adjust their constraint identification and their methodology during the course of the research project.

Farmer Problem Identification:
In order to identify problems which are relevant to farm families, the project has employed all but the final stage of the four traditional stages of FSR: descriptive/diagnostic, design, testing, and demonstration.

Starting with the exploratory survey in the diagnostic stage, the teams began by narrowing down the total number of problems identified by the sampled farmers into those which seemed to be researchable and those which were outside of the purview of agricultural research. For the former, trials were designed for farm implementation. For the latter, those which were considered most important formed the basis of the follow-up diagnostic survey, the MVRU (Multiple Visit Resource Utilization Survey). This second step in diagnosis has occupied the majority of the time of both the Mahalapye and Francistown agricultural economists.

The MVRU has also led to a third step in the diagnostic stage, namely single-purpose (or focus) surveys. These surveys are designed explicitly to fine-tune or elaborate upon certain areas identified as significant farm family problems. Examples of such surveys include (1) cropping plans, (2) institution's services and infrastructure, and (3) farmer decision studies in the Central Agricultural Region. More general surveys include (1) agricultural marketing study and (2) livestock and agronomic activities in the Francistown Agricultural Region. A complete listing of such surveys, is found in the Annual Reports of the project.

In addition to the socio-economic surveys, agronomic and livestock trials were planned and carried out in both agricultural regions. The design of these trials utilized the FSR approach to trial design: the use of interdisciplinary team meetings and the utilization of survey information. That such trials address problems considered serious by farmers was obvious to the evaluation team. It is still too early to detect if such trials address the most limiting constraint faced by farmers in the regions, but the teams are not content with their first round of trials to wait to find out.

Instead, both teams have designed second generation FSR trials which address in more depth many of the issues identified as original problems. Whereas the original surveys identified the major problem of stand establishment as extremely serious, both Mahalapye and Francistown FSR teams have designed farm trials to address many of the major components which influence stand establishment under low rainfall, rain-fed conditions. Examples of such trials include (1) ridge plowing, (2) steps in weed control, (3) replanting, and (4) overseeding/thinning in Mahalapye. Other examples are (1) planting strategy, (2) maximum production, and (3) steps in technology in Francistown. The complete listing of these farm trials is found in the Annual Reports.

To date, the project has identified a large range of farmer-identified problems. In fact, it is the opinion of the evaluation team that one of the primary problems the project faces is setting research priorities and not overloading the MIAC and GOB team members in the ATIP.

Farmer Opportunities Identification:

The arable crop opportunities of the Batswana are probably as limited, if not more limited, than those to be found in any comparable FSR project country. Both the uneven distribution of such rainfall and the propensity of serious drought make arable cropping opportunities severely limited. In fact, since 1979, there have been three severe drought cropping years in Botswana (1979-80, 1982-83 and 1983-84) out of a total of five cropping years. During 1982-83, national production of all basic grains were only about 20% of normal.

Given the very limited ecological buffer Batswana farmers have in cropping, and the good agricultural research history of DAR, it is intuitively obvious that there is not a large range of cropping opportunities waiting to be discovered. However, the project will be developing and offering cropping alternatives to Batswana which are specifically designed to address the most serious cropping problems of the farmer which are in turn amenable to agricultural research.

After the second year of FSAR in Mahalapye and the first year of FSAR in Francistown, it would normally be considered too early to have progressed to the demonstration stage in any given FSR project. Given the fact that the number of fields harvested in Mahalapye in 1982-83 was zero and that the number of harvested fields in both locations in 1983-84 was less than 25% of those

planted, it is impossible and totally unrealistic to expect results from these trials to be ready for dissemination to a larger population of farmers. However, it is the opinion of the evaluation team that each FSR team is doing all that it can to address the cropping problems of their respective farmer clientele through a series of agronomic, on-farm trials which are all designed to help identify, create and fine-tune new cropping opportunities to fit into the drought-induced risk-averse cropping strategies of the farming population. Hopefully some of these trials will result in alternatives which will allow these farmers better opportunities in the future.

Recommendations:
The ATIP teams should continue development of FSR methodologies appropriate for very high risk arable agriculture. Future evaluations should keep in mind the methodological innovations necessary in the research process, as well as in the technology itself.

II.B.2 Development of a Research Base, including Collecting, Assembling, and Managing Data

Development of a research base is a long-term process. In the context of dryland agriculture in Botswana, this task is easier because of the amount of information which has been developed by the experiment stations and from surveys which have been done with farmers in most regions of the country. There is always concern about the relevance of the research and the relevance of the data which has been collected. Nevertheless, there is a sound base on which to build, and the ATIP team has begun to sort out the technology and recommendations which appear to be appropriate for the conditions of the resource-poor farmers of the project villages, along with those which are more suited for the regions of better soils and rainfall.

Within the project, the team has begun to establish a long-term plan for research. This consists of testing some of the recommendations which appear to have merit under the climatic regime of the project villages. These include (1) early plowing, (2) double plowing, (3) use of seeders as an alternative to broadcast and plowing in the seed, (4) recommended varieties of sorghum, millet, and cowpea, and (5) low levels of phosphorus fertilizer. In response to the surveys in the villages on farming practices and constraints to production, the team is designing new alternative technologies which appear to meet some of the perceived problems which the farmers have identified, and which appear to the team to be consistent with the goals and resource bases of the small farms. The practices being tested include a better understanding of the role of animals in the total farming system, exchange relations that both facilitate and impinge on the farming system, labor availability and timing in relation to other activities outside the arable cropping work, the resource base of the farmer, and the climatic reality of the unpredictable onset, distribution, and total amount of rainfall.

The methodology of data collection, assembly, and management appears to be sound, although there is a need for introducing more qualitative methodologies in the areas of decision making, exchange relationship and understanding why the farmer does what he or she does within the social contexts of village and kin.

The team is in the early stages of testing these alternative technologies on farmers' fields. There is a large amount of data from the surveys, and a more limited amount coming in so far from the actual agronomic trials. The arrival of the microcomputers for the two field sites and two units at the project office in Sebele allows the team and support persons to quickly enter and process information so that the data can be used to make decisions for the next cropping year. This is a tremendous advantage to this project. The USAID Mission and contractor are both to be complemented on their support for this innovative initiative by the team. Other FSR teams in Botswana reported great interest in the use of micros and desire to learn from and apply the ATIP experience. These relatively inexpensive and portable data and word processing machines can easily be brought to the most remote station which has reliable electricity. This is a part of any methodology which can be offered developing countries. It is especially important to FSAR because of the quantity and complexity of data being collected and the need to process these data rapidly before the onset of the rains and the beginning of the next cropping season. This is a technology potential which should not be lost on research scientists from the MOA who are working directly with the FSR team. Acquiring more microcomputers for field use may be necessary to insure that counterparts can fully learn to utilize them.

In most parts of the world, the collection of data is relatively efficient, but the processing and interpretation of this data to help plan for the next research cycle is sadly behind what is possible today, given existing technology. ATIP may find a way to integrate more closely with current Botswana research projects by offering access to this processing capability and by teaching colleagues the benefits of this type of data handling and analysis. The micro computer course offered by a project consultant is an example of such a service. Once again, the acquisition of more equipment may be necessary for this to take place.

The review team sees no problems in the current orientation and implementation of the research base development. In fact, the COP and team are to be complimented on their efficiency and breadth of vision in getting this part of the field activity organized and functioning as quickly and as well as they have under extremely difficult environmental conditions. However, during the next stage of understanding farmers' response to the environment and technology recommendation, the planned sociological input will be an important methodological addition.

Recommendation:
More qualitative methodology needs to be introduced in such areas as group processes, decision making, and exchange relationships. The microcomputer analysis of field data is a methodological technique that should continue to be perfected and shared with other FSR teams. Appropriate equipment should continue to be made available to facilitate such analysis.

49X

II.B.3 Disaggregation of Data for Identifying Recommendation Domains and Measuring Project Impact

(a) Identification of Recommendation Domains:

The basic diagnostic tool of the project to date has been the MVRU survey. The survey document itself is 8 pages long and is supplemented with 14 individual data sheets. The topics covered by the supplemental sheets are included as Attachment D.

In general, the informal data collected during the exploratory surveys during the first few weeks of each team's presence in either Mahalapye or Francistown provided the basis for selecting the initial recommendation domains (RD) which, in the beginning, were discrete villages. This type of data (from exploratory surveys) is seldom analyzed beyond its practical use for RD definition, unless the FSR team has no plans to initiate a further diagnostic survey. In Botswana, both teams have been using the MVRU survey as a follow-up to the exploratory surveys.

The detail provided by the MVRUs has allowed each team to begin the process of RD refinement: within each village (initial RD), additional RDs can be defined based upon the availability of, or access to, draft power on a timely basis, or on relative household wealth, or both. The MVRU allows each team to account for the proportion of income generated by off- as well as on-farm activities. This can allow disaggregation into either part- versus full-time farm households or, as has been obvious during the last two drought years, into families which are dependent upon the GOB drought relief project to maintain subsistence and those which are relatively independent of such a program.

The evaluation team wishes both the FSAR teams and USAID/B to know that it views the evolutionary refinement of RDs at early stages of an FSR project as a necessary part of standard FSR practice. So often, projects do not bother to refine or redefine their RDs in terms of farmer realities revealed after the exploratory survey. In such situations, a given set of farm trials may not give consistent results -- with consistent results being the major prerequisite for the final FSR stage of demonstration and dissemination -- because they are conducted within a RD which is too heterogeneous. This leads to conflicting results and the lack of ability to extrapolate to large segments of the farming population. The evaluation team would further like to compliment both FSAR teams for their well thought out attempts to refine their initial RDs using both farm trial results and the MVRU.

(b) Project Impact:

While it is too early to use either trial or survey data to judge project impact on production -- if such an impact can be a rational expectation for a FSR project -- the evaluation team feels that there is no doubt that the correct data measurements are being taken to allow such a determination at a later date. Use of either the intensively-monitored farm trials or the MVRU survey would allow measurement of crop yield changes over time. The MVRU will be phased out at some point during the project life. If such data

were required at a later date for comparison with similar data collected during the past two years, either the MVRU or a shorter form thereof would have to be administered again would have to be administered again to allow such comparisons to be made. The same may or may not be true of the farm trials, depending on whether or not one of the treatments used later in the project corresponds exactly to a treatment used during the first two years of the project.

A much larger issue is the appropriateness of such measurement in the first place. Given (a) the incredibly low average annual crop yields in Botswana and (b) the cyclical nature of droughts, apparent success of any agricultural production project depends almost entirely upon when that project begins and when it ends. For example, a project which happens to begin at or near the end of the "normal" rainfall cycle, and which adds 10% to the average production of a given crop or system, will have its tangible results totally dominated by the drought which follows: crop production may fall by 82% instead of by 83%, a difference which is impossible to attribute statistically to the impact of the project. On the other hand, a project which begins during or near the end of a drought will have little or no statistically measurable impact during its initial years but could have a large statistical impact during the subsequent "normal" cropping years. Again, however, it may be very difficult to differentiate between the effect of the project and the overall effect of the environment unless the original farmer check plots are maintained throughout the life of the project.

