

BANGLADESH AGRICULTURAL RESEARCH PROJECT
US-AID PHASE-II

**MASTER PLAN
FOR
BANGLADESH AGRICULTURAL RESEARCH COUNCIL**

A CONSULTANCY REPORT
BY
R. L. CUSHING
INTERNATIONAL AGRICULTURAL DEVELOPMENT SERVICE
NOVEMBER 1982



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I. INTRODUCTION

This document was prepared to comply with the provisions of Sec. 4.2 of the grant agreement between the People's Republic of Bangladesh and the United States of America (6)* and of the 6th paragraph of Section VII, Appendix A, of the contract between the People's Republic of Bangladesh and the International Agricultural Development Service (IADS) (7). In summary, these provisions state that the project supervisor and other specialists employed by the contractor (IADS), in collaboration with their Bangladesh counterparts, will prepare a five-year master plan of action.

The plan is to cover the projected organization, operation, management and program of the Bangladesh Agricultural Research Council (BARC) and USAID Project Phase II.

BARC is a coordinating and sponsoring organization, rather than one that conducts research itself. The plan therefore refers to those institutes and other organizations that are responsible for doing agricultural research. A list of these is attached as Appendix A. Most of these were visited, even if only briefly, during the course of collecting information. In addition, some of them provided copies of their own plans and information about their programs.

There is no dearth of planning for agricultural research in Bangladesh, nor of reviews and evaluations of the plans (3, 4, 5, 18, 19, 22, 28, 31, 38). Although some plans, or recommendations in the plans, have been implemented, there are indications that sometimes there is lack of effective action. Recommendations that are neither accepted nor rejected are not very useful. For example, the review team in 1980 said, "..... no special list of recommendations is presented in this report. It would be necessary to essentially repeat all of the 21 recommendations in the April 1979 report of the Joint Review Team, Strengthening the Bangladesh Agricultural Research System. The present report does reemphasize some of the recommendations of the 1979 report in identifying areas where action should be taken promptly to enable the national research system to function and perform effectively" (32). As recently as February 1982 there was continuing discussion of the need for action on many of the 21 recommendations made by the joint review team (10).

The purpose of a plan should be to define clearly the direction in which programs are supposed to go, to identify constraints that may impede implementation of the plan and to suggest ways in which effects of constraints can be minimized. The aim of this plan is to integrate the principles that have been laid down and the plans that have been made already for the Agricultural Research Project, Phase II. Thorough plans have been prepared for most project components and there are specific and detailed schedules for action as, for example, in the training component. Rather than repeating these, they will be summarized and incorporated, where appropriate, by reference.

It should be noted that this plan has been based on the same principles that were used for the BARI Master Plan (19, pp. 5 & 7). They are not repeated here, except for the final paragraph:

"Finally, a plan is only as good as the use made of it. The problem frequently is the gap between plan and performance, between promise and fulfillment. No

*Numbers in parenthesis indicate references cited. See pages 61-64.

plan will be perfect. It will overlook some problems, will over-emphasize others and may propose routes that turn out to be unfeasible. But even an imperfect plan is better than no plan if those responsible for carrying it out give it their full support and commitment."

II. ROLE OF BARC IN THE NATIONAL AGRICULTURAL RESEARCH SYSTEM

Agricultural research in Bangladesh has evolved through a series of changes in governments and in organization of the institutions in the system. Responsibility for different parts of agricultural research was dispersed in several ministries and, within ministries, among several institutions (18, 19, 28, 32). Some research institutions were established as line organizations, responsible to officers in the ministries. Others as semi-autonomous organizations, with their own governing boards and with sources of funding that enhanced the autonomy. A few were established as divisions of government corporations, with responsibility to corporate officers.

The result was that research in all areas of agriculture was fragmented and coordinated poorly. National objectives for agricultural research were not defined clearly, priorities were not established effectively and there was duplication in facilities, staff and programs. Considering the urgency of the need for practical research results and the limited resources of scientific manpower and funds in the country, an effort had to be made to improve the situation.

Drawing on experience of the Indian Council of Agricultural Research and the Agricultural Research Council of Pakistan, the Bangladesh Agricultural Research Council (BARC) was established by Presidential Order No. 32 of 1973. Apparently from the beginning, BARC did not meet the expectations that had been held out for it and was the subject of reviews and studies starting soon after it was founded. Recommendations of a select committee appointed by the government were incorporated in an amendment to Order No. 32, which was published as BARC Amendment Ordinance No. LI on July 5, 1976 (14, 28).

It is clear from the history leading up to establishment of BARC that the objective was to provide national, coordinated leadership in agricultural research. It was to provide direction, so that the work of scientists in the several institutions would be applied to problems for which solutions were important to the nation. It was to coordinate programs in order to minimize duplication and to provide, or to channel, support where it was needed most.

This was summarized in 1980 as follows:

"A mechanism was needed to systematically coordinate and organise into a functional tool, all manpower, facilities and resources in agricultural research in order to accelerate food, fibre, fish and livestock production, labour productivity, farm income and ultimately national development. As a result BARC was created to provide a systematic approach to planning, coordination, direction and conduct of a national agricultural research program and integrated research system" (14).

Unfortunately, Presidential Order No. 32, as amended by Ordinance LI, is not clear and specific as to BARC objectives. In fact, there is no reference to objectives; they must be inferred from the history which led to BARC and from the list of functions headed, "THE COUNCIL SHALL" As frequently happens, objectives and functions are either confused or lumped together. The latter was done in the pamphlet, "This is

ARC" (14), where the functions listed in the Order are included under the heading, "OBJECTIVES AND FUNCTIONS."

At the beginning, and still to a large extent, BARC had the important but difficult role of leading and guiding agricultural research without line responsibility for the organizations actually doing it and without direct control over much of the funding. Priorities and direction of research ultimately depend on how available funds are budgeted and spent.

Highly centralized national agricultural research systems can provide effective direct control over program and budget but there are disadvantages, as well as advantages, in such systems. The main advantages are that there can be close coordination, effective prevention of duplication, specific assignment of priorities and efficient use of manpower and facilities. Disadvantages are that untried lines of research are less likely to be pursued, that if a centrally-made decision is wrong it can send the whole system off in a wrong direction, and that some duplication is necessary and desirable in order to test new developments in different environments and to provide confirmation and validation of results.

As a national organization, but without direct responsibility for the research institutions in the system, BARC is in a position to use the advantages and to minimize the disadvantages listed above. It can do so through leadership and direction rather than through control. Its position as coordinator should make it possible for BARC to maintain a better balance between the advantages and disadvantages than if it actually conducted research or was a major channel for funding research.

