

**BANGLADESH
AGRICULTURAL
RESEARCH
PROJECT II**

**REPORT OF
THE 1985 EXTERNAL
EVALUATION TEAM**

**BANGLADESH AGRICULTURAL RESEARCH COUNCIL
INTERNATIONAL AGRICULTURAL DEVELOPMENT SERVICE
U. S. AGENCY FOR INTERNATIONAL DEVELOPMENT**

1985 EXTERNAL EVALUATION:
BANGLADESH AGRICULTURAL RESEARCH PROJECT PHASE II

Final Draft
May 25, 1985

Team Members

Dr. Fletcher Riggs (Team Leader)
Agricultural Economist,
USAID (retired)

Dr. S. M. Arshad Ali
Irrigation & Water Management
Bangladesh Agricultural University

Dr. Kay Calavan
Anthropologist and Agronomist,
Independent Development Consultant

Dr. Reesnon Feuer
Soil Scientist and Extension Agronomist,
Cornell University (retired)

Mr. A. Waheed Khan
Agricultural Economist,
Ministry of Agriculture

Mr. M.A. Kamin (Soil Scientist)
Ministry of Planning & Finance
(Did not participate)

Dr. Maurice Peterson (Agronomist),
University of California, (retired)

Mr. Latifur Rahman
Agriclturist, USAID/Dhaka

ACKNOWLEDGEMENTS

The Team wishes to acknowledge the guidance and support provided by BARC, IADS, and USAID. We spoke with over one hundred people -- Bangladeshis and foreigners; scientists, administrators, advisors, and farmers. We learned something useful from each of them, and found them to be uniformly concerned with improving agriculture and agricultural research in Bangladesh. Many of the individuals who helped us are listed in Annex B. Those who are not, nevertheless have our gratitude. Special thanks go to Mr. Mazbahuddin Ahmed, General Manager of the IADS office; Mr. Easin and Mr. Siddique Ullah, who did our word processing; Mr. Kamal, who was our driver; and Mr. Danzil Gonsalves, who did our photocopying.

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TERMS OF REFERENCE

Terms of Reference for the team are to evaluate:

1. Contractor/BDG performance in terms of research management effectiveness, relevance, timeliness, quality, quantity, and responsiveness to national development objectives.
2. Impact of project resource use on field station results in relation to local farmer adoption, interaction with local extension systems and local training activities. Quantification of research efforts in terms of increased publications, farmer field days, on-farm research, and feedback to planners and administrators for bureaucratic/political support.
3. Identification of actual research success adopted by farmers and their contributions to changing public perceptions. Impact of such successes on judgement by administrators and their resource allocations and by scientists within the system.
4. Consistency of intended outputs as reflected in annual work plans with actual achievements as reflected in six monthly progress reports and annual evaluation reports.
5. Adequacy, timeliness, and relevance of the AID disbursement and BDG contributions and consequences on project implementation.
6. Review and evaluate draft USAID proposal for continuing support to the agricultural research system beyond PACD June 1987.

7. To the extent possible determine the impact of the research investments associated with the project on changes in food output and resource productivity, initiation of new horizons for productivity changes, and growth and productivity of research, educational, and training institutes. Evaluate the benefits of the present linkages between the BGS research activities and those of the regional and international efforts in terms of captured comparative strengths. Cite evidence of increased capacity of BARC in coordinating the national research system and its enhanced stature in the agricultural hierarchy of Bangladesh.
8. The team will prepare a draft report to leave with the Mission/BARC and debrief Mission/BARC personnel on the team's evaluation before departing.

I. EXECUTIVE SUMMARY

The research system through ARP-II has made significant accomplishments over the past several years. A number of new high yielding varieties have been developed and some excellent work is being done in analyzing how these fit into traditional cropping systems. The new varieties and improved cropping patterns have been adopted by many farmers. For more widespread adoption, however, researchers must "package" their results, particularly at moderate input levels, and get them into the national system for delivery to farmers. This will require a major effort over the next few years, including further strengthening of the research system, as well as the extension delivery system.

This evaluation has led to the conclusion that the objectives (proposed outputs) of the Project were appropriate as originally conceived, are still valid for building a national agricultural research system, are only partially accomplished, and that USAID should continue support until an effectively functioning national agricultural research system is in place.

Research, extension and farmer linkages at farmers fields have been developed through the cropping systems research program under ARP-II. Plans are now maturing to incorporate non-crop activities into the field program, achieving a full farming systems approach.

Project Management by the prime contractor has improved substantially and with additional improvements planned and with

the personnel now in place, good project management should become routine.

Management by the Bangladesh Agricultural Research Council (BARC) has also improved but further significant improvement is constrained by a number of factors. Scientific staffing at BARC is inadequate; difficulties in maintaining a full complement of Member-Directors has constrained progress in certain program areas, as has insufficient authority of BARC to fully implement its mandate.

Research planning and setting of research priorities will improve as BARC becomes more involved, as planned, in review and analysis of institute long range and annual plans. The National Agricultural Research Plan (NARP) has been prepared by BARC, assisted by IADS staff and senior Bangladeshi agricultural scientists. There is much uncertainty on the part of various elements of the Bangladesh Agricultural establishment about a Program Planning and Review Board (PPRB) for BARC. All of the pros and cons of such a Board have not surfaced so as to be understood by expatriate observers. The COB will need to sort out this issue among its constituent elements and create a PPRB in appropriate form, or decide that one is not necessary and bring the issue to resolution.

The NARP provides a good overview of research requirements and prioritizes them. A major effort for BARC, and for the International Agricultural Development Service (IADS), is conversion of the NARP into high priority research programs. BARC

will then have precise criteria to guide its review of institute plans and to effectively carry out its role in the review process for contract research and for new Annual Development Plan (ADP) projects which involve also the Ministry of Agriculture, Planning Commission, Establishment Ministry and Ministry of Finance.

A major problem in the national agricultural research system is the lack of funding balance between research personnel and the operating expenses required to make them productive. USAID has relieved the problem temporarily with PL480 Title II funds. A permanent solution is essential. This will require a major effort by GOB and will require changes in philosophy and procedure. Philosophically, the GOB apparently feels compelled to relieve unemployment to the maximum extent possible. This is a major factor in funding imbalances for personnel and operating expenses for agricultural research. The increased productivity of the research system when provided operating expenses has been clearly demonstrated over the past year or so. If this evidence is convincing to Government, they could, over the next several years, improve the balance of personnel/operating expense by not approving any new research projects that did not have a proper balance. In the interim, government should increase operating expenses for on-going projects. Continued USAID assistance will be very productive in assisting government to improve the balance.

Decentralization of activities within the research system has progressed substantially over the past year or so. Effectiveness of regional research planning and execution has been facilitated by the IADS Production Agronomists.

There are critical manpower shortages throughout the research system, particularly at the field level. Additional staff, reallocation of some staff, and further in-the-field training will require innovative management by BARC/IADS and the institutes to make the expanded cropping systems research (CSR), farming systems research (FSR), and Multiple Location Testing (MLT) programs work.

II. CONCLUSIONS AND RECOMMENDATIONS

This section highlights selected aspects of project progress, major conclusions reached, and recommendations that the Team feels are important enough to be tracked during future project implementation. In the body of the report are additional recommendations and "suggestions" that the Team believes will be helpful in project implementation.

Due to time constraints, the body of this report is not organized to directly address the Terms of Reference. Section IV is organized around the nine program areas of the project, and evaluates project performance against specific outputs listed in the Project Paper and Amendment. This is then followed by five sections which deal with major issues of the project (e.g., Technology Transfer and Contract Research). This section, Conclusions and Recommendations, directly addresses issues raised in the Terms of Reference. Main points responding to each Term of Reference are discussed in subsection A, and other summary points and recommendations are presented in subsection B.

A. Response to Terms of Reference

Term 1: Contractor/BDS performance in terms of research management effectiveness, relevance, timeliness, quality, quantity, and responsiveness to national development objectives.

The Team has evaluated the research management performance of the International Agricultural Development Service (IADS), the Bangladesh Agricultural Research Council (BARC) and the research institutes in the BARC network.

IADS Performance

The Team was impressed by the high calibre and hard work of Specialists fielded by IADS. IADS problems (identified in the 1983 evaluation) regarding identification, recruitment, and retention of Specialists is not now, nor should it be in the future, a serious problem; IADS is nearly fully staffed. The Specialists are generally focussed on objectives established for their respective program areas and working effectively to produce desired project outputs.

In all program areas there is a major problem that limits progress toward desired outputs, but has been underestimated in planning and implementation. This is the inadequacy of available manpower, and the inadequacy of their formal education, for carrying out field research and data analysis. Because the program areas did not identify candidates for out-of-country training soon enough, and the BARC Training Cell and the GDB did not process candidates quickly enough, the number of trainees sent for degree work under this project has been limited. In addition the strategy alternative of out-of-country, short-term training has been stifled by the cumbersome GDB approval process, although both BARC and IADS are working to identify suitable candidates for such programs.

As a consequence of difficulties in arranging foreign training, IADS Specialists in all program areas are spending a large proportion of their time preparing and teaching short courses in research skills, arranging for short-term foreign consultants to teach such courses, preparing curricula and manuals for use by local training institutes, and personally

aiding individual local scientists in learning to design, implement, analyze, and write up research projects.

In addition, IADS Specialists are involved in helping BARC and the various research institutes to define research policy and priorities in program areas that are particularly relevant to GOB national development goals. Recently BARC/IADS personnel have given particular attention to research policy in irrigation and water management, livestock research, dry land agriculture, integrated pest management, and farming systems research. Also IADS Specialists have been involved in teaching research management skills in their particular program areas: e.g. preparation of research proposals, review of proposals, monitoring and evaluation, development of annual work plans, and preparation of progress reports.

Some specialists have been important in forming linkages between research institutions (e.g., those in Irrigation and Water Management (IWM), Economics and Social Science (ESS), and Farming Systems Research (FSR)). Specialists have also supported closer links between research and extension units, and between researchers and farmers (e.g., the Associate Production Agronomists). The Team feels that in most quarters of the national research system, the efforts of the Specialists are appreciated. A primary problem is that development-oriented skills they are attempting to inculcate have not yet been fully transferred in any program area. This is due to lack of counterparts, frequent transfer of counterparts, training problems discussed above, and other research management problems.

IADS' current financial planning procedures are much improved over those existing in 1983, and further changes are planned. Annual financial plans are prepared in conjunction with Work Plan preparation. However, quarterly expenditure statements by overall project line items and by program area are not yet being prepared in a timely fashion for distribution to those concerned with the project. IADS estimates an unexpended balance in their contract of around \$7 million on June 30, 1985. This will reflect under-expenditures in some program categories (e.g., Water Management and Pest Management) and over-expenditure in others. During the remainder of ARP-II, BARC/IADS will need to give particular care to drawing up Work Plans and budgets for their program areas and ensuring orderly use of resources. Until now, money has not been a restraining factor; but now, more careful management strategies are called for during the next two years.

Recommendation: BARC/IADS and USAID should review the fiscal situation, set targets for scientific/administrative accomplishments and budget, transfer funds to needy lines, and self-consciously use the annual work and financial plan process to allocate resources to various program areas.

The IADS-created administrative support unit, (which replaced BARC's International Projects Service Unit (IPSU)), is performing well. Commodity import problems have been largely solved; commodities and spares inventories are being brought under control; and orientation of new IADS Specialists seems to be adequate.

GOB Performance.

Problems encountered with the Bangladesh system of management have not changed since the 1983 external evaluation. There is still no significant delegation of authority, nor any observed inclination to do so, resulting in delayed decisions and a general constriction of all management processes. This is particularly apparent in such project areas as training; procurement of commodities; and research project approval, monitoring, and evaluation.

Recommendation: The GOB should empower the BARC Chairman to approve requests of agricultural researchers for short term training abroad. A precedent has been set by similar empowerment of the BAU Vice-Chancellor.

Manpower development is one of the primary responsibilities of BARC. Up to this point it has not received attention commensurate with its importance. A logical progression of activities is outlined in Section VII which will lead to a comprehensive technical and managerial training program for the national agricultural research system.

A number of constraints are in the path of this effort: non-recognition by GOB/BARC of its importance; lack of adequate staff; lack of access to computer and other facilities; insufficient work space for the staff to be productive; and non-recognition of the level of leadership required to make manpower development an important part of BARC's program.

Recommendation: GOB/BARC should remove the above constraints and establish an effective Training Division at BARC as expeditiously

as possible. The Team also recommends that both IADS and USAID use resources at their command to assure execution of the manpower development program.

Routine, periodic staff transfers apparently is a phenomenon inherited by the GOB from history. Irrespective of its rationale, it is a very damaging procedure for the agricultural research system.

Recommendation: BARC should try to quantify the damage done to agricultural research by the policy and advise the GOB on appropriate changes.

BARC has not solved the space problem for its own staff nor for IADS Specialists. There is inadequate office space for new Member-Directors under recruitment; there is still lack of space for the Training Cell; and the present building is generally overcrowded.

Recommendation: While the World Bank is financing additional construction, BARC/GOB should consider renting temporary office space.

There is evidence of under-utilization of some AID-procured equipment, due to lack of spare parts and proper maintenance.

Recommendation: BARC/IADS and USAID should review the maintenance policy under ARC-II, determine whether it is causing under-utilization of AID-procured equipment, and set a policy accordingly.

The significance bestowed by previous evaluators on BARC management of contract research as a means of influencing allocation of research resources appears, at this point in time, to have been over-estimated. However, contract research-funded projects have provided research in some new and key areas. According to available information, about \$3 million has been made available through BARC for contract research. Less than half of this has been spent or committed to be spent. This is in relation to an annual agricultural research budget of \$10 million (1984/85) and \$35 to \$50 million over the time period the contract research program has operated. The significant volume of new funds to be supplied for contract research by the World Bank could enhance the significance of contract research.

The current managers of the contract research program inherited a number of problems. There has been a disproportionate allocation of funds to certain institutions and individuals; the Technical Committee of BARC has not operated efficiently; yearly monitoring and reobligation of unused funds has not occurred; and decisions on some research proposals appear to have been arbitrary. Also, BARC's financial management procedures need improvement (expected to begin this fall), and the financial reporting of the PI's and research institutes is too slow to meet USAID sixty day financial reporting requirement. As a consequence, there is an extremely slow money flow and spending rate of contract research projects.

Recommendations:

- (1) BARC, IADS and USAID should review on going projects. Deobligate funds that will probably not be able to be spent

during the next two years, fund approved projects, and transfer surplus funds to other needy lines (e.g. construction, commodities or local support).

- (2) BARC, based on priorities for research programs established in NARE and other available sources, should make an indicative allocation of available contract research funds to the various program areas, holding some portion in reserve.
- (3) BARC should advertise the availability of contract research resources and invite proposals based on the prioritized research programs.
- (4) BARC should re-establish technical committees for each program area (The Team understands that this is now being done informally, but to be really effective, and so the research system can understand what is going on, the arrangement should be formalized) and these committees should meet quarterly.
- (5) BARC should involve IADE expertise, along with local expertise, in technical review of proposals.
- (6) BARC should consider simplification of the management of approved contract research projects as suggested elsewhere in this report (see Section VI).
- (7) BARC should ensure that its contract research project monitoring and evaluation responsibilities are carried out.
- (8) BARC should ensure that new contract research funds from the World Bank and other donors are administered using uniform procedures.

(9) BARC should assure that the results coming out of contract research are appropriately utilized in the research system and particularly in the extension system.

The Contract Research Manual is a mixed blessing. Necessary planning, review and approval, monitoring, and evaluation procedures are there, but the procedures are so cumbersome with limited BARC staff as to stifle the contract research program. Meeting AID financial reporting requirements is a major factor in complexity and cumbersomeness.

Recommendation: BARC should manage the program on an annual rather than quarterly basis, purely for simplification; more financial and monitoring responsibility should be shifted to the administrators of the institutes and universities, and additional incentives should be provided to EIs to increase competition for awards, and then require commensurate substantive inputs from the EI into the project.

It is recognized that annual financial monitoring will not suffice, but AID/BARC/IADS should do some creative thinking to simplify procedures now in force.

Term 2: Impact of project resource use on field station results in relation to local farmer adoption, interaction with local extension systems and local training activities. Quantification of research efforts in terms of increased publications, farmer field days, on-farm research, and feedback to planners and administrators for bureaucratic/political support.

Local Farmer Adoption. Neither BARC nor the crop institutes have given enough attention to monitoring farmer reactions to the new technologies, adoption rates, and increased production and

income. This type of feedback is necessary to evaluate the appropriateness of present research directions and to identify potentially useful new research projects.

Two small block monitoring studies at CSR sites indicate farmers are adopting modern rice varieties for T. aman rice. The rapid survey of 26 farmers at five CSR sites by Team members indicates that these farmers were using modern varieties to the extent they have irrigation water and sufficient funds to purchase fertilizer and other inputs. Farmers with limited resources plant modern varieties on some, but not all, plots and use half or less of recommended fertilizer doses. Also, many farmers are adding a third crop to their annual cropping pattern. Generally, they feel they are producing more than they did five years ago because of irrigation, increased fertilizer use, modern varieties, and, in some cases, addition of a third crop.

Recommendation: BARC/IADS should carry out a systematic study of the response of farmers to improved technologies developed at CSR sites and regional stations. Specifically, researchers should look at such issues as: how much farmers know about new technologies, their information sources, their evaluation of various technologies, constraints to adoption, adoption rates, and measurable consequences of adoption. This study should compare villages close to and distant from CSR sites. Promising sites for these studies include: Kalikapur in Ishurdi, which has fairly active researcher-farmer and research-extension linkages with surrounding villages, Jamalpur or Hathazari sites where

there have been less active outreach efforts, and a set of villages in some area where there is no CSR site or regional station.

Researcher Interaction with Local Extension Systems. One of the most significant achievements of the crop research institutes has been establishment of technology transfer and planning linkages with Department of Agricultural Extension (DAE) personnel. This process has also been supported by the World Bank ERP-II project. These linkages have been most effectively developed in the Northwest, and in four other districts where pilot projects were set up under ERP-II. The model of formalized, regular research-extension interaction has been moderately effective in the pilot areas and is now being expanded to other parts of the country.

Considerable efforts are made, particularly by BRRI and BARI researchers at regional stations, to transfer technical information to generalist extension personnel. These efforts include: monthly District Technical Committee (DTC) and Regional Technical Committee (RTC) meetings; joint development of "impact point" farmer recommendations for local areas; local planning of agricultural research for CSR sites and regional stations; and training of local DAE officers by agricultural research staff through special courses and information bulletins.

About 90% of CSR site research is now planned locally and 25% of regional station research is also planned to specifically address local farmer needs. In addition, there is now a yearly inter-institutional review of CSR site research in each region at

which scientific papers are presented (e.g., There were were 120 participants at the spring, 1985 meeting in Ishurdi). Finally, within the last year there have been regional CSR workshop meetings, including both extension and research personnel, to select improved technologies for extension to Multiple Location Testing (MLT) sites.

Local Training Activities. The Ministry of Agriculture (MOA) has given the research institutes, particularly BIRRI and BARI responsibility for training. BIRRI has provided rice production technology courses to extension personnel for several years. Now BARI regional stations are giving crop technology courses for local DAE officers. Also, Ishurdi regional station is publishing a quarterly Research and Extension Bulletin which is in great demand among extension personnel for training Block Supervisors and farmers. Ishurdi and Hathazari stations are also giving vegetable and fruit production courses to extension workers and some contact farmers.

Core program areas at BARC/IADS are working with local institutions (e.g., BARI, BADC, DAE, BWDB, and fertilizer dealers) to provide training courses in soil fertility, horticultural production, irrigation and water management, and pest management. IADS specialists in these areas have helped develop training materials and curricula. Finally, the BARI On-Farm Research Division (OFFRD) is currently running a series of courses on Farming Systems Research Methods for their own staff and DAE Subject Matter Specialists (SMS) and Subject Matter Officers (SMO), who will jointly conduct MLT trials.

Publications. The Team identified 43 publications produced by the Bangladesh agricultural research system since January, 1984. This does not include a large number of reports by short-term expatriate consultants. Also, there are collections of workshop papers, a journal, and other publications in process at this time. Of the 43 publications, the Team identified 23 field station publications and several collections of papers analyzing CSR site data which will be published in the future. Except for a series of annual reports from regional field stations (usually published two-three years late) and some socio-economic benchmark surveys at early CSR sites, all regional and CSR field station publications have been published since January, 1984. Within the BARI system, Ishurdi and Hathazari have provided most of the publications, but some reports have also been produced at Jessore. In addition, other research institutes such as BAU, BJRI, SRTI, EWDB, and MCC have provided reports on CSR site research. The BARI station at Ishurdi has now published three quarterly issues of its newsletter.

Most field station publications have resulted from CSR site research (socio-economic surveys and agronomic trials). Except for BAU and MCC reports and BARI benchmark surveys and commodity based surveys, production of field station publications has often depended on the encouragement, editorial skills, and sometimes actual writing efforts of IADS Specialists.

The Team feels that much useful crops research has been done and some information is available. But crops researchers are not

putting sufficient effort into documenting their research results for dissemination to extension workers and farmers.

Recommendation. Publications covering all aspects of production of a particular crop should be prepared as research results permit. This will require scientists in crops, soils, entomology, plant pathology, irrigation, and economics to pool their knowledge and make recommendations useful to extension workers and Bangladeshi farmers.

Farmer Field Days. According to the Team's count, since January, 1984 there have been 15 Field Days or Farmer Rallies at ICARI regional stations and CSR sites. Hathazari and Ishurdi regional stations and nearby CSR sites have been the most active in this farmer outreach activity. The same Production Agronomist has encouraged organization of farmer field days at both locations. Also, he has initiated smaller meetings with farmers at the beginning and end of seasonal trials. This seems to be a highly effective form of interaction with farmers. The regional stations are also beginning to provide short production technology courses to contact farmers and other interested farmers (e.g., Ishurdi and Hathazari vegetable and fruit production courses).

It is the impression of the Team, based on 26 interviews with farmers near CSR sites, that CSR research activities have raised the interests and expectations of nearby farmers. They follow field trials rather closely, and are very much interested in information flowing from the agricultural researchers. Most farmers interviewed at the CSR sites said they have attended

farmer rallies; have learned about new technologies; and want the CSR activities to continue so they would have a source of new information. Beyond a one mile radius, the farmers know little or nothing about CSR sites, and their knowledge of new technologies depends on other sources such as DAE Block Supervisors, neighbors, etc.

On-Farm Research. Through the BARC-coordinated National Cropping Systems Research Program, a good start has been made toward establishing a system of on-farm research. There have been sixteen CSR sites run by five research institutes. Over 75 cropping patterns have been tested at these sites and a large number of component trials have been carried out. Because of this CSR research, there are now: experienced agronomists who have conducted on-farm cropping pattern trials; experienced farmers who have participated in the trials; and experienced economists who have carried out socio-economic surveys and analyzed some of the data collected.

In the next two years the on-farm research program will expand in several ways: i.e. through development of new CSR sites; conversion of some CSR sites to FSR sites with addition of new research components in livestock, fisheries, horticulture, pest management, water management, and agroforestry; and addition of many MLT sites. BARI, BARI, EAU, and SRTI will have MLT sites. A large On-Farm Research Division (OFRD) has recently been created at BARI to carry out CSR site and MLT activities.

Manpower shortages are already critical at the field level, especially at CSR sites, and trained manpower is being stretched

ever more thinly. The Team anticipates that this will be a major constraint in developing an effective FSR program. Solving this problem will tax the ingenuity and inventiveness of BARC, IADS, and the various institutes involved.

Recommendations. BARC should carry out a solid manpower analysis of the research system and develop a strong training program and personnel policy to address recognized needs.

IADS Associate Production Agronomists have an important role in helping junior officers at CSR sites to perform better field level research, have more effective communication with farmers, and establish stronger linkages with extension personnel.

Recommendation. If USAID and BARC are interested in increasing the effectiveness of CSR site research and the quality and relevance of regional station research, they should extend the Associate Production Agronomist positions through the life of the Project.

Feedback to Planners and Administrators. The Team did not identify or quantify all feedback channels. However, feedback is occurring through visits of administrators to regional stations and CSR sites; discussions of field activities in committee meetings attended by BARC Member-Directors, Directors General of research institutes, and BAU officials; BARC-sponsored seminars and workshops; reports of donors (e.g., World Bank and USAID) to the MDA and the Planning Commission; and reports by DAE. Research institutions and field researchers may not fully understand the importance of this feedback or lobbying role.

Term 3: Identification of actual research successes adopted by farmers and their contributions to changing public perceptions. Impact of such successes on judgement by administrators and their resource allocations and by scientists within the system.

BARC/IADS and the crop institutes have not done very well in identifying and publicizing cases in which significant new technologies have been developed and adopted, and have clearly resulted in higher farmer incomes. They have not seen this as a particularly important responsibility of the agricultural research system. BRRI (in unpublished surveys) is beginning to measure the spread of modern rice varieties. CSR site staff have baseline and block monitoring data that could be used in addressing this issue, but available information has not been analyzed in this manner. This Team did not have time to document specific success cases, but we feel there are cases in the system that can and should be documented.

Recommendation. BARC/IADS should document several cases of successful transfer of improved technology and see that this information reaches the hands of appropriate administrators and scientists within the system.

Term 4: Consistency of intended outputs, as reflected in annual work plans with actual achievements as reflected in six monthly progress reports and annual evaluation reports.

Accomplishment of individual project outputs varies from zero to 90% (see Table 3, pp. 62-65). Overall performance in specific program areas varies from 53% for FSR to zero for livestock. These estimates are subjective and tentative. A more refined mechanism for assessment of output achievement against

expenditure levels should be evolved by BARC/IADS. Annual work plans prepared by IADS Specialists in consultation with BARC Member-Directors have improved each year. They now (1984/85) represent a good statement of what is to be done and associated costs. A review of the six-monthly Progress Report for July/December, 1984 indicates that work plans were closely and consistently followed. The few variations from plans that did exist were noted in the Progress Report, explanations were given, and alternate plans were proposed for the following six months or year. It is doubtful at this time that BARC Member-Directors and their staffs could effectively use these research management procedures on their own, because most of the work on previous plans was done by IADS.

Recommendation. IADS and BARC should ensure that BARC Member-Directors and program area staff are trained in these relevant research management skills (i.e., annual work plan and financial plan; progress reports) by participating fully in document preparation and evaluation of progress.

Annual plans are not specifically oriented toward achieving outputs outlined in the Project Paper and Amendment, but USAID and BARC approval of the plans is dependent on their consistency with project objectives. Also, internal and external evaluations provide opportunities to match achievements and plans with expected outputs in each program area. BARC and crop institute officers participated in the 1984 internal evaluation.

Term 5: Adequacy, timeliness, and relevance of the AID disbursement and PDG contributions and consequences on project implementation.

Manpower productivity is low in the national agricultural research system, primarily because of lack of balance in funding personnel versus operating expenses to make them productive. The situation has been temporarily alleviated by USAID funding for operating expenses. Continued support by USAID will be required until the GOB can effectively tackle this problem.

Recommendation. Given inadequate operating funds for an effective agricultural research system, USAID should either continue to provide funds under direct project assistance or Title III funds should be provided through BARC.