For these reasons, the evaluation team urges the project to maintain, as nearly as possible, the original farmer check plots in at least one trial series as they proceed. This may not be easy if the project encounters marked success and most, if not all, farm households adopt their recommendations. In such a situation, the team may have to choose between subsidizing the farm households in kind if the retained check plots yield less than what are now the new farmer practices, or in depending upon a series of relative yield difference measures in the testing stage coupled with estimates of both (a) the proportion of farm households and (b) the proportion of arable crop land dedicated to the recommended practices.

Recommendations:
The RDs should continue to be refined. and the rationale behind them explained to DAFS staff. Multiple methodologies are needed to contribute to that refinement. The field teams should go to major efforts to maintain the original farmer check plots in at least one trial series, including considering subsidizing the maintenance of that check plot.

II.C.1 Planning, Implementation, and Analysis of On-Farm Research

(a) Planning of On-farm Research:

The initial amount of planning which went into this FSR project was quite large. Such planning was exhibited in several ways, not the least of which was allowing the contractor sufficient time and

51X

leeway to recommend the team members he felt were best for the overall project. This differs from some project contractors who feel forced by a time constraint into selecting second and third choices to put together FSR teams. AID in general should be extremely pleased that in this case the contractor assembled the best possible team.

Planning within teams in Mahalapye and Francistown -- once those sites had been selected -- was quite adequate. Joint planning among the teams at the current time seems to be an area where more concentrated effort is needed. While the divergence of trial and survey specifics at the two sites has been cited as a strength of the project, methodological homogeneity is still a very desirable goal of the project. There are obviously different ways to achieve this goal, but overall project concensus is still an extremely important part of the implementation process. The COP and several team members have expressed their individual concerns along this line. They agree that a more routine schedule of inter-team meetings would be highly beneficial to the project. This will be particularly necessary when the sociological component is added.

(b) Implementation of On-Farm Research:

In reviewing the implementation of this project, the evaluation team has tried to separate this issue from that of the two-year drought. This is not always an easy task.

Overall, the implementation of this project has been much superior to most FSR projects which evaluation team members have observed or evaluated. The technical implementation of this project to date has been second to no other FSR project. This is demonstrated by the development and evolution of the socioeconomic, agronomic and livestock methodologies which explicitly account for the subtle yet highly important differences between the two areas surrounding Mahalapye and Francistown. The addition of the sociological component should improve the fine-tuning which has taken place.

Development of the necessary social implementation -- as demonstrated by a growing feeling of esprit de corps among all team members and an increased willingness to work together and to discuss joint strategy -- has been outstanding. This is one area where project team members are currently making great strides toward team-building.

Administrative project implementation, as demonstrated by the relationships between the project in Botswana, USAID/B, MOA/GOB and MIAC, has been relatively impressive. While this project is certainly not free of differences of opinions concerning some administrative areas, these areas seem to be more important to those closely associated with the project than they do to the evaluation team. No similar USAID-financed FSR project which has recently been evaluated has escaped the administrative bottlenecks -- some real and some perceived.

(c) Analysis of On-farm Research:

(1) Socioeconomic data collection:
With the exception of the exploratory surveys, systematic socioeconomic data have been collected through the MVRU survey for nearly two years in Mahalapye and for nearly one year in Francistown. While the 1983-84 data have not been totally analyzed by either team, most of the 1982-83 data have been and such analysis has led to a significant refocusing of efforts of the socioeconomic team members. Such analyses have also assisted the nonsocial scientists on the teams to determine what types of agronomic or livestock issues need exploring, or which to continue. The availability of micro computers at both sites, as well as at the Sebele station, has contributed enormously to the prompt turn-around of data analyses which is so necessary for projects of this type. The data gathering thus far has been to a degree limited by survey research techniques and minimum enumerator skills. To date, this has not been a serious limitation. However, as the project proceeds, better enumerator training and the implementation of more varied methodologies will be necessary. The addition of the sociological component is therefore opportune.

Both FSR teams will be placing less and less emphasis in the future on the type of systematic data collection and analysis typified by the MVRU, with more emphasis being placed upon gathering data on specifically-identified problem areas (e.g. special plot monitoring, whole field monitoring and livestock practices in the agronomic and livestock areas, and village characteristics, farmer decision studies, and study of institutional arrangements in the socioeconomic area).

(2) Agro-livestock analyses:
Few of the agronomic trials were harvested from either the 1982-83 or the 1983-84 cropping seasons. There is no way to statistically compare team technological innovations with those of the farmer at this point in the project. Nor has either team attempted to do so. There are indications that some of the technological innovations being tested by the teams may indeed be superior to the local practices, but systematic yield data will have to confirm these indications in subsequent seasons. In addition, formal or informal socioeconomic observations as to the economic viability and cultural acceptability of these practices must accompany the field verifications of agronomic superiority.

The livestock strategy -- feeding supplemental minerals to enable animals to better utilize scarce feed supplies during the dry season and to enable those animals involved in providing draft power to enter the cropping season in better condition to provide such power -- may or may not be the most appropriate livestock improvement strategy in the two areas. However, it is viewed by the livestock expert as a good entry into the whole area of crop-livestock interaction, as well as being viewed as a systematic way of being able to observe the needs of the livestock sector to help focus on the serious problem of lack of sufficient feed at the end of the dry season.

One of the most difficult things to do is to measure the short-run impact of this type of livestock field research. Typical measurements -- such as fecundity increases, weight gains, increased milk production, better animal health, etc. -- are very difficult to quantify in the typical Botswana farm situation. This is especially true when the project is working in both FSR areas with 61 herds on 42 different farms.

A major methodological question raised by the feeding of supplemental minerals is cost. Currently, such supplements are available only in 50 kg bags -- enough to last the typical farm household for approximately one year were deterioration of the product not more rapid than this -- a classic case of the dilemma of lumpy input purchases. The project has been providing the supplements to the farmers so far, but cannot continue to do so for this part of the project to have lasting impact. The project livestock specialist has speculated about assisting a cooperative in the Francistown area with the idea of purchasing such bags, breaking them down into 5kg portions, and reselling the mineral supplements to farmers of the area.

Recommendations:
More effort should be given to joint planning of on-farm research by the two field tems. More routine inter-team meetings should be scheduled. It is recommended that the project dedicate a minimum of two working days per quarter to joint meetings chiefly dedicated to discussion of FSR state-of-the-art issues and methodological nuts-and-bolts and theoretical issues specifically related to the project. Such meetings should be attended by MIAC and GOB counterpart staff, as well as the COP. Data gathering techniques should be expanded and enumerator training intensified in the socio-economic data collection. Continued efforts should be made to relate the data collected in one aspect of the project to that collected in other aspects. More efforts should be given to finding a farmer-validated measure of success of livestock interventions.

II.D.1 Relevance of Project Results to Small Farmers

There is a strong expectation by USAID/B and those in the experiment station that this type of field research and development activity will lead to results which will be relevant to the problems of the small or limited resource farmer. With a direct access to the farmer on a regular basis, with surveys to assess what is happening on the farm and why, and with trials and demonstrations under the conditions of the small farm, this project is critically situated to begin to elucidate results which lead to recommendations of appropriate technology for the limited resource farmer. Several items were discussed previously in the section on appropriate technology and the experiment stations. It is hoped that the joint activities of the stations and the ATIP can lead to procedures which sort out those high-technology and high-input interventions which are completely inappropriate for the small farmer. The same procedure could be expected to lead to identification of alternative technologies which are better suited to low-input and sustainable cropping and animal-integrated systems.

24

The approach currently followed by the ATIP teams starts with diagnosis of production constraints and leads to formulation of hypotheses about alternative solutions to these constraints. This approach should provide a better opportunity to consider a range of technological alternatives. The traditional reliance on conventional farming wisdom, often gained from experience on large farms and high-technology agriculture, has brought solutions to the farmer which were more often appropriate to better environmental conditions and higher levels of resources and inputs. This approach is not appropriate for most farmers in a high-risk region such as Botswana. The review team was convinced during travel in the project zone and discussions with farmers that these traditional recommendations from the stations are not appropriate for an agricultural system which is highly dependent on, and integrated with animal raising, is based on planting methods and strategies to minimize risk, and is probably rather well developed with respect to the constraints which the farmer perceives within his or her environment.

There are two parts to the strategy of developing relevant and appropriate technologies for these farmers through the efforts of the ATIP. First is the specific research on components of technology and cropping systems which the team will develop through the FSAR in project villages and cooperative trials on the fields of cooperators. The second is the range of trials which may be generated in collaboration with station research staff, both on the station and on farms, which will begin to illustrate to the station staff the benefits of direct collaboration with farmers and this type of FSAR team. This cooperative effort is one which can lead to benefits for researchers in the stations, as well as those on the team. More important is the benefit to the Motswana farmer.

Recommendations:
ATIP continue to test existent component technology on farmers' fields and continue learning from farmers why they do what they do at each stage in the farming process.

I.E.1 Consistency of Project Activities with National Policy Goals

ATIP was designed and the project paper written in 1981 to fit into Botswana's Fifth National Development Plan (NDP V, 1979/80 - 1984/85). The principal objective of NDP V is to increase employment opportunities and income, particularly for the large portion of the population outside the formal sector. The plan emphasizes rural development to increase employment and incomes.

The design and extension of appropriate agricultural technology that meets the felt needs of the Motswana farmer and leads to increased production, decreased underemployment, and more resources at the local level could provide a key input toward achieving GOB policy goals as outlined in the NDP V. While extension is in place, and some research is being carried out, in the past the emphasis of both research and extension has been oriented toward the livestock sector, particularly cattle. A number of the cultural practice innovations offered by extension to small farmers have been

"standard recommendations" for over fifteen years, yet have not been adopted, nor even successfully demonstrated. There appears to be a real need to test current recommendations in farmers' fields under their conditions, and if necessary to develop new technology more adapted to the high risk, unpredictable climatic conditions prevalent in most areas where communal lands and small farms are located.

Policy in Botswana until NDP V also favored livestock production (particularly cattle) over crop production. This is in part because the traditions of the people have equated cattle ownership with prestige. There has not been a strong tradition among most Batswana of arable agriculture; instead, it has been carried out as a supplementary activity to livestock production.