Having recognized the difficulty of coordinating, without authority over budgets and funding, the joint review team recommended the establishment of a Program Planning and Review Board (PPRB) (28). An indication of the importance attached to this is found in the fact that more than one-third of the team's 21 recommendations referred to the PPRB. Yet the PPRB has not yet been established.

The policy question of whether BARC should be a "coordinating agency" or an operating agency was considered by the 1978 review team (28). Although the intent was clearly that BARC would coordinate, and this is generally understood, some ambiguity remains. This may be partly because operating -- getting something done -- is more attractive and easier than coordinating and partly because, as noted above, there was not a clear distinction between objectives and functions. Such a distinction can be made, as follows:

An objective is, "the purpose to be achieved," and for BARC the objectives can be summarized from reports and reviews as:

- to provide national, coordinated leadership in agricultural research;
- to provide direction in agricultural research, to assure that work of scientists is applied to problems of national importance;
- to minimize duplication and to channel support to those places where it is needed most; and
- to strengthen the capacity of the agricultural research system to generate new technology and to accelerate technology transfer to the farmer.

A function is, "the act or operation expected of a person or thing," and for BARC the functions are those acts and operations used to achieve its objectives. These are listed in Section 5 of Order No. 32, amended, as follows:

"5. THE COUNCIL SHALL --

- (a) Identify problems in various sectors of agriculture, determine priorities and draw up long-term and short-term programmes of research within the frame work of the national policy on agriculture;
- (b) scrutinize and approve research proposals of various research institutes and experimental stations before forwarding such proposals to the Government;
- (c) evaluate and co-ordinate research work done by various research institutes and experimental stations under the Government and autonomous bodies, such evaluation to be in addition to the normal evaluation by the institutes or stations concerned, and arrange periodic review of research programmes of the institutes and stations by competent experts of the Council;
- (d) evaluate if research facilities are adequate and whether existing facilities are properly utilized and, for this purpose, take such steps as are necessary to improve the quality of, and output from, research activities;
- (e) prepare master-plan for manpower requirement in agricultural research and select the required number of scientists and research workers for training abroad and within the country and award fellowships and scholarships in specialized fields for post-graduate studies and for attending international seminars and conferences with the approval of the Government;
- (f) guide and supervise the activities of research projects financed by the Council;
- (g) advise the Government on agricultural problems on national and international planes;
- (h) advise the Government in the matter of representation of Bangladesh in international conferences and seminars on agricultural research;
- (i) recommend measures for the utilisation of the results of research carried out by research institutes, experimental stations, educational institutions and laboratories under its control or under the control of the Government or autonomous bodies;
- (j) publish or otherwise disseminate technical and general information on the results of research and any other information considered relevant to research works and, for this purpose, give grants to the Universities and other institutes and may also recommend to the Government to publish or disseminate such information through Government agencies;

- (k) arrange national and international conference, seminars or short course training in such fields of agriculture as it deems necessary;
- (l) establish, or assist in establishing, research institutes, research centres, experimental stations, libraries and documentation centres, museums, herbaria, plant introduction centres and germplasm banks;
- (m) maintain contact with the agricultural research organisation of other countries to ensure the rapid testing, adaptation and use of potentially useful innovations for Bangladesh;
- (n) establish linkage between research and agencies propagating the results of the research;
- (o) sponsor and finance the travel expenses of suitable research workers to visit research institutes and laboratories where outstanding works in their respective fields are being conducted;
- (p) serve as the national organisation and a co-ordinating agency for research in all aspects of agriculture including crop, livestock, soil, water, crop protection, agricultural engineering, forestry, fishery and economic and social sciences;
- (q) consolidate the research related to agriculture undertaken by the various organisations;
- (r) advise the Government in matters relating to the utilisation of external aid for agricultural research; and
- (s) provide funds to specific projects selected by the council." (14)

III. BANGLADESH AGRICULTURAL RESEARCH PROJECT -- USAID PHASE I

An agreement was signed in March, 1976 between representatives of the government of the People's Republic of Bangladesh and the United States of America, providing for assistance under USAID Project No. 388-0003. The project was carried out during the period 1978-81 and a final report was submitted in 1981 (15).

The purpose of the project was to strengthen the agricultural research system in Bangladesh, especially the Bangladesh Agricultural Research Institute (BARI). Some assistance was also supplied to BARC.

1. Project Components

Main components of the project were:

- technical assistance -- both long-term resident and short-term consultants;
- training -- long-term degree, short-term career, attendance at conferences/workshops and study tours;
- research support through contracts to investigators;

- purchase of commodities (equipment);
- vertebrate pest control research; and
- development and improvement of physical facilities at some stations.

A total of \$4,391,800 was budgeted in grant funds for the project. Of this about 38 percent was for technical services, provided under contract by the International Agricultural Development Services; 4 percent for purchase of commodities; 5 percent for research support through contracts; 11 percent for training; 19 percent for vertebrate pest control research; and 23 percent for station development. Loan funds totaling \$4,200,000 were used to construct buildings, roads, irrigation and drainage systems, and to buy laboratory and farm equipment for the new BARI central station at Joydebpur.

For many years BARI had inadequate offices and laboratories at scattered locations in Dhaka. It had practically no experimental fields there because the land they once occupied had been requisitioned for a new capitol. BARI did have land at regional and substations but not enough scientists at them to use it effectively. BARI now has well-designed, modern facilities at Joydebpur for field and laboratory research. It is incumbent on those responsible for the work to ensure that they are being used to the full extent.

During the project, 11 long-term specialists in the fields of research administration and planning, agronomy, economics, engineering and vertebrate pest control provided 24.5 man-years of technical assistance. Twenty-seven short-term consultants (1 to 6 weeks) provided a total of 5.5 man-years of technical assistance in the subject-matter areas of research administration and planning, experiment station design and development, communications and training, agricultural economics, irrigation design, cropping systems, crop damage assessment, rodent behavior, and in reviewing and evaluating programs.

Eleven staff members of research institutions were supported in long-term study abroad toward M.S. or Ph.D. degrees; 17 were provided with short-term (1 to 7 months) specialized training in other countries.

Fifty-three individual staff members of various research organizations made a total of 75 trips out of Bangladesh to attend international meetings or workshops or for specific study tours, while five members of the project staff made 20 such trips, all of which were paid for with project funds.

Project Accomplishments

There were two major accomplishments of the project: improvement in physical facilities and equipment and improvement in staff capability.

Construction of laboratories, offices, workrooms, storage, and residences and the development of field experimental areas for BARI at Joydebpur was a tremendous improvement. For the first time in many years, it was possible to bring the BARI staff together in contiguous offices and laboratories and to provide them with fields and equipment to carry out experiments. Purchase of other equipment and the construction of buildings, roads, irrigation systems and electrification at the Ishurdi Regional Station also provided more and better physical facilities.