Recommendation: Every GOB organization in the channel of approvals for new research projects -- the Institutes, BARC, HCA, the Planning Commission, and the Ministry of Finance -- should give careful attention during the approval process to the balance in project budget between personnel and operating costs.

It is the feeling of the Team that additional senior scientific and administrative staff are needed to support each BARC Member-Director and to gradually take over many of the duties now being performed by IADS Specialists. These administrative and scientific professionals should be able to provide continuity during changes in Member-Director staffing.

Recommendation. There should be a manpower analysis of BARC itself, to determine what personnel at which levels of training are necessary to effectively accomplish duties assigned to BARC. The GOR should then establish and fill the needed positions and provide associated salaries and operating expenses.

There is some dissatisfaction at BARC, the institutes, and universities with disbursement of AID-supported contract research funds. There are several factors contributing to the very slow release of project funds to Principal Investigators (PI). These include: USAID quarterly reporting and control requirements (including a 60-day limit on outstanding funds); inadequate honoraria allowed to PIs and overhead fees to institutions for additional research and reporting work; and inefficient financial reporting and accounting by PIs, institutes, and BARC. In Section VI the Team suggests an alternative set of contract research procedures that might simplify the present cumbersome system. It is important that BARC develop a unified system that applies to all contract research funds, no matter which donor, and results in effective agricultural research directly relevant to national development objectives.

Recommendation. BARC, USAID, and other major donors (e.g., World Bank) should have frank discussions about the adequacy of present contract research procedures and of present disbursement and financial reporting systems and agree on necessary adjustments.

Term 6. Review and evaluate draft USAID proposal for continuing support to the agricultural research system beyond FAOD June 1987.

Recommendations:

1. This evaluation leads the Team to conclude that the objectives (proposed outputs) of the Project were appropriate as originally conceived, are still valid for building a national agricultural research system, and are only partially accomplished. USAID should continue to support these objectives until the bulk of the outputs have been satisfactorily achieved.
2. The Team agrees with the draft proposal's emphasis on decentralization of technical assistance to regional stations and CSR sites, and with the emphasis on full development of the farming system research activities. To ensure that both of these objectives are met, the Associate Production Agronomists working at the BARI regional research stations should be retained, but should expand their attention to work in support of all agricultural research institutes active in the region. Furthermore, they should work closely with the Mobile Farming Systems Team.
3. The proposed extension should provide technical assistance to the core disciplines of Crops and Soil Management to encourage basic research (e.g., development of new varieties) that will lead to new technologies for testing at CSR sites.

4. The Team strongly endorses proposed support for operating expenses and believes that USAID should ensure, throughout the remaining life of the project, that lack of operating expenses does not constrain the productivity of the research system.
5. The Team endorses the proposed direct payment procedures for contract research.
6. The Team has concluded that the overall performance of IADS has been at a satisfactory level. For the Project Extension, it is recommended that a host Government contracting arrangement be continued between BARC/BGS and IADS.

Term 7: To the extent possible determine the impact of the research investments associated with the project on changes in food output and resource productivity, initiation of new horizons for productivity changes, an growth and productivity of research, educational, an training institutes. Evaluate the benefits of the present linkages between the BGS research activities and those of the regional and international efforts in terms of captured comparative strengths. Site evidence of increased capacity of BARC in coordinating the national research system and its enhanced stature in the agricultural hierarchy of Bangladesh.

Changes in Food Output and Resources Productivity. The emphasis of the Project to this point has been on cropping systems for grain crops and a few pulse and oilseed crops. BARC and cooperating institutes have made significant progress in operationalizing the cropping system research concept and developing several cropping pattern packages that show high potential for increasing productivity with simple changes in traditional cropping patterns. As discussed above, actual adoption rates and increased food outputs resulting from these

packages have not been measured. The impression of the Team from its rapid survey of farmers near CSR sites is that many resource-poor farmers apply low inputs to modern varieties in order to attain moderate yield increases. Many are also adding a second or third crop to their annual rotation. At the BAU CSR site, researchers have initiated some low-input trials. At the Hathazari CSR site researchers have conducted studies of residual soil fertility, and are now in a position to suggest strategies for profitable reduction of fertilizer applications for some crops and seasons.

Recommendation: All CSR sites should conduct corresponding high input and low input trials, measure residual soil fertility effects, and devise other approaches to reach both rich and poor farmers.

Also, farmers can seldom meet the yield potential demonstrated in research trials, even those at CSR sites. Farmers still have less control over the production process (e.g., over selection of seed, site, planting time, storage, pest control etc.) than do CSR researchers.

Recommendation: Components which are essential to food production at the system level -- water management, pest management, grain storage technology -- must eventually be incorporated into trials at the CSR sites.

Now crops and varieties such as maize, potatoes, chillies and cabbage have been tested at CSR sites and successfully introduced to farmers. With introduction of new components at CSR

sites -- horticulture, agroforestry, aquaculture, and livestock -- farmers will eventually be exposed to a wide range of new options.

Growth and Productivity of Research Institutes. Throughout this report we note instances of growth and increased effectiveness of research institutes resulting from the project. For example, BARI has expanded core research activities at their Joydebpur headquarters including: Entomology and Pest Management, Horticulture, Soil Testing and Management, Irrigation and Water Management (Agricultural Engineering), and Agricultural Economics. Another major innovation at BARI is the recent establishment of the On-Farm Research Division to handle FSR and MLT research and research-extension linkages. Regional stations have achieved an improved capacity for research planning and developed significant new research in pulses, oil seeds, fruits, and vegetables.

All institutes which operate CSR sites have a better understanding of farmers and their problems, and have established some farmer-researcher contacts. BRRI and BARI, in particular, have mounted new efforts to train and work with extension personnel.

Growth and Productivity of Educational Institutions. The project has provided limited resources to educational institutes and, thus has had limited impact. At BRU, faculty projects and thesis research have been accomplished under contract research grants particularly in Irrigation and Water Management. However, there have been few attempts to change the curriculum to produce

students with field research skills. Dhaka University and IPFA have been little affected by the project outside of a few faculty projects.

Growth and Productivity of Training Institutes. There has been some effect on the activities of these institutes because training courses developed under the Project have been offered within them. There have been ESS courses at the Graduate Training Institute (GTI) at BAU, at the Rural Development Academy (RDA) at Bogra, and at the Bangladesh Academy for Rural Development (BARDA) at Comilla. There have been attempts to institutionalize introductory ESS courses at these institutes. Some courses that IADS Specialists in Soils, Water Management, Pest Management, etc. have prepared for extension workers are offered at CERDI and RDA-Bogra.

Linkages with International and Regional Institutions. The Team identified nine international research organizations and five regional organizations which have linkages with the Bangladesh agricultural research system as a result of specific efforts made in this Project. There are also at least ten agricultural research institutes in the US with which programs are linked. Although some linkages (e.g., with IRRI and ICRISAT) date back to the beginning of the project, there has been an expansion and intensification of ties since early 1984 as more in IADS Specialists have arrived and made arrangements for new activities. Such institutes as IRRI, ICRISAT, AVRDC, CIP, AIT, ISNAR and USDA have been important links for short term training

in Bangladesh and abroad. In addition, several institutions such as NIFTAL, IRRI, ICRISAT, and AVRDC have provided seeds and inoculum to research institutes in Bangladesh.

Some, but not enough, of the reports and journals of these international institutes are available to scientists in the Bangladesh agricultural research system.

Recommendation: The links between the Bangladesh agricultural research system and the international and regional centers should be increasingly shifted from IADS Specialists to Bangladeshi scientists. Project funds should support visits of Bangladeshi scientists to international centers and their participation in research conferences. Since GOB approval delays often limit timely travel of Bangladeshi scientists, project funds should also be used to bring international center scientists to Bangladesh.

Increased Capacity and Enhanced Stature of BARC. BARC has successfully assumed a leadership role in agricultural planning and coordination. An update of the 1979 National Agricultural Research Plan (NARP) has been completed by BARC, assisted by IADS staff and representing various program areas. The Team considers NARP an excellent basis for development of high priority research programs. BARC has increasingly assumed the role of the Government's representative in working with donors at the project planning stage to develop projects appropriate to the national plan and to reduce redundancy of projects.

BARC's role in planning and coordinating national agricultural research has increased over the past two years and will be enhanced in the future through a planned BARC-chaired review of each institute's annual research plan and through BARC's established position in the review and approval process for new agricultural research projects. This system should provide BARC with an effective coordinating mechanism for national agricultural research. However, BARC still lacks the means of enforcing its recommendations regarding institute research plans due to lack of control over budget and personnel. These are still in the hands of the Secretary of Agriculture. The Team was informed that a high level committee will be reviewing BARC's role and responsibilities, including the pros and cons of the Chairman of BARC also holding the title of Secretary to Government. This level of authority would solve many of BARC's present problems and could be the basis for increased research management effectiveness in the future.

BARC provides a forum for inter-institutional discussion of agricultural research topics which require coordination. Recent examples include: Barind and Dryland Agriculture, Priorities in Groundwater Research, Cropping Systems Research Results, National Farming Systems Research Program, Analysis of Socio-Economic Data from CSR sites, etc.

BARC has assumed a leadership/coordination role in Cropping Systems and Farming Systems Research. They have taken the lead in expeditiously establishing a National FSR Program Coordination Committee; assessing the current CSR sites to determine which

additional activities have most promise for which sites; and inviting proposals from research institutes. BARC/IADS is the appropriate unit to encourage submission of proposals, particularly from newly established research institutes such as BLRI, and to coordinate joint research between institutes.

BARC is involved as a member of the annual evaluation committee for each institute, conducts ad hoc evaluations that are program-or problem-oriented, and has established an evaluation program for contract research. The Team did not form a judgement regarding how effective the evaluation program is.

B. Comments on Program Areas

Livestock Research

Significant livestock research results will not be available for several years. Developments in this subject await establishment of BLRI facilities and training of research staff.

Recommendation. ARP-II resources should be utilized to assist in this major undertaking. In the interim, BARC and IADS should take available livestock and forage research results and begin to incorporate them into the ESR program.

Soil Management

The soil management program has been well developed and managed. Several technical suggestions are made in the soils management section. One particular policy recommendation is highlighted below. Fertilizer recommendations currently made to farmers are aimed at maximizing crop yields.

Recommendations.

1. Lower levels of fertilizer and other inputs should be researched, resulting in technology packages that will be more appropriate for Bangladesh farmers at the lower end of the resource-availability scale.
2. There should be more CSR research on rhizobium inoculation trials with HYV grain legumes and sulfur and zinc inputs.
3. Field soil test/crop yield correlations should be carried out on selected farms at CSR sites.

Water Management

The major conclusion reached by the Team is that the water management program has nearly reached full stride. More research needs to be focussed on groundwater development and water management. While a substantial portion of funds allocated to Water Management will not be spent during the life of the Project, the large back-log of contract research proposals in Water Management should substantially increase utilization of this budget category.

Recommendation. DARC/IADS and USAID should analyze Water Management fund requirements for the life of the project and make reallocations to other programs as appropriate and feasible.

Recommendation. The vehicle needs of the Irrigation and Water Management Program should be given serious consideration in the current budget decisions.

Pest Management

The pathology and entomology elements of the pest management program are just getting well underway. The two IADS Specialists involved will be able to assist in development of additional proposals for useful contract research. Implementation of an integrated pest management approach to crop protection has been initiated and will be emphasized during the remainder of the project.

Recommendations.

1. The Vertebrate Pest Management program is working well and should be continued.
2. Required physical facilities and equipment for adequate pest management research (i.e., methouse for plant pathology, screenhouse/insect rearing facility, and toxicology lab.) should be included in the next Annual Work and Financial Plan by BARC/IADS.

Crops

Recommendations.

1. The Horticulture research program should be strengthened, making use of the AVRRS linkage. A new seed production, distribution and promotion program should be established as part of it.

2. Greater emphasis should be given to working with junior level scientists at research institutes and field stations emphasizing inter-disciplinary research and preparation of commodity oriented publications for extension and farmers.

Farming Systems

Recommendation. BARC and the associated institutes should initiate their National Farming Systems Research Program by adding livestock, horticulture, and other research components to the CSR sites in 1985-86.

Economics and Social Science

The ESS program has produced some valuable benchmark surveys which have enhanced knowledge of scientists and extension workers about the local farming situation. Some useful studies have been done by expatriate consultants and some collaborative research between expatriate and local social scientists is underway. This research includes an important study of the role of women in rural household economics. The establishment of a series of short courses to upgrade research skills of economists and agriculturalists and the organization of quarterly Agricultural Economics Workshops are major achievements of the BARC/IADS ESS program.

Recommendations:

1. Give high priority to analysis of data previously collected and largely unanalyzed and preservation of data in a computerized data bank.

2. Focus their socio-economic analyses on major policy and developmental issues affecting the achievement of IFYP goals and objectives (e.g., crop diversification, rural employment, markets, and risk management).
3. Arrange regular fora at BARC and the institutes for interchange/discussion among agricultural scientists from all program areas and the agricultural economists.
4. Institutionalize the research skills training at BAU and other training institutions.

III. INTRODUCTION

A. Agriculture in the national economy

Agriculture is the most important sector in the national economy, accounting for about 47 percent of the gross domestic product, at current prices, 66 percent of all employment and a large proportion of the country's export. Of the total population of about 100 million (1985), 64 percent live in rural areas. The rural population is comprised mainly of farmers, and agricultural labourers. Of the total land area of 35.3 million acres, 21.2 million acres are under cultivation, at a cropping intensity of about 154 percent. Over 80 percent of all farms in Bangladesh are less than three acres in size. (1982 Statistical Yearbook of Bangladesh).

Bangladesh as a whole, has been a food-deficit area for 20 years. Although two rice crops a year are possible in the areas of low flooding, yields are very low as compared to those of other rice growing countries in Asia. The need for growing more and more foodgrains (rice and wheat) has been increasing with the population increase. Since there is very little opportunity to bring additional land under cultivation, production increases must come from more intensive cropping and from higher yields on existing acreage. To achieve this will require significant improvements in land and labour productivity which can only come from improved technology created by agricultural research and extended to farmers through the technology delivery system.

The role of agricultural research in permitting Bangladesh to maintain a static food import gap in spite of 2.5% per year increase in population is a major contribution of the research system. The yearly food production/consumption gap remained at 2.0 million MT on an average throughout the 1970's and into the 1980's. The increased population was fed by increases in crop yields based on agricultural research.

The value of agricultural research to the national economy should not be at issue. Studies throughout the world reflect rates of return on agricultural research investments of 20 to 90%. Studies in Bangladesh show a minimum rate of return of 30%, but a more realistic estimate of 50% (Pray, 1979).

B. Goals of the Five Year Plan

Self-sufficiency in foodgrains at a higher level of per capita consumption and with more balanced diets, through increase in the production of oilseeds, pulses, vegetables, fish and poultry, is one of the prime objectives of the Second Five Year Plan (SFYP). The SFYP calls for substantial increases in the production of foodgrains and selected other crops including oilseeds and pulses. The plan also places great emphasis on labour intensive methods of improving farming systems and soil and water management practices in order to use scarce resources more effectively to increase food production and to generate employment in Bangladesh.

The Third Five Year Plan (TFYP) is being developed which

relies heavily on the country's ability to achieve food self-sufficiency. The reduction of rural poverty is a dominant theme of the plan and most of the burden for providing nutritional needs, generating employment and for supplying exports falls on the agriculture sector. The agricultural sector will be widely diversified with greater emphasis on crops, forestry, livestock and fisheries. The available technology and current research will be mobilized to support programs for foodgrain self-sufficiency and crop diversification. Applied or adaptive research projects will be essential for agricultural research to make a marked contribution to national development during the TFYP.

C. The National Agricultural Research Systems

1. The Overall System

During the last decade significant developments have taken place to establish an effective agricultural research system in Bangladesh. The national agricultural research system has been strengthened by the Government with active assistance from many international donor agencies.

As the national agricultural research system of Bangladesh enters 1985, it is composed of over 1550 scientists working at eleven primary research organisations:

- o Bangladesh Agricultural Research Institute
- o Bangladesh Rice Research Institute
- o Bangladesh Jute Research Institute
- o Directorate of Fisheries

- o Fisheries Research Institute
- o Marine Fisheries Institute
- o Forest Research Institute
- o Institute of Nuclear Agriculture
- o Sugarcane Research and Training Institute
- o Bangladesh Tea Research Institute
- o Bangladesh Agricultural University
- o Livestock Research Institute

Several other educational institutions also conduct research in some field of agriculture science:

- o Dhaka University
- o Bangladesh University of Engineering and Technology
- o Chittagong University
- o Rajshahi University
- o Bangladesh Academy of Rural Development (Comilla and Bogra)

The Bangladesh Council of Scientific and Industrial Research and the Bangladesh Institute of Development Studies are also involved in agricultural research studies.

Two new institutes viz., Bangladesh Livestock Research Institute (BLRI) and National Institute for Fisheries Research (NIFR) have been created by the Government in 1984.

2. The BARC

The Bangladesh Agricultural Research Council is at the apex of the national agricultural research system. It has the responsibility for strengthening the national agricultural

research capability through planning and integration of resources. BARC is the umbrella under which the entire agricultural research effort is coordinated.

Some of BARC's basic responsibilities are to:

a. Research Planning

- Assume responsibility for nationwide research planning.
- Establish a forum to analyze the overall situation of the Agricultural Sector and guide the government in setting research priorities.
- Develop and update the National Agricultural Research Plan (NARP) and provide policy guidance to the constituent research institutes.
- Review and approve research programs/projects for execution by the constituent institutes.
- Monitor, evaluate, and coordinate ongoing research activities.

b. Manpower Development

- Make an inventory of current manpower assessment in agriculture and identify training requirement.
- Prepare master training plan and organize training programs to accomplish these needs.
- Guide agricultural education and training. The Government, according to MOA officials, feels it appropriate to make BARC responsible for the academics of all agricultural education and training under the Ministry of Agriculture, including IPSEA, the Agricultural College, the Agricultural Extension Training Institutes (AETIs) pre-service course and

other extension education and training. This will involve curriculum development and the preparation and administration of examinations for the trainees. This will be a new and significant assignment for BARC reflecting its growth in stature and the confidence of the GOB in its capabilities.)

c. A Grant Commission

- BARC's role as coordinator of a diverse range of research activities has been assisted through the mechanism of contract research. Currently seven donors including USAID (other six are the World Bank, FAO, CIDA, IFDC, IDRC and GOB) are providing funds for contract research which are entirely managed and implemented by BARC. BARC solicits research proposals and screens them, provides funds for selected projects, monitors the quality of their progress and evaluates the usefulness of the end results. Donors have demonstrated their confidence in BARC's capacity to coordinate and manage a grant research program. This capacity is growing through the assistance of AID and other donors.
- In 1993-94, USAID augmented the government's financing of recurrent costs with the taka equivalent of \$ 4.4 million of revenue generated from supplemental grant to PL-400 Title II. The entire fund was allocated to BARC by the government to reallocate to nine agricultural research institutes for meeting research operational expenses at regional and sub-stations. BARC has been effective in managing PL-400 funds.

- for recurrent costs.
- The Government is keen to continue this mechanism in the future which will help strengthen BARC's role in the national research system. The government has also decided to channelize other non-governmental sources of funds (foreign donors) for agricultural research through BARC, further indication of the growing stature and capability of BARC.

d. National Documentation Centre

- Improve agricultural communications, including publications, libraries, workshops, and conferences.
- Acquire and catalog all documents related to agricultural research and development.
- Have a system to make relevant documentation available to each scientist and keep up-dating documentation.
- Strengthen internal and international linkages among various research institutions.

D. The National Agricultural Research Plan (NARP)

A major responsibility of BARC is to prepare the National Agricultural Research Plan (NARP) to respond to the national priorities as described in the SFYP and projected for the TFYP. The NARP document helps BARC in discharging its role of research program planning and coordination of research activities. The first NARP was prepared in 1979 which served a useful purpose but had some deficiencies. Attempts have been made to correct these deficiencies in the NARP for 1984 through 1989. There is still

scope for improvement through periodic review and revision as needed to meet the national development goals and to take account of future government policies and national needs. The NARP has been accepted by Government and the first annual revision is now in process.

E. USAID Project Goals and Purposes

The USAID Agricultural Research Project Phase I was drawn up in 1976 for a five year implementation period with grant assistance of US \$ 8 million. The main purpose of the Project was to increase the effectiveness of agricultural research necessary for development of appropriate agricultural technologies for farmers. Phase I concentrated on building research facilities at IARI through technical assistance, training and commodities.

The USAID Agricultural Research Project Phase II started implementation on June 5, 1981 for a period of six years with grant assistance of US \$ 25.5 million. The purpose of the Phase II Project was an extension of the Phase I purpose. A key thrust of the Project is to develop capabilities in widely applicable, low-risk, high-yield and farm tested technological interventions for extension delivery to farmers. In general terms, this Project is targeted at developing technologies appropriate for use by those rural families who own two acres of land or less. The Project is concentrating on research system management; farming system research; economic and social science; soil and water management; crop and livestock research; information and

library services; and pest control research. The Project will help establish an effectively functioning agricultural research system by strengthening BARC's capacity to plan, implement, monitor and evaluate research programs.

F. Support from Other Donors

USAID's Agricultural Research II Project is not conducted in isolation but is integrated in the overall agricultural research program being coordinated by BARC. There are many other donors supporting various development projects of BARC and other institutions in the agricultural research network.

By far the most important donor in dollar terms has been the World Bank (IDA). The World Bank, after completion of the first Phase of its Agricultural Research Project, has provided a credit of \$ 32.18 million for implementation of the second Phase during 1985-90. The principal components of this project consist of (i) supplying machinery, equipment, furniture and vehicles for developing the physical facilities of BARC, Bangladesh Agricultural Research Institute (BARI), (BLRI), (NIFR) and Forest Research Institute (FRI); (ii) Contract Research funds; (iii) Manpower development and training for research scientists; and (iv) technical assistance. The first Agricultural Research Project funded by the World Bank contributed to the development of crops research only. The second Phase on the other hand has put more emphasis and major thrust on the fisheries, forestry and livestock research as the activities under USAID's Agricultural Research II Project are concentrated mainly in the areas of crops, soils and water management research. These complements

are made through close linkage among the donors in order to avoid wasteful duplication of effort and make efficient use of research resources.

USAID is the second-most important donor supporting agricultural research activities, and the Canadian International Development Agency (CIDA) is the third. CIDA is about to embark upon a major crop diversification program which will involve the promotion and development of potatoes, pulses, and oilseeds. CIDA is expected to contribute \$ 50 to 60 million over ten years to the crop diversification program. Various UNDP/FAO sponsored technical assistance programs/projects in agricultural research are in different stages of implementation and more are in the pipeline for implementation during the TFYE. In the areas of research policy formulation and research staff training, the Ford Foundation, the Agricultural Development Council and the International Research Institutes (notably IRRI, CIMMYT, ICRISAT, IDRC, IFDC, etc.) are also playing active roles.

While this reflects confidence of the GOB and foreign donors in BARC's capability, it will also require further strengthening of BARC's management and administrative capacities.

Rice research has had foreign donor support for over seventeen years. In recent years the main support to ERRI has been through the informal multi-donor consortium. The four-member aid consortium consists of USAID, CIDA, Australian Government and Ford Foundation. Besides, the Overseas Development Agency (ODA) of Britain has been providing technical

and other financial support for carrying out research on deep water rice in Bangladesh. The World Bank is also financing rice production and training through the Extension and Research II (ERP-II) Project.

G. Project Evaluation

A regular process of evaluation is an integral part of the Project. Scheduled annual evaluations are internal and external in alternate years. The purpose of annual evaluation is to determine how effectively resources are being used to achieve objectives and to recommend improvements in the performance of the Project. Evaluation team recommendations are reflected in the annual work and financial plans prepared for each financial year during the life of the project. This evaluation process has been a productive project management tool.

Three annual evaluations (two internal--1982, 1984 and one external--1983) were carried out earlier. This is the report of the external evaluation conducted in April 1985.

This Evaluation Team has evaluated the Project in terms of the achievement of the outputs specified in the AID Project Paper and the Project Paper Amendment. The general time frame therefore is from the beginning of the Project. However, the Team has concentrated primarily on what has happened since the last external evaluation.

IV. CONTRACTOR AND GOB PERFORMANCE

A. Research Management

1. Objectives and Priorities

The overall objective of this Program Area is to "strengthen and expand research management, planning, coordination, implementation, and technical and financial monitoring whereby a national research system can function and perform effectively". (FP p 14).

Proposed outputs from this program area include:

- a) Managerial and planning skills in place which will make the research system responsive to national goals, regional research priorities, and end-users (farmers);
- b) An inventory of research skills continually assessed and maintained and an appropriate personnel development program in place to meet requirements;
- c) A financial system which can assure funds are planned, allocated and disbursed in a judicious and timely manner;
- e) An evaluation procedure in operation that has the capabilities to interact at all levels within the research system;

None of the above outputs have been fully achieved, but progress has been made on most of them and planned activities will assure further progress in the remaining two years of the Project. Complete achievement of all of the outputs will require additional time and funds.

2. Managerial and Planning Skills

a. Skill Training

Managerial and planning skills in BARC and its constituent institutes are to be enhanced through training and by the advice and assistance of project supported specialists. Extensive in-country managerial training is underway. In 1984/85 (the 1983/84 program was rather limited) 190 persons were to be trained in-country in six separate training activities covering various aspects of research management. Participants are drawn from throughout the national research system. Some academic training in research management was proposed in the 1984/85 Work Plan but not carried out due to insufficient time to complete a degree before the PACD. Training has also included short term observation trips for senior research managers as well as attendance at international conferences.

The research planning and management training activities are appropriate and should be continued at the 1984/85 level of intensity until necessary training is completed.

b. Research Planning

The basis for improved research planning has been enhanced through preparation by BARC, assisted by IADS and the research community, of the National Agricultural Research Plan. This plan lays out and prioritizes all areas of agricultural research significant to Bangladesh agricultural development and was developed in terms of the SFYP and available TFYP targets. High priority research areas are clearly identified. The NARP is regionalized by the fact that certain commodities and resource

problems are identified with particular regions. The next step, which is underway at BARC, is to convert these priority areas of research into research programs.

The irrigation and water management program area has had a series of national conferences or workshops to identify and recommend important areas of research. BARC held the first conference in 1979, another in 1981, and the most recent in 1983. The 1983 report (Priorities for Research in Irrigation and Water Management) provided the basis for water management research priorities in the National Plan. The irrigation and water management group's effort appears to have been useful, and other research areas could benefit from this kind of dialogue. However, the National Agricultural Research Plan contains specific enough priorities that scientists in all fields of agricultural research should have no difficulty in preparing relevant research proposals. Research administrators in the various institutes should also have little difficulty in prioritizing the research programs for which they are responsible.

The national research system (all of its elements) should use the NARP priorities to guide the development of their research programs. The BARC should arrange for an annual update of the NARP to assure that research priorities are kept current with emerging problems.

The criticism of the NARP that it is really only a "cafeteria" of problems and issues is not accepted by the Team. The published plan is suitable for its purpose. Successive

annual reviews by Bangladesh senior research scientists should keep the NARP current and relevant. As indicated above, it does provide the basis for developing relevant research programs and projects.

2. Research Coordination

There are a number of mechanisms evolving through which BARC exercises its role in the coordination of the national research system.