Price policy, for example, has been more favorable to cattle than to crops. The whole development of the Botswana Agricultural Marketing Board (BAMB) and the parastatal abattoir (slaughter facility) have undergirded the development of beef as a major export. Quotas to South Africa and the EEC have guaranteed markets and price for cattle raisers -- if disease does not lead their major markets to impose a quarantine on their products. Thus the government has subsidized vaccines for hoof and mouth disease, blackquarter, anthrax and brucellosis, which are applied by Animal Production Officers (APOs). Dosing and dipping of livestock against parasite infestations are also subsidized. Although not universally accepted, these practices have increased the growth rate of the cattle herds and helped keep the market channels open. Despite animal health and market stimuli for cattle production, which have resulted from concrete policy decisions based on the foreign exchange they generate, the off-take rate for cattle among traditional producers is low.

In addition, stimulation of cattle production has resulted in further skewing of income distribution within the country, disadvantaging resource-limited farmers in general and households headed by women in particular. Increased stock production related to both cattle and goats may have serious evironmental implications as well, although there has been no policy decision to limit access to grazing lands or to limit herd size. Finally, the investment choice of small producers of cattle over crops has not been systematically examined as a policy issue.

Other pre-existing policies mitigate against small farmer investment in arable agriculture over livestock, and thus limit the adoption of recommended technology It is difficult to guarantee remunerative prices for local grain producers. BAMB has fixed producer prices at a level competitive with those in South Africa to avoid illegal marketing across the border. While this is a direct disincentive for the market responsive farmer, it also may be a disincentive for the subsistence producer, who may calculate that he or she can buy grain more cheaply than grow it, particularly given the opportunity costs of labor and capital. To date, those opportunity costs have not been measured.

The main GOB vehicle for stimulating crop production and rural development is the Arable Lands Development Program (ALDEP). The objectives of ALDEP are (1) to approach self-sufficiency in basic

grains and legumes, (2) to raise small holder incomes, (3) to create employment in rural areas, and (4) to slow rural to urban migration. ALDEP employs a two pronged strategy: first, to promote production-oriented activities which are expected to have a positive impact on crop output, incomes, and employment (i.e. improving input delivery, agricultural credit, extension and marketing); second, to implement infrastructure improvement such as the construction of wells, small dams, fencing, and farm to market roads.

ALDEP utilizes and builds upon existing institutions such as the Agricultural Extension Serivce, BAMB, and the cooperative movement. BAMB and the cooperative movement are developing marketing and input supply points nearer to farming communities. Selected inputs are being subsidized in combination with small holder credit administered by the National Development Bank. Cost sharing is available for draft power, planters, and cultivators. Cost sharing grants, including sweat equity as the farmer's contribution to stump removal projects, are available for such farm improvements as water catchment tanks and fencing of fields.

ATIP could make some important inputs into ALDEP and other GOB programs to strengthen rural areas by 1) determining the appropriateness of the technology extension recommends and ALDEP funds; 2) developing more appropriate technologies to be distributed through those channels by more closely linking research and extension; 3) devising methods of demonstrating those appropriate technologies; and 4) determining the impact of existing ALDEP strategies on farmer behavior and crop production to see if they indeed encourage farmers to invest more time, energy and capital in their operations. While ATIP is linked directly to ALDEP in Francistown, efforts should be made to increase linkages at higher levels within MOA in order that ATIP can assist the MOA as it fine-tunes ALDEP implementation.

An additional area where ATIP could have policy relevance is the link between cattle and crop production. EEC has recently banned all meat containing tapeworm - a parasite whose presence is rapidly increasing in Botswana beef. The BMC will penalize producers 50% in price for tapeworm infested meat. Because tapeworm presence is related to management practices, this ruling will differentially impact the small farmer. Its impact needs to be traced and preventative techniques feasible for small farmers to utilize need to be developed.

ATIP seems firmly within National Policy goals. Arable agriculture will continue to be emphasized in the Sixth National Development Plan, although irrigated agricultural projects will receive special emphasis. The spillover effects of more closely united research and extension oriented to the small farmers should serve to make small farms more productive and increase the desirability and possibility of rural living. If improved crop production does occur, and increased incomes are the result, research in other countries suggests that employment and income generation in rural areas will also increase. Indeed, Mellor's work at IFPRI gives empirical

evidence that the best way to generate rural non-farm income is to increase the production and income of the small and medium land holders. Such increase in employment, income, and equity are squarely within stated GOB policy goals.

Recommendation:
Formal linkages should be established between ATIP and ALDEP. A liaison within DPS/MOA be appointed to coordinate policy-tuning research questions with all FSR projects, including ATIP.

II.F.1 Project Emphasis on Agricultural Policy Considerations and Recommended Changes

As discussed in Section E, ATIP has an important potential for helping GOB achieve National Policy goals by specifying the linkages between policy, implementation, and practice. To do this satisfactorily, however, greater attention must be paid to identifying potential policy issues or decision points and link those decision points explicitly to field work. For example, does ALDEP's subsidy for acquiring draft power increase its timely availability for scarce resource farmers? Or does it tend to increase the price of donkeys and oxen, maintaining the current draft power distribution and limited access to timely plowing? Which groups of RD farmers most utilize which parts of the ALDEP program? By specifically seeking the answers to these questions, which farming systems projects such as ATIP are able to do, ALDEP goals and ALDEP strategies could be more tightly joined.

The same is true for other institutions the GOB has designed to serve the needs of small farmers. Decisions are made concerning the types of technology to be stressed by ADs and the type of training ADs need. ATIP, if properly linked and focused toward addressing these problems, could serve an important policy function. Coordination with the farm management surveys and other FSR projects could heighten the utility of that function.

Other macro policies, such as differential pricing, rural interest rates, degree of subsidized credit, grazing limitations, and others could conceivably be addressed through a farming systems approach to policy. In a scarce resource situation, such attention would certainly seem warranted. Attention to policy issues might also prove to be crucial in showing the utility of a farming systems approach to research and extension.

Not only would a shift to a greater policy emphasis require input and liaison with the MOA, it may require some reallocation of the COP's time. Major administrative housekeeping issues have been overcome now that the project is established. This should mean less COP time and energy will be devoted to administrative issues in the future.

While many of the constraints to increased production are endogenous, and the emphasis on agronomic research must remain strong, adoption of any technological improvement depends on the motivation of the farmer to invest the resources necessary for its implementation. Policy can be used to encourage or discourage such

adoption. Macro level research has given few clues as to how that process of policy impact on farmer decision making takes place. In a situation where the possibilities are limited and the linkages between policy and behavior are not clear, a farming systems approach to policy could be very beneficial. An overriding assumption which underlies this entire section is that GOB policy makers would be amenable to receiving data from ATIP researchers and using this base to consider macro policy alternatives.

Recommendations:
ATIP staff should give more attention to relating results of field trials and household surveys through proper GOB channels, when such results have policy implications. Implementation of this recommendation would require some realignment of resources and the establishment of new linkages within the MOA and with other FSR projects.

An agricultural economist from the MOA, preferably with farming systems experience, should be assigned as part of his or her regular duties, to liaison with the COP and other FSR project leaders to facilitate linkages to DPS, ALDEP, the Ministry of Finance, and other GOB policy making and implementing institutions.

III.C.1 GOB Inputs in Social Science Training and Technical Assistance

The initial project document included a provision by which the GOB was to provide social science technical assistance and training. Up to the date of the evaluation, such technical assistance and training has not been provided. Each of the field agricultural economists has some undergraduate training in anthropology and rural sociology, which has to a degree diminished the necessity of such input at project initiation. As the project matures, the need for more qualitative methodology, particularly in terms of increasing the efficient utilization and training of counterparts and enumerators, becomes more important.

The GOB has a Rural Sociology Unit within the Division of Planning and Statistics in the MOA. They are heavily involved in their own immediate research needs and have not been able to second an individual to serve in the social scientist capacity in ATIP. An individual has been named for the coming year, but he has only diploma level training, and no formal sociological or anthropological preparation, although he demonstrates interest and intelligence related to field work. He did work with two expatriate OPEX anthropologists when they were associated with the Botswana Rural Sociology Unit. Lack of disciplinary skill, plus junior status, will make meaningful sociological or anthropological input difficult.

The field projects have proceeded to the point that they have nearly exhausted the limits of discrete answer survey research in seeking answers to why farmers farm the way they do. There is a need for a continuing fulltime sociologist with the project. The field researchers have decided to expand their data gathering to focus on decision-making processes and exchange relationships -- both areas of particular methodological strength for rural sociologists and

anthropologists with advanced training and field experience. The Rural Sociology Unit, while willing to cooperate, is unable to free its master's level scientists to consistently backstop the sociology trainee. Further, the staff of the Rural Sociology Unit has no experience in the necessary methodological techniques, and could substantially benefit from training in them. To be particularly beneficial, that training should have the potential of feeding into a degree program at a later point in their career. Thus there is a definite need for systematic, consistent social science input, as anticipated in the project paper.

The seconded individual from the Rural Sociology Unit should be located in one of the two ATIP regions, although it should be recognized that he/she is more of a trainee than a co-professional with the highly skilled and experienced PhD level agricultural economists. Much more effort regarding inter-team coordination between Mahalapye and Francistown will be necessary if this individual can make an input into both teams. That coordination should include emphasis on debriefing the enumerators regarding the qualitative, village level phenomena they observed related to agriculture production. It should also include additional training of enumerators to recognize and record observations in the villages where they live with the rural sociologist working with the agricultural economists in translating such observations into data useful to furthering technology improvement in production agriculture. Examples of such observations might be the timing of migration of members of village households, beyond the ten households in the intensive sample, from lands to village, from urban or mine employment to lands and from school to lands; the frequency and intensity of village meetings, both formal and informal; the tendency of the villagers to discuss agricultural practices, animal husbandry, and other agriculturally relevant topics, particularly noting the indicators the villagers discuss among themselves as relevant in their decision making; topics discussed and interaction patterns in the Kgotla meetings; village contacts with the AD, particularly effective methodology certain ADs might use in communicating technological innovations, etc.

The rural sociologist and professional backup can help design and test consultation and feedback systems with formal and informal local village and district institutions that may be key in opinion formation and thus technology adoption. One informal institution for male farmers might be the village beer party that some see as an alternative Kgotla for the "small man" who may feel that old-timers or traditional elites dominate the village Kgotla (Gulbrandsen, 1980). Non-survey research and group-oriented qualitative research methods may be crucial in eliciting insights to guide technology development strategies.

Since the social scientist assigned to the project lacks such qualitative skills, as well as the methodological framework from which to impart them, it becomes crucial that regular discussions of sociological methods relevant to FSR be established. One method to accomplish this would be regular meetings of the agricultural economics/rural sociology project members with the head of the rural sociology unit and the consultant sociologist/anthropologist, rotating between Gabarone, Mahalapye and Francistown. When

possible, enumerators should be included. The link between data gathered, its method of analysis, and implications for agricultural technology should be stressed, with input from the rural sociologist on how to make those links more effective.

An additional mechanism to sociological input is for ATIP to give TDY assignments connected with scientist's leave plans or at the recommended professional meetings to meet with social science farming systems experts, identified by the FSSP. That additional time away from post might involve extra funds in travel and per diem while in the United States (or other countries outside Botswana).