Staff capabilities were enhanced by the overseas training provided to many staff members in research and administrative positions. In addition to this direct, specific, subject-matter training, there was strengthening of staff capabilities through shared experiences and examples provided by expatriate technical specialists. There is no way to measure or to evaluate such improvement objectively but it can be seen in the attitudes, enthusiasm and quality of the work done by the research staff.

Details of specific areas to which the project contributed are in the final report and are not repeated here (15).

IV. USAID PROJECT PHASE II

Phase II of the project is broader in scope and will provide assistance to many more institutions than Phase I. The first phase was concerned primarily with BARI, while the second is concerned with BARC which, through its national coordinating responsibility, touches all institutions and agencies that do agricultural research. In addition, it was recognized in planning Phase II that there was an urgent need for better integration of agricultural research, both at national and local levels; that it was essential to improve the total agricultural research system, not just the individual parts of it. It was also recognized that results from experiments that are not based on actual, clearly identified farm problems or research results that are not translated into feasible actions on farms do not contribute toward increased production and efficiency.

Objectives

On the basis of the conclusions stated above, the overall objective is "... to increase the effectiveness of agricultural research necessary for development of appropriate technologies to Bangladesh farmers (6)."

To do this will require strengthening the institutions responsible for agricultural research and improving their research planning and direction. The following objectives identify areas in which improvement is needed:

1. Skills of research staff members in planning and conducting practical, multidisciplinary, on-farm experiments should be improved.
2. Capability of research institutions to work with farmers to develop and deliver farm-tested technologies should be increased through staff training and by providing necessary equipment.
3. "Core research" programs and a "farming systems" approach should be incorporated in the programs of the research institutions.
4. Farming systems research should be adapted to environments in which farmers operate and the systems and their components should be tested in those environments, with continuous participation by farmers.
5. Existing farming systems should be identified and research should be aimed at modifications that will enhance farm performance.
6. Coordination and cooperation among the agricultural research institutions should be improved. Research should be planned so that total resources of

the system can be applied to common problems, in order to improve effectiveness and to minimize duplication.

7. The agricultural research system and the institutions of which it is comprised should be fundamentally strengthened by: increasing the professionalism and capability of research staff members, improving organization and administration and providing critically needed supplies and equipment.

The project proposes to achieve these objectives through assistance organized as a matrix consisting of "project components" and "program areas." Cost estimates have been prepared for each segment of the grid and it is stipulated that financial statements on project expenditures under each of the five components will be related to each of the nine program areas (7).

As an example of the matrix of program areas and project components, Table 1 shows the amount of funds budgeted and available for the period July 1982 to June 1983 for the combinations of areas and components. The proportionate amount of funds for each program area and project component are also illustrated in Fig. 1.

The following two sections discuss the project components and the program areas.

3. Components

There are five components of the project: technical assistance, staff development, research support, contract research, supplies and equipment and construction. These are identified in both contracts (6, 7) but not always in those same terms. For example, "staff development" includes training of all kinds and travel for staff improvement; "research support" includes contract research and sabbatical studies. The sections which follow outline the elements in each component.

1. Technical Assistance

There are two classes of technical assistance provided for in the contract between BARC and IADS (7): specialists (long-term) and consultants (short-term). The subject-matter specialties required, the program areas to be served, and the length of service are listed in Appendix A to the contract, but the schedule of service is not.

a. Specialists (long-term).

There is to be a total of 24 specialists for a total of 73 person-years over the five-year duration of the project. Length of service ranges from 12 to 60 months. Table 2 provides a list of the subject-matter specialists according to program areas and the proposed schedule of service by six-month intervals.

Table 1. Program Areas and Project Components;
Funds Budgeted and Available, July 1982-June 1983

Program Areas	Technical Assistance ¹	Local Support	Staff Development	Contract Research	Commodities and Construction	Total
(Thousands of Dollars, Rounded)						
Research Management	317	317	142	---	422	1,198
Support Services	513	---	16	---	285	814
Farming Systems	556	---	91	30	174	851
Economics/Social Science	294	---	35	19	124	472
Crops	355	---	53	1	232	641
Livestock	90	---	2-	8	32	150
Soil	134	---	32	7	60	233
Water	229	32	301	197	206	965
Pest Control	103	---	26	23	52	204
Total	2,591	349	716	285	1,587	5,528

¹Includes external evaluation.