A process is being developed where BARC will chair a review of the annual plan of work of each of its constituent institutes. This review process will give BARC an opportunity to see that proposed research is consistent with the NARP, does not duplicate the work of other institutes, and an opportunity to suggest inter-institute research activities where there is a common objective. BARC recommendations, if accepted by the institute Directors General, will be implemented by them. If BARC recommendations are not acceptable to the institute D.G.s the recommendations are sent to the Ministry of Agriculture where decisions are made and instructions given to the institutes or to BARC, as appropriate.

This system, while it does not vest control over the national research program in BARC, should provide an effective coordination mechanism for that research funded under the ADP. In the case of contract research, BARC exercises direct control over project approval and funding. Even though contract research has not represented a large part of the annual research budget,

it is still an important coordination/ planning mechanism in the hands of BARC,

Another coordination mechanism in the hands of BARC is its review of all new research projects, irrespective of the source of funding. BARC chairs a project review committee including local consultants and other experts in the field for each proposed new research activity from all of its constituent institutes, as well as other institutes and the universities.

No permanent coordinating bodies have been created by GOB within BARC. The recommendation for a Program Planning and Review Board (PPRB), made initially in the 1979 Moseman report and by most project evaluators since then, is still under review by BARC and by the GOB. There are serious problems of defining the role of PPRB in relation to the BARC Governing Board, the executive committee, the technical committee, and the Ministry itself.

The primary rationale for the PPRB is to involve scientists and administrators outside of the national agricultural research system in an active and helpful way in the system. A satisfactory arrangement for doing this has not been evolved and no formal action has been taken by GOB.

The Reasons for this are several and varied:

1. The institute directors do not want to be coordinated by another programming body, even though they are members of that body.

2. The MDA feels that the BARC Governing Board, Chaired by the Minister, is fully capable of handling the responsibilities proposed to be vested in the PFRB (Annex E)
3. The BARC has been reluctant to push for the PFRB because the PFRB role has not been clearly defined in relation to the BARC itself, and to the various committees created to help manage and execute the BARC's responsibilities.

The result has been a lack of action on this particular recommendation. There being this much uncertainty on the part of various elements of the Bangladesh agricultural establishment suggests that all of the pros and cons of such a Board have not surfaced so as to be understood by expatriate observers. It is recommended by the Team that the GOB sort out this issue among its constituent elements and create a PFRB in appropriate form, or decide that one is not necessary and bring the issue to resolution.

3. Research Skills Inventory

(see Manpower Development Section)

4. Financial System

a. The system

IAES has underway a major effort at revising and upgrading the accounting and financial system for the Project, not for BARC. The accuracy of the accounting and financial management system has been increased during 1984. In continued progression along these lines, computerization of the system records and reports will occur during July-September 1985. It is expected that the manual and automated systems will be maintained

simultaneously until March 1985. Having the accounting and financial systems computerized for ARP-II will be of substantial assistance to managers and decision makers in BARC and USAID, as well as IADS.

The Member-Director A&F of BARC is waiting until the IADS computerized financial management system is in place and working well. BARC will then consider whether or not to computerize their own system. No commitment has been made to do so. BARC's accounting and financial system was created to meet the peculiar and varied reporting requirements imposed by law and by regulation.

The Team recommends that BARC should expeditiously establish a computerized accounting and financial system and take advantage of the IADS experience and expertise with their system.

b. Project Expenditures

Table 1 provides information on actual project expenditures by program area for the life of the Project (to March 31, 1985). Funds committed but not spent are not included. Therefore, Table 1 overstates the amounts of funds remaining, and probably differentially, for the various program areas. Three program areas - Technical Support Services (TSS), Farming Systems Research (FSR), and Water Management Research (WMR) - have had essentially the same level of expenditures, i.e., 12%. Crops (14%) has had somewhat more, and soils (9%) and economics (7%) somewhat less. Research management (25%) is twice as high and pest management (3%) and livestock (2%) are very low.

TABLE 1: ARP-11 ACTUAL EXPENDITURES STATEMENT FOR THE PERIOD FROM JULY 1981 - MARCH 1985

Line Item	PSM	TSS	FSR	ESS	CRDPS	LRA	SMR	MNR	FMR	Cornell Contract Consultants	Sub Expense	HQ Staff Expense	Total	Project Budget	% Expen
1. Specialist and Consultant	976694	655789	835153	390288	697666	137800	325378	600626	222933	65231	-	-	4665352	9,136,000	53
2. Local Support	725020	913	13898	3798	6202	517	378	23588	5480	-	-	-	779960	1,891,000	71
3. Overseas Training and Travel	216151	32358	81521	73394	211908	16718	212462	138838	77795	-	-	-	1261124	2,261,000	47
4. In-country Training	37137	22492	2763	58077	42271	9954	34751	32984	16775	-	-	-	279286	1,135,000	25
5. Contract Research	-	-	6315	69306	115149	11391	52573	133139	-	-	-	-	387877	1,358,000	29
6. Evaluation	5482	-	-	-	-	-	-	-	-	-	-	-	5482	90,000	7
7. Commodities	423592	271906	155521	60834	305962	4564	221173	164114	47226	-	-	-	1654896	2,178,000	76
8. Construction	-	116852	-	-	-	-	-	-	-	-	-	-	116852	170,000	72
9. IAGB Headquarter Staff Expense	-	-	-	-	-	-	-	-	-	-	-	283518	283518	271,000	185
Total Direct Cost	2384847	1102304	1095163	646889	1379054	160946	826718	1123204	369310	65231	-	283518	9455352	17,666,000	53
% Distribution	25	12	12	7	14	2	9	12	3	1	-	3	100		
10. IAGB Management Fee													1464136	2,938,000	50
11. Procurement Fee													115792	152,000	76
12. Contingencies													-	1,049,000	-
13. Pre-Contract Exp.													25000	25,000	100
													11260320	21,200,000	51

BARC/IADS are not working against a total life-of-project budget for each program area, though one can be roughly approximated from PP data (see table 2). The annual budget evolves out of the work plan preparation process. This provides a great deal of flexibility to BARC/IADS in allocating resources to the various program areas. It does not provide a benchmark to determine which areas are behind and which are ahead of targets. This probably doesn't matter since funds, overall, have not been a limiting factor in allocations to the various program areas.

Some line items, like commodities, are in high demand and funds shortages have created some difficulties. BARC/IADS should review remaining Project commodity requirements and make recommendations to USAID, within USAID guidelines, for additional commodities that can be established as critically constraining a particular program area. An across-the-board request would receive less serious consideration.

USAID payments have obviously been adequate and appropriate but the timeliness issue is difficult to sort out. IADS has, in some cases, been unable to respond to BARC requests for activities execution because new commitments could have exceeded the \$500,000 advance from AID. Available funds can always be increased by IADS by submitting vouchers against the advance. For the most part, these vouchers come from BARC/GOB and are not timely. BARC needs to improve its financial monitoring, the institutes need to be more responsive to BARC, and USAID/Dhaka needs to do what it can within its authority to relieve this situation.

Table 2: Rough Program Budget Estimates from AID Project
Paper (1980) and FP Amendment (1982)
(Thousands of Dollars)

Program Area	TA	Training	Const. Commd	Cont. Res.	Budget Total	Actual Exp. (Table 1)	Diff. Amt	Remaining %
ARM	1,973	143	679	***	3,566	2,384		
Info/Lib	382	51				1,102		
Support Serv.			447			-----		
						3,466	60	2
FSR	703	185	273	***	1,161	1,295	66	6
ESS	1,685	217	198	***	1,530	647	853	57
Crops	1,285	224	347	***	1,656	1,379	477	26
LS	341	92	50	***	483	181	302	62
Soils	427	80	108	***	605	627	-216	-36 over
W.Mgt	1,428*	1462*	264*	983	4,246	1,123	2,923	72
			(322)					
PNR	1,426	193	74	***	1,693	386	1,307	77
Total	6,225	1355	2,423	1480	14,914	9,455	5,959	39
	717*	45(Travel)	56*		520	65 CU		
	-----	-----	-----		-----	284 HQ Staff		
	6,942	1400	2,481		15,418			
		1292						

		2692						

* Adjustments from '82 Amendment

** Allocated from R.L. Cushing Master Plan, Table 1.

*** \$520,020 available for contract research

CU = Cornell University

Table 2 was created from data in the PP and Amendment. Commodities were allocated as R.L. Cushing did for the 1982-83 fiscal year (a rough estimate) because they were not allocated in the PP. No attempt was made to allocate contract research funds.

Water Management and Pest Management budgets are about three fourths underutilized. USAID over optimistic estimates of what could be spent in the former; delays by BARC in initiating the Pest Management work and some IADS recruiting difficulties in the latter.

The Soils program area is over spent and Research Management/Support Services and Farming Systems are about exhausted. Livestock and Economics and Social Science (ESS) have three fifth of their budget remaining. There were delays in appointing a Member-Director for the Livestock program and in recruiting an IADS Specialist. BARC never accepted any IADS candidate for the second agricultural economist position. Crops appears about on target.

Soils, Research Management, and Farming Systems obviously need continued support. It is unlikely that Pest Management, Water Management, Livestock, or ESS will be able to utilize the original estimated budget. This is not necessarily a problem. Some things have changed since PP preparation, others have not evolved as expected. It is timely now to reassess and reallocate.

It is recommended that BARC/IADS/JID review this situation, set targets for accomplishments (and budget) in the various program areas for the remaining life of the Project, and use the annual work and financial plan process (as is presently being done) to allocate resources to the various program areas.

c. Expenditures in relation to outputs

Table 3 is an attempt to relate Project inputs to expected outputs. Program area expenditures from Table 1 are taken as the inputs. Outputs detailed in the PP and PP Amendment are taken as the expected outputs. Progress toward achieving individual outputs is a judgement based on available documentation, interviews with BARC, GOB, and IADS staff, and observations in the field. These are subjective estimates of the percentage completion of the various outputs. By averaging the outputs for each program area (in effect adding apples and oranges together) a very rough overall performance can be measured against accumulated expenditures.

Pest Management appears the most efficient in achieving outputs--35 percent with only 3 percent of the funds expended. The most progress has been made by Farming Systems and Soils with about 50% of outputs. The least efficient program area is Research Management/Technical Support which has achieved 35 percent of its outputs but used 37 percent of the funds expended. Crops and Economics are on the low side and Livestock is near zero.

Table 3: Project Inputs (Expenditures ---- 3/31/88 by Program Area and a Subjective Assessment of Progress Toward Achieving Expected Outputs.

Program Areas	Inputs	X	Expected outputs	Progress Toward Achieving Outputs (%)
1. RSM	\$ 2.4 million	25	a. Managerial and planning skills in place that are responsive to national goals, regional research priorities and end-users (farmers);	50
1.a ISS	\$ 1.1 million	12		
Total	\$ 3.5 million	37		
			b. Coordination bodies within the research system in place which decisively address issues and enact recommendations related to the direction and quality of research and use of scarce human and physical resources;	PPRB- 2 40
			c. An inventory of research skill continually assessed and maintained and an appropriate personnel development program in place to meet requirements;	30 0
			d. An evaluation procedure in operation that has the capabilities to interact at all levels within the research system;	40 60 (Contract Research)
			e. Financial system which can assure funds are disbursed in a judicious and timely manner;	30
				(31 average)
2. FSR (On-Farm Trials)	\$ 1.1 million	12	a. A functional Field Trials Division able to design, program, and manage a farming systems program;	90
			b. Pilot activities for livestock interventions;	0
			c. Functional units of research/extension teams under the technical committees (DTC) at the District level;	50
			d. Major crop commodities tested and found appropriate;	75
			e. Research personnel trained in farming systems activities in place at those research stations participating in collaborative research/extension/farmer research programs.	50
				(53 average)

3. ESS	\$ 650 Thousand	7	a. Fully operational units within the research system capable of providing socio-economic inputs with social and economic scientists trained in field level farming systems research;	63
			b. Special undertaking in the major areas of agricultural development requiring socio-economic analysis;	50
			c. A centralized unit within the research system capable of processing social and economic data generated by the agricultural research institutes.	0
			d. Policies and procedures for selecting research activities and programs that will produce technologies designed for adoption in small farm agriculture systems.	20
				(32 average)
4. Information & Library Science	Funding Included in Item 1		a. Facilities for agricultural research information dissemination to concerned agencies and individuals in the agricultural sector.	50
			b. Basic audio-visual materials in place for instructional programs related to agro-technology transfer.	40
			c. Operational Technical Libraries) and documentation services in the national agricultural research network at the central and regional station levels.	30
			d. Personnel trained and in place to perform tasks in library sciences and information communication.	30
				(38 average)
5. CRC	\$ 1.4 million	14	a. personnel trained at the post-baccalaureat level to address key basic research problems in four crop areas;	30
			b. An operational multidisciplinary effort involving selected crops including three key factors (soil/water, socio-economics, pest/weed management);	40
			c. Special studies including the role of women in summer vegetable crops and/or root crops, marketing and post harvest technology;	10

			d. Basic packages of proven food crop production technologies available for testing as part of a cropping systems program.	50
				(33 average)
6. LAC	\$ 150 Thousand	2	a. Basic information available on feed sources for livestock; studies underway on feed practices in at least three pilot areas;	0
			b. Minimum of four fodder crops being tested in cropping systems research;	0
			c. On-going studies in feed nutrition, farm wastes and by-products;	0
			d. Studies underway on draft animals use, husbandry and health.	10 (2 average)
7. Soil Management	\$ 825 Thousand	9	a. Trained personnel in selected areas of soil management research and fully operational coordinated units addressing soil research problems;	45
			b. Functional soils research program in place in a division of 4 areas;	50
			c. An operational program which will address the adoption, use and maintenance of equipment for tillage operations.	0
			d. Specialized soil research projects that generate information to help resolve cropping systems problems.	70
			f. Soils diagnostic services operational from one central laboratory to service an all station network.	80
				(49 average)
8. WMC	\$ 1.1 million	12	a. Water resources development	20
			b. Professional development	25
			c. Research results documentation	30
			d. Research/extension linkages strengthened	20
				(25 average)
9. PNC	\$ 370 thousand	3	a. Methodologies developed, tested and utilized which mitigate crop losses due to pests;	40

- | | |
|---|--------------|
| b. Functional research facilities and staff capabilities to monitor pest problems, test pest control technologies and produce effective recommendations that are socially and economically acceptable to farmers; | 30 |
| c. Personnel trained in managing and implementing research projects in pest management; | 50 |
| d. Formulation of a national pest control program with personnel capable of management and implementation at the field level. | 20 |
| | (35 average) |

Non-program
cost \$ 2.8 million

The readers attention is called again to the subjective nature of this exercise. It could be considered as the first step in an approach that could be refined by BARC/IADS to (a) provide useful information on project performance to the GDB, AID, and others interested in the Project, and (b) to provide BARC/IADS with insights into where things are happening and where they are not, in relation to funds expended.

The Team recognizes that there are logical explanations for much of the variability in performance. PNR was late getting started. Livestock and Fisheries do not have operating institutes yet. Only one of the two planned agricultural economists was recruited.

5. Evaluation Procedure

Current evaluation procedures of BARC fall into three categories. There is an annual internal evaluation of each institutes research program. BARC serves as a member of the evaluation team. In addition, BARC may schedule smaller evaluations which are done on an "as needed" basis. These are more project or problem oriented. One report of this type of evaluation was available for review. An external evaluation team of six scientists was formed by BARC to evaluate the research program under the Soil Science and Water Management Division of BARI during July/August 1983. The team was composed of leading scientists in the fields involved. They were provided clear terms of reference by BARC. They carried out the evaluation by interview of involved scientists and review of written reports by each section Head of their past and present research

activities. A set of recommendations was made by the team to guide activities of the Division. We do not have a follow-up analysis of the extent to which the recommendations, some of which appeared rather unrealistic, were adopted but assumed that BARC does have appropriate follow-up procedures. It is useful for BARC to conduct external evaluations which result in a better understanding by BARC officials of the programs and activities of its constituent institutes.

Finally, BARC has developed a specific set of evaluation procedures for contract research, including a scheduled timing for the evaluation.

Evaluation procedures appear rather general as in the case of BARC participation as an evaluation team member for the internal evaluation of each institute. It is not clear what preparation BARC makes for participation in evaluation meetings, nor what kind of followup activities are carried out.

BARC should formalize its evaluation procedures with notice to all constituent institutes.

B. Support Services

1. International Projects Service Unit (IPSU)

Under the USAID Agricultural Research Project Phase I, BARC established an International Staff Support and Coordination Cell (ISSCC) for the administration of certain technical assistance activities. All staff of the Cell were recruited locally and for the first three years, expenditure of ISSCC was covered from the USAID grant. It was intended that ISSCC would initially support the ARP-I expatriate scientists, but would evolve into a section of BARC through which all foreign donors to agricultural research could channel their resources. The ISSCC was subsequently renamed as the International Projects Service Unit (IPSU) in order to identify it more clearly as a service and support unit of BARC. The IPSU was responsible mainly for providing logistic support to expatriate specialists/consultants and providing arrangements for Bangladeshi scientists to attend overseas training/international conferences and workshops.

For reasons not analyzed by this Team, the IPSU was not able to properly support ARP II. It was therefore decided that IADS should develop its own support unit. This has been done. At present, there is minimal interaction between ARP II and IPSU.

It is recommended that BARC should review the IPSU performance and develop an alternative system that is effective. They could consider a contracted system such as the one IADS is currently using.

2. Logistic Support (IADS)

Housing, orientation and other problems of IADS Specialists mentioned in the 1983 External Evaluation appear to have been solved or moderated to such an extent that no one sought out Team members to complain.

The size of the IADS motor pool is inconsistent with the size of the IADS staff, particularly considering the fact that there is a continuous, large flow of short term consultants. This problem is being addressed by the acquisition of additional vehicles. However, these have been delayed too long by the slow clearance of them through the COB by EARC.

Field work in water management and crops research, as reported by IADS specialists and all research administrators in the field, is constrained by lack of vehicles with a capability to move equipment, as well as people, between work sites. The 1982 PF Amendment provided for five vehicles for water management activities which have never been available for this program.

3. Commodities and procurement

Apparently adequate spare parts for AID financed equipment were not acquired with the initial purchases. This situation should be reviewed in detail by IADS and the appropriate complement of spare parts acquired.

Throughout the National Agricultural Research System, there is a shortage of appropriate transport available to research scientists. Shortage of laboratory and other equipment was consistently reported to Team members visiting the institutes and

field stations. Based on the team's observations, we believe these complaints are valid. The Team is not in a position to make a specific recommendation, only that BARC and its donors give serious consideration to scientists requests. The mobility of research scientists is essential if linkages with farmers and with the extension system are to be made effective. The maintenance program recommended below should get some of the "down" vehicles and equipment back in use and keep them there.

4. Utilization of Micro Computers Procured from the ARP II

Fifteen Micro computers, consisting of four IBM - PC XT's and 11 IBM - PC portables were delivered to BARC on January 30, 1985. The rationale for procuring the machines was the need for computer assisted analysis of field data at the regional research stations of BARI as well as the need for introducing computerization at the constituent research institutes of BARC. Following an orientation and training program in the BARC Computer center, the machines will be distributed to the institutes and to divisions within BARC.

Rooms to house the machines have been refurbished and wiring, electrical sockets, air conditioning, tables and cabinets have been provided at BARC. One local consultant was hired to install, coordinate and manage the computers.

Training programs taught by an expatriate consultant began early in April and will be continued for 2 months. Training focuses are orientation to computers, word processing, spread

sheet and data base programs. The initial plan was to continue training activities for about 6 months before distribution of the machines.

Major activities for the use of computers are planned and a few are underway. At the present time, computerization of a water management bibliography is in process. A short-term consultant-librarian and computer enthusiast has trained BARC operators to utilize the computers for the water management bibliography and has shown how the same program can be used for all library holdings, accession, etc.

By cooperation between IADS and ISMAR a major human resources data bank to track scientific manpower is in the design stage using BARC data collected earlier. ISMAR has agreed to provide one of its staff members to design and implement a human resource data base. He will visit Bangladesh about five times in the next 18 months and in October of 1985 present a workshop on computerization of Bangladesh scientific manpower, to be attended by representatives of all constituent units of BARC. Areas of BARC which need computer support are:

- a. The National Library and Documentation Center (NALDOC)
- b. The Training Cell
- c. The Accounts Division
- d. Human Resources Management Cell
- e. Inventory Control

Distribution and use of computers in the field is expected to enhance regional and institute research capability. It is

especially important to get computers and trained manpower into the field. With the transfer of the portable computers to the field, it will be important to provide BARC with more powerful computers and staff training in their use in order to carry out intended computerization. These needs will have to be assessed as the program evolves.

5. Maintenance

Current policy of AID/IADS is that, when equipment is turned over to the institutes or BARC, the Project has no further responsibility for it. Maintenance is not provided under the Project. A change in policy is required to allow maintenance of such equipment under the project for effective use of the equipment.

A system for timely maintenance of field and laboratory equipment, including the appropriate complement of spare parts, needs to be developed for the entire national research system. For most maintenance requirements a system should be installed at each institute in the BARC system. The Team recommends that the system for inventory and tracking of equipment and spare parts being installed at BARI is impressive and should also be implemented at other BARC institutes.

For more sophisticated equipment, the BARC should implement the plan it has developed for a centralized facility to serve all institutes, including the mobile repair capability.

6. Training

A wide range of training programs have been carried out under ARF-II. These are amply illustrated in the 1984/85 Plan of Work. The heavy emphasis in the Project on training of all kinds is highly lauded by the Team. The Project has included post graduate degrees, short-term training courses within the country and outside of the country. In addition, study tours and participation in international conference/seminars were also planned. This Project has provided \$ 3.4 million to carry out the training program.

Seven PhD and 22 MSc degree programs outside the country have been filled as planned in the PP. The short-term training courses outside of the country are lagging behind the planned schedule. The utilization of funds, including those committed, upto March 31, 1985 is 47%. The main constraint to sending scientists abroad is to obtain approval from GDB. Several reasons have been put forth for the reluctance of GDB to approve some training. The cumbersome procedure for obtaining approval has caused some difficulties, but more significant may be the Ministry of Agriculture view that some of the proposed training was not really needed for the individuals proposed or that the training program was poorly designed.

For the in-country training program this project has provided \$ 1.14 million. Though the utilization of funds increased in 1984-85 compared to the past, still the total expended and committed amount up to March 31, 1985 is only 25 per cent. Eighteen PhD and 29 MSc in-country scholarships have been awarded to scientists. A series of in-country short-term

training courses have been conducted to train both researchers and agricultural extension personnel. The DG of DAE considers BARC supported training extremely important to the functioning of the extension program. Under the in-country training program, provision has been made for sabbatical studies and 10 scientists have taken part in these studies.

Recommendations

1. The chairman of BARC be empowered by the government of Bangladesh to authorise personnel of the national agricultural research system to take part in the overseas training and travel in the same manner as such authority is now delegated to vice-chancellors of universities.

Comment: This recommendation has been made by each evaluation team since the 1983 External Evaluation and has not been acted on by Government, perhaps for the reasons given above and perhaps for other reasons. BARC, with IADS analytical and programming assistance, should prepare its case for the short-term training that is not being approved and take it directly to the Ministry of Agriculture for resolutions. Resolution meaning either positive action by Government on the recommendation on a set of criteria to be followed by BARC in implementing this kind of training so that the Ministry of Agriculture would approve.

2. To conduct more in-country short-term training courses, seminars, workshops, and farmers field days. Over the next two years a plan should be developed and appropriate funds be allocated to the participating research institutes. These institutes will conduct the training program, as outlined in the plan approved by BARC, from their own funds and will be reimbursed from BARC after submission of vouchers.

Note: See Manpower Development Section for additional recommendations.

3. BARC should reconsider the ineffectiveness of IPSU and develop an alternative system that is effective.
4. BARC should establish computerized systems to handle the following activities: NALDOC; Training; Accounting; Manpower Management; and Equipment Inventory.
5. BARC and USAID make a change in policy to allow maintenance under the project of equipment turned over to BARC and the research institutes.
6. The new BARC inventory system should be expanded to include all equipment for BARI and other research institutes.

C. Farming Systems Research

Objectives

When the Agricultural Research Project-Phase II was developed, there was a primary concern on the part of the Review Team that within this project "scarce manpower and financial resources are utilized efficiently in overcoming problems facing farmers, and in achieving national food production, employment, and other agricultural sector goals" (Report of the Review Team, 1980). In order to achieve this, it would be essential to avoid inefficiencies that had occurred in some past agricultural research system development projects. These inefficiencies were: 1) failure to develop improved technologies that met the needs of farmers and 2) failure to adequately transfer the new information to farmers. They could be corrected by improving the dialogue between researchers and farmers. The purpose of this component consisted of two parts: a) to identify farm production problems and more productive uses of the limited available resources of the entire farming system; and b) to carry out research on all aspects of the farming system by means of a multi-disciplinary research effort.

There were five expected project outputs:

- a) A functional Field Trials Division able to design, program, and manage a farming systems program;
- b) Pilot activities for livestock interventions;
- c) Functional units of research/extension teams under the technical committees (DTC) at the District Level;

- d) Major crops tested and found appropriate;
- e) Research personnel trained in farming systems activities in place at those research stations participating in collaborative research/extension/farmer research programs.

Problems and Issues

Delayed Conversion To A Full Farming Systems Approach. The concept of farming system research includes two aspects:

1. research scientists interacting with participating farmers to learn about their needs and production systems and to carry out collaborative research on their fields;
2. researchers from various disciplines carrying out research on all components of the farming system.

The first aspect of the farming systems approach has been operationalized in the CSR sites. The second aspect has not been developed. As also emphasized by the 1993 External Evaluation Team, the emphasis at the sites has been on developing cropping system technology but with some data collection on the rest of the farming system.

To this point there have been no significant efforts to introduce livestock, fisheries, vegetable or fruit production, or pest management research into the CSR sites. There has mainly been an emphasis on grain crops, some oil seeds, some pulses and the potato. Some trials near Hathazari have included chillies and shim beans, and some near Jessore have included cabbage. However, at least three of the EARI regional stations and associated CSR sites have begun to do more work on vegetables

because farmers are asking for improved technology in this area. In general, there has been little work at the CSR sites on post harvest technology, storage, and marketing issues. There was some work at the Ishardi regional station on seed storage. The water management program has only recently been integrated into a few sites because the original plan called for the CSR sites to focus on rainfed production systems. However, in time many of the rainfed sites have developed irrigated areas, and the rainfed/irrigated land distinction has become an important one in developing appropriate improved technologies. Water management research is primarily being carried out on a separate network of village command areas. This team feels that many of these additional farming system components could usefully be addressed in the CSR (FSR) sites.

The major reason the research focus did not broaden beyond the cropping systems focus for the first four years of the project is that in 1980 BARC had initiated a work plan for a National Cropping System Research Program. BARC and the crop institutes wanted to complete this planned program first. There was no interest in BARC or the Ministry of Agriculture in shifting the focus at the CSR sites until the latter part of 1984 when the former Secretary of Agriculture began to urge BARC to add other research components into the farming systems research. At this time BARC took the initiative in addressing the issue of converting from a cropping systems focus to multidisciplinary farming system research teams. These efforts are discussed below in the "Accomplishments" Section. This Team feels that the

correct decision was made to concentrate scarce resources first on developing the cropping systems research.