For example, the Mahalapye based agricultural economist is to attend the Farming Systems Research and Extension Symposium October 7-10, 1984 at Kansas State University. Most of the social scientists in the United States, and many from other countries, involved in farming systems approaches to research will be there. With advance notice, particularly if accompanied by documentation of perceived methodological issues, the FSSP could arrange for consultant meetings to occur in conjunction with the Symposium. It might even be possible to link such consultancies by the agricultural economists with U.S. universities' Title XII Strengthening Grant funds to tap such sociological and anthropological expertise as exists at U.S. universities while sharing the lessons learned in the Botswana situation. The head of the Rural Sociological Unit could participate in such consultancies under an additional short term training arrangement. Short-term training funds should be made available to send the senior rual sociologist to the FS Symposium October 7-10, and contacts with FSR/E sociologists and anthropologists should be arranged then. Prior to the Symposium, the Senior Rural Sociologist should accompany the COP on one of his regular visits to Mahalapye and Francistown.

The FSSP can be used to help identify a short list of rural sociologists/anthropologists with FSR field experience and expertise in research in agricultural decision making and exchange relationships. From that pool, MOA and ATIP would jointly select an individual to come to Botswana to work with the teams and with the unit of Rural Sociology, for a series of short term consultancies from three to five months each. MIAC should investigate possible ways that research methodology courses offered by that scientist be applicable toward a degree program. The scientist should devote time both to training, utilizing in part the facilities of the FSSP, and to research, as an ad hoc member/advisor to both field teams. Batswana taking the courses should be regularly evaluated to determine their progress in the course, and a final grade assigned.

In consultation with the Rural Sociology Unit, potential trainees in rural sociology should be identified for bachelor and masters level training under ATIP, with careful selection of program and advisors to insure the greatest return to the training investment. Serious consideration should also be given to training a Motswana to advanced level in either rural sociology or applied anthropology at a carefully selected U.S. institution, perhaps under a different training mechanism.

Recommendations:

(1) A short-term consultant be assigned a series of three to five month research/training consultancies with ATIP and the Rural Sociology Unit of the MOA.

(2) Degree level training be provided by ATIP for Batswana, under ATIP auspicies, to study rural sociology or applied anthropology at carefully-selected U.S. universities.

(3) TDY of the ATIP staff should include time for interactions with anthropologists and rural sociologists with experience in FSR.

(4) The Senior Rural Sociologist be sent for short-term training in FSR methodology in conjunction with the FSR Symposium at Kansas State University October 7-10, and follow up with consultancies with FSR-experienced rural sociologists in conjunction with the FSSP.

(5) The Mahalapye agricultural economist should be given a TDY assignment to attend the same Symposium.

III.D.1 Endogenous Farm Factors including Household Labor and Off-Farm Employment, Cropping Choices and Livestock Access

An appropriate definition of the household unit that is relevant to the introduction of techology to small farmers in Botswana is difficult. The household is not spatially limited, nor does it appear to be limited by blood, legal or fictive ties. High rates of migration of households between lands and village, and household members between cattle post, mines, urban employment, and casual rural labor further complicate the defininition of the household and adequate enumeration of the household labor force. ATIP, while not solving the problem of definition nor solidly and irrefutably establishing limits for household membership -- and thus the household labor force -- seems to have done as adequate a job as any of the research reviewed to date. They have also made clear the necessity of examining the intra-household provision of resources to the farming system by different household members, whether that resource be labor, capital or land.

Differential labor provision is perhaps the easiest to measure, because it is more or less observable. Through a variety of data gathering mechanisms, the teams have made clear that, while there is a rudimentary division of agricultural labor by sex and age, it can vary tremendously. They have found that women do plow, even with oxen (although not with tractors). Only men destump and fence, although women can actively assist both activities. Women primarily weed, harvest, thresh and store, while children are particularly important in bird scaring and other labor intensive crop protection activities. The importance of children in these activities results in complicated exchange relationships between parents and grandparents, whereby the rural resident cares for the grandchildren in exchange for food, clothing, some money, and the use of the children's labor at peak production periods. The project initially attempted to measure the direct labor inputs by household members and, in response to their findings, are now carrying out the appropriate next step of looking at exchange relationships as well, focusing on labor exchanges.

Capital is another key resource that the project is attempting to disaggregate by sex. This includes direct cash transfers as well as capital subsidies in terms of such things as the use of animals. These also result in complex exchange relationships that seem to involve mutual obligation of provision of labor for capital. This is particularly noteworthy in relation to herding activities, childcare activities, and plowing. The forthcoming studies on exchange relations will document them more fully.

Despite the lack of formal land ownership in the villages, as local Land Boards allocate the land assigned by the government for village use, there is a tendency toward usufruct land control. The policy of ALDEP toward land fencing reinforces de facto land ownership. The research results have not yet looked at land control by sex, but future surveys may want to include land access by sex, particularly the land used by de jure female heads of households, as part of the complex resource exchange that keeps families on the land surviving in drought years and may greatly influence technology adoption in years of adequate and timely rainfall.

The project has been particularly sensitive to the inclusion of female headed households in selecting cooperating farmers. This is because of careful attention to farming systems methodology and recognition of the importance of recommendation domains. Currently technology requiring minimal resource inputs but addressing the key constraint of inadequate soil moisture receives the major assessment effort by the teams. Even the experimental technologies of row planting and early plowing (but not early planting) may be differentially implementable by farmers with differential resource bases. The researchers, in establishing their recommendation domains and in stratifying their sample for data gathering purposes, have been aware that women are more likely to fall into the category of low resource farmers (initially defined as those who hire traction), but also may have less obvious resource constraints. As a result, women farmers compose nearly half the small intensive samples. This is both an accurate reflection of the reality of arable agriculture in the areas under consideration and an assurance that some of the hidden disadvantages of gender will not be further imposed by the technology improvements developed.

In the newly-initiated animal portion of the study that directly involves animal components of the complex farming system, women farmers and women's livestock have been included. Not only are cattle, the main male livestock/rural sector activity included, but so are goats and donkeys. In addition, data are gathered on chickens, which are primarily a female-managed component of the farming system.

There is remarkable homogeneity of cropping choices among limited resource farmers in the study area. Almost all of them broadcast a seed mixture that generally includes some or all of the following: maize, sorghum, millet, jugobeans, cowpeas, and melons. In some places, groundnuts are sown. (Only the highly drought tolerant or late maturing species and varieties that were able to take advantage of the late rains emerged and were actually harvested this year). Such crop mixes are very typical of situations where risk avoidance is extremely important. While all scarce resource farmers, particularly women, were less likely to have experienced any crop

43X

emergence or harvest, there does not seem to be a gender bias in crop sown or cropping choice. The researchers have been careful to note differential access to livestock by household, although they have not differentiated livestock ownership by gender (or age or residential status) within the household. This may be a fruitful area for future research, both regarding exchange relationships and the limits to decisions which farmers of different resource bases can make within given environmental constraints.

Off-farm employment -- and off-farm income generation -- has been looked at by the researchers and disaggregated by sex of family member. This has proved to be both a sensitive topic and one for which it has been difficult to gather data. Rapport with respondents has not developed to the point that all cooperating families see the links between what they do off the farm and whether or not their sorghum comes up, and a certain reticence to answer income questions has emerged. A strategy of focusing on presence or absence of off-farm employment for different family members at different time points, if efforts are made by the enumerators to show the relation of such employment to agricultural and animal husbandry activity, may prove more effective.

The term "off-farm employment" is biased toward the formal labor market and toward male activity. The project has avoided that bias to a degree by looking at income sources rather than at formal employment. That seems a good strategy to solve a complex problem that undoubtedly has important, indirect implications for key decision points within the farming system.

Some feminist sociological theorists have pointed out the implicit bias of quantitative methodologies toward male activities. One could widen that critique to include a bias toward formal sector activities that for various reasons are less accessible to limited resource individuals, particularly in the rural sector. It is hoped that inclusion of more sociological and anthropological input will help provide the kind of data that will help the agronomist to better design technology that the farmers with most limited resources, who tend to be female, are able to utilize at key decision points within the cropping season. The initial work in attempting to map allocation of all household resources, and continuing to disaggregate those resources by sex, should help guide the agronomic work.

The Mahalapye team has decided to eliminate the lowest stratum from their continuous monitoring. This is the group that has not planted in the last two years. While the group tends to be women, it is not exclusively so. This decision seems reasonable, given the goals of the project and the numbers of female farmers in many of the other strata. By increasing agricultural production among neighboring farmers through the introduction of the right technology applicable at key decision points to relieve bottlenecks, the benefits for female headed households who depend indirectly on local agriculture through beer brewing and sale are clear. Substantial data have been gathered on this group to allow the documentation of spillover effects when production increases due to either technological innovations or improved rainfall conditions.

ATIP in both locations has made substantial progress in assessing the endogenous aspects of the farming households, pressing discrete category survey research to its limit. In doing so, remarkable attention has been paid to intra-household resource provision. Finer tuning of the agronomic practice recommendations should be accompanied by further refinement of the social science methodology to be able to capture both the exogenous community variables -- which may have different impacts on different household members -- and the endogenous elements of the process of resource allocation within the household. Different methodological strategies may be required. The new planning documents indicate a broadening of samples and attention to contextual issues that affect the household and therefore the farming system. Hopefully, including the rural sociological/anthropological input will broaden the methodological techniques as well.

Recommendations:
The team should (1) continue with a relatively fluid definition of household; (2) strive to disaggregate data on not only resource input but intra household resource distribution by sex and age; (3) continue its excellent efforts to include female farmers as cooperating farmers for on-farm trials; (4) broaden methodological strategies to include qualitative rationales by sex for crop and livestock decisions.

III.E.1 Functioning of Interdisciplinary Teams

Interdisciplinary teamwork goes against all the norms and behaviors learned in formal graduate training and against all professional reward structures. Yet it is the basis of a farming systems approach to research in a field situation. There are few successful models on which to build and little formal training situations where it can be learned. Yet problems have no disciplinary limit, although they may need rigorous application of disciplinary tools in order to be solved. Translation of a perceived constraint into a researchable question is often beyond the capabilities of a single discipline. Disciplines -- and even commodity-based research, which under good conditions tends to be multidisciplinary -- often fail to make the link between field problem and research problem. Thus much research is defined by what is intellectually interesting (and publishable in a professional journal) rather than by the needs of research users -- those who must translate research results into technology and those who must then use the technology in field situations.

A farming systems approach to research attempts to make the translation from perceived problem to researchable problem for the disciplinary or commodity researcher and then test the success of that translation under field conditions. The greater the social distance between reseacher and farmer, the less likely is the disciplinary research to address perceived constraints.