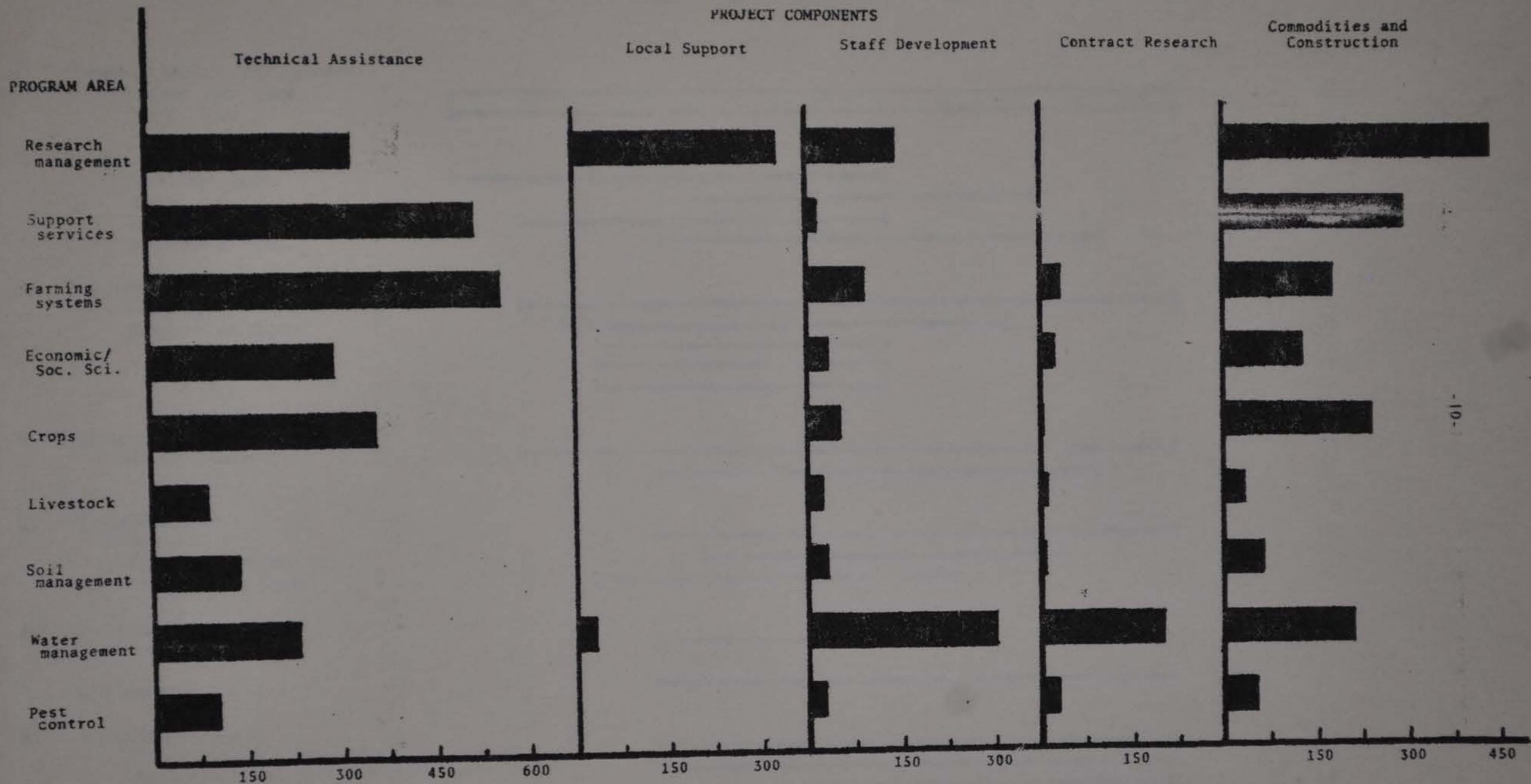


Figure 1. Program areas and project components: funds budgeted and available July 1982 - June 1983, in thousands of dollars.

Program Areas and Schedule of Service.

Program Areas Specialists	Contract Years										Number months
	I 1981-82		II 1982-83		III 1983-84		IV 1984-85		V 1985-86		
	7/1/81	1/1/82	7/1/82	1/1/83	7/1/83	1/1/84	7/1/84	1/1/85	7/1/85	1/1/86	
1. Research System Management Project Supervisor Admin. Spec.	[Horizontal bars from 7/1/81 to 7/1/86]										60 60
2. Technical Support Farm Dev. Spec. Maint. Spec. Training Spec. Information Spec.	[Horizontal bars: Farm Dev. 7/1/81-7/1/84; Maint. 1/1/83-7/1/85; Training 1/1/82-7/1/84; Information 1/1/83-1/1/86]										36 24 24 36
3. Farming Systems Research Farming System Spec. Assoc. Prod. Agron. " " " " " " " " "	[Horizontal bars: Farming System 7/1/81-7/1/86; Assoc. Prod. 7/1/82-7/1/85; " " " II 7/1/82-7/1/84; " " " III 7/1/82-7/1/84; " " " IV 7/1/82-7/1/84]										54 36 24 24 24
4. Economic & Social Science Agr. Economist " "	[Horizontal bars: Agr. Economist I 7/1/81-7/1/86; " " II 1/1/83-1/1/86]										54 36
5. Crops Research Agronomist Crop Coordinator Horticultural Spec.	[Horizontal bars: Agronomist 1/1/83-7/1/86; Crop Coordinator 7/1/83-7/1/85; Horticultural 7/1/82-7/1/85]										42 30 30
6. Livestock Research Livestock Spec.	[Horizontal bar: Livestock Spec. 1/1/83-7/1/85]										24
7. Soil Management	[Horizontal bar: 1/1/83-7/1/86]										42
8. Water Management On-Farm Water Mgt. Spec. Agricultural Engineer Extension Specialist	[Horizontal bars: On-Farm Water Mgt. 1/1/83-7/1/86; Agricultural Engineer 1/1/83-7/1/86; Extension Specialist 1/1/83-7/1/86]										42 42 42
9. Pest Control Plant Pathology Entomology	[Horizontal bars: Plant Pathology 7/1/83-7/1/85; Entomology 7/1/83-7/1/84]										24 12

Total

822
(68.5 years)

It will be the responsibility of the specialists in each program area to work with their counterparts in BARC and the several research institutions: to identify problems that need research, to evaluate needs and priorities, to assess research capabilities, to plan research programs, to assign or coordinate assignment of responsibility for doing the research, to advise on research methods, to assist in interpreting and evaluating results, to advise and assist in extending and adapting results to use on farms, and to assist in evaluating the effectiveness of the program. Descriptions of the assignment for each specialist are in Appendix A of the contract (7).

Considering Farming Systems, Crops Research and Pest Control all to comprise research on crops, there is a total of 300 person-months of long-term specialist services for crops. There are 54 person months for Water Management, 48 for Soil Management and 24 for Livestock. These allocations, as well as those for the other areas, should be reviewed.

Is the proportion for crops too high? Is that for livestock too low? Even though fisheries is not one of the nine program areas, should some long-term specialist service be provided for it?

Consultants (short-term)

There is to be a total of 12.3 person-years of consultants (short-term specialists) who will provide specialized skills to meet particular problems or give added emphasis in selected problem areas. Table 3 provides a proposed schedule of specialties likely to be most useful and the time and duration of the consultants service. This should be considered the best estimate, subject to change as the project develops and as needs can be better identified and evaluated.

The consultants should be qualified by training and extensive experience in their subject-matter areas. They should be given complete and specific terms of reference which describe the objectives of the consulting, the subject-matter problems to be considered and the product to result from the work. The counterpart (from among BARC, IADS or Research Institute staff) with whom the consultant will work and to whom he will be responsible, should be designated and a schedule of meetings and field trips should be provided.

General

The difficulties in achieving effective work from expatriate specialists, particularly on short-term assignments, are well known. There is no way to overcome all of them but they can be minimized. It seems worthwhile to mention the following:

Table 3. Consultants (short-term specialists):
Proposed Assignment by Program Areas and Schedule of Service

Program Areas and Specialists	Date of Start of Consultation	Person- months
	yr.	
Farming Systems	1983	3
" "	1984	3
" "	1985	3
		<u>9</u>
Economics & Soc. Sci.		
Economist	1983	12
Social Scientist	1983	12
		<u>24</u>
Communications		
Computer Spec.	1982	2
" "	1983	1
Library Spec.	1983	12
		<u>15</u>
Crops Research:		
Agronomist-Breeder	1983	12
Horticulturist	1984	12
		<u>24</u>
Livestock	1982	3
"	1983	9
		<u>12</u>
Water Management	1982	4
" "	1983	18
" "	1984	18
		<u>40</u>
Pest Management	1984	12
		<u>12</u>
Total		<u>136 (11.3 years)</u>

Recognizing the difficulties inherent in distance and in sometimes slow communications, every effort should be made to inform the more than 40 specialists who will participate in the project as fully and effectively as possible about the project and their part in it.

Job descriptions (for long-term) and terms of reference (for short-term) specialists should be as specific as possible about responsibility, reporting relationships, including designated counterparts, and the nature of the product expected to result from the assignment.