Institutional Development Lag. A second reason it has been difficult to implement an interdisciplinary farming systems approach at the CSR sites has been the asynchronous development of Bangladesh research institutes and research programs. The program areas of BARI that were developed sufficiently at the beginning to do on-farm trials were crops and soils areas. BARI Horticulture, Pest Management, Post Harvest Technology and Water Management programs have just begun their research and manpower development in the last 2-3 years with the help of USAID and other donor funds. BAU, BJRI, and SRI were also able to take advantage of the new funds and establish CSR sites which conducted cropping system research. None of these institutes had a research capacity in the livestock or fisheries areas. The livestock and fisheries research institutes are just being created and funded. All of these research areas soon will be able to offer some expertise and do some on-farm research at the FSR sites.

Limited Researcher-Farmer Interaction. An important idea in the ARF-II project concept of farming systems research was to reduce the information and status gap between professional scientist researchers and farmers. The goal was to develop an "outreach-oriented agricultural research" by improving the professional knowledge about farmers "complex farming strategies" and developing an attitude of a joint effort by professional

researchers and farmers in dealing with farm production problems (PR, Annex H, p.5).

In the actual development of the CSR site research there has been a mixed performance with regard to these goals. Critical positions in this farming systems approach were assigned to the agronomist and economist junior scientific officers (SOs) at the CSR sites. This was a new role in the Bangladesh agricultural research system and a tough role in terms of close interaction with farmer realities. It has been difficult for the new recruits at isolated sites to define this role for themselves, stay committed, and do useful work without trainer-models supervising them and encouraging them. Also, until this last year the CSR site officers were on temporary contracts with no job security as permanent BARI employees. This contributed to frequent turnover in these positions. There is also high mobility due to frequent transfers from one location to another in the OFRD system. Another disruptive factor in the program is that some of these scientific officers officially remain in their positions while they are completing in-country masters degrees. These staff are often absent from the CSR sites.

Finally, because of trained manpower shortages and scarce funds, in the Northwest the SOs at the BARI CSR sites are also managing OFRD substations. There is a similar situation of multiple job responsibilities for the scientific officer at the BAU CSR site. In spite of these conditions, there are some dedicated young staff who have done some effective work at the CSR sites. However, in the least effective cases, there is little

direct contact between an SO (agronomist or economist) and farmers at a site. For reasons listed above, the SOs may not often be working at the sites. Also they spend time at the regional station or their CSF office writing reports, briefing visitors, or compiling data. In these cases the main contact with the farmers is through the field assistants (local workers usually with 10-12 years of education) who carry out surveys and work with participating farmers in putting in and measuring yields of the experimental trials. In these cases, there is limited learning by the SOs about the farmers' point of view.

The IADS Production Agronomists at the regional stations have been moderately successful in encouraging SOs to spend more time at the sites and to take a more active role in managing on-farm trials, organizing farmer field days, and monitoring farm systems. These Production Agronomists are doing a valuable job in acting as model-trainers for these SOs and providing support to them.

Limited Socio-Economic Input In Cropping Systems Research. In the ARP-II Project, the economists and social scientists have the important role of collecting information about the socio-economic conditions and production decision-making of local farmers. They are to feed this information to agricultural researchers to ensure that new technologies are economically and socially viable in the rural farming system. A second responsibility was to monitor performance of cultivators to assess the pay-off of new technologies as a guide for further research efforts.

Although the economists completed comprehensive benchmark surveys, these generally took too long to complete to be able to significantly affect the direction of experimental research at the sites. In some cases, however, preliminary reports provided information about traditional cropping patterns which formed the basis for experimental trials.

At this point, the Team was not able to discover much monitoring of cultivators' attitudes toward the improved technologies and adoption of them. Reliable information should be collected by rapid rural appraisal with direct questions eliciting the farmers' point of view. These should be semi-structured interviews or discussions to allow farmers the opportunity to express their ideas more freely.

The economists are beginning to evaluate the improved cropping patterns developed at each site in terms of factors such as: net returns, marginal returns using partial budgeting, labor and draft power demands, variable input costs, and market risks. This is useful analysis but could be even more valuable if it is done for each FSR site and communicated in a convincing and timely fashion to the agricultural research program that is involved. In the case of BARI OFRD, this useful input could be presented at the DTC and RTC meetings. Alternatively, there could be regular meetings between the Agricultural Economics Division and the OFRD at BARI to consider the socio-economic evaluation of proposed technological packages. At these meetings the farmers' evaluation of new technologies should also be presented. When

additional research components are added at some sites, the economists should follow the same approaches.

Need to Focus on Markets. One important element of farming systems research that has just begun to receive research attention is local, regional, and national agricultural commodity market structures and needs (e.g., Elias *et al.*, 1984; Elias and Hossain, 1985). This involves an action-oriented kind of research particularly regarding new crops or crops with expanding production (eg. maize, vegetables, etc). This means that the research findings are fed to a government unit which has the responsibility of facilitating new market infrastructures. This link between economic research on issues in local, regional, and national agricultural market systems and an action oriented body should be arranged by BARC. BARC should tie in the proposed CIDA project on commodity marketing to the ESS and FSR programs of USAID's ARP-II Project.

Accomplishments

Data Base About Farmers. There are valuable baseline site descriptions prepared by socio-economic research teams of six village areas in diverse agroclimatic zones of Bangladesh. These provide comprehensive data on various aspects of farming systems in these areas. Some of this data has been usefully pulled together in Benchmark Surveys with some preliminary analysis carried out. They may be most useful as baseline studies. This information has helped maintain some focus in agricultural research on farmers and their production needs and constraints.

Testing of Existing and Improved Cropping Systems. On farm trials have been conducted comparing existing cropping patterns with improved cropping patterns, usually consisting of replacing local varieties by improved ones or adding a third crop. This has resulted in some adoption of the improved varieties near the CSR sites and spread by extension to other farmers. Farmers near the CSR sites have learned about the yield differences in the comparisons and do make changes when they feel they can make the adjustment.

The BARC/IADS component on Farming Systems is compiling and interpreting the large amount of results obtained in four years (1982-1984) in the cropping systems research. This is an important step in defining specific research gaps and determining what improved technology is ready for transfer. This Team also suggests that there be some further analysis of these results in relation to soil flooding and drainage data.

The data compiled indicate that there is a high potential to increase the production of the cropping patterns and/or individual crops in the pattern by introducing simple changes in the practices used by farmers. These changes include "technological packages" for more than 50 local and HYVs of rice, wheat, potato, mustard, and pulses. However, one major weakness is that many of the packages may be too costly (e.g., fertilizer rates). Also, the research is just beginning to consider residual soil fertility (i.e., Hathazari trials). In Annex C - there is a discussion of some specific soil and crop areas the Team feels should be addressed in future on-farm trials.

BARC Plan for National FSR Programme. In the last few months BARC, the crop institutes, and IADS have systematically discussed the conversion to a multidisciplinary research focus in the CSR program (FSR Workshop, December, 1984). Teams were organized to assess needs and potentials of each CSR site. A Farming Systems Research Coordination Committee was appointed by BARC on February 28, 1985. Members of this Committee are the BARC Chairman, Member-Directors, Directors of Agricultural Institutes, and the IADS Farming Systems and Agricultural Economics Specialists. A Farming Systems Coordinating Unit will be organized in BARC with an appointed Technical Coordinator.

BARC has requested all institutes interested in developing agricultural research with a FSR approach to submit their proposals following the specific guidelines provided by BARC. BARC's plan is to examine the proposals presented by BARI, BJRI, SAU, BLRI, BRRI and any other institute. The proposals will be consolidated in a PP that will be ready for implementation starting July 1, 1985.

The BARI On-Farm Research Division (OFRD) has submitted to BARC its FSR proposal covering the next three years. It is a single proposal covering a program of multidisciplinary research at 11 BARI/FSR sites (6 current and 5 planned) and cropping system trials at 83 MLT sites. The BARC overall plan is more gradual with site-specific recommendations made concerning component "thrusts" that should be added to the present crops emphasis. The BARC FSR Coordination Committee is presently considering the BARI proposal and will determine which portions they will be able to fund from contract research funds.

The BARC/IADS Farming Systems component is currently compiling for the Farming Systems Research Manual a list of "Suggested Research Activities for a Farming Systems Research Site." They are inviting input on this from each program area. This list is a useful planning device and communication device across program areas.

BARI On-Farm Research Division Consolidation. A large On-Farm Research Division has recently been created at BARI staffed with more than 300 workers including the CSR site staff. This Division has the function of designing and managing research programs for the BARI FSR sites; managing OFRD substations; and working with the DAE Extension Officers in the Multilocation Testing at 93 sites and in DTC and RTC meetings. The research planning for the CSR sites has become bottom up planning with initial plans designed to meet district needs coming out of the DTC and RTC meetings. This is one of the most successful achievements of this program.

These significant changes require major training efforts. This On-Farm Research Division is presently conducting a series of training courses on farming systems research methodology. BARC/IADS has appointed a Production Economist that will provide assistance to the OFRD of BARI to develop plans for a more effective dissemination of technology and to help organize the training courses in farming systems research that are currently being conducted. However, effective implementation will require close supervision.

Evaluation

Output a: To meet this output there is the large newly reorganized DFRD at EARI, the CSR Program and NLT (at 5 sites) that BAU is developing and the small CSR units at EJRI & SRTI. They are experienced in planning and doing cropping systems research now. In 1985-86 BARI and hopefully some of the other institutions will be able to add other farming system research components.

Output b: There has been no livestock research at any of the FSR sites for a number of reasons discussed in the Livestock Section. However, this Team feels that with increased demand for draught energy due to greater cropping intensity, increased feed for livestock is a critical need of small scale farmers.

Output c: The output of functioning research/extension units under the District Technical Committees is a reality in the Northwest and a few other districts where the ERP-II pilot program was started. The new head of the BARI on-Farm Research Division comes from a successful research/extension experience at Ishurdi and is orienting his nation-wide program in this manner. There is also a current reorientation of the extension people in the other districts of Bangladesh. Much of the responsibility for training the SMOs and SSOs in DAE in technical agriculture areas and field trial results falls on the agricultural research people at the level of the Regional Technical Committee, the District Technical Committee, and the FSR sites. Limited trained manpower will be a major problem in meeting this objective at a country-wide level.

Output d: Some major crop commodities tested and beginning to be transferred are HYV of rice, wheat, potatoes, and mustard. These are discussed in the Crops Section.

Output e: There are some trained research personnel conducting socio-economic and cropping system research at the CSR sites and working in the DTC and RTC meetings with extension staff. However, these positions are understaffed; the staff need more supervision and encouragement; and there is often a lack of research continuity at particular site locations. The scarce manpower will be stretched further with the OFRD expansion of activities.

Recommendations

1. THAT THE BARC NATIONAL FARMING SYSTEMS RESEARCH PROGRAM INITIATE MULTIDISCIPLINARY RESEARCH ACTIVITIES AT THE FSR SITES IN 1965-66.
2. THAT THE CROPPING SYSTEMS RESEARCH AT THE FSR SITES CONDUCT SOME TRIALS TO DETERMINE LOW AND MODERATE INPUT PACKAGES FOR THE HYV VARIETIES THAT WILL INCREASE PRODUCTION FOR LOW INCOME FARMERS.
3. THAT THERE BE EFFORTS TO MONITOR ATTITUDES OF FARMERS TO NEW TECHNOLOGIES, ADOPTION RATES, AND INCREASED FARM INCOME NEAR THE FSR SITES.
4. THE RESEARCH SYSTEM AT FSR SITES SHOULD BE REVISED SO THAT SOCIAL SCIENTISTS ARE INVOLVED EARLIER, CONDUCT RAPID RURAL APPRAISAL AND SURVEY WORK IN A TIMELY FASHION, AND PASS THEIR FINDINGS TO AGRICULTURAL SCIENTISTS RESPONSIBLE FOR DESIGNING RESEARCH TRIALS.

D. Economic and Social Science

1. Objectives

Historically in Bangladesh the fields of economics and social science have not had the priority and prestige that the physical sciences have had. As a result, there are few agricultural economists and rural sociologists or anthropologists in the country doing relevant work in agricultural development.

The general purpose of the economic and social science component was "To develop a research competency in the social and economic sciences which can effectively support the direction and use of improved agro-technology for varied target groups within Bangladesh" (FP, p.16). The following outputs were specified:

- a. Fully operational units within the research system capable of providing socio-economic inputs with social and economic scientists trained in field level farming systems programs;
- b. Special undertaking in the major areas of agricultural development requiring socio-economic analysis;
- c. A centralized unit within the research system capable of processing social and economic data generated by the agricultural research institutes.
- d. Policies and procedures for selecting research activities and programs that will produce technologies designed for adoption in small farm agriculture systems.

Problems in achieving each objective and progress made toward fulfilling each objective are discussed below.

2. Objective a: Fully operational units within the research system capable of providing socio-economic inputs with social and economic scientists trained in field level farming systems programs.

a. Problems and Issues

Unanticipated Manpower Training Needs. The Scientific Officers (SO) and Senior Scientific Officers (SSO) who have in-country masters degrees in agriculture or economics did not have the level of research skills expected and required for effective research performance. The ESS division at BARC was the first to recognize this deficiency and began to address it with a series of specially tailored research skills courses. These were initially provided for economics officers and then were expanded to include other agricultural scientific officers.

There were several reasons this training responsibility fell on the BARC ESS Division:

- (1) A limited number of students can go for degree training abroad;
- (2) GOB places severe constraints on out-of-country short-term training;
- (3) No appropriate training programs had yet been developed by Bangladesh universities or institutes;
- (4) The BARC Training Cell did not have the capacity to organize such a training sequence.

Difficulties in Staffing. The ARP-II project calls for two long-term agricultural economists to work with the ESS research component. One long-term position was filled but the second has not been filled because BARC did not accept any candidates provided by IADS. BARI requires a person qualified to help plan and implement their applied economics research and training programs and with particular skills in quantitative analysis and computer analysis of data.

The single IADS ESS Specialist works out of BARC and supports all the institutes in the CSR program, focussing primarily on training. To fill specific deficiencies in research design and analysis skills it was decided to use the IADS specialist and a series of expatriate short-term consultants to offer some applied courses on research design and implementation, statistics, methods of field data analysis, and preparation of research reports. IADS was unable to identify suitable consultants. Finally, the ESS Member-Director and the IADS Specialist identified appropriate people, informally contacted them, and arranged course schedules. IADS was asked to process these requests (arrangements for consultants, books, etc.). However, since this varies from established IADS procedures for obtaining consultants there were a number of problems. It is desirable that problems of untimely arrangements for contracting expatriate consultant-trainers can be worked out jointly by IADS and each BARC program area, because training in several program areas will by necessity be organized in this manner during the remainder of the project.

Budgetary Constraints. Data collection and analysis at FSR sites is restricted due to budgetary constraints. With the planned expansion of activities by the BARI On-Farm Research Division (increasing the number of FSR sites and adding the Multilocation Testing Sites) the field level officers in the BARI Agricultural Economics Division should also be increased. BARI and BARC will need to carefully define priority areas for data collection and analysis. They will need to decide whether to: expand benchmark data collection work to new FSR sites; collect additional data on specific problems at selected sites; do more thorough description and analysis of data already collected; and/or carry out field studies of rates of technology adoption and constraints to adoption. This Evaluation Team feels there is an urgent need for the ESS program to: measure rates of adoption of improved technology; examine factors that facilitate or limit such adoption; and determine impacts of adoption on rural households.

Inadequate Coordination Between the Socioeconomic and Agricultural Research Programs. Economic and social science research is still a peripheral and misunderstood component of the national agricultural research system. It has been a struggle for this program area to convince some crops and soils people that it has a legitimate role in agricultural research planning, implementation, and evaluation. The Farming Systems Research Program is an obvious component where there should be some coordination of agricultural and socio-economic research. However, up to this point these have been parallel programs with little effective communication. For example, when BARI received

ERP-II funds to expand their Farming System sites in the Northwest region, neither the ESS section at BARC nor the Agricultural Economics Division of EARI was informed so they could consider expanding their research to these sites. An upcoming major training session in the On-Farm Research Division of EARI to train staff for Farming System Sites and the new Multilocation Testing Sites had initially included resource persons from several disciplines but did not include a resource person from the ESS area. The Acting Chairman of BARC has requested that the IADS Agricultural Economist Specialist be included both as a resource person in that training program and as a member of the BARC Committee for Coordination of the FSR Program.

There are many reasons for the poor linkage between economists and the agriculturalists. However, one reason is that the economists often did not have enough research lead time to complete comprehensive benchmark surveys and pull out useful findings before the agriculturalists began their on-farm trials. Also they have not conducted rapid rural appraisal studies to get farmers opinions about improved technologies. This type of feedback is critical to the success of the agricultural research project. Another problem is that the agricultural economists, like the agriculturalists, have had a number of difficulties in stabilizing their research work at CSR sites because of the high mobility of scientific officer employees (see FSR section). In addition the junior economists have needed training in field research methods and socio economic data analysis.

Now that there is decentralized planning of CSR research and the development of recommendations for farmers at the district and region levels (DTC and RTC meetings with extension officers) the agricultural economists will need to be able to select certain problem areas, rapidly collect data and analyse it, and present it in a convincing manner to agriculturalists and the extension officers.

This Team feels that BARC/IADS must take the lead in creating a useful dialogue between the ESS program and the other programs. An initial agenda for discussion could be the following: 1) the agricultural economists can outline the types of research they are prepared to do and the expected contributions of these to the whole project, and 2) the agriculturalists (particularly QFRD and other areas involved in the FSR program) can outline kinds of information needed in their sequence of research decision-making. From this type of discussion the agricultural economists and other groups can jointly select some research objectives for the next phase of the FSR program.

b. Accomplishments

Better Understanding of Bangladesh Farmers. Economist SOs at FSR sites who have been supervising local surveys do have a good understanding of farm household characteristics and current agricultural practices. There is also improved knowledge at crop institute headquarters, where senior economists are preparing descriptive benchmark reports for each site. The problem is that much of this knowledge may not be transferred to

crop scientists who design and carry out cropping systems trials. However, information about traditional cropping systems was used as a base for designing improved systems.

Training of Scientists. Establishment of a training program to upgrade quantitative and general analytical research skills of junior level agricultural economists in the agricultural research system is an extremely important achievement by the ESS section. All thirty agricultural economists in the crop institutes and FSR sites have participated in the courses. In addition, many (total of 150) agricultural SOs, SSOs, and some PSO's have also received training. Although the IADS Specialist and consultants initially taught the courses, there have been some efforts toward institutionalizing the introductory courses at GTI at BAU, RDA-Bogra, and BARD-Comilla. This Evaluation Team feels that efforts should be made to rapidly institutionalize these training courses at local institutions. In the interim they should be conducted by short-term trainer-consultants (as recommended by Nelson, 1984) so that BARC/IADS can concentrate on other critical program objectives.

BARC ESS has organized quarterly workshops as a means of developing skills in more advanced quantitative and qualitative analysis and presentation of findings from CSR site data. Fourteen agricultural economists (from BARI and other institutes) have prepared reports at the workshops. A collegial atmosphere has been created so that junior scientists in agricultural development are not working in isolation. The workshops also establish links between crop institutes, BARC,

EWDB, and BARD.

3. Objective b: Special undertaking in the major areas of agricultural development requiring socio-economic analysis.

a. Problems and Issues

Need to Examine Technology Adoption and Impacts of Adoption. In the Evaluation Team's communication with AID/Washington, USAID/Dhaka, the GOB Planning Commission, and the GOB Ministry of Agriculture, the primary concern has been whether there is any evidence that money invested over the last nine years in the agricultural research system has increased farmer productivity. They asked this Team whether ARP-II has provided improved technologies which have been adopted by farmers and increased their production. Our Team was specifically asked to examine all documentary evidence of these impacts. The Team has found that this issue has not yet been adequately addressed by EARC or the crop institutes. The Team feels that responsibility for attacking this major issue lies primarily with the ESS program at EARC, but also with agricultural economics units at the various crop institutes.

This research should be carried out soon so that useful feedback can be provided to the agricultural research system, to the GOB, and to USAID and other donors. This effort must be carefully planned in order to produce results of maximum value with least effort. Foreign and local consultants may be required to help perform this task. Standard survey methodology will not adequately answer all the questions. Some in-depth interviews

will need to be conducted with farmers, FSR staff, and extension people. There may be some value in assembling some "success stories" to analyze what factors contributed to successful adoption. It is also necessary for ESS to carefully examine data already collected under this project and the ERP-II project, to see if some information on adoption is already there and merely needs to be integrated into this analysis.

Need to Research Important Socio-Economic Issues in Agricultural Development. Objective "b" requires greater research experience and analytical skill than the Benchmark Surveys. It requires the attention of the Member-Director (ESS), the IADS specialist, senior agricultural economics staff at BARI and BRRI, and competent people at Bangladesh universities and other institutes, such as BIDS. If Bangladeshis with the right areas of expertise are available, they should be encouraged to work on current issues in agricultural development. If they lack expertise in some areas, collaborative projects should be organized in which outside consultants provide guidance to local researchers. In fact, this type of collaboration has been initiated in two ESS projects (see "Accomplishments" below).

The May, 1983 Evaluation discussed the failure of the ESS program to address major socio-economic issues such as: assessment of the distribution of research benefits; returns to research; rural employment; landlessness; and commodity pricing. There are also other important issues such as: the structure of commodity markets and possibilities for marketing cooperatives; rural

credit issues; local water management; and the role of women in acceptance of innovations. The ESS program has now initiated research in some of these areas (discussed below under "ESS Accomplishments".)

The 1983 Team felt that much of the data collected was not being used effectively to answer important agricultural development questions. They also noted that most contract research funds in the ESS area were going to the 5 crop institutes, although many top economics and social science researchers who could effectively address these questions are at other institutions (eg. BAU, BIDS, and DU). The situation may be that the ESS researchers in the crop institutes are probably more experienced in specific issues of agricultural development, but some scientists at other institutions may have more analytical experience. Since BARC does not have its own expert unit to work on these critical topics, it will need to increase capability at crop institutes and encourage economists and social scientists in other institutions to do more research on agricultural development issues.

Accomplishments

Benchmark Survey Reports From the ESS Sites. Six Socio-Economic Benchmark Reports have been produced for 4 BARI sites, the BAU site, and 1 BJRI site. These provide descriptive data from surveys at the sites. There has been improvement in the quality of the reports with the inclusion of more data of use to agronomists and agricultural economists. In later reports there is more discussion of the data, and summaries of main points such

as "constraints in crop production". It would be useful to have additional analysis of this data.

Initiation of Some Socio-Economic Studies on Important Topics in Agricultural Development. There has been significant progress made on this objective since the 1982 Evaluation. One outside consultant did a comprehensive analysis of equity issues in irrigation technology and water management. This study has stimulated some local follow up research proposals sponsored by ESS and Water Management. Another outside consultant completed a useful village study near a F&R site; he was looking at the constraints on technology adoption and diffusion. This consultant and one other have now joined in collaborative research projects primarily conducted by Bangladeshi social scientists at Dhaka University. They are looking at 1) the role of women in rural household economies and their participation in technology adoption and 2) rural to urban migration as related to rural employment, landlessness and management of absentee landowners' farms. The study on the economic role of rural women should provide useful information for the planned BARI horticultural project.

Another recent initiative is the proposed collaborative research project on agricultural credit. This is an area of concern for farmers, agriculture researchers, foreign donors, banks, and the GOB. This issue should be addressed, but perhaps in a more rapid, less comprehensive manner than the proposed 3 year project.

The ESS program at BARC has initiated some research at local universities but could cast a wider net by enlisting BIDS and BAU participation.

4. Objective c: A. centralized unit within the research system capable of processing social and economic data generated by the agricultural research institutes.

At this point the collected data from the FSR sites is held by the separate crop institutes that collected it. For this data to be available to scientist users from outside the particular crop institutes, it would be better to transfer the data into a BARC central computer data bank. Beyond this data storage capacity, it does not seem feasible to develop a permanent unit for analysis of the data because of present BARC manpower and funding constraints. There could be a system in which scientists from other institutions could use the data. At this time the research and analysis capacity is scattered in different institutions with only BARC/IADS to link data collectors, compilers, and analysts at different competence levels.

Some of the microcomputers which have just arrived and are being used in training will be sent out to the crop institutes for data processing at that level. Additional computer equipment will be needed at BARC to accommodate a central database of FSR data and other social economic data.

5. Objective d: Policies and procedures for selecting research activities and programs that will produce technologies designed for adoption in small farm agriculture systems.

a. Problems and Issues

Minimum Impact of ESS Research on Agricultural Planning and Policy. Although some studies have been done by the economists

and other social scientists on the constraints on farmer adoption of certain agricultural technologies (e.g., marketing constraints on maize production) and impacts of certain technological adoptions on various rural groups (e.g., equity issues with different irrigation technology strategies) these findings and recommendations have not often provided input to planning nor to policy making.

A number of policy oriented issues for concentrated research effort were described above. Successful completion of these studies and incorporation of the research results into agricultural development program proposals will permit BARC ESS and other economics researchers to influence policy in direction that are productive for Bangladesh agriculture.

6. Recommendations

- a. THAT THE ESS PROGRAM IN BARC RAPIDLY BEGIN TO ASSESS DEGREE OF ADOPTION OF NEW TECHNOLOGY, FACTORS THAT HAVE FACILITATED OR CONSTRAINED TECHNOLOGY TRANSFER, AND IMPACTS OF ADOPTION ON VARIOUS RURAL GROUPS.
- b. THAT THE ESS PROGRAM IN BARC FOCUS ON THE SOCIO-ECONOMIC RESEARCH QUALITIES NEEDED FOR MAJOR AREAS OF AGRICULTURAL DEVELOPMENT.
- c. THAT THERE BE REGULAR FORA ARRANGED AT BARC AND ENCOURAGED AT THE RESEARCH INSTITUTES FOR PRODUCTIVE DISCUSSIONS BETWEEN AGRICULTURAL SCIENTISTS AND AGRICULTURAL ECONOMISTS REGARDING THE FOR PROGRAM.

d. THAT THE ESS PROGRAM GIVE HIGH PRIORITY TO ANALYSIS OF PREVIOUSLY COLLECTED BUT LARGELY UNANALYZED DATA AND PRESERVATION OF THE DATA IN A COMPUTERIZED DATA BANK.

E. Crops Research

1. Objectives and Priorities

The crops problem is inadequacy of improved varieties and cultural practices, particularly with the crops other than rice. The purpose is to strengthen research competency and productivity of selected food crops, to develop improved disease resistant varieties of short duration and the kind of production technologies suitable to farming conditions in Bangladesh.

Inputs for the crops research program area are technical assistance, training, contract research and commodities. Expenditure for crops research has been \$ 1.2 million through 3/31/85.

Outputs:

- a. Personnel trained at the post-baccalaureate level to address key basic research problems in four crop areas;
- b. An operational multidisciplinary effort involving selected crops including three key factors; soil/water, socio-economics and pest/weed management;
- c. Special studies including the role of women in summer vegetable crops and/or root crops, marketing and post harvest technology;
- d. Basic packages of proven food crop production technologies available for testing as part of a cropping systems program.

2. Planned Activities

Planned activities in the crops area are to provide technical assistance, plan and develop research programs in

agronomy, crops and horticulture, improve research methodology and plan and direct improvement of field and laboratory facilities for research.