Two ATIP teams are now in the field, one composed of an agronomist and an agricultural economist, and one of the same composition plus an animal scientist. Interdisciplinary team building is not yet complete -- nor is the breadth of disciplinary viewpoints fully established. The degree to which an animal science perspective is to be included on the Mahalapye team and the degree to which a rural sociological/anthropological perspective is to be included on either team is still in flux. Yet the team building achieved is impressive. Researchers strong in their own disciplines are learning to ask questions from the point of view of the complementary disciplines on the team, and to define adequate answers in terms of a more complete understanding of the total farming system than their own disciplines can provide. For the PhD level scientists on the team, interdisciplinary understanding has indeed increased, and although perhaps imperfectly at times, had a positive effect on the total research effort.

Each PhD level researcher up to this point has carried out separate studies, although there seem to be growing attempts at each field station to include other disciplinary points of view into planning of field studies. They have made a conscious effort to work separately with the same sample. The attempt at broader samples with agronomic, economic and animal questions will be an important tool in team building, both conceptually and in implementing questionnaire construction and, even more difficult, questionnaire analysis. There needs to be further effort on the part of all PhD researchers to ask themselves why the data they are gathering is relevant to other parts of the farming system and how finding the answers to their questions can increase the productivity for the total farming household. The move to a combined questionnaire is an excellent one, and probably should not have been attempted earlier in the team building process. A combined rather than disciplinary analysis of field trials will be the next difficult hurdle to attempt. On the other hand, given the detail required in making relevant agronomic measurements, it is obvious that the teams cannot spread themselves thin in fine-tuning the diagnostic phase of FSR without specifically relating it to crop/livestock production.

The roles and functions of the counterparts in the interdisciplinary teams is not totally clear. The counterparts are not particularly strong in their own disciplines. Yet, if farming systems is to be successfully institutionalized, it must be able to depend on certificate or bachelor level researchers to implement the approach. It is clear that each professional is attempting to train and include his counterpart. It is unfortunate that the training function may at times be necessarily a precedent to full team participation.

The relative success of team building in the face of strong disciplinary preparation and strong individual personalities is never without cost. An important factor in the ability of each team to truly work together comes in part through careful team selection. Just as important, the team members are all characterized by: (1) an underlying value base of respect for small

farmers, (2) a high level of empathy for their plight, (3) prior African experience, and (4) preparation for work and life under less-than-ideal conditions.

On each of the interdisciplinary field teams, all of the PhD professional scientists work as co-equals. The COP has deliberately decided not to name a team chief in each location. The two expatriate scientists at Mahalapye and the three expatriate scientists at Francistown are forced to work together with equal responsibility and equal control over project development. That strategy may have delayed the design of collective projects, but has kept each scientist highly productive. It also means that each counterpart is responsible to the expatriate scientist in his or her discipline and the COP. The COP has extra responsibility, since he, not a local team leader, is the final recourse in case of disputes. However, the result ultimately should be highly self-sufficient, autonomous teams that are not dominated by a single disciplinary approach. In terms of institutionalization, such an approach may appear to take longer than a more hierarchical one. However, it has clearly been quite successful and eliminated potential discord in the current situation.

In sum, there has been much progress on the part of both teams toward functioning as interdisciplinary units. There is still progress to be made. However, it is difficult to point to other field situations, where most team members were unknown to each other prior to arriving in the field, where such good adjustment and accomodation has been made. The results of team building efforts, and the contributing factors of common values and past experience are already clear in both the work plans and the field data gathered and analyzed.

Recommendations:
Formal mechanisms should be continued to assure interdisciplinary research, rather than parallel multidisciplinary activities.

III.F.1 Training and Supervising of Interviewers

There has been an incredible amount of data generated by the researchers during the first years of the project. Attempts were made to quickly get into the field with on-farm trials and to gather data that would indicate the variety of situations to which such trials were relevant. The socio-economic research is noteworthy both for its attempts to meet planned guidelines of FSR methodology and to respond to the unique situations which were encountered in the field to generate data that would hopefully be useful to the project.

Yet the data are only as useful as they are valid and reliable. Validity is the degree to which the answers actually respond to the

questions asked. Do the indicators actually measure what they are intended to measure? Internal reliability is the degree to which the same question, when asked of the same person at a different time, generates the same response. External reliability is the degree to which the answers generated by a sample would generate the same distribution of answers in the population to which one wishes to generalize. Reliability and validity depend in part on the study design and questionnaire construction and in part on the skill and truthfulness of the interviewers.

The project sought to get trial and survey overseers for each village at the T-4 level from the MOA. The project now has three village overseers in place, and there is hope that three more will be identified. In locations where T-4s were not available, local enumerators have been chosen from among the enumerators used in the first sample census. These staff-designated "trainees" - are now studying for the T-5 exam.

Some problems with both methods of staffing have emerged. In the case of the enumerators, stationing in a rural village to gather data bi-weekly from ten families was seen as a dead-end posting. Many have left in discouragement.

The COP had originally negotiated for the T-4s to utilize the data gathering period as training leading to professional promotion. Because of the general shortage of T-4s within the MOA, local enumerators have been hired in many of the villages. There seems at the onset to be a number of advantages in recruiting local residents as interviewers. They know the local language and idioms. They know the local people. They do not suddenly disappear for an undisclosed reason, taking with them intimate information about the family's financial status. Certainly in terms of validity issues, use of local enumerators -- if their local expertise is utilized in question construction -- can be beneficial. Further, given the time and energy taken to establish close relationships, they are ideal local informants for less formalized data gathering activities.

On the negative side, these local residents have much less formal training than do the T-4s. They require much more supervision and a great deal more training by the scientists involved. Good progress has been made in identifying capable local people to serve as interviewers. However, more efforts should be put into training them to understand the purpose of the project and all the data they are gathering. Special efforts should be made to discuss the questionnaire with them question by question, both as the questionnaire is formulated and as they attempt to implement it. The sociologist on the team may prove useful in this training. The researchers have already proven alert to problems of questions too complex for local interviewer skills, and have managed to adequately break questions down into components to facilitate data gathering.

However, during the next stage of data collection, greater efforts must be made to train, supervise, and debrief the locally based

interviewers. This task is complicated by the fact that the agricultural economics counterparts, who are directly responsible for interviewer supervision, do not speak the native language of the area as a first language. The agricultural economist in the Setswana area speaks Kalanga, and vice versa. This will be particularly disadvantageous when attempts are made to find native classifications for such natural phenomena as soil moisture, rainfall, pest infestation, and the complex exchange relationships which undergird the local farming systems.

One way of handling that unfortunate distribution of linguistic skill is to hold collective training sessions for all the village level interviewers, bringing them together several times at common points, and using both the agricultural economics counterparts in the training. Although each team -- and each individual team member -- is to a degree carrying out distinct research agendas, a combination of training efforts seems required by the current situation. As the questions get more complex, beyond the initial 16 question census form, interviewer skill becomes more and more important.

Recommendation:
The entire ATIP team make a special effort to meet jointly to hold collective training sessions for all village-level interviewers.

IV.B.1 Target Area and Research Area Selection

Target Area Selection Process Assessment:

The basis for selecting the two research bases of Mahalapye and Francistown was not agronomic, but political and socio-economic. This is true of most agricultural development projects world wide. The mandate of having the project begin work in the Districts of Mahalapye East and West and Palapye in the Central Agricultural Region and in the Tutume District of the Francistown Agricultural Region was because no other arable agricultural research projects were seriously working in those areas. Some of the assumptions implicit in such a decision are:

(1) FSR claims to be scale-neutral or even biased toward the extremely resource-limited farmers. Thus, if any approach to meaningful agricultural research might help these farmers, FSR should.

(2) There are a sufficient number of farmers in these areas to make worthwhile the focusing of a large amount of monetary and human resources on a FSR project tailored to their needs and problems.

(3) Meaningful research alternatives emerging from these two areas should also be applicable to similar areas of Botswana and other SADCC countries with similar environmental conditions.

While the evaluation team finds nothing wrong with using these non-agronomic criteria for selecting areas to begin implementation of FSR activities, it wishes to reinforce that fact that severe environmental constraints (i.e. rainfall scarcity and unreliability) lengthen the time normally required to produce meaningful results for area farmers and measurable results for project evaluation purposes.

Research Area Selection Process Assessment:

Mahalapye - It was expected that the FSR team would work in the districts of Mahalapye East, West and Palapye by the end of the project. In less than two years, the team has been able to work extensively in the recommendation domains of East Shoshong and Makwate (respectively in West Mahalapye and East Mahalapye Districts), while exploratory survey work in Makoro in the Palapye District has just begun. The full addition of this latter village and District depends on provision of more personnel by the GOB to assist the work in this area.

Farmer access to draft power was the basic criterion of stratification for Shoshong East and Makwate recommendation domains. The former is dominated by oxen and tractor rental for land preparation after the first rains of the cropping season, while the latter is dominated by donkey land preparation, with the option of tractor rental just beginning to be offered. The team therefore based the definition of recommendation domain on degree of timely access to draft power -- a serious and overriding constraint in the system. The evaluation team finds such a choice perfectly acceptable, but wishes to caution the Mahalapye FSR team against spreading themselves too thin in carrying out their future work in these villages. Normal rainfall will lead to more harvestable trials and additional work for the teams. This again may necessitate making hard choices to redefine priorities at this time.

The FSR team has anticipated some of these problems, and proposes to conduct several RI/RM (researcher-implemented/researcher-managed) trials during the 1984-85 cropping season on representative farms near Mahalapye. The evaluation team agrees that such a strategy could potentially save the team virtually hundreds of person-days during the upcoming cropping season. Further, the need for RI/RM trials is greater than in other FSR type projects, as the constraints defined by farmers are limited by what they see as variable, and among variables, which of those are controllable. RI/RM trials have the potential of expanding farm families'

definitions of the situation and ultimately faciliting technological innovation and adoption. In addition, until both the types and the detail (and frequency) of important measurements in agronomic field trials are known, researcher input into all trials must remain at a relatively high and continuous level.

Francistown - This FSR team determined from the exploratory survey and the MVRU survey that there were no major agronomic practice differences in any of the villages visited. However, there were differences in (1) crop management, (2) resource endowment, and (3) social structure. This entire area of Botswana has Kalanga as its first language: Tswana and English must both be learned in school. This has obvious implications for oral survey work (see Section III.F.1).

The criteria used to select the villages of Matobo, Marapong and Mathangwane included all of the above with the addition of two others: presence of ADs and logistics. Thus, Marapong was selected for its social uniqueness: it consists of a close-knit group which emigrated to Zimbabwe and then returned. The village appears to be very progressive vis a vis social infrastructure in general. Matobo, the farthest site from Francistown, was selected because it was quite traditional and relatively homogeneous, with few or no rich families. Most of the village families own a few head of cattle. Finally, Mathangwane was selected because of its diversity and because, logistically, it is the closest village to Francistown in the Tutume District. (It should be noted that Francistown is located in the Tati District). All villages are not far from paved roads, especially when compared to the Mahalapye areas, minimizing potential logistical problems. Again, the evaluation team sees the selection of these three villages as perfectly logical to represent three possible RDs within the area. Like the Mahalapye team, the Francistown team will probably locate several more detailed farm trials this next cropping season with selected farmers in Mathangwane. This village is about 20-30 minutes from Francistown. However, such a strategy would allow the team to continue fulfilling its mandate of working in the Tutume District.