Recognizing the limits on resources and the physical limitations, which affect staff of the institutions in the country as well as expatriates, specialists should be supported as fully as possible. This would, among other things, include necessary supplies, transportation, secretarial assistance, and appropriate work areas.

Recommendation

Success of the project depends heavily on the capabilities, dedication, and effectiveness of the specialists in the technical assistance component. Specialists should be chosen carefully, should be informed fully about the project, should be given as complete information as possible about their role in it and what they are expected to contribute to it, and should be provided with the necessary service and support.

1. Staff Development

The objective of this component is to improve and enhance the capabilities of the staff members in Bangladesh agricultural research institutions. As in any such set of institutions, the amount and quality of formal training the staff members have received varies widely. Similarly, there is wide variation in the range and relevance of other forms of improvement, such as attendance at international conferences, professional exchanges and visits, etc., in which staff members have participated. Although it is known that staff development is needed, there has not been a complete inventory of manpower according to number, degree attained, position held, etc., since 1978 (2). Even that study did not include all of the institutions. A new inventory is being compiled, as described below.

It is proposed that staff development will be achieved by in-service overseas training, in-service local training and individual study.

a. Assessment and planning

There should be an up-to-date assessment of existing staff capabilities, identification of institutions and subject-matter areas in which improvement is needed and then a plan to provide the training that will achieve the improvement needed.

An assessment of current capability has been started by requesting each institution to complete a simple form. This will provide information on the number of staff members in each professional grade, the number according to academic degree attained and the age distribution. It also will report the number of technicians and other

employees (see sample in Table 5.) This inventory should be completed as part of the project and should be revised periodically as a means of measuring progress.

Planning for staff improvement has mostly been done. The objectives have been listed, the selection criteria defined and schedules have been prepared for overseas training (both long- and short-term) and for in-country training through workshops, conferences and seminars (11). Details, including budgeted expenses, are in the reference. In summary, the plan proposes overseas training for 6 Ph.D. and 24 M.S. candidates; post-graduate/post-doctorate training for 5; 98 persons will be provided non-degree training ranging from three to six months. It provides for an unspecified number of overseas trips to enable senior staff members to attend international conferences or to make individual visits to observe work at comparable institutions. It proposes a number of conferences/workshops/seminars to be held in Bangladesh over the five years of the project, of which 30 to 40 will be in-country water management courses. Participants will be designated as the conferences are organized.

Table 5 provides a summary of the planned program.

Even though considerable planning has been done, some of the proposed programs merit specific comment.

In-service overseas training

The proposed program (11) lists six selection criteria, which were subsequently replaced by a set of nine factors, each of which is weighted in importance. The factors and the weight of each are: academic record (24), publications (15), experience, general (5) - specific (10), research contributions (10), oral test (15), appearance and manner (3), English proficiency (8), service at field station (6), and contact with outreach program (4). Each candidate is interviewed and scored by a selection committee. Amendment No. 6 to the contract (6) provides for training 24 persons at the M.Sc. level; 6 in the U.S. and 18 in third countries. Short-term training (3 to 6 months) will be provided for 98 persons.

In selecting candidates for overseas graduate training, three things should be matched and the importance of doing the best possible job cannot be overemphasized. These are: (1) the subject-matter fields and research institutions for which trained staff are needed; (2) the experience, qualifications and interests of the candidates; and (3) the institution to which the candidates are to be sent for training. Compromises are inevitable but they should be minimized. For example, the temptation to place a candidate at an institution, "because he can get admitted there," should be resisted.

The candidate should be competent to study in the language of the place of study. This degree of competency needed for study is much greater than that necessary for ordinary conversations. To succeed in overseas study, the student must be able to understand lectures,

Table 4. Sample of Information to be Compiled as Part of a System-wide Inventory of Staff Capabilities in Bangladesh Agricultural Research Institutions.

Professionals (Scientific Officers)									
Number Positions by Level of Training									
Institute	Authorized				Filled				Total
	Ph.D.	MSc.	BSc.	Total	Ph.D.	MSc.	BSc.	Total	
ARI	---	147	14	161	6	47	27	80	
RTI	4	31	6	41	4	31	6	41	

Supporting Staff									
Institute	Adm.	Acc.	Repair & Mtc.		Steno/ Clerk/ Typist	Technicians			Total
			Lab Eqpt.	Vehicle & Imp.		Field	Lab.	Other	
ARI	---	13	19	4	61	226	73	127	523
RTI	16	3	10	15	23	12	7	75	161

Age Distribution of Professional Staff						
Institute	20-29	30-39	40-49	50-59	60-+	Total
	ARI	9	35	33	3	--
RTI	15	24	2	--	--	41

Table 5. Summary of Proposed In-Service Training to be Provided Under the Project. Compiled from "Programs in the Agricultural Research Project, Phase II" (10), amended.

Kind	Overseas Training		Total Person-Years
	Number Participants	Duration (Months)	
<u>Degree</u>			
Ph.D.	6	42	21
MSc.	24	24	48
<u>Non-Degree</u>			
PD/PG ¹	5	12	5
Short-Term	70	6	35
" "	<u>16</u>	3	<u>4</u>
TOTAL:	121		113

¹Post-doctorate/Post-graduate

frequently containing specialized terms and delivered at a rapid pace, and must be able to write reports and examinations clearly and quickly. The possible need for special language training for candidates who will study abroad should be considered.

There should be a commitment for the candidate to return to Bangladesh upon completion of study and to work for a specified period at a research institution or station where his skills are needed. Such commitment is referred to in paragraph 6 of the selection criteria (II). Rather than a "certification of regular appointment with and return to institute", perhaps the commitment should be part of an agreement stipulating that the staff member, in return for the training received, would serve for at least three years at a regional station or a substation.

The project emphasizes farming system research and on-farm testing and it is proposed to strengthen the capabilities of the regional stations in these areas. Candidates for overseas training are not likely to be drawn from existing staff of the regional stations, so requiring a trainee to return to the institute from which he was selected probably won't provide this strengthening. Maintaining the maximum amount of flexibility is desirable, so that staff members who have received the kind of training needed for a particular program at a specific regional station (or other institution) can be assigned where needed most. These needs cannot be anticipated fully at the time plans are made and probably not even when candidates are selected for training, hence the desirability of having an understanding in advance, by contract, that the returning staff member will apply his skills and training where they are needed most. The issue of ways in which service at regional stations can be made more attractive is discussed elsewhere.

The contract should also require trainees to submit progress reports and a final report. In the case of candidates for degrees, there should be a report at the end of each academic period. This should include a brief narrative report by the trainee, which should be endorsed by the trainee's faculty adviser, and a copy of the institution's academic report (credits earned, grades and standing). For degree candidates, the awarding of the degree could serve as the final report.