These programs are assisted by long-term specialists in crops, horticulture and agronomy, and use of short-term consultants needed in specific areas. The Specialists are to assist the Member-Director for crops in BARC in developing national programs. They are also to contribute to the development of a five-year National Agricultural Research Plan, and assist in planning of training programs conducted within and outside of Bangladesh. Specialists are to assess needs for field and laboratory equipment and arrange for their purchase.

3. Issues and problems

Issues and problems that surfaced in this review were those that apply specifically to crops, those that apply also to other program areas, and some that may fall outside the terms of reference for this review but impinge on the Project's success.

Problems of a general nature were a deficiency of operating funds and equipment, lack of transportation facilities and management difficulties with contract research funds. These are general issues considered in another part of this report. A rather basic question in the crops area, and possibly other areas also, is whether the support by AID has advanced research at BARI sufficiently to permit the AID proposed shift in technical assistance from core research to FSR. Our conclusions are that

BARI does require additional support under the proposal to extend USAID's Agricultural Research Project - Phase II. Without sustained technical assistance, the new technology needed for the farming systems program could wither.

The issue of technical support in the horticulture area appears to be particularly acute, especially with vegetables. Reports indicate that as much as 2/3 of the population may be protein deficient, half of the children seriously undernourished, and as many as 50,000 children per year suffer from blindness due to vitamin A deficiency. These problems could grow worse as the population growth rate of 2.3% per year puts even more pressure on land to grow more rice, wheat and other grains. Consumption of more green vegetables could help solve these nutritional problems.

The Bangladesh Institute of Nuclear Agriculture (BINA) has relatively young well trained staff, good laboratory facilities and is located next door to Bangladesh Agricultural University. Because of origin and later policy, this institute is confined to using nuclear techniques. It appears to the review team that this role is too narrow and that valuable human and material resources are not being used to their full potential.

Developing shorter maturity mutants of new high yielding rice and pulse varieties by BINA, for final selection by the original plant breeder, would provide crops to more efficiently utilize the growing seasons and irrigation water supplies of Bangladesh.

4. Evaluation in relation to proposed outputs

A. Training

The training activities in the area of agronomy, crops and horticulture were conducted by Specialists working directly with research workers on specific problems, through short-courses both within and outside Bangladesh, seminar-type presentations, and graduate training at the MS and PhD levels.

Much of the individual training was provided by Specialists assisting research personnel in the design of field crop studies, the analysis of data, drawing conclusions and writing reports. Assistance also was provided to researchers on writing proposals for contract research funded by AID and other donors.

Short courses were conducted to train research farm managers and research workers on weed control, seed production and plant breeding methods. Two principal scientific officers from BARI attended a conference on the mechanization of field experiments in Ireland and another study tour abroad was planned for crop research workers.

At the graduate study level in agronomy, two PhD students, and five MS students are studying abroad. In this same area two PhD students and four MS students are studying in Bangladesh. In crops, one PhD student is at North Dakota State University. One is studying for the MS degree in the horticulture area.

Getting approvals for short term overseas study has become exceedingly difficult and for this reason, training programs within Bangladesh have expanded.

The quantity of degree training overseas in the crops and horticulture area is much below needs. Degree training within the country also is deficient because of the interruption of university classes, and under-staffing at the new Institute for Post-Graduate studies in Agriculture. Bangladesh Agricultural University is temporarily understaffed because of members in overseas training and two vacant position in the water management field.

B. Operational multidisciplinary research involving soil/water pest management and socio-economic problems.

Progress in interdisciplinary research is difficult to assess and quantify. Considering the fact that before this project was started, very little interdisciplinary cooperation existed, good progress has been made. However, compartmentalization of research operations still lingers on. A pattern of research behavior long followed is not easily corrected.

IADS Crops Specialists through their teaching and example have done a good job of selling the idea of cooperation in research and the practicing of it is beginning to take hold. At the field level, interdisciplinary research planned by the scientists themselves with organizational help of the Crops Specialists appears to be working. At the administrative level, (i.e. IARS, and Ministry of Agriculture), planning is being done across various fields of science as well as among other agencies of government. An example is the National Research and Development Program in Fulsas and Oilseeds. The Crops Specialist working

with a review team composed of members from the Extension Directorate and the Bangladesh Agricultural Development Corporation, with the Member-Director of BARC as chairman, reviewed the program and made recommendations to strengthen research, seed production, and extension. There also are coordinated programs in wheat, maize, potatoes/sweet potatoes, and other crops. Through contract research, a soybean research project was completed and there are projects in progress on black gram and khesari (chick pea), root crops with emphasis on sweet potatoes and aroids (taro), cropping systems and pest surveillance.

Because the problem is implementation more than planning at this stage, the review team suggests that the Specialists put more emphasis on cooperative interdisciplinary work planned and conducted at the junior scientific staff level, particularly at the regional stations. These regional stations are staffed by younger persons whose habits have not hardened and whose future may in time include administration and policy formulation. The future of Bangladesh Agriculture is in the hands of these young research and extension workers.

C. Special Studies including the role of women in summer vegetable crops.

A special project was started in January 1984 on the role of women in the economy of rural Bangladesh. The project is under the direction of the Agricultural Economic and Social Sciences Division of BARC through a research contract with the Department of Geography, Dhaka University. The project was

scheduled for completion in July 1985, but has been extended to December 1985.

The research is being done through two survey instruments, the first being a household economic survey and the second a questionnaire dealing with the contributions made by women to the rural economy.

There are plans to use some of the findings from the anthropological field study of the role of women in agriculture to strengthen planning and implementation of the horticulture program.

D. Basic packages of proven food crop production technologies available for testing as part of a cropping systems program.

Information is available to assemble recommendations for the culture of most important crops, including the new high yielding ones, but this output has not been achieved by the research personnel as a part of their research reporting procedures. Improvements have been made in reporting but much greater progress is needed. There are several publications that make detailed recommendations for culture of a particular crop. The comprehensive volume on "Pulses in Bangladesh" and its simplified version produced for agricultural extension, in cooperation with FAO, is an excellent example of recommendations for culture of the important grain legume crops, prepared in usable forms for different categories of users.

Researchers at the working level at the field stations should draw conclusions from their data. This should be a requirement for all project reports.

A consultancy report in 1984 covering the Jamalpur area recommends technology for the production of rice and mustard. For each rice crop (T. Aman, Boro, T. Aus, B. Aus), mustard, and wheat, information is given for the best variety, land preparation, planting date, seeding rate, fertilizer application, weeding and insect control. Similar information has been assembled for the farming systems sites by the farming systems Specialist.

The research workers at BARI and its field stations should be required to prepare publications covering the culture of each crop and how it fits into various cropping systems. This would require scientists in crops, soils, entomology, plant pathology and irrigation to pool their knowledge. This action would enforce interdisciplinary cooperation as well as possibly identify unsolved problems. At present, research workers conduct many repetitive experiments of dubious value. Information from various sources can be assembled to prepare improved production practices but the research workers appear not to consider this as their responsibility. Clearly, this is the responsibility of research personnel and BARI and BARC should require these proven production practices to be prepared, and to be updated as new information becomes available.

OTHER INSTITUTES AND PROGRAMS

RICE RESEARCH

An amendment to the project paper - Phase II in 1982 added rice research and emphasized water management in the project. The rice component was funded by AID at \$ 3,000,000 as part of a support package totaling \$6,400,000, other donors being the Canadian and Australian Governments and the Ford Foundation. Project technical assistance is contracted from the International Rice Research Institute. A proposal to extend USAID's Agricultural Research Project Phase II would fund rice research at \$2,000,000 to June 1991. The IRRI program has been reviewed in a separate, November, 1984, evaluation.

The Team concurs with the AID proposal to continue support of rice research and that the level of support proposed (\$2,000,000) should be adequate assuming other donor support is forthcoming. IRRI appears to have had good success in extending its technology through Agricultural Extension and we recommend that this pipeline of technology transfer be continued in addition to their expressed interest in participation in the farming systems activities.

POTATOES

The potato research and development project was initiated in 1980 with financial support of the World Bank and later the Government of Australia. Technical support is provided by the International Potato Center, Lima Peru. The program receives no direct support from AID except that it is a component part of the

farming systems research activity. The current potato research contract is scheduled to terminate on June 30, 1985 and a renewal proposal is being prepared.

The potato project is implementing a strong three-phase training program that is developing many research scientists and several kinds of production individuals in specialized aspects of potato research production, and long term degree programs in Bangladesh and abroad. The results of this in depth training program should give Bangladesh capable leadership in its national potato program.

Good progress has been made in the potato research and development project. The standard local varieties are low yielding and contain virus diseases passed on from generation to generation. These varieties originated from types adapted to temperate regions. Through the introduction of breeding lines from various sources it has been possible to select plants that double the yield of standard varieties now grown. Diseases of potatoes are transmitted by an aphid vector whose presence differs by region and season. By adjusting planting time and location, it has been possible to produce virus free potato seed for an indefinite number of generations. This has never been done before. Seed supplies have been introduced each year and become diseased after a single generation.

The highest research priority is to build a self-sustained national seed production program of disease free seed for farmers to use. Information is in place to accomplish this goal.

Continuation of the project to achieve this as well as other goals is strongly endorsed.

JUTE

The Bangladesh Jute Research Institute was started in 1952 in Dhaka. It has three directorates - research, jute fiber technology and seed production. About 25 to 30% of the seed needs each year are produced under the institutes control, the remainder being produced by farmers. Jute was described as the most important cash crop in Bangladesh. This is important as there is a need for cash income to purchase fertilizers and other inputs necessary for increased crop yields.

The Director-General of the Institute was a firm believer in the principal of producing varieties that farmers could grow with very little or no fertilizer. The institute has developed and released five varieties suitable for low input production. One is an early variety more suitable for multiple cropping systems. Yields have increased in the past five years but the area has been reduced so production remains about the same.

Bangladesh uses about 4 million bales of jute fiber annually and any surplus is exported. Farmers growing the crop have the choice of harvesting it for fiber or for seed. When the price of fiber is high, the crop is harvested for fiber and less seed is produced. Because of the high fiber price in one year more farmers want to grow the crop the following year when the seed is scarce and more expensive. The Institute should be able to

smoothout these seed price and supply problems with 25-30% of seed production under their own control.

Members of the review team visited a jute-based cropping systems site at Choto Kalampur. Here, jute was grown in cropping systems with rice, mustard, potatoes, or wheat, the jute being grown during the wet season. Comparisons were being made of production from the farming system research farms with production by local farmers.

Because jute is important as a cash crop, its promotion at the farming systems research program is certainly a worthy activity. Economic analysis of all aspects of jute production is a critical issue and is in the early stages of development at the Institute. The Team strongly encourages this effort and recommends the establishment of an economics analysis division at BJRI, strongly staffed by economists and other social scientists, and strongly supported by BARC and the GOB in its early stages of development.

Sugarcane Research

The review teams visit to the Sugarcane Research and Training Institute was rather brief due to time limitations. We were given a brief review of their program followed by a field visit to a multiple cropping site. The Institutes research is divided into section for breeding, agronomy and soils, physiology, nutrition, entomology, pathology, economics and training. The socio-economic research capability, particularly, needs strengthening.

The Institute released 16 improved varieties of sugarcane from 1952 but only four are presently grown. The most satisfactory cultural practice is planting in November and harvesting in January with 13 months growing time. This planting arrangement permitted the possibility of interplanting winter crops while the cane was getting established. Crops that were tried included potatoes, onions, garlic, lentils, khesary, matikalai, sun-hemp, peanuts, wheat, mustard, millet and tobacco. The most suitable crops were potatoes, onions and garlic. These crops did not reduce sugarcane yields and produced satisfactory intertilled crop yields. Wheat, mustard and millets were too competitive with cane.

Scientists at the Sugarcane Research and Training Institute were interested in and were cooperating with the intertilled cropping studies. BARC provides the financial support. This system provides vegetables for direct consumption as well as cash income. In a field study the best potato variety, Cardinal, intertilled with sugarcane increased income by 2050 Tk. per hectare over cane grown alone. The intertilling system is being promoted through the farming systems activity.

5. RECOMMENDATIONS

1. THAT THE HORTICULTURE RESEARCH PROGRAM BE STRENGTHENED BY CONTINUED PRESENCE OF A LONG-TERM HORTICULTURAL SPECIALIST, AS WELL AS WITH A HORTICULTURE MEMBER ON THE SIX HEYER PARTNER SYSTEMS RESEARCH TEAM IN THE PROPOSED AID PROJECT EXPANSION. SEED OF VEGETABLES IN COMMON USE SHOULD BE COLLECTED,

CATALOGUED, AND A SEED PRODUCTION, DISTRIBUTION, AND PROMOTION PROGRAM INITIATED WITH THE ASSISTANCE OF THE AVDRG.

Explanation: Human nutrition is a neglected area in Bangladesh. Serious malnutrition is present in part of the population leading to blindness and other manifestations of protein and vitamin deficiencies. The problems will become even more severe because of high population growth rates putting more pressure on the land to produce rice and wheat. Home gardens including green and leafy vegetables and other horticultural research activities can help solve malnutrition problems.

2. THAT GREATER EMPHASIS BE GIVEN TO WORKING WITH THE MORE JUNIOR LEVEL SCIENTISTS AT THE VARIOUS RESEARCH INSTITUTES AND FIELD STATIONS, TEACHING THEM THE ART OF INTERDISCIPLINARY RESEARCH AND THE PREPARATION OF COMMODITY ORIENTED PUBLICATIONS USEFUL TO THOSE WHO TEACH THE FARMERS.

Explanation: Good progress has been made in teaching field plot methods, data analysis, and improving facilities for research. Annual reports are still presenting raw data from repetitive experiments without conclusion and therefore of limited use. The more junior scientists are the future teachers, senior scientists, administrators and policy makers. Their work habits can be molded and they need help. They can still be taught the advantages of cooperative research and the presentation of results in a form useful to those who work with farmers. Publications should be prepared by the research

workers with Specialist assistance covering all aspects of crop production including diseases, insects, weeds and irrigation.

3. THAT THE MINISTRY OF AGRICULTURE AND BARC CONSIDER THE PROBABLE ADVANTAGES OF BROADENING THE ROLE OF THE INSTITUTE OF NUCLEAR AGRICULTURE.

Explanation: Limiting research to the use of nuclear techniques is too restrictive to retain BINA as a viable research institute. BINA is fortunate in having a well trained staff, excellent laboratory facilities, and close proximity to Bangladesh Agricultural University. It is also located in a geographic area with its own unique problems.

4. THE GOB SHOULD REVIEW ITS SYSTEM FOR APPROVING AND RELEASING CROP VARIETIES.

Explanation: At present it takes two or three years for formal approval after promising new varieties have been identified, and two or three additional years for seed multiplication. The process is cumbersome, and seldom identifies inappropriate varieties.

F. Livestock

Objectives

The general purpose for the livestock research component, defined in the 1980 Project Paper, was to "Initiate a unified research commitment to acquire data on livestock feed, health, husbandry and production and to develop an improved livestock technology component in farming systems" (PP, p.18). The following outputs were specified:

- a. Basic information available on feed sources for livestock; studies underway on feed practices in at least three pilot areas;
- b. Minimum of four fodder crops being tested in cropping systems research;
- c. On-going studies in feed nutrition, farm wastes and by-products;
- d. Studies underway in draft animals use, husbandry and health.

Problems and Issues:

The major problems listed for this component area by the May, 1983, External Evaluation Team have continued to plague the Livestock Program Area for the last two years. These are: the low priority given to this research area by the GOB and the "remarkably small" allocation of funds for research. There was no review of this program area in the 1984 Internal Evaluation because the Member Director had recently been appointed and the IADS Livestock Specialist had recently begun work. The first plan of activities appeared in the 1984-85 Work Plan.

This program area should soon be receiving significant resource support with the recent agreement reached between the World Bank and the GOB on the IDA Second Agricultural Research Project. The following review of specific problems and issues in this research area draws on information collected by this evaluation team as well as the findings of the recent Wallington and Rahman (1985) report on "Livestock and Poultry Research in Bangladesh".

Absence of a Well - Developed Research Infrastructure.

There has been no livestock research institute comparable to IARI and BRRI. There were scattered and uncoordinated research facilities under the Directorate of Livestock doing low level research primarily on diagnosis of infectious diseases of livestock and on cattle breeding.

In discussions with the GOB in 1983 on the IDA Second Agricultural Research Project, the World Bank intended to earmark significant funds for livestock and fisheries research to strengthen these previously neglected areas. In their project paper (1984) they emphasized that an autonomous livestock research institute like IARI was needed that had a "clear mandate for planning and implementing short and long term research programs on all aspects of livestock health and productivity." They argued that there was no existing institute to carry this mandate out and that there was also a serious gap of skilled manpower.

One of their conditions of credit worthiness was the establishment of the Bangladesh Livestock Research Institute (BLRI) at the Savar Livestock Farm, with a full-time director appointed. These conditions have been met in 1984-85, although the IDA funds for development of BLRI await the agreement on the credit effectiveness conditions. Under realistic assumptions it will take at least two years for development of the physical, administrative and research infrastructure.

Serious Shortage of Qualified Manpower. One study (IFPRI/ISNAR, 1981) has shown there is a serious imbalance between crop and livestock research manpower in Bangladesh with only 3.2% of agricultural research scientists in the livestock sector. In addition, Wellington and Rahman (1985) concluded that some livestock research professionals in Bangladesh do not provide a high research performance because of lack of incentives and inadequate research supervision. As has been necessary in other agricultural program areas, it will be necessary to retrain some staff from the Directorate of Livestock Services as they are assigned to positions at BLRI and in the Farming Systems program.

With the initiation of IDA funds for training, there should be support for PhD and MS training abroad. Currently candidates are being selected for degree training at BCU. This training is being supported by USAID ARP-II funds. With regard to the short-term training needs at BLRI, a series of short courses for BLRI staff will need to be developed with planning input from BLRI and BARC. BARC funds for short-term consultants may be used to bring in trainer specialists. BLRI will have a Training Section which should be able to manage this training.

Absence of a Well-Defined Livestock Research Plan. In the past, most funds for livestock research and extension have supported livestock breeding programs and production and distribution of a limited amount of vaccines for prevention of major livestock and poultry diseases. A broader set of research priorities focussing on livestock feed and management problems as well as animal health is beginning to develop. This is due to the efforts of BARC (particularly the Member-Director for Livestock Research), the IADS Livestock Specialist, and World Bank and other donor discussions with the Ministry of Agriculture. There is still some disagreement on priorities; the research direction of DLRI and the nature of participation in the Farming Systems Research Program are not yet specified. One problem was the delay in GOB appointment of a Member-Director for Livestock until March, 1984 and the early departure of the first IADS Livestock Specialist in June, 1984. Now that both positions are filled there can be some concentrated efforts in defining the research plan for this program area.

Failure to Secure Contract Research Funds. The livestock research program has been able to secure only minimal contract research money (about \$5000) for reasons listed above and for the following additional reasons: 1) most of the ARP - II contract research money was obligated to well - established program areas before the Livestock area could submit proposals; 2) the long-delayed IDA Phase II Project was expected to provide funding for Livestock and Fisheries; and 3) there was a BARC- World Bank misunderstanding about use of ERP - II funds for contract

research which caused some Livestock and Fisheries projects to be terminated after 6 months.

This early termination of projects and unexpected lack of contract research funds has damaged the credibility of the BARC Livestock Program among university animal science researchers who had been encouraged to submit proposals. In addition, review of the BARC proposals was delayed for several months because the BARC Technical Committee failed to hold quarterly meetings. Finally, the Technical Committee only approved two proposals of nine submitted, failing to approve a key proposal which directly addresses expected program outputs listed by USAID in the PP. The only comment of the Committee was that this information on cattle management practices in three locations in Bangladesh is general knowledge (Minutes of Technical Committee, January, 1985). This kind of general comment by people who are not expert in the field suggests that perhaps it is difficult to achieve careful, even-handed review of projects from diverse research areas by a single committee, particularly when large numbers of proposals must be rapidly reviewed.

Delay in Integrating Livestock Research Into the Farming System Program. Some of the expected outputs of the livestock component of the project can be usefully addressed at the FSR sites. However, livestock research has not been integrated into the FSR work for the following reasons; 1) no functioning livestock institute with its own FSR sites; 2) no trained staff; 3) until recently, no Member-Director or IABS Specialist to push and plan for this component during strategic discussions on the Farming System Program at BARC and its component institutes; and

4) - administrative difficulties in arranging a joint research effort between BLRI and BARI, which belong to separate administrative divisions of the Ministry of Agriculture (i.e., the Division of Fisheries and Livestock and the Division of Agriculture and Forests). This type of coordination is new, and BARC will have to assume a major role in arranging it.

Accomplishments

Establishment of BLRI and a BARC Livestock Component. BARC and IADS made significant contributions to planning the World Bank Phase II Agricultural Development Project with its emphasis on strengthening the neglected research areas of livestock, fisheries, and forestry. BARC was directly involved in the GOB-World Bank discussions over the last two years which have resulted in appointment of the Member-Director for Livestock at BARC, establishment of BLRI, and appointment of a full-time director to BLRI.

Plan for Integrating the Livestock Component into the Farming Systems Research. The Member-Director for Livestock and the IADS Specialist have been working with the BARC FSR Coordination Committee, the Director of BLRI, and BARI to develop a feasible plan to accomplish livestock program objectives at the FSR sites. The initial research will include testing current livestock management systems, inclusion of a relay legume or maize crop in the cropping pattern for forage use, and basic measurements such as seasonal weight variation and draft use of cattle and buffalo. The details concerning which staff will be trained and will implement the research will be determined in

livestock activities discussions of the BARC Coordinating Committee for the FSR Program and in discussions between BLRI and other crop institutes.

Initiate Discussion on Priorities for Livestock and Poultry Research in Bangladesh. At this early stage of research development, the Member Director and IADS Specialist have presented new ideas and encouraged debate on: current status of livestock and poultry in Bangladesh, research constraints, and research priorities. Some of the ideas are new ideas to Directorate of Livestock researchers, university researchers and crop researchers. This discussion has been carried on through presentation of papers to professional associations, workshops for livestock researchers and administrators, and participation in crops and FSR workshops.

Encourage Research proposals From University Scientists. The Member Director and IADS Specialist have contacted most potential researchers and have worked with them in preparing proposals, and included them in workshops. As mentioned earlier, it is unfortunate that proposals were encouraged when funds were not available.

Training. Three candidates for PhD training and six candidates for MSc training at BAU have been selected. Three workshops have been held this year (1984-85); one on poultry production, one on cattle and buffalo production, and one on feed and fodder production. The purpose of the last workshop was to encourage the Savar Farm research staff to analyze some of the data they have already collected.

Evaluation

There were two general goals in the livestock component of the ARP-II Project:

1. initiate a unified research commitment on livestock;
2. develop an improved livestock technology component in farming systems.

The program is just beginning to address the first goal. It is not at the stage of improved livestock technology development because the institutional infrastructure was not in place at the beginning of ARP - II. The livestock research structure has just begun to take shape in the last year. EGRC, IADS, and outside donors are working hard to create a research system committed to livestock research which will be directly useful to farmers. As BLRI becomes firmly established, it can lead and focus these efforts. Expected World Bank funding and USAID extension of ARP - II should provide support needed to obtain outputs listed in the original FP.

Recommendations

1. THAT THE BARC COMMITTEE ON COORDINATION OF THE FSR PROGRAM GIVE PRIORITY ATTENTION TO PREPARATION OF AN EFFECTIVE PLAN FOR JOINT RESEARCH BETWEEN BLRI AND THE CROP INSTITUTES SO THAT LIVESTOCK CAN BE INCORPORATED INTO THE FARMING SYSTEMS SITES.
2. THAT THE PROCESS OF PROPOSAL REVIEW BY THE BARC TECHNICAL COMMITTEE BE IMPROVED SO THERE ARE QUARTERLY REVIEWS, CLEARLY STATED REVIEW CRITERIA, AND EVEN-HANDED CONSIDERATION OF

PROPOSALS FROM ALL RESEARCH PROGRAM AREAS BY A GROUP WHICH INCLUDES SOME EXPERTS IN THE AREAS BEING CONSIDERED.

3. THAT ALL MEMBER-DIRECTORS AND IADS SPECIALISTS HAVE MORE DETAILED, UP-TO-DATE BUDGET INFORMATION ABOUT AVAILABILITY OF CONTRACT RESEARCH FUNDS.
4. THAT QUALITY PROPOSALS FROM LIVESTOCK AND POULTRY RESEARCHERS AT ACADEMIC INSTITUTIONS BE GIVEN PRIORITY FUNDING.

Explanation: Because DLRI will not be prepared to do all of the research needed in this area over the next two years, university researchers will be needed to do some of the work.

5. THAT PRIORITY BE GIVEN FOR ADVANCED DEGREE TRAINING TO QUALIFIED RESEARCH PEOPLE WHO WILL BE ASSIGNED TO BLRI.

G. Soil Management

The purpose of the soil management program area under the Agricultural Research Project II is to develop a multidisciplinary research program aimed at on-farm soil management. Overall, this is to be developed in a "farming systems" framework.

One problem is that crop output response to fertilizer has not been satisfactory. Soil fertility management by small scale farmers is difficult with most having less than two acres, scattered in 6 to 12 parcels that usually differ in wet season flooding depths from zero to as much as ten feet. These are additional constraints to increasing crop yields.

Five outputs are expected of the soil management program. These are:

- a. Trained personnel in selected areas of soil management research and fully operational coordinated units addressing soil research problems;
- b. Functional soils research programs in place in a minimum of four areas;
- c. An operational program which will address the adoption, use and maintenance of equipment for tillage operations;
- d. Specialized soil research projects that generate information to help resolve cropping systems problems;
- e. Soils diagnostic services operational from one central laboratory to service an all station network.

Inputs to accomplish these outputs are technical assistance, training, contract research and commodities. The ARP-II

expenditure through March 31, 1985 for soil management research was \$ 739 thousand.

1. General

Progress of the soil management program has been documented in the May 1983 external evaluation report and in the May 1984 internal evaluation report.

The soil management program area emphasis to date has been on soil fertility. A high capacity central soil, plant and water analysis laboratory became operational in July 1984 at the Bangladesh Agricultural Research Institute (BARI), Joydebpur. Current capacity of the laboratory is 150 soil samples per day with 12 determinations per sample. Upon installation of some minor equipment, not yet installed, and the continued upgrading of technicians and the system, the eventual capacity of the laboratory is expected to exceed 300 samples per day. As of April 1985 some 4,000 soil samples have been analyzed. These samples are from benchmark soil series, and from high priority research sites of on-going and planned crop and soil research experiments. Some are from farm fields of the cropping systems research sites and from organizations working directly with farmers (DAE, Tea Company, Tobacco Company and Cotton Development Board). To early 1985, farmer soil samples totaled approximately 1,000.

Excellent progress has been made in developing a national soil fertility evaluation and improvement program.

The goal of the soil management program is to identify soil management constraints and train research and extension personnel for more effective management of the soils and crops of Bangladesh.

2. Achieved Outputs.

- a. Several hundred people have undergone training in soils, soil management, soils laboratory techniques and soil microbiology. Three people are receiving long term training outside the country; one PhD in the Philippines and two MS candidates in the United States.