Recommendation:
Both FSAR teams should avoid the tendency to spread themselves too thinly by exploring all of the interesting problems at too many sites: priorities for research will have to be set jointly.

Appropriate Problem Identification and Potential for Finding Solutions:

Using slightly different approaches within the same FSAR methodological framework, both FSR teams have reached the conclusion that the major constraint to crop production is access to draft power. This may be manifest in what the farm household owns or in its overall wealth enabling it to rent traction power in a timely fashion. The issue of timely land preparation for most rapid

planting after the first adequate rainfall at the beginning of a given cropping season is critical to both areas.

While both area teams have some agronomic trials in common to address this problem (i.e. land preparation methods as described in the Annual Reports) each team has adopted a slightly different approach to implementing the specifics of FSAR. This is not accidental, but is indicative of at least three important factors:

(1) Each area is slightly different ecologically and contains different ethnic groups as well as different agronomic potential.

(2) Each group consists of different and uniquely trained and qualified personnel, both USAID and GOB funded.

(3) The COP has encouraged a non-homogeneous approach precisely <u>because</u> of the extremely harsh environmental conditions under which the farmers of both areas must live and attempt to raise their crops.

While the two first points may be obvious, the third requires a brief explanation. The harsh environmental conditions of Botswana lead to the farmers having an extremely small buffer between the conditions of crop surpluses (never observed since the initiation of this project), subsistence (seldom observed since the initiation of this project), sub-subsistence (the norm since this project began), and starvation (which is the same as sub-subsistence if drought relief projects do not take up the difference between sub-subsistence and subsistence). For this reason, it is even more intuitively obvious that <u>any</u> technical solutions for farmers to somehow raise more crops (or stover for their livestock) are extremely unlikely to raise area production by a substantial amount. Since average sorghum yields in the area are roughly 200kg/ha year, an average <u>area</u> incremental increase of 25% would be considered an excellent achievement. This works out to increasing the average yield of sorghum approximately 50kg/ha. It is difficult to even <u>measure</u> this small a yield increase in well-monitored plots.

<u>Recommendations</u>:
For such a breakthrough to occur, not only must these FSR teams spend a great deal of time in monitoring and harvest measurements, but, more importantly, their research trials should be diverse enough in design so as to maximize the probablity that one (or more) of the farms trials will actually produce cropping alternatives which are (1) agronomically superior to current practices, (2) culturally acceptable, and (3) economically feasible for the Batswana farmers typically found in these recommendation domains to adopt and implement.

IV.C.1 Data Collection Forms and Field Design

Field designs for experiments in the project zones are varied and depend on the objectives of each specific study. In general, the experiments are designed around the individual "plots" which make up each field and comprise the area often planted on one day when conditions are right. These are of varying sizes, but may average about one acre. Since the farmer will often broadcast a part of a plot, plow the seed in, then continue this process until the plot planting is completed, usually on the same day, the use of a plot as a main research unit is useful for experimentation. This is an area understood and used by the farmer, and can be subdivided with treatments either at planting or for subsequent testing of other agronomic variables. The several types of experiments are summarized below.

The Mahalapye team implemented a number of trials in the first two years of the project in the villages of Makwate and Shoshong, especially during the cropping season just completed. A third village, Makoro in the Palapye District, will be added for the coming season. In farmer plot monitoring, the fields were identified and characterized by planting date and variety planted. Rainfall data and a gravimetric measure of soil moisture were collected. Data were collected through the growing season to give a total data base of 23 fields and 192 plots. These large numbers are necessary to use statistical analyses and produce confident results. Although the analyses are still in progress, the design of the monitoring exercise appears to be valid, and the two years envisioned for this work should provide useful insight into farmer's current practices.

In addition to the studies which monitor farmer's plots, the team has measured within-field variability by marking about 200 field sites within farmer's plots. Data are yet to be analyzed, but the approach is valid. A paired comparison test was used to evaluate methods of planting. Although final harvest was not possible from most of the plots, the methods were evaluated using emergence stand counts of plants. Fifteen comparisons showed little difference between traditional and alternative methods of planting, except for the plow-planter, which gave significantly lower stands than the traditional broadcast planting. In one trial two replications of early plowing followed by a second plowing were compared to traditional single plowing at planting time. In this drought year, the double-plowed fields produced almost 500 kg/ha, while the other methods produced less than 100 kg/ha. While useful indicators, the results of these trials were based on an extremely small sample of harvested fields and cannot be extrapolated statistically at this time. Any such use of these indicators would be a disservice to the project and to the FSR methodology. However, these types of experiments, with minimal or no replication in one site, would appear appropriate for these conditions, and the approach most consistent with the objectives of the team.

In the Francistown area field experiments, located in the villages of Marapong, Matobo, and Mathangware, the approach was minimal two replication trials which focused on potential production in the region, alternative types of tillage and weeding, and different depths of plowing. There was one trial of each type in each village. Plots with each treatment were necessarily large, since the plot to be planted in a given day had to be divided into the eight or twelve subplots needed for the treatments and the two replications.

There will no doubt be large variations within these large plots. Relatively large plots are needed, however, to implement plowing and other agronomic treatments. From the design standpoint, the two replications are minimal in order to generate an inter-plot error term for hypothesis testing. The team is correct in not replicating further, due to the complications of implementation and control on the farm. More locations in each village would be desirable, but this would require cutting back on other activities. In summary, these agronomic trials appear to be well-designed and appropriate for the questions they are designed to answer.

The surveys conducted in both villages have been extensive, and have attempted to measure such variables as farmer practices and principal constraints to production, characteristics of farmer families, labor availability and use, cash flow, animal use and sale, social organization of agricultural activities, crop and animal husbandry practices, and other perspectives of the farmer on livestock and arable crop production. These surveys had different numbers of respondents, but were extensive in each of the project villages and are an on-going activity. There is some question about the need for random sampling in this type of research, since a conclusion from the results of the first surveys and the impressions of the team is that the region is relatively homogeneous. This implies that departure from complete randomness in selection of collaborating families would not bias the results. The approach again appears valid, and the results will be of great use to the team and to the MOA in planning further activities on farms.

Recommendations:
The teams should continue with farmer-designated plots as the appropriate unit for on-farm trial analysis and continue its monitoring program. Consideration of increasing with-in site replication might be necessary at a future stage, but the current design is appropriate at present.

ATTACHMENT B

REFERENCES

A collection of project survey and monitoring forms. Undated. Provided by Mahalapye team.

Agency for International Development "Country Development Strategy Statement FY 1985 Botswana (revised)" September, 1983.

Agronomy program summary Francistown 1983-84. Undated. Provided by Francistown team.

Anonymous. Undated. Technical evaluation of cultivation practices ATIP Mahalapye.

ATIP project (Francistown) 1983-84. Undated. Provided by Francistown team.

Baker, D., V.C.Smith, S.Lynch, W.Whelan, J.Strauss. "Household Food Consumption in Rural Sierra Leone". Rural Development Series Working Paper No. 7. East Lansing, Michigan State University, Department of Agricultural Economics, 1979.

Baker,D., V.Barrett, G.Lassiter, D.Wilcock, E.Crawford. "Animal Traction in Eastern Upper Volta. A Technical, Economic and Institutional Analysis". International Development Paper No. 4. East Lansing, Michigan State University, Department of Agricultural Economics, 1983.

Baker, D. 1983. Household characteristics in Shoshong East and Makwate: November, 1982 sample frame census summary results. ATIP Mahalapye, October.

Baker, D. Undated. Crop management survey tables. ATIP Mahalapye.

Baker, D. 1984. Agricultural demonstrator survey tables. ATIP Mahalapye, July.

Baker, Doyle. 1984. ATIP Makwate farmer workshop April 1984. ATIP Mahalapye. June.

Baker, Doyle. 1983. Early season cropping plans of ATIP Mahalapye farmers. ATIP Mahalapye. December.

Balogun, T.F. and B.A. Koch, 1975. Coffee grounds replacing sorghum grains in swine rations. Tropical Agriculture (Trinidad) 52:243.

Balogun, T.F. and B.A. Koch, 1979. Raw or roasted groundnuts as a partial protein and energy source in rations for growing pigs. Tropical Agriculture (Trinidad) 56:135.

Balogun, T.F. and B.A. Koch, 1979. Influence of trypsin inhibitor level and processing on the nutritional value of groundnuts for finishing pigs. Tropical Agriculture (Trinidad) 56:245.

Bettles, F.M. Women's Access to Agricultural Extension Services in Botswana. Women's Extension Unit, DAFS/MOA, Gaborone, 1980.

Botswana Agricultural Technology Improvement Project (ATIP). Undated. Provided by KSU project backstop.

Eicher, C.K. and D. Baker. "Research on Agricultural Development in Sub-Saharan Africa: A Critical Survey." International Development Paper No. 1. East Lansing, Michigan State University, Department of Agricultural Economics, 1982.

External Review Panel (CRSP). 1983. Project evaluation profile, Botswana/Colorado State University (Initiated July 1982). MSU, East Lansing, MI.

Farmer sucess in Shoshong. Undated. Provided by Mahalapye team.

Farming systems profile. Undated. Provided by Mahalapye team.

Farrington, T. and C.R. Riches. Draught Power in Botswana: I. The Draught Power Problem in Perspective and II. The Design and Testing of Solutions, EFSAIP/DAR, 1983.

Fortman, Louise. "Women's Involvement in High Risk Arable Agriculture: The Botswana Case" Office of Women in Development, USAID, April, 1980.

Gulbrandsen, Ornulf. Agro-Pastoral Production and Communal Land Use: A Socio-Economic Study of the Bangwaketse MOA/GOB. Gaborone, 1980.

Heinrich, G.M. Stability of grain sorghum (Sorghum bicolor (L) Moench) Yield components across adverse environments Crop Science, 1982.

Hobbs, A. with Herring, Peaslee, Harris and Fairbanks. Deep Tillage Effects on Soils and Crops. Agron. J. 53: 313-316, 1961.

Hobbs, A. and L.E. Wittsell. Mechanics of Water Movements and Storage in Soils: A Teaching Technique. Agron. J. 55: 67-70, 1963.

Hobbs, A. Yield and Protein Contents of Crops in Various Rotations. Agron J. 63: 832-835, 1971.