For staff members on three- and six-month study tours, there should be at least one interim report and a final report. These should include the trainee's evaluation of his progress, his evaluation of the program and a description of the ways in which he can apply the results of the training in his work.

Who should review these reports? Probably the trainee's immediate supervisor and the project training coordinator.

c. In-service local training

The project proposes two types of in-service, in-country training: (1) research scholarships and (2) workshops/seminars/field days/short courses.

Research scholarships, funded by the project, have the objectives of: encouraging Bangladesh scientists to continue study in Bangladesh toward an advanced degree; making it possible for scientists who are degree candidates at overseas institutions to conduct their research in Bangladesh; and strengthening the linkage between agricultural research institutions. Selection criteria and procedures, financial and operating procedures, and accountability are described in detail in the program document (11). It is proposed that support be provided for six Ph.D. candidates and 24 M.S. candidates.

Various kinds of training, such as "workshops," "seminars," and "conferences" have essentially the same meaning -- a meeting to exchange information and have discussion. These different terms are not important in the general planning but are significant when it comes to the specifics of organizing the programs. The objectives, the participants (or audience), the size, the length, the location, and the amount of preparation will be different.

At this stage, it is not possible nor necessary to be specific because the need and usefulness for training of this type will evolve as the project is carried out. For example, there is no purpose in scheduling a field day until there is something in the field worth demonstrating. There is no purpose in a short course until the project officers have identified the staff members who need training, the subjects in which it is needed and the people that can provide it. In short, there should be a great deal of flexibility.

One caution: when money and authorization are available, it is easy to overdo seminars, field days, etc. Meetings and field trips are attractive and if there are too many of them they can interfere with essential work. There are ways to minimize this tendency: authorize such meetings only when need has been demonstrated, limit participation to those who need and can use the information and require follow-up reports from participants.

Individual improvement

The opportunity and benefits of individual improvement are frequently overlooked and unused. One essential for independent study and improvement is motivation, and this is connected directly to job satisfaction and to opportunities for advancement. Where these are lacking there isn't much incentive to do extra work for the purpose of improving knowledge and skill.

The other essentials are opportunity to do independent study and the availability of study materials. Staff members who have the will and the interest should not only be encouraged but should have access to books, periodicals and other study material.

Individual study can be either self-directed or highly structured. Self-study programs consisting of well organized material in books, manuals, film strips, audio and video cassettes are available for some technical subjects and are common for language, mathematics and other basic skills. Special programs can also be produced to meet specific needs. Once such a program has been prepared, it can be duplicated and modified as needed.

As the Bangladesh agricultural research system places more emphasis on regional and on-farm research and has more staff members posted to regional and other outlying stations, the need for and the opportunity to use individual improvement programs will become greater.

Recommendation

Success of the plans for staff development, including advanced degree training, both overseas and locally, non-degree study abroad, staff travel for conferences and visits, seminars and field days, and individual study will depend primarily on sound administration of four key elements:

- a. There should be clear and specific statements of objectives in terms of staff capabilities needed and the kinds of training appropriate to meet those needs.
- b. There should be rigorous selection of staff-member candidates for training based on potential capability, interest and the relevance of the training to the job assignment. Where training is to be at an overseas or local university or similar institution, there should be equally rigorous selection of the institution. There should be a good match between the kind of training needed and that offered by the institution.
- c. There should be continuing evaluation of the programs. Are they providing the kind of improvement needed? Are staff development programs benefiting both the institution and the individual or only the individual? Are improved skills being maintained in the system or are they being lost? Are such skills being used to improve the skills of others in the system?
- d. There should be flexibility in the program. Although needs can be identified generally and programs to meet them can be outlined, there should be flexibility to meet changed needs and to modify programs as experience indicates ways in which they can be improved.

Research Support

The project provides for two means of encouraging and funding research that could not be done within the funding of the institutions themselves. These are: contract research, with a budget of \$1,350,000 for the five years, and sabbatic research with a budget of \$250,000 for the five years.

The aim of contract research, "... is to provide resource support to scientists of participating institutions in the diagnosis and analysis of

priority on-farm problems, implementation of research for their resolution, and making readily available results for adoption by farmers or for further verification and farm validation." (11)

Any research officer in any of the institutions coordinated by BARC could propose a research project and apply for contract research funds. Considerable effort has gone into developing procedures for administering the contract part of the project. The description of programs under the Phase I project (11) includes, for contract research: objectives, selection criteria, process of selection, operational procedures, administrative direction, financial procedures and accountability. In addition, there has been a research monitoring manual prepared (16) and there is a recent report on selection, monitoring and evaluation of research projects by Dr. J. V. Lake (29).

To ensure that the available funds are used effectively, one critical step in the contract research program is rigorous evaluation of proposals and careful selection of those to be supported. As the Lake report emphasizes, the proposals should have technical competence and should be relevant to high priority needs not being met by existing research programs. In order to achieve this, BARC has the responsibility not only to evaluate and select proposals but to define the research areas within which proposals will be received. This can be done as part of BARC's major responsibility to set research priorities and to coordinate research; once problems of high priority have been identified, BARC should invite contract research proposals only within the specific priorities it has established. By limiting the scope within which proposals will be considered, there should be greater competition and higher quality of those accepted.

Another critical step in supporting contract research is to make substantial grants to worthwhile projects on problems of high priority that promise substantial results that can be used promptly on farms. It is tempting to allocate grants on a proportional basis that will give each subject-matter area and each institution something. This should be resisted and instead of many small grants there should be fewer but larger ones. Larger grants may mean that proposals will require the participation of several research officers, even from different institutions, but this would be consistent with the objective of promoting coordinated, multidisciplinary research directed at on-farm problems.

Standardized procedures are necessary in administering a program such as that on contract research. Forms for uniform reporting and specified routing and approval are part of such procedures. The research monitoring manual (16) proposes such forms and procedures. There is a total of 16 forms suggested for contract research proposal, evaluation and monitoring. Some, such as the proposal, would be prepared only once but others would be completed annually, semi-annually or quarterly during the life of the project. Some would require only one copy but others up to five and the number of pages varies. However, a single research project could generate up to some 140 pages of forms annually. Inasmuch as most, if not all, of these would be routed to Member-Directors of BARC, it looks as if they could be subjected to a large burden of paper work.

In addition to being burdensome, forms and procedures that are too detailed and cumbersome can result in harmful delays and, even worse, can interfere with getting the research work done. As Dr. Portch says, "The soil scientist should spend as little time preparing proposals as possible. Most of his time should be spent on his research and transferring his findings to out-reach personnel." (35) Ways should be sought to meet the requirements for proposing, evaluating, monitoring, and reporting on contract research with a simplified procedure that would use fewer and shorter forms.