Seven courses averaging 25 participants each have been given during the past year. One covered soil laboratory techniques. An international symposium on potassium was attended by 60 participants with seven different countries represented. A course on biological nitrogen fixation was given by one consultant from the Nifal Project of the University of Hawaii. This course was totally organized by GTI in Mymensingh. A course was given to fertilizer dealers of the Bangladesh Agricultural Development Corporation. Two courses were given by a short term IADS consultant from Cornell University on laboratory instruments and a three week course in fertilizer efficiency research was given to researchers IFDC staff.

Two soil fertility courses were presented with 2/3 of the participants from research and 1/3 from extension. Participants responded enthusiastically to the soil fertility

courses. One three day short courses on soil management have been given to Tea Estate and BADC farm managers, respectively.

A workshop was held on the development and presentation of soils data. Ten seminars were held with 4/5 of the participants from research and 1/5 from extension.

Short term training of two months duration was undertaken by 8 to 10 soils research personnel.

During 1984 the Soil Management group hosted the Commission Meeting 4, Soil Test Crop Response Correlation Studies, meeting of the International Soil Science Society in Bangladesh.

- b. Functional soil research programs in seven institutions have been upgraded and soil laboratories improved. The one at the Bangladesh Agricultural University, and the Central facility at BARI both offer farmer service.
- c. No work has been done in tillage equipment because it is not considered practical. There is considerable interest, however, in minimum tillage methods. In planting wheat early, immediately after the harvest of second season (aman) transplanted rice, if the soil is still moist, rice stubble cut low, and no weeds in the field, no tillage is done. Another practice developed by farmers on the wet "gray terrace soils" of the Barind Tract is to sow wheat on low ridges made while the soil is still moist after harvesting the transplanted aman crop. With this timing, maximum utilization of residual soil moisture is made available for the (rabi) dry

season non-irrigated wheat crop. Earlier planting of the wheat crop while soil and air temperatures are still warm and day length longer, results in higher yields of wheat. Similarly there is an interest in planting grain legumes (pulses) early to get maximization of residual soil moisture for the unirrigated dry season pulse crop after transplanted aman rice.

- d. Several specialized soil research projects in various stages of completion are in progress at BARI, the regional institutes, universities, on-farm cropping systems research and BRRI multilocation on-farm trials.

The UNDP/FAO/Fertilizer program has implemented 4,000 extension farm trials with fertilizers, sulphur and zinc on irrigated HYV rice with the Department of Agricultural Extension during the past six years. The average increase in yield from adding sulphur was 0.5 tone per hectare. Adding zinc also increased yields an average of 0.5 tons per hectare. The results of limited research when both S and Zn were applied to soils deficient in both indicates that the separate results are additive, giving twice the increase in yield from adding only S or only Zn.

This Program, jointly with BARI, will study NPK, sulphur, zinc, and sulphur plus zinc treatments, and rates of these, for the on-farm trials of the farming systems research sites, with special emphasis on residual effects in the predominant cropping patterns. This cooperative plan is an excellent

example of using on-farm generated information as "feedback" in farming systems research.

The Soil Science Department of Dhaka University has a contract research project on cauliflower production. A private farm with strongly acid soils produced cauliflower by liming and the addition of boron.

Another project is studying rice production in the northern half of the southern saline zone of Bangladesh where only one crop of local salt tolerant rice is grown during the wet season. The land remains fallow during the dry season when salt crusts form on the surface. BR10 and BR 11 high yielding rice varieties will germinate better than the salt tolerant Patna variety. It was found that BR11 is quite tolerant of salinity during the seedling stage. Immediately after harvest, certain varieties of wheat and barley can be grown during the early dry season with nearly normal yields.

The Soil Microbiology Division of BARI has a collection of Rhizobia for inoculation of grain legumes. Rhizobium selections has been made from local collections. The Hawaii NIFTAL project has supplied key rhizobia cultures to BARI, to Bangladesh Agricultural University, to the Bangladesh Institute of Nuclear Agriculture (BINA), and to Dhaka University.

Some legume inoculation trials have been carried out at BARI, BAU, BINA and on some regional research stations. Yield increases of 10 to 30 per cent are reported.

BARI and BAU each have two Kg fermenting units. Suitable peat carrier material is available. Peat based rhizobia inoculants could readily be prepared for legume inoculation experiments and for extension to use on "contact" farmer fields. To date, only BAU has been producing inoculum for commercial distribution. This was done through the Mennonite Central Committee Program.

New technology packages should move to the on-farm research trials with the new high yielding selections and varieties of grain legumes, specially of the "summer" mung beans. The package should include rhizobia inoculation, and fertilization according to soil analysis recommendations.

Linkages with DAE and other institutes working with farmers have been formed through continued participation in training courses, seminars, workshops, and field days organized by others.

A national Soil Fertility Advisory Committee consisting of high level officials from seed organisation BADC, BARC, DAE and the has been organized and had one meeting in late 1984. Further meetings are awaiting the appointment of the Member-Director for Soils at BARC, who is the automatic Chairman of the committee.

. The central high capacity soil and plant analysis laboratory staffed with skilled technicians became operational in mid 1984. The staff of BARI and the long term soil management

specialist have upgraded the operations and training of laboratory personnel of seven regional and university laboratories.

With the assistance of the Bangladesh Department of Soil Survey, samples were collected from 25 soils representative of the major agro-ecological regions of the country. The soils were collected from cropped fields where fertilizers had been applied, but not sulphur or zinc. To date (April 1985) 20 of these have been analyzed in the laboratory at BARI, and greenhouse correlations have been completed using a very simple, yet highly sophisticated procedure. Some of the field correlations are in progress.

Results of the soils analyses, and greenhouse correlations indicate that lack of available nitrogen is most limiting, with phosphorus second, sulphur third, zinc fourth and potassium fifth.

Of the 20 benchmark soils analysed, 80 to 85 percent were found deficient in available sulphur and 100 per cent were deficient of zinc on calcareous soils. Fifty per cent of the soils cropped to rice were deficient in available zinc. Soils growing dry season (rabi) crops showed that 30 to 35 per cent were deficient in available zinc.

The phosphorus soil test results are difficult to interpret because in the wet or flooded rice paddy, phosphorus availability to the rice plant increases. After the soil is sampled and dried much of the phosphorus becomes "fixed"

chemically, resulting in low test readings. This effect is being studied to determine if adjustment in the critical level will improve predictability.

Ten soil samples from the red Ultisol (Red Podzolic) eastern hill tracts, with tea as a crop, were found deficient in available copper.

The soil management program received soil samples from the ten on-farm cropping system research sites and the plans are to sample soils from all major research sites and all cropping system on-farm sites. Soil sampling is planned for the 83 on-farm multilocation pilot production sites, each with 5 to 10 farms per cropping pattern.

The overall goal of this soil sampling is to obtain sufficient soil test data to determine general fertility requirements. A fertilizer test guide incorporating results of soil test analysis and fertilizer recommendations is to be published in May 1985. The intended use is for research scientists, agricultural extension subject matter specialists and extension subject matter officers, and block supervisors (extension agents).

An illustrated one page diagram in color with simplified text in Bengali on "How to Sample Soil" for a soil test has been printed and distributed. A simplified soil test results report form also has been printed.

3. SOIL MANAGEMENT RECOMMENDATIONS

1. Encourage field soil test/crop yield correlations, by contract or grant, on selected farms of the on-farm farming system research sites project. Additional funding for this essential work is recommended for the next few years.
2. Include sulphur, zinc, as well as sulphur plus zinc, treatments in current and future on-farm trials. Rate and residual studies also are needed, particularly with the low cost, highly soluble zinc sulfate (36 per cent zinc) to determine if low amounts of zinc, and, of sulphur, will give profitable yield increases of HYV crop varieties grown in cropping patterns of HYV rice, HYV grain legumes (pulses), HYV mustard, wheat and HYV potatoes.
3. Encourage implementation of HYV grain legume (pulse) rhizobium inoculation trials with proper fertilization especially using phosphorus and sulphur. Trials to be on farms in the component testing on the farming system research sites to determine if a viable "package" of HYV pulse technology can be developed for transfer to extension using the MINI-KIT technique, of HYV seed plus inputs with appropriate contact" farmers.
5. Encourage the inclusion of BR11 HYV rice, in rotations using a low input level of fertilizer plus sulphur and zinc sulfate in component trials on farms in the farming systems research sites to determine if a moderate cost "package" of BR11 rice production practices can be developed which would be more acceptable to "contact" farmers and those farmers they are supposed to influence.

H. Water Management

1. OBJECTIVES AND PRIORITIES

The national slogan in the agriculture sector of Bangladesh is to achieve self sufficiency in food. The purpose of the Agricultural Research Project Phase II, parallel with the national goal, is to increase the effectiveness of agricultural research necessary for the development of appropriate agricultural technology for Bangladeshi farmers (Contract, Appendix A, p.2).

The objectives of the Water Management Program area of the Project are made more explicit in the amendment No.6 of the contract. The amendment recognizes the inter-relationship between increases in rice production and expansion of irrigated acreages. The complementarities among research efforts directed toward increasing water use efficiency, improving cost and energy efficiency of water lifting devices, expanding irrigated command areas and growing more rice per crop and per unit of land, are the main objectives of water management. These fit well with the GOB policy which has placed increased emphasis on the activities of water management in the top priority area. (Moseman Report, July 19, 1988, p 113).

Consistent with the purpose and objectives of this program area, the inputs to be provided by the Project to the Water Management Program area and the outputs expected from it are set in the Project Papers (PP Amendment, July 1982, p 9). The inputs are to provide supports for the development of an inter-institutional capacity, under BARC's leadership to design, test,

monitor, and evaluate more efficient irrigation systems. The broad general outputs, which have been made more explicit in the Project Papers, are:

- a. Water Resource Development
- b. Professional Development
- c. Research Result Documentation, and
- d. Research/Extension Linkages Strengthened

2. ISSUES AND PROBLEMS

The purpose of the ARP Phase II requires the building of capabilities to get more agricultural research activities into farmers' fields where production problems can be identified and solutions tested and to build strong responsive core discipline research programs to develop the new technologies that can address these problems.

a) Institutional and Manpower Development

For carrying out research successfully, it is a prerequisite that the research Institutes under the BARC-umbrella viz BARI, BRRI, BINA, and BORI and those beyond, like BAU, BUET, DU, SRTI etc. be capable of conducting the research both from the point of view of scientific equipment and research manpower. Most of the institutes lack adequate scientific equipment to conduct water management research. The shortage of research manpower in the water management area retards the growth of research activities. There is an urgent need to immediately develop the research facilities of the institutes as well as the trained research

manpower in the water management area. The area is lacking in manpower and equipment because the discipline is comparatively new in Bangladesh.

b. Ground water development

The potential of the ground water resource must be fully assessed and developed. The total cultivable land of Bangladesh is about 22.5 million acres and at present 11% of this area is being irrigated from ground water sources. The country's total ground water resources has the potential to irrigate 34% of the net cropped area with full development, if the present rice dominated agriculture regime is continued. If a rice-wheat cropping regime is pursued in the future, the nation's groundwater resources can help increase the irrigated acreage to 50%. This means that development of the ground water resources is vital for the country.

c. Operational Expenses.

Availability of funds for meeting operational expenses is a critical necessity. Most of the research institutes, especially BAU, do not have enough funds to meet this item. Until June 1985, PL-480, title II is providing some operational funds but beyond June 85, operational funds will become a severe problem. Without these funds, arranged from AID or some other sources, research output is bound to slow down.

d. Fund for water management

The total fund allocated to the Water Management Program area of ARP-II is \$5,000,000 (about 23% of the total ARP-II fund)

which, many believe, is too much to absorb. Keeping in mind the GOE policy regulations, one can see that it is difficult to send many Bangladeshi scientists abroad for short term (6-month) training and other outside training as provided in the contract. At the same time, keeping in mind the limited number of trained research personnel and research facilities in the country, it seems also difficult to utilize \$ 900,000 on contract research. Therefore, it would be logical for BARC to reallocate excess funds within the line items of the Water Management Program area, or to other areas.

3. EVALUATION

Planning and implementation of the activities of Water Management Program area are carried out through four divisions of BARC, viz, Soils and Irrigation Division, Agricultural Engineering Division, Economics and Social Sciences Division, and the Crops Division. However, evaluation of the combined activities of the four divisions of BARC until March 31, 1985 will be presented in this report in terms of four major line items against which funds have been allocated in the contract. These line items are:

- a) Technical Assistance
- b) Training
- c) Contract Research, and
- d) Commodities.

a. Technical Assistance

i) Specialist

The contract provides three specialists in the Water Management Program area to assist BARC in developing and implementing water management related activities. They are all on board and working effectively within their terms of reference. We believe that the combined efforts of the 3 specialists and the BARC Member-Director (Agricultural Engineering) are very useful to BARC in having its overall Water Management research system strengthened.

ii) Expatriate Consultants.

The Water Management Program has brought, until March 31, 1985, 31 expatriate consultants, including 7 in connection with in country short-term training. Fourteen valuable reports of the consultancy services on irrigation equipment, irrigation economics, water law and policy, workshop feasibility, university programs, water management research priorities and guidelines for Water Management Specialists have been published up to December 31, 1984, with 122 recommendations, of which 10 have been finalized for implementation, 54 in the process of being implemented, 15 under consideration for implementation, and 13 were found not applicable. This sort of follow-up-action is a good way to benefit from the consultancy services and the Team feels that Water Management area of BARC should continue to keep track of the recommendations and implement them as soon as possible. Arranging local consultants to work in conjunction with expatriate consultants would, perhaps, reduce the number of inappropriate recommendations.

iii) Local Consultants

The project provided 60 man-months of services from local consultants to work in the planned areas of Irrigation Water Management against which only 34 man-months (10 consultants) have been utilized/comitted until June 30, 1985. Their concentrated efforts to make the BARC's Water Management research system more productive is useful.

It is the understanding of the Team that local consultants are difficult to find as there is a shortage of highly trained manpower in the water management area. In that regard, BARC should look for local consultants ahead of the time they are needed, or alternately BARC may consider offering part-time local consultancy arrangements so that persons willing to offer their services are not hung up with "release from duty" problems from their parent institutes.

b. Training.

i) Overseas Training.

BARC's Water Management Program area has implemented 1 Ph.D degree program in the USA and 10 M.Sc. degree programs in TWC. One 11-day training course for 11 individuals in the TWC has been implemented against 40 six-month overseas trainings. Three staff trips to international conferences and 2 staff visits to India (involving 3 individuals) have been completed against trips for 30 individuals as called for in the Project Paper. The short-term trainings/travels are very helpful in that they widen the knowledge and skill of the research community. The remaining short-term overseas trips will be difficult to accomplish because

of the GOB rules. BARC should plan for these programs very early in order to help cope with the approval problem. On the other hand, the GOB may be persuaded to authorize the BARC-Chairman to issue clearances for short-term travel up to three months. If that is not allowed, the six-month short-term training courses may be converted to less than 3-month trainings, as within the existing rules, the university personnel can take advantage of less than 3-month overseas trips. About 36 more six-month training courses are yet to be accomplished.

ii) In-country Training.

Three in-country M.Sc. programs are in progress and 12 in-country short training courses to 214 individuals have been conducted/in process against training opportunities for 720 individuals (50.4 %). Three workshops and seminars involving 265 individuals against 24 (workshops and seminars) have been accomplished. The Team is left with an impression, through interviews, that the short training courses are very effective as the materials presented in these training courses are relevant and useful in the Bangladesh context. The workshops conducted proved productive; one workshop in prioritizing water management research produced some valuable guidelines for the GOB water management policy makers. Most of these activities have been carried out very recently and the Team feels that if the present momentum of in-country training is maintained, the total commitment as outlined in the Project Paper would not be difficult to achieve except that more emphasis has to be given to holding more workshops/seminars. The PP target of having 24

workshops turned out to be unrealistic as there are not enough participants to make this a worthwhile exercise. However, the Team suggests that the present rate of effort be continued in the future. Evidences from very recent activities indicate that it may even be possible to conduct more in-country training in which case a budgetary adjustment between line items is suggested.

c. Contract Research.

Contract research in the water management area has a budgetary provision of \$900,000. Until now, only 11 contract research proposals have been approved and funded. Work on these is proceeding. Twenty five more proposals submitted for funding are at various stages of approval. The number of funded research projects could have been greater. Some Project start-up problems, the lengthy procedures for project approval and delays of fund release are, some of the main reasons behind this. However, the overall objectives of the on-going projects appear to be consistent with the purpose of the Water Management Program area, except that the water management aspects are not in focus in some of the projects. Attention to this is needed in funding research projects in the future. It seems that the projects having distinct water management component have created some impacts on the farmers' water management practices.

An amount of \$133,139 has been spent on the on-going contract research projects until March 31, 1980. (amount committed upto June, 1985 is \$261,223). This indicates that it will be difficult to conduct contract research worth 1900,000 during the project period. Specialist assistance proposers of

contract research as is being done now is useful and should be continued. Absence of provisions in the contracts for transport to research projects seems to be a major constraint. This needs to be solved from funds made available from some other less restrictive sources like the IDA funds. Also, the lack of incentives to the Project FIs does not attract many potential researchers. BARC may consider providing some monetary incentives to the Project FIs. The long process of funding a proposed research project needs to be reduced. In spite of doing all the above, it still may not be feasible to put all the contract research funds into research efforts. To this end, the total fund against contract research may be reappropriated to shift a portion to the overseas Ph.D degree & in-country short training courses. Along with this, contract research efforts may be focused to research related to groundwater development and water management. That way, in addition to BAW, BARI, BRRI and BINA, resource personnel from BWDB and BAOC would be encouraged to take up more ground water/ water management related projects, which is ultimately a necessity for the country.

d. Commodities.

The Project provides purchase of tools, field equipment and supplies related to research and training components of the Water Management area. Until March 1985, the Irrigation Engineering Section of BARI has been provided with a Pipe Test Bed and various laboratory and field equipment have been ordered for different research institutes viz BARI, BRRI, BINA, BAW, BUET

and BARC to help run contract research and develop research institutes. Part of the order has already arrived as reported by the Agricultural Engineer (Specialist). Providing commodities to different research institutes will help, at the moment, to conduct contract research and in the future to develop the country's manpower skill. The status of the five utility vehicles provided in the PP Amendment needs to be sorted out. The Team feels that the small amount of funds remaining for commodities will be inadequate for the remaining two years of the Project and suggests diversion of some funds from contract research or 6-month short term overseas training to commodity purchases.

Table 1 shows the accomplishments made/committed with budgetary positions until March, 1985.

4. Conclusions.

The activities accomplished during the last four years of the project indicate that much has been accomplished in the water management area in respect of the expected project outputs. For example:

- a. in respect of Water Resources Development, the Project component has provided many distinct contract research projects, viz the Integrated Irrigated Command Area Development Project, the Comprehensive Study of Economic Viability of DTW in Joydebpur Area, the Efficiency of Bamboo Tubewells for Small Scale Irrigation and Crop Systems, the National Survey on Performance of Different Types of Tubewell and LLP Equipment, etc., in addition to offering training courses on Water Resource Development;

- b. in respect of Professional Development, the component has provided opportunities for 14 individuals to pursue higher studies in Irrigation Water Management (1 PhD and 13 MSc degrees), 13 water management related short term training courses to 225 individuals, 5 international study tours for 8 individuals, 3 workshops involving 265 individuals;
- c. in respect of Documentation of Research Results, the Water Management component has produced many BARC publications on irrigation water management activities, viz. 1 IWP training manual, 1 publication on IWM research priority, as well as more than 14 valuable consultancy and 3 evaluation reports; and
- d. in respect of Strengthening the Research/Extension Linkages, the Program area has provided training to 25 SMSs and SMOs of the Department of Agricultural Extension and created avenues for farmers' participation to Bamboo Tubewell and Command Area Development Project.

This shows that an acceptable amount of accomplishments have been made and the Water Management Component of the BARC's research system has started functioning, comparatively smoothly. The planning and activities were slow in the initial two to three years but are catching up now. Activities performed in different line items are more or less in time and of adequate quantity except the short term (6-month) overseas training, staff travel and contract research. The quality of the consultancy services, in-country training and workshops is reported to be high but that of the contract research as a whole is difficult to judge at this

stage. It is likely that by the end of the project period, a satisfactory level of accomplishments in respect of the four expected outputs of the Water Management Program area would be achievable.

5. RECOMMENDATIONS

1. Process cases of hiring local consultants much ahead of time, and arrange their work in conjunction with the expatriate consultants. Part-time local consultancy offer may be considered.
2. Reallocate funds, as considered necessary, from contract research and 6-month overseas training in favour of 4 Ph.D degree trainings - 2 in USA and 2 in TWC and some less than 3-month overseas, and short term in-country, training courses.

Developing an in-country interneeship training system for the fresh graduates of the Irrigation and Water Management Department of EAU would be useful.

3. Provide monetary incentives to the project PIs and arrange for transport to be used in water management research programs from some less restrictive non-AID fund source/sources.
4. Fund more contract research proposals - proposals having more water management components, groundwater development and irrigation water quality studies.
5. Hire more Senior Scientific Officer/Scientific officer in the Water Management Cell of Agricultural Engineering Division of EARC.

I. Pest Management

1. Objective and Priorities

The main objective of the Pest Management Program Area is to develop the technologies to protect field crops against pest and diseases. To achieve this objective technical assistance, human resources development, commodities and contract research were supplied. The expected outputs were:

- * Methodologies developed, tested and utilized which mitigate crop losses due to pests;
- * Functional research facilities and staff capabilities to monitor pest problems, test pest control technologies and produce effective recommendations that are socially and economically acceptable to farmers;
- * Personnel trained in managing and implementing research projects in pest management;
- * Formulation of a national pest control program with personnel capable of management and implementation at the field level.

The Master Plan for Bangladesh Agricultural Research Council proposed by R.L. Cushing identified priority areas of emphasis: identification of pests on major crops and estimates of damage caused; establishment of a system for monitoring and reporting outbreak of pests, and research on simple, safe and inexpensive methods of pest control that would be integrated with research on farming systems and onfarm research.

2. Issues and Problems.

The problems in pest management program areas were identified as:

- * inadequately trained researchers;
- * inadequate operational funds to conduct research;
- * insect green house facilities are not available;
- * inadequate supply of spareparts to repair and maintain equipment;
- * the need for a net house for plant pathology at BARI to provide off-season research capability in screening for disease resistance.
- * inadequate transport facilities for mobility of the scientists;
- * inadequate literature, in the form of current professional journals and reference books;
- * a big constraint is obtaining BGD approval in sufficient time to send trainees for short-term research programs.

3. EVALUATION

The plant pathology and the entomology specialists arrived in Bangladesh later than originally scheduled. The pathologist arrived in October 1983 and the entomologist in March 1984. The vertebrate pest specialist was in Bangladesh from the beginning of the project. The implementation of pest management programs was delayed due to recruiting problems and by BARC for programming reasons.

The plan of work for 1983-84 provided for 3 short-term expatriate consultants but none were employed. The plan of work for 1984-85 provided 9 short-term expatriate consultants,

including trainer consultants, of which 4 expatriate trainer consultants have completed their work. Two other consultants in Entomology and one in VPM have been and gone, and 3 consultants are currently in-country. Only one consultant in VPM has yet to come. Advertisement for local consultants has been made and selection will be made by GOB.

All three provisions for overseas MS degree program were filled. No scientists were sent to attend international conferences/workshops/study tour during FY 1983-84. In FY 1984-85, an eight week study tour was made by one Assistant Professor at BAU. Another scientist of BARI visited ICRISAT for an intensive two-week course in pulse diseases. Two BARI scientists attended a training course in Crop Loss Assessment at University of Minn. and subsequently visited IPM programs at Texas A&M. The fund utilization during July 1, 1984 to December 31, 1984 was 27 percent of the total budget. The main reason of low utilization is the delayed procedure to get BDC approval for short-term overseas training program.

The number of in-country training programs have increased in 1984-85 compared to the past but still fund utilization is only 8% during the first six months. Plans have been made to spend the in-country training fund in the last half of the year. Two one-week courses in plant disease diagnosis were completed in conjunction with seminars and informal training at all the BARI regional stations, BAU and CU. A short course in ELISA techniques for detection of plant viruses was conducted at BARI, Joydebpur by a scientist from the Potato Research Institute in

Peru. An in-country training course on "Experimental Design and Evaluation for Entomological Research" was held in Feb. 1985 by a foreign consultant.

An integrated pest management Workshop has been arranged for two weeks in-country training by three experts from USA, one each in Entomology, plant pathology and vertebrate pest control. The participants are senior pest management personnel from different institutions including DAE. A total of 4 scholarships have been awarded for in-country PhD and MSc degree programs. A 5-week in-country training course in plant diseases diagnosis was conducted with the help of a foreign consultant.

There were no contract research projects under the pest management program area and as such more of the contract research funds were unutilized although the Annual Work Plan made a provision to do so. However, a contract research proposal for research on the economic control of nematode caused diseases of Bangladesh was prepared and submitted to BARC for consideration and another contract research proposal on a survey of insect pathogen has been submitted to BARC for approval.

All of the available commodity money has been committed as outlined in the Annual Work Plans. Some equipment has already arrived such as a baby taxi (three-wheeled motor scooter with cab), 3 microscope, one PH meter, one refrigerator, one magnetic stirrer, one centrifuge wheel with motor, one area planimeter and two insect collection vials. The available funds for equipment for laboratory research and on-farm research are inadequate, though some equipment was given. It was reported by both

expatriate specialists that the baby taxi was purchased for pest management but was given to some other area.

It is shown in the six-monthly progress report (July-Dec. 1984) that many of the superfluous experiments were eliminated and emphasis was placed on regional research priorities and closer links with the selection and breeding program. This is a desirable attempt to develop the technology on different agroclimatic conditions under site specified socio-economic conditions. Another desirable activity has been to implement integrated pest management approaches to crop protection which include (1) a component of sampling to monitor pest density per plant or per unit of crop areas; (2) a broader selection of germplasm for host-plant resistance screening; (3) curative intervention, in contrast to a prophylactic scheduled application of insecticides (4) cultural and other non-chemical controls (5) crop loss assessment in relation to time and intensity of pest attack. This approach has been implemented through a series of in-country training courses and workshops.

The most significant achievements have been made in vertebrate pest management program through the participation in the National Rat Control Campaign on wheat. A two year survey of actual damage and control measures on 100 farms growing wheat in nine Upazillas carried out in cooperation with agricultural extension, showed estimated reduction in rat damage of 100 million Tk in 1984 alone. In addition, the program has conducted a successful large-scale trial on control of rats in deep-water rice, the use of repellent chemicals to reduce bird damage to

sprouting wheat, and evaluation of bird control chemicals. A study was made to estimate stored food losses per farm household due to rodents. Losses were estimated at approximately 15 percent of stored grains.

A series of training programs have been accomplished on vertebrate pest management at IARI regional and sub-stations with researchers and with subject matter specialists and subject matter officers of the Ag. Extension Directorate.

A training manual for agricultural extension personnel is being prepared in collaboration with the Agricultural Information Service and printed in Bengali on the subject of vertebrate pest identification, methods of assessing vertebrate pest damage to field crops and simple methods of vertebrate pest control that can be done by farmers.