Hutcheson, A. MacGregor, et.al. 1984. Africa: 1983-84. "Botswana."

ibid. 1982-83. Evaluation of Farming Systems and Agricultural Implements Project (EFSAIP) Botswana. Report No. 7

ibid. 1984. Annual Report Number 2 (Period: August, 1983 - September, 1984), ATIP. (Preliminary draft only for mid term evaluation term). June.

ibid. 1983. Annual Work Plan Number 2 (Period: October, 1983 - September, 1984), ATIP. December.

ibid. 1984. Annual report for the division of arable crops research 1982-83. Agricultural research station, Sebele. April.

Information and issues checklist. Undated. Provided by Mahalapye team.

Kerven, Carol. Urban and Rural Female Headed Households: Dependence on Agriculture. National Migration Survey, MOA/DPS/RSU

Kossoudji, Sherrie and Eva Mueller. "The Economics and Demographic Status of Female-Headed Households in Rural Botswana" University of Michigan Population Studies Center Research Report No. 81-10, March, 1981.

Miller, Wayne. "Agricultural Credit in Tanzania" University of Illinios Agricultural Economics Staff Paper, 1977 (Joint Author).

MOA/B-DAR/MIAC. 1983. Annual Report Number 1. (Period: August 1982-September, 1983). ATIP. December.

MOA/B-DAR. 1983. The bulletin of agricultural research in Botswana. Gaborone. June.

MVRU farmer profiles. Undated. Provided by Mahalapye team.

Norman, D., Baker and J.Siebert. 1983. The challenge of developing agriculture in the 400-600mm rainfall zone within the SADCC countries. Invited for SADCC seminar on agronomic adjustment to the 400-600mm rainfall zone. Harare, Zimbabwe, 14-16 September. ATIP/DAR/MOA/B.

Norman, David. 1984. Summary of topics for introductory discussion with mid-term evaluation team. ATIP Sebele. July.

Norman, David. 1983. Helping resource poor farmers: the agricultural technology improvement project. Botswana. Sebele research station, Botswana. May.

Norman, David. 1983. Some probelms in the implementation of agricultural research projects with a farming systems perspective. Invited paper for a seminar for senior agricultural research administrators from Eastern and Southern Africa on the Introduction of On-Farm Research with a Farming Systems Perspective, sponsored by CIMMYT, Nairobi, Kenya. April 18-20.

Norman, D. Labour inputs of farmers: a case study of the Zaria Province of the North Central State of Nigeria. The Nigerian Journal of Economic and Social Studies 11:1 (March, 1969). p.1-14. Also produced as Samaru Research Bulletin No. 116.

Norman, D. Economic and non-economic variables in village surveys. Rural Africana, 8 (Spring, 1969) p.18-24. Reprinted in the Samaru Agricultural Newsletter 13:3 (June, 1971). p.61-64.

Norman, D. Economic analysis of agricultural production and labour utilization among the Hausa in the north of Nigeria. African Rural Employment Paper No.4. East Lansing, Michigan State University, 1973. Also produced as Samaru Research Bulletin No. 191.

Norman, D. and E.B. Simmons. Determination of relevant research priorities for farm development in West Africa. (Published in I.M. Ofori (ed)). Factors of Agricultural Growth in West Africa, Legon, published by ISSER, University of Ghana and printed by Presbyterian Press, Accra, 1973. p.42-48. Also produced as Samaru Research Bulletin No. 204.

Norman, D. The rationalisation of a crop mixture strategy adopted by farmers under indigenous conditions: the example of northern Nigeria. Journal of Development Studies, 11:1 (October, 1974). p.3-21. Also produced as Samaru Research Bulletin No. 232.

Norman, D. and E.F.I.Baker. Cropping systems in northern Nigeria. (Published in IRRI (ed). Proceedings of the Cropping Systems Workshop, Los Banos, International Rice Research Institute, 18-20 March 1975) p.334-361.

Norman, D. The organisational consequences of social and economic constraints and policies in dry-land areas. (In Hunter, G., Bunting, A.H. and A. Bottrall (eds))

Norman, D. Developing mixed cropping systems relevant to the farmers' environment. (In Monyo, J.H., A.D.R. Ker and M.Campbell (eds)), Intercropping in Semi-Arid Areas, Ottawa, IDRC, 1976 p.52-58.

Norman, D. Economic rationality of traditional Hausa dryland farmers in the North of Nigeria. (In Stevens, R.D. (ed)), Tradition and Dynamics in Small-Farm Agriculture, Ames, Iowa State University Press 1977 p.63-91.

Norman, D. The rationalisation of intercropping. African Environment, 2, 3 (1977), p.97-109.

Norman, D. and W. Palmer-Jones. Economic methodology for assessing cropping systems (In IRRI (ed)), Cropping Systems Research and Development for the Asian Rice Farmer, Los Banos, IRRI, Phillipines 1977 p.241-260.

Norman, D. Farming systems and problems of improving them. (In Kowal, J.M. and A.H. Kassam, Agricultural Ecology of the West African Savanna, Oxford, Clarendon Press, 1978 p.318-347.

Norman, D. The farming systems approach; Relevancy for the small farmer. MSU Rural Development Paper No. 5. East Lansing, Michigan State University, 26p. Also in French and Spanish.

Norman, D. and M.Newman and I. Ouedraogo. Farm level studies in the semi-arid tropics of West Africa. (In ICRISAT (ed)), International Workshop on Socio-Economic Constraints to Development of Semi-Arid Tropical Agriculture. Hyderabad, ICRISAT, 1980. p.241-263

Norman, D. Micro-level accomplishments and challenges for the less developed world, Discussion of M.Collinson's paper. In IAAE(ed)), Rural Change-the Challenge for Agricultural Economists. Oxford Institute of Agricultural Economics, 1981. p.53-56.

Norman, D. and E.H. Gilbert. A general overview of farming systems research. (In Shaner, W.W.Philipp, P.F. and W.R. Schmehl (ed)), Readings in Farming Systems Research and Development. Boulder Westview Press, 1982. p.18-34.

Norman, D. and E.H. Gilbert. Farming system research programs in West Africa: some general characteristics and possible roles for U.S. Universities. (In B.G. Schoepf (ed)), The Role of U.S. Universities in International Rural and Agricultural Development, Tuskegee, Center for Rural Development, Tuskegee Institute. p.125-132.

Norman, D., E.Simmons and H.Hayes. Farming Systems in the Nigerian Savanna Research and Strategies for Development. Boulder, Westview Press, 1982.

Norman, D. and H.Binswanger. Socioeconomic consideration in sorghum based farming systems. (In ICRISAT (ed) Sorghum in the Eighties Vol 2 . Hyderabad, ICRISAT, 1982) p.633-646.

Norman, D., E.Modiakgotla, J. Siebert and M.Tjirongo. Helping the limited resource farmer through the farming systems approach to research. Culture and Agriculture, 19 (1983), p.1-8.

Odell, Malcolm J. "Local Institutions and Farming Systems Research in Botswana" paper present to Small Farming Systems Research Program Associates, Kansas State University, Manhattan, Kansas, 1982.

Overview of ATIP Mahalapye activities. Undated. Provided by Mahalapye team.

Review team tour - July 13, 1984. Undated. Provided by Francistown team.

USAID. 1981 Botswana Agricultural Technology Improvement Project (No. 633-0221). Unclassified.

U.S. Department of Commerce. Bureau of the Centres Country Demographic Profiles: Botswana Series ISP-DP-27, July, 1981

ATTACHMENT C

LIST OF PERSONS CONTACTED

IN GABORONE/SEBELE:

Brown, Peter. Team Leader, Evaluation of Farming Systems & Agricultural Supplements Project (EFSAIP)

Butler, Edward. Deputy Director, USAID/B

Edwards, Richard. Agronomist, Integrated Farming Pilot Project (IFPP)

Finlay, David. Permanent Secretary, GOB.

Flint, Michael, Agricultural Economist, Integrated Farming Pilot Project

Gollifer, Dr. David Director (acting), DAR, GOB

Guedet, Paul. Director, USAID/B

Horspool, David. EFSAID, DAR

Larsen, John. Agricultural Economist, DPS,GOB.

Lesotlho, John. Rural Sociologist, Rural Sociology Unit, DPS, GOB

Mackie, Anita. ADO, ATIP Project Officer.

Mathake, Justice Principal Agricultural Officer, DAFS, GOB

Masolotate, H.O. Chief Crop Production Officer, DAFS, GOB

Merafe, Yvonne, Rural Sociologist and head of the Rural Sociology Unit, DPS, GOB.

Minor, Dr. R. Deputy Director, Veterinary Services, DAH, GOB

Mokone, Mishak Deputy Permanent Secretary, GOB

Muggeridge, Elizabeth. Ministry of Finance

Ndimande, B.N. Deputy Director, Department of Research & Specialist Services, Government of Zimbabwe

Norman, David. ATIP Chief of Party, MIAC/KSU Sebele

Sigwele, Howard Agricultural Economist, DSP/GOB

Stewart-Jones, Bill. DAR, GOB

Taylor, Lucretia. Program Officer, USAID/B

Taukobong, Tom. Director, Field Services, DAFS, GOB.

IN CENTRAL AGRICULTURAL REGION

Baker, Doyle.	ATIP Agricultural Economist, MIAC/KSU Mahalapye team
Dira, D.	T-4, Makwate, Central Ag Region
Keipeile, W.	T-4, Shoshong, Central Ag Region
Keipeile, W.	T-4, Shoshong, Central Region
Luzani, J.	DAR, Central Region
Mahelo, C.	Technical Assisant, Shoshong, Central Region
Mahelo, C.	Technical Assistant, Shoshong, Central Ag Region
Malatsi, Mr.	DAO, Mahalapye East, Central Region
Maribe, M.	RAO, Serowe, Central Region
Matsela, M.	Makwate farmer
Modidi, Mr.	CPO, Serowe, Central Region
Modisa, G.	Enumerator, Shoshong, Central Ag Region
Okaile, K.	Technical Assistant, Makwate, Central Ag Region
Sedimo, B.	Makwate farmer
Siebert, Jay	ATIP Agronomist, MIAC/KSU Mahalapye Team
Tibone, C.	DPS, Central Region

IN FRANCISTOWN AGRICULTURAL REGION

Bango, Mr.	Mathangwane farmer
Geche, Mr.	Matobo farmer
Heinrich, G.	ATIP agronomist, MIAC/KSU Francistown team
Koch, B.	ATIP Livestock specialist, MIAC/KSU Francistown team
Madani, Mr.	Marapong farmer
Miller, W.	ATIP agricultural economist, MIAC/KSU Francistown team
Seleka, T.	
Senai, P.	Agronomist counterpart, Heinrich
Sono, Mr.	RAO, Francistown agricultural region

Taylor, M. ALDEP representative, Francistown agricultural region.