The aim of sabbatic research is to provide funds to enable staff members in universities ~~and research institutes~~ to undertake research while on sabbatic leave. This would strengthen linkage between the universities and the research institutes while also supporting needed research. "Programs" (11) provides detailed descriptions of procedures and reports.

Obviously, BARC has no way of knowing what staff members will be taking sabbatic leave or when, so there has to be some procedure for inviting applications, reviewing and evaluating them and making the grants. These procedures should be as simple of possible. Responsibility within BARC should be delegated clearly and specifically for making the grants, for receiving reports and for evaluating the worth of the program.

Recommendation

BARC should identify and specify the high-priority research areas in which proposals for contract research and sabbatic research will be received. There should be rigorous evaluation of applications for grants under these two programs and only proposals showing technical competence and relevance to on-farm problems of high priority should be approved. Substantial grants for proposals that promise significant results should be preferred to a larger number of small grants.

Procedures and forms for applying for contract and sabbatic research grants, for evaluating progress, for accounting for funds used and for reporting final results should be as few and simple as possible. The time and effort of BARC Member-Directors and technical staff is needed more critically and can be used more effectively in identifying and finding ways to meet research needs than in detailed monitoring.

Program Areas Included in the Project

The project documents stipulate that the components discussed above will be applied to nine program areas. (The agreement between the People's Republic of Bangladesh and the U.S.A. calls these program areas "Project Components" while the BARC/IADS contract calls them "Programs.") (6, 7) In order to be consistent, the nine areas will be called, "Program Areas" from here on.

It is important to retain these designations because the BARC/IADS contract requires that expenditures in the several project components shall be related to the program areas.

There are two main reasons for the high degree of specificity in the program areas. In developing the contracts for the agricultural research project Phase II, and in developing plans to carry them out, it was recognized that there are two critical areas in which the research should be concentrated. These are: farming systems research and on-farm research. The thrust of the farming systems research is to emphasize the need for working on real farm problems and to consider each problem as part of a system rather than as an individual problem that can be studied in isolation. The research worker must be familiar with the farmers' problems and with resources available to the farmer. He should also recognize that the farmer is part of the solution to problems because answers must be found that can be applied within the farmers' constraints. Improvements in technology resulting from agricultural research contribute little toward increased production unless they can be taken to the farms and applied there effectively.

Although several of the program areas do not appear to be related directly to these two main thrusts, they are implicit throughout the plans for the entire project.

The nine program areas are discussed individually in the same order in which they appear in Table I and throughout the report.

I. Research Management

In a system as large and diverse and consisting of as many units as the agricultural research system in Bangladesh, it is important to have strong capable research management. With the establishment of BARC and the coordination and support it has provided, there has been strengthening of research management in several of the institutions within the system. Further improvements can be made, however. The following are some of the major factors that should be considered.

a. Organization

i. Authorization and Responsibility: One of the basic requirements for effective organization is to establish clear lines of authority and responsibility. The responsibilities and limits of authority should be written and should be distributed to all persons concerned. It is also desirable for the entire system organization and for each of the units within it to have an organization chart. Such charts are ordinarily used to illustrate "line responsibility." These can also be used to indicate program responsibility.

In addition to fixing responsibility, another reason for delegation is to improve the capabilities of the staff and to develop trust and confidence. Experience has shown that staff members respond to the delegation of responsibility by greater development of their skills and capabilities. Delegation is a clear expression of trust and confidence.

The authority so essential for good operation sometimes gets blurred because of a failure to distinguish between line responsibility and program responsibility. These can be the same but frequently they are not. Line responsibility, that is, the direct responsibility for personnel, budget, finances, physical facilities, etc., has to be specifically defined and generally follows a subject-matter definition.

Programs, on the other hand, frequently cross subject-matter lines, which is essential when multidisciplinary research is applied to broad agricultural problems.

ii. Decentralization: In view of the emphasis on farming systems research and on-farm experiments, both of which have the objective of developing useful results that can be extended and adopted quickly, there should be decentralization of responsibility within the system.

While objectives and guidelines for such research can come from the central institutes and from the on-farm trials coordinator, the direct responsibility for planning and carrying out these programs should be assigned to the regional stations. The personnel at the regional stations are in a better position to learn about, to evaluate and to plan research to meet the urgent farm problems. However, in order to do this successfully, the number and capability of the staff at regional and branch stations should be improved. One way for obtaining this improvement is through the in-service training program discussed previously under the Project Components. Another way is to consider periodic transfers because experience elsewhere has shown that occasional transfers frequently will stimulate renewed interest and better performance.

In order to attract more capable staff to the regional and branch stations there should be incentives for service at such stations. Some of them are isolated; schools for children, medical facilities, recreational opportunities, etc. are limited. While loyalty and dedication will go part of the way in attracting staff members to serve at regional and branch stations, more tangible incentives are also important.

While most of the regional stations now have adequate physical facilities in the form of buildings, roads and irrigation systems, there is still need for some essential equipment. Most do not have adequate transport (cars, trucks, motorcycles). Some need field equipment and some need basic laboratory equipment. Almost invariably where such equipment is available, there is need for improved maintenance and repair. In order to strengthen the role of the regional stations in the farming systems and on-farms research, some of these needs will have to be met and, in addition, adequate funds will be needed for fertilizer, pesticides and other supplies.

Planning

It should be emphasized at the outset that "planning" cannot stand alone. If planning is not followed by prompt and effective execution it amounts to naught. Planning must be based on a realistic assessment and budget of resources, including funds, personnel and facilities. Once this assessment has been made then the objectives, programs and priorities can be drafted and related to the budgets.

Long-range plans, say up to five years, should be general. The purpose of research is to develop new information -- new principles, new methods, new materials -- hence, planning for research on a long-range program should be general enough so that plans can be modified as results are developed. The basic purpose of long-range plans should be to define objectives, to provide an inventory of capabilities, to identify constraints, and to suggest ways in which constraints can be minimized.

Short-range plans, on the other hand, should be specific. Usually the short-range plan is the annual plan which basically should be the budget. It is the budget which determines what and how much can be done. Budgets should be built from the "bottom up." Such planning and budgeting encourages participation by the research workers at the place where the work is being done. It makes it possible to plan in stages, with each stage having an achievement target, and as these are reached there is opportunity for concurrent application of results and for changes in the plan (19).

The process should start with an estimate of the probable total amount of funds available for each element in the research system. Within this estimate of the probable amount available, each unit should develop its financial and program budget on the basis of what needs done most urgently within the amount of funds available. Each unit's draft budget prepared in this way is then submitted to the next higher unit for review and revision, if necessary. Once the budget and program plan has been approved, then it is the blueprint for the work to be done during that period.

Funding

One of the recurring problems in the Bangladesh agricultural research system is the failure for funds to be released on time. Almost every institution visited described problems resulting from the unavailability of funds when needed.