Recommendation:

1. The current professional journals and reference works in the institutional libraries should be made available to upgrade the knowledge and skills of the scientists.
2. Since no contract research funds were utilized in the pest management component, funds should be shifted to some other purpose.
3. An inventory of equipment should be made to find out the additional needs. The supply of spareparts should be adequate.
4. Physical facilities for the scientists should be adequate such as a net house for plant pathology at IARI, Joydebpur to

provide facilities for off-season research in disease-resistance, a screenhouse/insect rearing facility, and a toxicology laboratory equipped for dosage mortality studies and pesticide residue analysis. BARC/IADS should get those items in the Work Plan and Annual Budget.

5. Trained man-power shortage is definitely a big constraint for all program areas, but attempts should be made to fill vacant positions with the available human resources. If suitable candidates are not available, emphasis should be given to training programs to upgrade their knowledge and skills. Overseas degree program should be given emphasis but if funds are not available more PhD's and MSc's could be trained.

V. TECHNOLOGY TRANSFER

In this section, we review the following points: 1) the technologies that have been examined in the CSR program; 2) problems with the transferability of the derived technological packages; 3) linkage activities between agricultural researchers and extension and between researchers and farmers; and data representing farmer feedback and adoption of the new technologies. There have been two studies at CSR sites on the spread of HYV rice varieties. The bulk of this section includes some summary points from semi-structured interviews carried out with 26 farmers located mainly near CSR sites.

Technologies Developed

There has been a recent BARC/IADS compilation (BARC/IADS, 1985) of the results of research trials conducted by five agricultural research institutes over a four year period (1980-1984). At the first seven CSR sites, it is noted, there were over 100 experiments carried out. These experiments included the testing of 60 cropping patterns. The cropping patterns were evaluated according to different land types and to irrigated or rainfed conditions. These evaluated patterns included: the major local cropping patterns with the technology used by farmers; the traditional patterns with an added improvement (e.g. higher fertilizer input or modern variety replacing a local variety); or a new pattern with a new crop or an additional crop planted on land that usually remained fallow. The improved patterns were compared with the local patterns on the basis of yields/ha and net returns.

In addition, component technology experiments have been carried out with all modern varieties of rice, wheat, potato, mustard, jute, sugarcane, pulses, maize, and cabbage released by the regional stations to be tested at the CSR sites. More than 100 of these experiments were carried out by supervising the participating farmers as they tested the new varieties, fertilizer rates, seed rates, plowing methods etc.

Similar kinds of experiments have been conducted since 1983-84 on the original seven sites plus four more BARI CSR sites in Jamalpur and the Northwestern region. However, there have been a limited number of experiments at some of these sites because of the delay in first conducting benchmark surveys and because of an unstable staffing situation at the CSR sites.

From the research from all of these sites, the OFRD of BARI in discussion with extension officers at DTC and RTC meeting have selected promising cropping technological packages for Multilocation Testing at 83 sites in 58 districts. BAU, BRRI, and SRTI also are participating in the MLT program. These will be tested on specific land types and are specific for irrigated or rainfed areas. These selected technological packages showed a high potential for increasing productivity of individual crops or whole cropping patterns by introducing limited changes (mainly a modern variety or fertilizer) in the farmers' current practices. This is an important first level achievement. Some examples of this increased yield potential are given in the following:

Selected CSR Field Trial Results

CSR Site Area	Crop and Variety	Technology NPK Kg/ha	Yield (t/ha)	Net Return (Tk)
Kalikapur (BARI) (1982-83)	SS-75 (improved)	80-60-40	1.19	
Mustard Trials	SS-75 (improved)	Farmers Practice/No Fertilizer	.45	
	Tori-7 (local)	Farmers practice/No Fertilizer	.56	
Kalikapur (1982-83)	Anad (improved)	60-40-0	2.92	
Wheat Trials	Konehan (improved)	60-40-0	2.81	
	Balaka (improved)	60-40-0	3.05	
	Sonalika	Farmers Practice	1.34	
Trishal Thana BAU (1982-83)				
Farmers Pattern	T. aman (Fajam)	55-20-0	3.75	9,763
	Boro (Jagali) fallow	40- 0-0	2.43	7,239
Improved Pattern	T. aus (BR-1)	85-55-60+30S	4.24	14,609
	T. aman (BR-11)	48-40-40+5Zn	4.85	17,216
	Mustard (improved)	45-33-17	0.46	804

Possible Problems With The Technologies

The major problem with the development of these improved technologies is that the recommended input levels are not always appropriate to the resource level of poor farmers and the level of risk they can afford. There is less attention to moderate or marginal improvement in productivity for low resource farmers. Realizing the high potential yields and profit will, in many cases, require high fertilizer inputs, secure soil water management, secure markets (e.g. winter maize or potatoes), good

pest management, and ability to obtain needed labor and draft power in quick turn-around production activities. Farmers may not accept whole technological packages depending on such factors as whether they are grain surplus farmers or not; they will adopt the parts that do not leave them at too high a risk level and which they can manage with their respective level of resources. The technological packages have often not been evaluated at moderate or low input levels. Also, there has seldom been research to break the packages down into component inputs so farmers can evaluate how much each component adds to yields. (Gibbon, 1985).

Technological packages need to be developed in other areas of farming systems. There is need for work on the technology of effective management of irrigated systems at the CSR sites. BARC/IADS has aided the BWDB and DAE in preparing a training manual for farmer-managers of irrigation command areas; these courses are presented at various places including RDA-Bogra. In many areas (e.g. Ishurdi) farmers have asked researchers to provide information on vegetables. Some regional research stations and CSR sites are beginning to address these research needs. Also, there is a need for farmer-tested technologies on pest management, post harvest technology (e.g., some seed storage work at Ishurdi), livestock management, and fruit tree production. There also needs to be some work carried out on agricultural credit and market facilities.

Research-Extension Linkage

Because the ERF-II pilot project has been operating for four years in the Northwest, the most successful research-extension linkages are there. The model was then extended to Mymensingh Region and Dhaka Region and most recently (July, 1984) to Jessore and Borisal Regions. Now the system is being ambitiously expanded to the entire country (9 DAE regions). There is still uneven functioning of linkage activities depending on the commitment and expertise of the DAE and research personnel and on the research infrastructure and manpower. There were 5 BARI research substations in the Northwest but only one in Jamalpur. The Northwest pilot region was atypical in terms of support resources.

The researchers are expected to train the "generalist" extension SMSs and SMOs in agricultural technology and research methods. This is carried out through the following specific activities which are occurring as planned.

1. Week to 10-day Crop Technology Courses for extension SMO's. Presented by BRRI and BARI at their regional stations. The BARI regional stations each conducted 2-4 of these courses in the last year with 20 participants per course.
2. Monthly RTC meetings and research-extension workshops. Participants are the regional station research officers, Regional Director of Extension, and DAE SMS officers (e.g., the Jessore Regional Director of Extension wants his SMSs to

meet with the researchers at Jessore Regional Station for 3 days each month).

3. Regional Research Planning and Review Meetings. There are 3-day meetings three times a year to plan the next season's research. About 90% of the CSR site research is now planned locally, and 25% of the regional station research is planned to specifically address local needs.
4. Regional Review/Workshop on Cropping Systems Research. This workshop was organized this year for the first time at each BARI regional station. Participants included extension people and any research institutes involved in the CSR program in the region. At the Ishurdi Workshop there were seven reports presented which were later published as the Proceedings (1984).
5. Monthly DTC meetings. The participants are the DFRD Coordinator of CSR sites in the district, other invited research scientists, and district extension officers (SMSs and SMOs). At these meeting current farmer problems are discussed and district-wide "impact point" recommendations for farmers are developed.
6. Ishurdi Regional Extension and Research Bulletin. This was initiated by the IADS Associate Production Agronomist in October, 1984. but now has mainly local scientist contributions. The demand for this technological bulletin has been so great, particularly by extension officers that each

publication now provides 2000 copies. It is now published in Bengali.

7. Regional Station Field Days. Participants include extension SMSs, SMOs, Block supervisors, and invited farmers.

8. CSR Site Field Day visits by Block Supervisors.

The quality and the quantity of the technology transfer and learning that occurs in this model varies depending on the commitment and knowledge of the participants and on sufficient manpower on both sides to sustain these activities. During over site visits we learned of some very effective linkages in the Northwest and in Jessore. A major problem is a shortage of good technical manpower on both sides. A second obstacle is frequent transfers or leave absences which break up specific working linkage. The support and occasional guidance given by the IADS Associate Production Agronomist appears to be one key factor in maintaining continuity and effectiveness in these activities.

Researcher-Farmer Linkages:

Farmer input and participation is invited in certain activities. A main one is through the benchmark surveys and other surveys of farm production resources and activities at the CSR sites. Some ideas for new technologies have been picked up from farmer innovators in these surveys (e.g., inter cropping sugarcane and potatoes). A second major area is the participation of farmers in the field trials on their land. Unlike research station trials, farmers have input into the type of trials they will use

on their land. If they don't think the scientific officer's research plan is feasible for them, they can reject it or negotiate for a slightly different trial. These farmers learn the improved technology by doing the comparison experiment and seeing the labor and other input differences and yield difference. For their participation they obtain free inputs and the latest modern variety seeds before these variety seeds are distributed by BADC.

Farmers Rallies at the CSR sites and at the Regional stations or substations are also important times for farmer learning. The amount of learning often depends on whether the occasions are mainly "ceremonial" with 100 or more participants or small and more interactive. Some of the research station Farmer Days may border on the ceremonial, but the CSR site smaller (20-70 farmers) farmer rallies or meetings can be better occasions for discussion and mutual learning. Some CSR sites are now holding at least three farmer meetings a year to cover each season and doing crop cuts in comparisons fields with farmers in attendance. These are the best opportunities to achieve transfer of technology. On the other hand, some CSR scientific officers are sending out the field assistants to measure yields without any attempt to organize an event for farmers. The next stage of Multiple Location Testing should follow the effective model of site farmer meetings.

Also, the Ishurdi regional station had organized a vegetable production course for Block Supervisors and interested farmers.

Limited Evidence On Technology Adoption

Within the time constraints of this evaluation, the Team has searched for studies that have monitored adoption of the new technologies. Unfortunately there have been no systematic studies of adoption, and it was unclear whether there may be data on various CSR surveys that could be used to address this issue. There were two small surveys concerning the adoption of modern varieties of rice near CSR sites.

A 1984 block monitoring survey of the cultivation of modern varieties of *T. aman* rice was conducted by the economist at the Kalikapur CSR site.

Cultivation of ER-11 Rice: Kalikapur CSR site (7.5 ha Block)

	1982 Survey -----	1984 Survey -----
Number of Farmers	5	18
Number of Plots	5	53
Total area	100 m	4.4 ha (4150 kg/ha) Mean yield

A second monitoring of modern varieties of *T. aman* rice was carried out by BAU in 1980 and 1984. There was a 40 ha block surveyed in each of two CSR site villages: Kanhar which is mainly irrigated and Ujan Bolor which is rainfed. The results are provided below:

	Kanhar Village (irrigated)			Ujan Boilar Village (rainfed)		
	1981 Area percent	1984 Area percent	1984 Yield/ha (Kg)	1981 Area percent	1984 Area percent	1984 Yield/ha (Kg)
Pajam		10	3684		30	3502
BR11		50	4148		25	3687
BR4		25	3502		10	2949
Total	15	85		6	65	
Local Varieties	85	15	1720 (Mean yield)	94	35	1698 (Mean yield)

Semi-Structured Interviews With Farmers

The team carried out some systematic semi-structured interviews with 26 farmers but had limited time to devote to this collection of data about technology transfer to farmers.

The data were collected from villages near four different CSR sites.

The interviews averaged about 15-25 minutes each. The farmers were from the following locations:

CSR Site	Village	Number of Farmers	Size of Landholdings (Acres)
BAU Trishal site- Mymensingh.	Kanhar (irrigated)	2	.85, 1.4
	Ujan Boilar (rainfed)	3	.7, 2, 3
10 miles south	Buelo village	2	.3, 1
BARI Kalikapur CSR site.	Kalikapur	4	1, 3, 4, 4
	Champur	2	.7, 2.3
	Chokhari	3	1, 1, 6
	Sultapur	5	.2, 1.3, 10, 30, 35
BARI Hathazari site near regional str.	Mirjapur	4	.4, 1.6, 2, 3.0
BARI Bogra site		1	-

Below are summarized some general points dealing with technology transfer from the farmer interviews. These interviews support points made in other sections of the report.

1. Almost all the farmers we talked to in the CSR site village areas had attended CSR Farmer Rallies; had learned about modern varieties, balanced fertilizer doses, and other practices from this work; and wanted the crop institutes to continue this work in their village area. Some of these farmers had been or currently were participating in the research trials. In addition, most of the farmers within a 1 mile radius knew about the activities and had attended one or two farmer rallies. The sphere of the CSR program contact with farmers did not extend beyond this distance, but a few of the more distant farmers had attended a regional station farmer rally.
2. There was a very active and highly respected extension Block Supervisor working with farmers in the three villages outside the Kalikapur CSR site near Ishurdi. He is representative of the better trained and more committed extension workers who were developed in the ERF-II pilot program in the Northwest. There was also active extension work with one farmer beside the main road in Bueio village 10 miles south of the BAU CSR site. The other farmers reported no extension activity.
3. Most of the farmers interviewed, and all of those near the CSR sites, emphasized that they had made major changes in their cultivation practices in the last five years. They were now

using, in varying degrees, modern varieties of rice, wheat, potatoes, and occasionally mustard and had begun to use or greatly increased the use of fertilizers. For some of the farmers (e.g. Kalikapur area) recent establishment of Deep Tubewells had also changed their water management practices. Most farmers stated they had increased their production in the last 3-5 years in terms of higher yields and increased cropping intensity.

4. Farmers with available irrigation water and with sufficient resources (land and money) were applying recommended or larger fertilizer doses (e.g. BAI recommendation, 85-25-35 kg/ha of N,P,K for T. aman rice) and obtaining T. aman rice yields of from 40-60 maunds/acre (3700-5575 kg/ha). These farmers were cultivating modern varieties of aman rice and winter wheat and some use of the modern potato variety. However, the adoption of the Cardinal potato variety is limited by the traditional preference for the local potato cooking qualities. Farmers with less resources and rainfed conditions vary in their strategies with cultivation of modern varieties on 1/4 to 3/4 of their land in various seasons. Mainly they are using BR-11 and Pajam in the aman rice season and modern varieties of wheat in the winter season. They are using varying amounts of fertilizer on these modern varieties but the range is usually 1/3 to 1/2 of the recommended dose. Their aman rice yields are in the 20-30 maund/acre range (about 1850-2790 kg/ha).

Very poor farmers we interviewed often are using Pajam rice in the aman season but are using small amounts of mainly urea fertilizer (about 35/kg/ha) and obtaining yields of 20 maunds/acre (1250 jg/ha) or less.

5. Some resource poor farmers stated they were glad the researchers were working at the CSR site but that the trials were not very useful to them because they could not afford the inputs or afford the risk with the small amount of land they had.

One example is a farmer near the Bogra CSR site who was commenting on the comparison trial between the local mustard and a HYV variety with fertilizer and irrigation inputs. He said that he liked the new ideas that were being presented at the site, but he was limited in adopting the technology because of high costs of fertilizer, insecticide, and irrigation water, and because there was no secure price for the mustard. Also, he couldn't make his irrigation cooperative begin pumping water at this rabi time of the year.

6. The farmers in Kalikapur CSR village were using the most recent modern wheat varieties. The farmers in villages over a mile away were using modern wheat varieties released 2-3 years ago. This demonstrates the delay in distribution due to BADC seed multiplication and distribution time. In the village in Hathazari modern varieties released a few years ago are being used.

7. One small farmer arranges his cropping pattern for plots in particular blocks according to the predominant pattern followed by other farmers with plots in that area (e.g. aus-aman-wheat or aus-aman-fallow). In the latter blocks farmers are grazing their cattle in the winter fallow fields. One participating farmer with the BAU CSR project planted a trial of mustard and pulses during the last rabi season but much of the crops were eaten by cattle. This man has some prestige in the village and organized a village meeting to discuss the possibility of more farmers in that block raising winter rabi crops and keeping the grazing cattle out of the area. This would be a pattern of adoption by consensus.
8. The manager for an irrigation command area in Kalikapur wanted to tell us about his efforts to organize his water management system more efficiently. He had attended a training course for command area water managers at RDA-Bogra held by DAE and BWDB. BARC/IADS Water Management Program had prepared the training course. The manager was organizing his command area into blocks and had set up an irrigation schedule. He was urging farmers in each block organize compatible cropping patterns, to to transplant at the same time, and to plan for irrigation water on certain days of the week.

This brief set of farmer interviews suggests that both crop and water management technology are being transferred in a selective way at certain research sites and extension areas. Most of these farmers say they have increased their yields in the last five years.

Recommendations:

1. ACTION SHOULD BE TAKEN TO INTRODUCE NEW RESEARCH ACTIVITIES INTO THE FSR SITES. THESE NEW ACTIVITIES WILL SUPPLY NECESSARY TECHNOLOGIES WHICH LIE OUTSIDE THE RANGE OF ORDINARY CROP RESEARCH. THEY INCLUDE: IRRIGATION MANAGEMENT, PEST MANAGEMENT, SEED STORAGE TECHNOLOGY, HOMESTEAD (HORTICULTURAL AND AGROFORESTRY) PRODUCTION, LIVESTOCK PRODUCTION, AND COMMODITY MARKETING. SOME OF THESE WILL REQUIRE INTRODUCTION OF FULL-TIME RESEARCHERS DIRECTLY INTO THE FSR SITES OTHERS WILL NOT.
2. THE ASSOCIATE PRODUCTION AGRONOMIST POSITIONS SHOULD BE EXTENDED WITH THE PROJECT EXTENSION, SO THAT THESE INDIVIDUALS CAN CONTINUE THEIR IMPORTANT WORK IN DEVELOPMENT OF MORE APPROPRIATE PRODUCTION TECHNOLOGIES AT THE REGIONAL STATIONS AND CSR SITES.
3. A SYSTEM SHOULD BE ESTABLISHED FOR PERIODIC (SEMI-ANNUAL OR ANNUAL) MONITORING OF ADOPTION OF NEW TECHNOLOGIES PRODUCED BY THE AGRICULTURAL RESEARCH SYSTEM. IN ADDITION, A SPECIAL STUDY OF PROJECT "SUCCESSSES" SHOULD BE CARRIED OUT WITHIN THE NEXT SEVERAL MONTHS (BEFORE THE END OF 1985).

VI. CONTRACT RESEARCH

The principle of competitive grants for research has been widely used in other countries. It has been successful for funding research of good quality on critical problems and has not been the target of much criticism.

Contract research is a particularly attractive approach in Bangladesh because it brings to bear on an important agricultural development problem the necessary balance of manpower and operating costs which has been so difficult to achieve in the present research system. The present contract research system has been developed over the last two years with implementation of the approved Contract Research Manual only in the last few months.

The amount of funds devoted to contract research in Bangladesh has not been large. There has been a total commitment of about 3 million from donors and the GOB of which only \$1.3 million has been granted for research since inception of the program in 1976. This compares to very crudely estimated expenditures for the entire agricultural research system of \$35 to \$50 million over the same period. A contract research program continuing at present levels would not bring forth the simplification recommendation to be made below. However, proposed inputs by the World Bank and USAID of \$10 million over the next five years, or so, will require substantial simplification over present procedures to make the proposed much larger program effective.

A. Simplifying the system

An evaluation of contract research was made by the May, 1984 Internal Evaluation Team. Many of the problems noted in their report still persist, although a Manual for Contract Research has been published.

The problems with the Bangladesh system are mostly with the cumbersome procedures. The Manual for Contract Research clarifies procedures but has not simplified them.

The Team recognizes the enormous difficulty involved in establishing an effective competitive grant system that produces quality research on critical questions. The Team believes that great progress has been made over the last couple of years. However, scientists every place we visited expressed concerns about various aspects of this particular system. The Team recognizes it is too soon to begin major revision of a system which is only now being put into full operation but will make some suggestions to be considered when the time is right for review of the system.

What is suggested below is an annual, rather than quarterly, reporting and control mechanism. BARC presently makes direct grants to the institute or university by whom the principal investigator is employed. When a contract research proposal is approved, BARC could deposit funds for the first years work. The institute or university could provide the financial and program supervision according to their own procedures. They are in closer contact with daily operations than BARC and better able to supervise the research. An annual report

of progress is frequent enough for research substance although reporting of expenditures may need to be more frequent. Failure to perform the work proposed in the plan would cause default of the grant and require the institute or university to return the funds to BARC.

A satisfactory progress report would be the basis for release of the next years funds. The institute or university should be the agency to certify that the research was properly done, aided by a BARC internal/external evaluation.

Suggested simplification procedures follow in sequential order. (The word institute hereafter means institute or university).

1. At the beginning of the fiscal year BARC announce the amount of funds that are to be made available to the various program areas according to the priorities in the Ministry of Agriculture and BARC five year plans.
2. BARC informs the institutes, universities, and general public of program areas for which proposals are to be accepted.
3. Proposals prepared by PI's and submitted to BARC through their institutions.
4. Proposals sent out for peer review and, if acceptable, further review and approval by BARCs approval processes.
5. Grant is made to the institute responsible for the research in accordance with a previously negotiated memorandum of understanding or contract between BARC and the research

institute, or some other mechanism consistent with this purpose.

6. Accounting and financial reporting to be done by the institute. The funding for the honorarium would be included in the grant and paid annually to the principal investigator.
7. Annual report of progress due one month before the anniversary date of awarding the grant.
8. BARC would arrange an internal/external evaluation annually prior to the release of the next years funds.
9. Second year grant and first year honorarium made when a satisfactory report is received.

There are several advantages to this simplified method of funding research through BARC. (a) BARC would be viewed by the Institutes as a source of needed research funds rather than as an agency that financially manages research personnel assigned to institute work. (b) the grant funds could be used in support of an on-going project that is important but under funded by BARC or the GOB, but would have to go through the above approval process. (c) the problems of funding delays, if not removed entirely, would be only those delays attributable to the institute. (d) the institute is in a far better position to supervise the research than is BARC. (e) The Principal Investigators would be relieved of some of the accounting requirements as that would be done by the institute. (f) the principal investigators could be paid

their honorarium annually as the work progresses, as is presently the case. Unsatisfactory performance would not be anticipated under this system of supervision by the institute and evaluation by BARC.

A project worthy of grant support should take not less than 1/4 time of a principal investigator. If salaries were adequate, it would be inappropriate to pay an honorarium. Since they are low, and a research project requires additional work and skills, an honorarium seems justifiable. Also, the contract research grants would be more attractive to home institutions if there was an allowance of a 5% overhead charge.

We understand that the present level of honoraria are limited by law. The creation by GOB/BARC of an innovative mechanism to increase remuneration of PI's without violating the law would increase competition for grant proposals and therefore their quality and could increase the quality of the research done by requiring PI's to devote more time directly to the research. The inequality in pay between those with and without grants can be considered as merit pay, a principal that is widely used in other countries as a stimulus to superior performance.

It is recommended that BARC manage the contract research program on an annual rather than quarterly basis; that more responsibility be shifted to the administrators of the institutes and universities; and that the actual work performed by PI's on the research project be increased.

It is suggested that USAID review the mechanisms/procedures under its control for the transfer of uncommitted contract research funds (now in ARP-II) directly, i.e., not through the prime contractor, to BARC in a manner that simplifies the funding and control processes. However, BARC also must greatly improve the efficiency of their accounting, financial reporting and disbursement activities in order to reduce delays in the system.

B. Overall Contract Research Procedures

The current managers of the contract research program inherited a number of problems. There has been a disproportionate allocation of funds to certain institutions and individuals, the Technical Committee of BARC has not operated efficiently, and decisions on some research proposals appear to have been arbitrary.

In order to correct this situation, the Team recommends that:

- (1) BARC, based on prioritizing research programs from NARF and other available sources, make an indicative allocation of available contract research funds to the various program areas, holding some amount in reserve.
- (2) BARC advertise the availability of contract research resources and invite proposals based on the prioritized research programs.

- (3) BARC re-established technical committees for each program area (The Team understands that this is now being done informally, but to be really effective, and so the research system can understand what is going on, the arrangement should be formalized) and these committees meet quarterly.
- (4) BARC should involve IADS expertise, along with local expertise, in the technical review of proposals.
- (5) BARC should consider simplification of the management of approved contract research projects as suggested elsewhere in this report.
- (6) BARC should assure that its contract research project review, monitoring and evaluation responsibilities are carried out uniformly on all projects no matter what the donor source.
- (7) BARC should assure that the results coming out of contract research are appropriately utilized in the research system and particularly in the extension system.

A number of other suggestions made in the 1984 Internal Evaluation are confirmed or modified below:

1. BARC should involve IADS Specialists in the appraisal of project proposals and in their evaluation. Specialist expertise is not presently being used for these purposes to a significant degree.
2. Defense of project proposals before a panel of peer scientists, extension specialists, educators, planners,

administrators and donors was recommended by the 1984 evaluators. This Team recommends, instead, that extension, planning, or any other required involvement take place in the expert appraisal of the project for approval. The system should be kept as simple as possible, but including adequate substantive and financial control.

3. A more balanced allocation of contract research funds - institutionally and individually - should be maintained by BARC.
4. The workshops evaluating contract research that were held last fall appear to have been very useful. Such workshops should continue on a regularly scheduled basis.

C. Contract Research Funding

The Team received numerous comments regarding lack of funds for contract research, specifically in non-water management areas. Any shortage that actually exists could be solved in a number of ways.

- (1) Fund utilization of some grants is far below what can be effectively used. BARC should require these projects to be replanned and rebudgeted and excess funds recovered by BARC for funding other projects.
- (2) IADS has authority to increase contract funding by 15% by transfer from other budgeted line items.

(3) Approval should be sought from USAID to transfer some contract research funds from water management to other program areas.

It is recommended that each of the above possibilities be pursued by BARC/IADS.

VII. MANPOWER DEVELOPMENT

A. Manpower Planning

One of the primary responsibilities of BARC is the development of manpower for the national agricultural research system. The first question to be answered is manpower for what? Manpower cannot be developed for the national agricultural research system in the abstract. The first step was to develop a national research plan. This has been done. The next step is to convert that plan into a set of priority research programs for which manpower requirements can be estimated. This has not been done.

Once the manpower requirements have been determined they must be measured against a current inventory of research manpower. This inventory is reportedly underway but not completed as yet. When the inventory is completed and checked against manpower requirements, the gaps will be identified. These gaps can then be filled by training. A comprehensive training program should then be developed to guide the execution of BARC's training activities to cover the entire research establishment.

The manpower requirements cannot be identified in the planning stage down to the last individual needing training. However, there should be a clear understanding of the major areas of technical and scientific deficiencies for which training programs can be developed and individuals selected for training.

The time frame will vary for different types of training and the planning framework will vary accordingly. Individuals sent for academic training in the next few years will, for the most part, not be productive researchers before Bangladesh is into its fourth 5-year plan. That is why long range planning for academic training is required. On the other hand, a much shorter time frame will suffice for short-term on-the-job training, workshops and seminars, and sabbatical studies.

The manpower planning and development process should be pushed hard by IADS and by USAID. Funds are no constraint. The present Training Cell organization is not functioning effectively in developing a manpower plan for research or organizing a plan for training. The GOB has not been able to make appropriate and full use of resources from donors because they have not placed a high priority on training nor created a strong BARC division to organize this program.