ADDITIONAL PERSONS INCLUDED:

Headman, Matobo Kgotla

Headman, Marapong Kgotla

Headman, Mathangwane Kgotla

Enumerator, Matobo

Enumerator, Marapong

Enumerator, Marapong

Enumerator, Mathangwane

Enumerator, Mathangwane

ATTACHMENT D

MAJOR TOPICS INCLUDED IN MIAC MVRU SURVEY

(The following data are collected twice weekly on 12 "Detail" Sheets)

I. Household (HH) labor data: includes disaggregation by type (hire versus family), sex, activity, dates, etc., all on a plot within field basis, for HH members and others.

II. HH use of inputs and crop removals: includes draft power, non-labor inputs and specifics of crops removed. This section of the survey asks for details on livestock (use of supplemental feed, watering, frequency, etc.) and on crops (seed type(s), mixtures, treatments, weediness of seedbed, moisture condition of the soil, etc).

III. Inner- and Extra-HH income activities: includes labor used on other HHs, production/sales of non-agricultural HH products or activities, work off-farm for wages, and HH income activities.

IV. HH use of livestock: includes fieldwork, transportation and other uses, such as hiring to others. This sub-section includes both money received and hours per person the animals were worked.

V. HH sale or exchange of crop or livestock products: includes crops, livestock, livestock by-products and other products gathered or made by HH members.

VI. HH purchases of food and all other consumer goods: includes both cash outlays and in-kind transfers for equipment for farming, livestock, grains and meat, drinks, fuels, water, clothing, etc.

VII. HH receipt of revenues in cash or kind: includes gifts, loans, non-farm wage employment and fieldwork.

VIII. HH expenditures in cash or kind: includes gifts, loans, transportation, livestock fees, fieldwork and other.

(The following data are collected biweekly on 2 "Detail" Sheets).

IX. HH Livestock inventory: includes changes in numbers of cattle, goats and sheep, donkeys, poultry and other animals due to births, deaths, sacrifices, gifts, thefts, losses and HH consumption, as well as sales and purchases of individual animals.

X. Non-cropping HH activities: includes tending livestock, gathering either firewood or edible plants, fetching water, cooking and washing and improving household capital (fence, rethatching the roof, etc.).

FSAD	Farming Systems Approach to Development
FSAR	Farming System Approach to Research (ATIP term)
FSR	Farming Systems Research (generic for FSAR)
FSP	Farming Systems Perspective (ATIP term which means "involving the influence and of relevant policies and support systems")
FSSP	Farming Systems Support Project
GOB	Government of Botswana
HH	Household
IARC	International Agricultural Research Center(s)
ICRISAT	International Center for Research in Sub-humid and Arid Tropics
IFPP	Integrated Farming Pilot Project
INTSORMIL	Grain Sorghum and Pearl Millet CRSP
KSU	Kansas State University
LUPAG	Land Use Planning and Advisory Group
MFDP	Ministry of Finance and Development Planning
MOA	Ministry of Agriculture
MVRU	Multiple Visit Resource Utilization (Survey: ATIP FSAR teams)
NDB	National Development Bank
ODA	Overseas Development Agency (U.K.)
OPEX	Operational Expert
PACD	Project Assistance Completion Date
PASA	Participating Agency Service Agreement
PS	Permanent Secretary (of the MOA)
RAO	Regional Agricultural Officer
RD	Recommendation Domain
REC	Research Extension Coordinator
RELO	Research-Extension Liason Officer

RI	Researcher-implemented (farm trial): contrast with FI
RM	Researcher-managed (farm trial): contrast with FM
RSU	Rural Sociology Unit
SADCC	Southern African Development Coordination Conference
SAMDP	Southern Africa Manpower Development Project
SMU	Seed Multiplication Unit
TA	Technical Assistance
T-4	Next to beginning level technical (non-certificate) GOB hire
T-5	Beginning level technical (non-certificate) GOB hire
TGLP	Tribal Grazing Lands Program
USAID/B	U.S. Agency for International Development Mission in Botswana
USDA	U.S. Department of Agriculture
VDC	Village Development Council

ATTACHMENT E

USEFUL ABBREVIATIONS AND ACRONYMS

AD	Agricultural Demonstrator
ALDEP	Arable Lands Development Program
APO	Animal Production Officer
APRU	Animal Production Research Unit
AS	Agricultural Supervisor
ATIP	Agriculture Technology Improvement Project
BAC	Botswana Agricultural Colleqe
BAMB	Botswana Agriculture Marketing Board
CAM	Collaborative Assistance Mode (AID contracting)
CDO	Community Development Officer
CDSS	Country Development Strategy Statement
CFDA	Communal First Development Area
CIMMYT	International Center for Corn and Wheat Improvement
CCPO	Chief Crop Production Officer
CPO	Crop Production Officer
CRSP	Collaborative Research Support Programs
DAFS	Department of Agricultural Field Services
DAH	Department of Animal Health
DAO	District Agricultural Officer
DAR	Department of Agricultural Research
DAS	District Agricultural Supervisor
DLFRS	Dryland Farming Research Scheme
DPS	Department of Planning and Statistics
DtPS	Deputy Permanent Secretary
EFSAIP	Evaluation of Farming Systems and Implements Project
FI	Farmer-implemented (farm trial): contrast with RI
FM	Farmer-managed (farm trial): contrast with RM

ATTACHMENT F

AGRICULTURAL TECHNOLOGY IMPROVEMENT PROJECT

(ATIP)

MID-TERM EVALUATION - JULY 23, 1984

Findings and Recommendations for Discussion

The team has found the project to be exceptional in terms of design and implementation. Its complex, though efficient organization is focused on the challenge of implementing a farming systems approach to research, stimulating linkages between experiment station and on-farm research, and catalyzing the communication between research workers in DAR and extension personnel in DAFS. Despite the drought, the team estimates that most activities in the project are on track in concept and timing. The project has set in motion an approach to agricultural development that will benefit the limited-resource farm family in the harsh and unpredictable environment of Botswana, and has begun the process of institutionalizing this approach. Significant progress toward project goals can be expected by the end of the current contract. In terms of the substantive goals of improving technology that result in increases in small farm production, exogenous conditions have prevented the project from producing measurable, reliable results.

The GOB is to be congratulated for their participation in the planning and implementation of this project. USAID/B has provided valuable administrative and support services facilitating the efficient operation of the project. The contract team has done a superb job in a short time to organize and implement an exemplary program.

The mid-term evaluation has assessed the organization and team approach followed in the ATIP to address problems of the small farmer. The team has identified a number of specific procedural questions which should be resolved for more efficient project implementation, as well as a series of larger conceptual issues which are critical to long-term success and institutionalization of the farming systems approach to development. Indicators of progress in the project have been evaluated against the log frame. This evaluation also addresses the policy issues which should be assessed as a result of the research findings of this type of project.

1. Finding

   The current number of Batswana scheduled for long-term training and their levels of training are not sufficient to effect the institutionalization of the farming systems approach to development.

   Recommendations

   A. A training schedule be developed that includes the time period of training, the number of individuals

involved, the degrees sought, and the positions which may be assumed at the end of training. The training plan should be designed to double the potential for training related to FSR projects in the MOA central staff, DAFS field staff, and DAR research backstopping.

B. Intensify the effort of training Batswana in B.S.and M.Sc.(and Ph.D. level only when necessary and appropriate), so that trained personnel will be available to work in the ATIP to continue its approach to research and the linkage of research and extension when the project is terminated.

2. Finding
The current five year time frame of the ATIP is part of a longer USAID/B and GOB plan which should allow for institutionalization of a farming systems approach to research in Botswana.

Recommendation
At least two years prior to the PACD (Project Assistance Completion Date), consideration should be given to the extension of the project.

3. Finding
There is a need for more specialized social science input to the ATIP that the GOB is currently unable to provide.

Recommendation
A. A short term consultant be assigned a series of three to five month research/training consultancies with ATIP and the Rural Sociology Unit.

B. Degree level training be provided for Batswana under ATIP auspices.

C. TDY of the ATIP staff include time for interactions with FSR-experienced anthropologists and sociologists.

4. Finding
There is a need for continued structured short-term training of ATIP counterparts.

Recommendation
The ATIP should continue the use of in-country short courses for specific training of Batswana counterparts and others associated with the project. Whenever appropriate they should be given in Botswana, and when necessary the opportunity to attend courses and workshops outside the country should be taken.

5. Finding
There is a need and an opportunity for ATIP to have agricultural policy input.

Recommendations:

A. The ATIP Chief of Party, working with his field teams, should consider the policy implications of their field findings in the farming systems process, through the Director of Agricultural Research to the Policy Committee of MOA.

B. A MOA liaison in DPS with an understanding of farming systems work be named to work with the chief of party and team in identifying policy issues and drafting statements relevant to policy to feed into appropriate MOA channels.

6. Finding

Currently graduates of the BAC have little understanding or appreciation of a farming systems approach to research and extension.

Recommendations

A. Linkages should be established between the RELO and the Principal and staff of the BAC.

B. Consideration should be given to the integration of FSR into the BAC curriculum for ADs, perhaps through short-term consultancies with FSSP personnel.

7. Finding

The small staff of experiment station scientists are concerned about on-farm testing of crop varieties and practices which have been tested on the station and need verification on farms. The ATIP scientists are interested in keeping close communications with the experiment stations and in conducting a limited number of trials under controlled conditions.

Recommendations

A. There should be frequent communication between the scientists based at the central research station and the scientists working in the ATIP villages, including visits of experiment station scientists to the farmers' fields.

B. ATIP personnel should be encouraged to participate in any initiative of the Department of Agricultural Research which is designed for testing component technology on station and on farm, and which could move new varieties and practices rapidly to the farm for testing.

8. Finding

The chief of party seems to be spending a disproportionate amount of time and energy working on details that could be handled by someone more appropriate. This takes time away from areas where he has unique talents in farming systems research and the development parts of the program, including consideration of policy issues.

89X

Recommendations

A. The team leader should be urged to delegate more of the routine administrative matters to others on the technical assistance team, including the deputy team leader and his counterpart, and the administrative assistant.

B. USAID/B should explore internal mechanisms to better facilitate the handling of forms and other government procedures in a routinized and specified manner. A clearly defined point of contact within USAID is the project officer, and a clear designate is needed if the principal contact person is traveling or otherwise out of the office.

9. Finding

ATIP is spread between two departments, DAR and DAFS, and has a close working relationship with the DPS. There is a need to assure that the project continue as an institutionalized integral part of the MOA, to continue beyond the life of the project.

Recommendations

A. A Motswana be assigned as interim counterpart to the chief of part, subject to approval of both the ATIP project and the GOB.

B. Thought be given in the MOA to where the ATIP should be institutionalized.

C. The RELO be a senior established post to effect liaison between research and extension groups in MOA.

10. Finding

The commercial seed production facility as planned for Botswana in the ATIP has been delayed in implementation.

Recommendation

Attention needs to be paid to the recommendation in the project paper on the seed requirements of Botswana. Subject to availability of resources from the GOB, this activity should be initiated to solve the current seed crisis and build a long-term potential for quality seed production in the country.