B. Manpower Productivity

There are, speaking about the overall research system, gross inefficiencies in the use of existing agricultural research personnel in most of the institutes and universities. This is brought about by the lack of balance in the budgetary allocations for research. Research requires manpower, of course, but it also requires that researchers have scientific equipment and supplies, physical facilities, mobility, and other operational support. Manpower is over budgeted, physical facilities are reported as adequate, scientific equipment is in need, but the crippling deficiency in the national agricultural research system is the

severe paucity of operating funds, including laboratory and other research supplies and transportation. So the Bangladeshi research administrator has more than an adequate number of research staff, and adequate physical facilities, but inadequate operating funds to make these resources productive.

This situation has been alleviated during the short run by USAID assistance for operating expense funds. This assistance was highly effective in increasing the output and productivity of the research system. (See Wahed and Ahmekd, "The Impact Study of the Commodity Grant PL480 Funded Project/Scheme", 1984.)

The operational funding situation for Bangladesh agricultural research was analysed by Dr. Gerald J. Gill. In his paper (Operational Funding Constraints in Agricultural Research in Bangladesh, April 1981) published by BARC, he concluded that there were three possibilities for covering deficient operational funds:

1. revenue generation by the institutes;
2. increased allocation from the GOB; or
3. donor support

He rejected the first two and opted for donor support. This support was forthcoming from AID through PL480 Title II imports. These funds will be essentially exhausted by the end of the 1984/85 fiscal year. USAID's proposed extension of the Project to June 1991 includes operating funds support on a declining basis starting in July 1986. This leaves a 1985/86 gap in operating expense funding. PL 480 Title III resources should be

used to fill this gap. Difficulties with this approach have been noted. If it cannot be negotiated, USAID is strongly urged to fill the 1985/86 gap.

There is a fourth option for the GOB that was not discussed by Dr. Gill. This option will not solve the immediate 1985/86 problem but could help during the period of the proposed extension and into the long run. What is suggested is that the institute directors, BARC, the Ministry of Agriculture, the Planning Commission, the Establishment Ministry and the Ministry of Finance, which are all in the chain of approvals required for a new research project, give careful consideration during the project approval process to the balance in the project budget between personnel and operating costs. The GOB felt a need to provide as much employment as possible is recognized. However, the national agricultural research system will never be as productive as it could be unless operating costs are balanced with research personnel.

C. Periodic Staff Transfers

The GOB policy of transferring staff to different physical locations and, more troublesome, from one technical assignment to another, has a very deleterious effect on agricultural research. In most technical areas of agriculture, but particularly in plant and animal breeding, the transfer of staff every three years brings a discontinuity into the research work that makes it very difficult for the research administrator and his scientific staff to accomplish their objectives.

It is suggested that BARC try to quantify the effects of this policy on agricultural research and to advise the GOB. Government could then review this policy, revise it if feasible, or perhaps make exceptions for critical areas of agricultural research where long term involvement of the same scientists is essential for productive research.

D. Academic Quality in Agricultural Training

The GOB is considering an expanded role for BARC in manpower development. In order to upgrade the quality of graduates, BARC, as a third party, will be given responsibility for the "academics" of the program. This will include curriculum development and the preparation and administration of examinations at the agricultural institutions. This is understood by GOB to require additional staff of different qualifications for BARC than exist at present.

E. Recommendations

1. In order to make appropriate and full use of resources from donors, the GOB and BARC should create a strong training unit which can effectively develop a manpower development plan and a training program for the agricultural research system.
2. The importance of manpower development to the increased productivity of the national agricultural research system requires that this activity be headed by a Member-Director of BARC. This Member-Director must be provided adequate staff, access to computer and other facilities, and sufficient office space.

3. USAID is strongly urged to continue its efforts to see that operating expense funds shortages do not constrain the productivity of the national research systems.
4. BARC should attempt to quantify the damaging effects of GOP staff transfer policy on the productivity of the agricultural research system and advise GOB.

VIII. INFORMATION AND LIBRARY SERVICES

A. Objective

The general purpose for the information and library science was to strengthen BARC and the participant institutions information and communications services for agricultural research and systematically expand their scientific libraries and documentation services (pp. p16).

Inputs for this program area are technical assistance, training and commodities. The following outputs are expected under this program area.

- a. Facilities for agricultural research information dissemination to concerned agencies and individuals in the agricultural sector in place.
- b. Basic audio-visual materials in place for instructional program related to agro-technology transfer.
- c. Operational technical library (ies) and documentation services in the national agricultural research network at the central and regional station levels.
- d. Personnel trained and in place to perform tasks in library sciences and information communication.

The National Agricultural Library and Documentation Centre (NALDOC) has been established to provide information and documentation service to agricultural scientist. The main objectives of NALDOC are (BARC's PP):

- a. To strengthen and coordinate activities of the Bangladesh Agricultural Information Network (BAIN)
- b. To collect, preserve, maintain and control national agricultural literature.
- c. To provide information and documentation services to agricultural scientists and other related professionals in Bangladesh and out-side within regional and international networks.
- d. To consolidated participation in the regional and international agricultural information system like international information system for the agricultural sciences and technology (AGRIG); Current Agricultural Research Information System (CARIS); and Agricultural Information Bank for Asia (AIBA).

B. Evaluation

The expected outputs as outlined in the Agricultural Research II Project Paper have not been fully acheived but substantial progress has been made on most of them.

NALDOC has already formed the Bangladesh Agricultural Information Network (BAIN) with all agricultural research and educational institutes. This BAIN has established a system for actual transfer, absorption, adoption and utilization of available agricultural information.

NALDOC has made attempts to accomplish other objectives through five short training course/workshops. The trainees were from all agricultural research and education institutes. The short training course for journalists is a valuable public relations move and one such in-country training course was conducted. Two Bangladeshi participated in overseas training to learn more about agricultural research and how research findings are disseminated. The National Symposium on Agricultural Research was conducted by BARC on December 22-23, 1983 and 300 persons attended the symposium and 70 papers were presented. The symposium was a unique opportunity for scientists of many disciplines to interact and exchange views. Similar symposia should be held.

NALDOC has compiled a union list of agricultural periodicals. It has also started to provide photocopies of documents on request by scientists at no cost. It also established a regular abstracting service through the publication of Bangladesh Agricultural abstracts journals in 1983. NALDOC has been publishing quarterly Agricultural Research News and Bangladesh Journal of Agriculture. About 2000 documents were provided to the scientists on their request from outside the country and within the country.

The English version of Agricultural Research in Bangladesh has been published and distributed within the country and outside the country. A Bengali edition is being prepared. To provide information about BARC's activity, a slide film has been developed and a Bengali version is under way.

NALDOC has been participating in the international information system such AGRIS, CARIS, CAB, SARL, ISNAR, DIBA, NEIS. It has also started exchange of scientific information, journals, periodicals with foreign countries

C. Recommendations.

1. The training of all librarians of research and education institutes should be continued within the country and outside the country on library management.
2. The library services of regional stations and sub-station should be strengthened with sufficient documents (relevant books and journals) and equipment such as a photocopy machine, micrographic equipment and audiovisual equipment.
3. All the libraries of the Agricultural Research System should have a computerized list of holdings.
4. The coordination between libraries and documentation centres should be strengthened.
5. BARC/IADS should explore linkages with national and international libraries that specialise in agricultural holdings.

IX. AID PROPOSED EXTENSION OF THE PROJECT

The following comments are in chronological order based on the draft extension proposals.

A. The proposed administrative mechanisms within AID for extending the project are simple, direct, and commendable.

B. Program Area

1. Research Management

a. PPRB

The GOB will be establishing a committee (per the Planning Commission) to review BARC's responsibilities in relation to the national research system. Hopefully, this committee would address the issues involved in the establishment of a PPRB and create a structure within BARC that will perform the functions of the PPRB, either as a separate body or through existing or additional parts of BARC that may be created.

This issue is further discussed in section III A. of the report and para D below.

b. Technical Assistance

The reaction of the Team is that there is not enough TA devoted to core research activities (particularly crops and soil management) and too much devoted to farming systems. The rationale behind this feeling is that the core research program needs to be brought along further, particularly at the regional level. in order to have improved technology components to use in farming systems.

The Team has observed that among the most productive of IADS staff have been the field agronomists. They are not included in the extension. This local facilitative function is critical for the proposed extension if USAID wants to keep the FSR sites and the regional stations functioning smoothly, as well as the interaction with agricultural extension.

USAID should, when appropriate, invite the IADS to comment on the project extension. This collective experience should be valuable in defining the substance of the extension.

c. Human Resource Development

The team concurs with AID proposal

d. Equipment Maintenance Program

The Team concurs with AID proposal. However, spares may be required before the extension is in force.

e. Evaluations

The team concurs.

f. Contract Research and Sabbatical Studies.

See the Section on Contract Research

g. Recurrent costs

The team has concluded that the operating expense financing proposed by AID for the extension period is appropriate, necessary, and will be highly productive.

In the case of the 1985/86 gap, attempts probably should be made to have the gap funded under the PL480, Title III program. Failing this, the team strongly recommends direct AID financing through BARC to appropriate institutes. See the manpower Development Section for more detailed discussion.

h. Physical Facilities and Infrastructure

The team recommends that BARC commission an analysis of field training facilities for the purpose of bringing up to date the requirements necessary for an effective in-country training program. Kitchens and adequate sleeping and studying facilities will be required at several locations. Perhaps those can be financed by USAID as "unforeseen minor construction needs".

2. Farming Systems Research

A comment was made earlier on the balance of TA between farming systems and "Core" research. There is also the matter of continuing the highly productive field agronomist function. The Team recommends that one Associate Production Agronomist be assigned to each research region and work closely with the mobile FSR Team.

3. Information and Library Services

The draft extension does not indicate that AID will equip the NALDOC to handle the tremendous reproduction job required if NALDOC is to provide copies of papers, journal articles, etc. to scientists throughout the system from its central documents store. Field scientists are not presently receiving such materials.

4. Economic and Social Science

The Team concurs

5. Crops Research

A strong case is made by the team report for more emphasis on horticulture crops - particularly those that would address existing serious nutrition problems.

It is not clear why USAID proposes not to support crop water requirements studies. The EWDE identified this kind of information, available for current cropping patterns and HYV varieties, as a critical constraint in the design of irrigation projects.

6. Livestock and Fisheries Research

The Team concurs

7. Soil Management

USAID should include a sulphur and zinc program in future research with the GOB.

8. Water Management

The Team concurs

9. Pest Management

The Team concurs

C. Financial summary

No comment

D. Conditions Precedent and Covenants

The Team believes that the PFRB issue should be brought to a

head. The CP might better be written in this view. See section IV. A

E. Links with Other Donors

No comment

F. Commingling Donor Funds for Contract Research

The Team strongly endorses USAID's approach to providing contract research funds to BARC. The Team has made a suggestion for AID and GOB consideration regarding the simplification and streamlining of contract research administration by BARC. See Section VII.

G. Contracting Mechanisms and advertising

(1) Process

The Team believes that retaining the present host country contract and contractor will provide the most efficient and effective use of the additional funds to be invested by AID and the GOB.

Competitive solicitation of a prime contractor for the proposed extension under a direct USAID contract would avoid some of the problems associated with a host country contract, but, if a different contractor wins the award, which appears very unlikely given the predominant capability" which IADS could argue, there is still a substantial lead-in and orientation required - with Bangladesh and with the GOB - that will make the project less efficient and likely to achieve fewer results than continuation of the present contractor.

(2) Contractor Performance

The detail provided in the program sections of this report establish an overall satisfactory performance by IADS. While weaknesses in certain program areas still need attention, IADS performance over the past year, or so, is noted well above satisfactory.

The Team has made specific recommendations regarding lagging program areas in relevant sections and noted those areas that are meeting or exceeding a reasonable performance. Judging the overall performance of IADS is difficult because the PP and PP Amendment are overly optimistic about output achievement in terms of the capacity of the host government to respond and the contractor to produce. Thus, we have an overall achievement of project outputs that is 50% or less of what was expected in the PP but a satisfactory performance under the circumstances.

The Team received no serious complaints from BARC/GOB staff regarding the services of IADS. Should such develop, they could be corrected by changes in personnel or amendment of the contract.

There are certain actions that can be taken by USAID that will reduce the potential for conflict between BARC and its prime contractor. AID's proposed way of handling Contract Research funds will take some pressure off of the contractor. AID should also consider providing funds for in-country training directly to BARC. The contractor can assist BARC with the program, but being in BARC's hands during the extension period should result in

greater capability by BARC, at the end of the Project, to manage an in-country training program. Having in-country training funds go directly to BARC should also relieve some past tensions between BARC and the contractor.

ANNEX -- A

List of Abbreviations

ADB	--	Asian Development Bank
AETI	--	Agricultural Extension Training Institute
ARP-II	--	USAID Agricultural Research Project Phase - II
AVRDC	--	Asian Vegetable Research and Development Center
BADC	--	Bangladesh Agricultural Development Corporation
BARC	--	Bangladesh Agricultural Research Council
BARI	--	Bangladesh Agricultural Research Institute
BAU	--	Bangladesh Agricultural University
BIDS	--	Bangladesh Institute of Development Studies
BINA	--	Bangladesh Institute of Nuclear Agriculture
BJRI	--	Bangladesh Jute Research Institute
BLRI	--	Bangladesh Livestock Research Institute
BRDB	--	Bangladesh Rural Development Board
BWDB	--	Bangladesh Water Development Board
CIDA	--	Canadian International Development Agency
CIMMYT	--	International Center for Wheat and Maize Research
CSR	--	Cropping Systems Research
DAE	--	Department of Agricultural Extension
DS	--	Director General of a research institute
DTC	--	District Technical Committee
ERP-II	--	World Bank Extension - Research Project, Phase - II
ESS	--	Economics and Social Science Component of BARC
FRI	--	Forest Research Institute
FSR	--	Government of Bangladesh Farming Systems Research
GOB	--	Government of Bangladesh
GTI	--	Graduate Training Institute at Bangladesh Agricultural University
IADS	--	International Agricultural Development Service
ICRISAT	--	International Centre for Research in the Semi Arid Tropics
IDRC	--	International Development Research Center
IFDC	--	International Fertilizer Development Center
IPSA	--	Institute for Post-Graduate Studies in Agriculture
IPSU	--	International Projects Service Unit of IARC
IRRI	--	International Rice Research Institute
ISNAR	--	International Service for National Agricultural Research
MCC	--	Mononite Central Committee
MLT	--	Multiple Location Testing
MOA	--	Ministry of Agriculture
NALDOC	--	National Agricultural Library & Documentation Centre
NARP	--	National Agricultural Research Plan
NIFR	--	National Institute for Fisheries
OFRD	--	On-Farm Research Division of IARI
RARS	--	Regional Agricultural Research Station
RDA	--	Rural Development Academy
RTC	--	Regional Technical Committee
SFYP	--	Second Five Year Plan

SNO - Subject Matter Officer
SMS - Subject Matter Specialist
SO - Scientific Officer
SRTI - Sugarcane Research and Training Institute
SSO - Senior Scientific Officer
TFYP - Third Five Year Plan

ANNEX B

Institutions/Individuals Contacted by the Evaluation Team

EARC

Dr. Ekramul Ahsan, Chairman (Acting)
Mr. Kamaluddin Ahmed, Member-Director (Crops)
Dr. M.S.U. Chowdhury, Member-Director (Admn)
Dr. Omar Ali, Member-Director (Forestry)
Dr. Azharul Haque, Member-Director (Irrigation)
Dr. Altaf Hussain, Member-Director (Livestock)
Mr. Ahmed Husain, Director (Training)
Dr. N. Alam, P.S.O. (Planning)
Dr. Ruhul Amin, P.S.O. (Forestry)
Dr. A. Razzaque, P.S.O.
Mr. M. Z. Islam, P.S.O.

IADS

Dr. D.M. Daugherty, Project Supervisor
Dr. A.K. Kaul, Crops Specialist
Dr. A.H. Manzano, Farming Systems Specialist
Dr. D. Gisselquist, Water Management Extension Specialist
Dr. C. Garces, Agril. Engineer
Dr. B. A. Greene, Agril. Economist
Dr. Sam Fortch, Soil Specialist
Dr. R. C. Lazaro, Water Management Specialist
Dr. D. Krigsvold, Plant Pathologist
Dr. T. Everett, Entomologist
Dr. J. Dickey, Livestock Specialist

Dr. Ed. Loomis, Horticulturist
 Mr. H. Carr, Maintenance Specialist
 Mr. Ed. Rosentel, Administration Specialist
 Mr. Ed. Ferdon, Assoc. Production Agronomist
 Mr. R. N. Mallick, Assoc. Production Agronomist
 Mr. L. C. Sikka, Potato Specialist
 Mrs. Iris Gill, Program Assistant
 Mr. Leopoldo Villegas, Assoc. Production Agronomist
 Mr. Joe Brooks, Vertebrate Pest Specialist

USAID

Dr. William R. Joslin, Director (Acting)
 Dr. Pat Peterson, Chief Food & Agr
 Mr. Bill Jadwin, Asst. A.D.O.
 Ms. Joanne T. Hale, Deputy Chief, Food & Agr

BARI/Joydebpur

Dr. M. M. Rahman, Director General
 Dr. M. H. Mondal, Director (Research)
 Dr. Amerul Islam, Director (TCP)
 Dr. M.M. Rashid, Director, FRC
 Dr. M. Zaman, Head, Agronomy Division
 Dr. S.M. Elias, Head, Agricultural Economics
 Dr. Amzad Hussain, head, Horticulture Division
 Dr. M. Sahidul Islam, P.S.O., Soil Science Division
 Dr. M. A. Karim, Head, Entomology Division
 Dr. Hamizddin Ahmed, Head, Plant Pathology Division
 Dr. Mosleuddin, P.S.O.

BARI/Hathazari

Dr. M. A. Quasham, F.S.O.

All Scientists

BARI/Ishurdi

Mr. Ashraful Islam, F.S.O.

All Scientists

BARI/Jessore

Mr. Ali Hossain, F.S.O.

All Scientists

IPSA

Dr. S. H. Khan, Director

Dr. A. Hamid, Assistant Prof.

BRRI

Dr. M. A. Mannan, Director General

Dr. S. Alam, Director (Research)

Dr. Frank Sheppard, IRRI Representative

Mr. Tom Brackney, Rice Production Specialist, BRRI-IRRI

EJRI

Dr. Ayubur Rahman, Director General

Dr. Mosharraf Hussain, Director (Research)

Dr. M. Myser Ali, Director

Dr. M.A. Khan Majlish, Soil Science Division

BAU

Dr. Altaf Hussain, Associate Professor

Dr. Rafiqul Haque, Assistant Professor

Mr. M. A. Samad, Assistant Professor

Mr. Mofarah-us Sattar, Scientific Officer

Mr. T. Hossain, Irrigation Economist

FAO

Mr. Hugh Brammer

Dr. Emmanuël R. Genio

DAE

Mr. Shahidul Islam, Director-General

MOA

Major General M. A. Munim, Minister

Mr. S. A. Mahmood, Secretary

Mr. Ejazul Huq, Joint Secretary

Planning Commission

Prof. S.H.K. Eusufzai, Member (Agriculture)

Dr. Altaf Ali, Chief, Agri. Division

Dr. Nurul Islam, Jt. Chief, Agri. Division

Farmers

Interviewed 26-farmers at Hathazari, Ishurdi, and Mymensingh.

ANNEX - C

**Suggested Technology Options for
Farming Systems Research**

Farming systems research involves research on farms of all aspects of the farm, the farm family, the farm enterprises, the soils, the crops, the livestock, crop pests and diseases, climate and weather, the surrounding neighborhood of the farm, the support services, including markets, labour, information flow and socio-economics of the farm family as a productive unit. Each farm unit is unique, although in a localized area they have many features in common. In a practical sense only the more important productive aspects of the farm family enterprise are considered in farming systems research.

The extreme complexity of the conditions under which the 14 million small farm families in Bangladesh operate has been well documented. Most of these farms are two acres or less in size. Not as well documented is the dynamic seasonal and year to year changes many Bangladesh farmers are making as they attempt to adjust to current year weather, new crops (wheat, potatoes) new crops varieties, especially the high yielding varieties (HYV) of rice, spread of irrigation, very low cash incomes and increased economic costs.

The Soil Management section of this report notes that the complexities of soils, land flooding phases (types), time of draining of flood water, wet season "dry breaks", and increasing extent of sulphur and zinc deficiencies are constraints farmers face as they attempt to increase crop yields.

Bangladesh agriculture is crop oriented, 80 percent of crop production is rice grown in relation to six major land flooding phases (types) and in recent years HYV rice varieties and irrigation. Draught bullocks, cattle for milk, draught and manure, goats and poultry may comprise 25 to 55 percent of the typical small farm capital.

The problem is the very incomplete knowledge on the part of the research system of the small scale farm family's agro-economic environment and current dynamic farming systems so as to identify problems and potential for on-farm agricultural research, adapting available and continuing agricultural experiment station results to the farm unit conditions.

The purpose of ARF II is to develop and mount a comprehensive multi-disciplinary research effort that will identify more productive uses of the limited available resources, of the entire farming system.

The 1983 external review report dealt in considerable depth with the concepts of cropping systems on-farm research and farming systems on-farm research, pointing out that the emphasis at the time, at the several sites, was mainly a cropping systems approach but with recognition of the farm family, its economics, livestock and gardening efforts. The 1983 team was not convinced that the several sites did represent different agro-ecological regions. The 1983 team recommended increased emphasis on developing a farming systems approach and reduction of amount of data collected and more in depth analysis of results. Finally, the 1983 team recommended that extension agents be involved in

designing the trials, monitoring the results and adoption of the new technologies.

The 1985 team is impressed with the progress being made at the several on-farm research sites that were visited, from discussions with several levels of research and extension personnel, and from a review of national, regional and contract research reports and summaries.

Admittedly the on-farm research sites are still largely crop oriented, but with slight beginnings to emphasize the farming systems research approach of whole farms.

Especially impressive was the identification of more productive "cropping patterns" (commonly known in temperate region countries as "crop rotation" or the sequence of crops grown in a year on a field(s)) by the members of site teams at each of the five on-farm sites visited.

An excellent first step of summarizing, compiling, and interpreting the huge amount of results obtained in four years, 1980-1984, of on-farm cropping systems research is now available. (See A.H. Manzano, "quite litte").

Further analyses are suggested of these results in relation to soils, land flooding depth phase (land types), draining time phases, liklihood of wet season "dry breaks", climate and weather, soil test data and crop varieties. Publication in agro-climatic units would facilitate the transfer of appropriate findings for extension use on farms through the extension T&V system with its more than one million "contact" farmers already identified throughout the nation.

In general the fertilization rates used in the non-farm cropping systems research sites were current per crop recommendation or, in some cases, half rates. Some of the crops of the developed new cropping patterns should have fertilizer residual, and potentially other, beneficial effects that may be found from further analyses of the results.

It is suggested that, in all cropping pattern trials, component trials and multilocation trials when a grain legume (pulse) is grown that it be inoculated with an appropriate rhizobium and receive phosphorus, potassium and sulphur fertilizer. The BARI Soil Microbiology Division has a two kilo fermenter unit to prepare inoculant for field use from the Divisions stock of cultures. BINA also has a large stock of rhizobium cultures, as well as a two-kilo fermenter unit for preparing inoculants for field use.

In some component trials, sulphur or zinc treatments were made. In the opinion of the Team more comprehensive use of sulphur and zinc, singly, and in combination at more than one rate, should be made in the component farms of the planned farming systems sites and on the new multilocation sites in order to determine the most economical rates for profitable yield increases from S or Zn and from S + Zn.

It is suggested that a new moderate input "package" of technology be tested in "on-farm" farming systems research component sites having impermeable soils and "Medium Highland One" land type phase (upto one foot flooding depth). Soil sampling for initial fertility status should be taken at the end of the dry season while the soil is still dry. The "package" to

be tested is BR-11 HYV rice; transplanted aman, rainfed, early August; 40+20+20 fertilizer; 50 lbs. of gypsum (for 8 lb input of sulphur); and 5 lbs of 35 percent zinc sulphate, (for 1.8 lbs input of zinc); all per acre rates. Yield goal is 1.5 + tons per acre (approx. 40+ maunds per acre). The objective of this suggestion is to confirm the possibility of developing a low cost reasonably high yield "package" of production technology for initial trials on farms of extension T&V system "contact" farmers.

Increased feed for livestock is a critical need of Bangladesh small scale farmers, especially for the draught animals. As the on-farm farming systems research farms begin to develop research on whole farm testing, the potential of relay sowing of khesari (Lathyrus grasspea, vegetative types) in transplanted aman rice is a suggestion. Growing a plot of Pennesitum grass for a "cut and feed" is a possibility on Highland, non-flooding land type soils. There is a local cross of two Pennesitum grasses which is claimed to have superior growth and palatability. A clump of giant ipil-ipil, peruvian type, on permeable soils, Highland type, is another possibility for high protein feed as leaves and twigs are harvested on a 60 day schedule. Establishing paragrass along roadway ditches is another possible source of increased feed for livestock.

Establishing a small, fenced, raised bed kitchen garden on the homestead for growing leafy vegetables, kangkong (drysoil type), KK heat resistant summer cabbages, tomatoes and bush or pole sitao beans is a possibility for increased family nutrition.

Developing a small compost pile in a corner of the homestead area could be a source of fertilizer for the homestead garden, and for fruit trees as well as bananas. An easily grown woody legume shrub with edible seeds, pods and leaves very high in protein and vitamin A, planted along the edge of the homestead or along parcel boundaries on Highland-type soils, is another possibility. The shrub is *Moringa oleifera*, known in the Philippines as malunggay and in English called the horse-radish tree. It is currently grown in Bangladesh.

ANNEX D

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ANNEX E

**Abstracts from the 1979 Moseman Report--
Staffing Pattern and Responsibilities of PPRB.**

The Program Planning and Review Board

The following membership is proposed for the Program Planning and Review Board:

- | | | |
|----|---|---------------------|
| a. | Director General, Bangladesh Agricultural Research Council. | Chairman |
| b. | Member of Agriculture, Planning Commission | Member |
| c. | Director, Bangladesh Agricultural Research Institute. | Member |
| d. | Director, Bangladesh Rice Research Institute | Member |
| e. | Executive Director, Bangladesh Jute Research Institute. | Member |
| f. | Director of Livestock Services | Member |
| g. | Chairman, Committee on Advanced Studies and Research, Bangladesh Agricultural University. | Member |
| h. | Representative of other Universities under the Ministry of Education, to be nominated by that Ministry. | Member |
| i. | Director, Institute of Nuclear Agriculture | Member |
| j. | Director, Sugarcane Research Institute | Member |
| k. | Director, Forest Research Institute | Member |
| l. | Director of Agriculture (Extension) | Member |
| m. | Two eminent agricultural scientists, to be nominated by the Government. | Member |
| n. | Secretary of the Bangladesh Agricultural Research Council. | Member / Secretary. |

The Program Planning and Review Board would have the following responsibilities:

- a. Development of a national research plan and establishment of national research priorities.
- b. Development of coordinated and integrated research program plans.
- c. Determination of research funding requirements.
- d. Establishment of a research manpower training and development program.
- e. Improvement of national research facilities.
- f. Effective implementation and monitoring of research programs.
- g. Evaluation and application of technology.
- h. Improvement of technical support services.
- i. Coordination of external support.