Successful farming depends upon critical timing of operations. Land must be tilled when the moisture content is right; seeds must be planted at the right time; pests must be controlled before they become established; and crops must be harvested when ripe in order to avoid losses. Agricultural research is subject to the same critical timing because it deals with the same crops and animals. In order for agricultural research results to be applicable and useful, they must have been obtained from experiments that were planted, cared for and harvested on time. Too often there apparently is delay in some of the experimental operations resulting from the unavailability of funds on time.

Recognizing the need for proper use and accountability of government funds, there should be an effort to simplify procedures for transmittal of funds, for disbursements, and for accounting. These changes should be related to those concerning decentralization and delegation of responsibility. Delegation of responsibility for a given program should also be accompanied by delegation of responsibility for the use and accounting of funds.

Evaluation

In agricultural research there is a need for evaluation of programs to determine whether objectives are being met, whether useful results are being produced, whether reports are prepared on time, and are complete and accurate.

There are two kinds of program evaluation -- formal and informal. Formal evaluation is based on a periodic, systematic review of program objectives and accomplishments based generally on written reports and submissions of data. Informal evaluation and monitoring is almost continuous. It takes place when the director, the department head, the station superintendent, etc. discuss progress with the investigator, visits the laboratories or visits sites of field experiments. There will be five formal reviews of the Phase II project, three internal and two external.

Personnel evaluation is also of two kinds -- objective and subjective. Objective evaluation can be based on a standardized set of procedures and criteria. In organizations as large and complex as those making up the Bangladesh agricultural research system, there should be objective personnel evaluations. They should, however, be kept as simple as possible. Objective personnel evaluation should be regular and should be carried out no less than annually.

Subjective personnel evaluation is based on a supervisor's judgment of the quality and quantity of work performed by the staff members for whom he is responsible. Results of personnel evaluation must be communicated to the employee. In order for the staff member to improve, to attempt to correct shortcomings, and to become a more capable and responsible employee, he must know firsthand from his supervisor what his strengths and weaknesses have been found to be.

Communications

One of the most difficult parts of research management is to maintain satisfactory communications. The research manager must keep his staff informed of objectives, problems, policies, procedures, new research results, etc. On the other hand, the manager must also communicate with those to whom he is responsible. He must report to them periodically on the problems being investigated, on the progress of the research, on the results, and of needs.

Within the Bangladesh agricultural research system, with its several institutes, several locations and large number of programs, communication is essential if coordination and cooperation is to be encouraged and maintained. The several audiences and the several kinds of information that have to be transmitted almost require that there be several methods for maintaining communication. The main ones are periodic written reports, intermittent written reports, staff conferences, meetings, seminars, field days, etc.

At the minimum, there should be an annual report from each research Institute. Depending on the nature of the institution and its work,

there may also be quarterly or monthly reports. The problem is to maintain a sensible balance; the frequency of reporting should be such that needed information is prepared and reported on time but should not be so frequent as to become burdensome on the staff to prepare it.

There is no yardstick which can determine how frequently the periodic reports should be issued or how long they should be, or how detailed. This can only be determined when the audiences are defined and when the content of the material to be reported is known.

Effective communication appears to be one of the great needs in the Bangladesh agricultural research system. There is no lack of written reports but there is doubt as to whether the audiences for reports has been defined clearly, whether reports are reaching the audiences they should and whether reports are being prepared efficiently and effectively. These questions have been reviewed recently in a report on BARC publications by Stephen A. Breth (17).

Recommendation

Effectiveness and efficiency of research management should be strengthened by: establishing clear lines of authority and responsibility; specifically delegating authority and responsibility, especially decentralizing more to regional and branch stations; developing a planning-budgeting process that involves more participation of research workers; providing budgeted funds on time; improving, but simplifying, procedures for evaluation of programs and personnel; and improving the systems and means for internal and external communications.] continue page 30

Supporting Services

The importance of service and support in the research operation cannot be overemphasized. The research staff must be provided with facilities, including offices, laboratories, library, etc., equipment, supplies, transport and all the other services that underlie the operation of the research system. Among those that need to be considered in the Bangladesh agricultural research system are the following:

a. Experimental Fields

With the completion of the central BARI research facilities at Joydebpur and with the facilities now in place at the other major institutes, concentration should be on using them to the fullest extent. Especially in view of the emphasis to be placed on farming systems and on-farm experiments, there should be continued improvements at the branch stations such as in land leveling, the installation of irrigation systems, and the improvement of access and internal roads.

The project budget provides \$170,000 for minor construction at regional and branch stations.

By and large, the agricultural research system is not constrained by lack of buildings. Many of them are not designed as well as they might have been for research use, nor have all of them been well maintained. Any construction, therefore, should be limited to essential repairs and minor modifications.

Field Experiment Division

It was proposed to establish a field experiment division in BARI and this has not been carried out. The prior recommendations should be reviewed and modified, if necessary, and the field experiment division established.

As an integral part of BARI, which will carry responsibility for much of the on-farm and farming systems research, a well organized capable field experiment division can serve as a coordinating and service unit in carrying out the broad programs in the project.

Maintenance

Maintenance of field and laboratory equipment has been a continuing serious problem. This is due to the inability of the research institutes to retain trained maintenance and service personnel and to the lack of convenient and reliable sources of repair parts.

This problem is especially difficult in the case of laboratory instruments because of the wide variety of manufacturers, the different sources and the resulting incompatibility of repair parts. At least minimum standardization would be desirable. With two of the large institutes now located at Joydebpur and with others, as for example the Jute Research Institute, in Dhaka there should be consideration of two centralized maintenance and repair facilities -- one for motor equipment, including trucks, tractors, automobiles, pumps, etc., and one for laboratory instruments.

The problem of retaining trained personnel is a difficult one because it is caused mainly by the fact that research institutes cannot pay competitive salaries.

Maintenance of buildings should be improved, especially in laboratories where analyses are performed. Contamination from dust and dirt are an ever present possibility that should be minimized.

1. Personnel Services

An essential in research support is a sound system for maintaining personnel records, for coordinating formal employee evaluations, and for assuring fair and equitable treatment of employees in matters of salary, promotion, reimbursement for expenses, etc.

If some research programs are decentralized, as recommended previously, responsibility for maintenance of personnel records should also be decentralized. There should, however, be standardized criteria, procedures and forms for the maintenance of personnel records.

There also should be consistent coordinated personnel policies to ensure equity.

Personnel policies and procedures should not become too complicated and burdensome. Policy statements should be direct and brief; evaluation procedures and forms should be brief and simple; and the volume of records to be maintained should be kept to the bare essentials.

e. Training

The objective of training, as discussed previously under the section on staff development, is to improve the capability of the research staff in technical subject-matter fields. There should also be training to improve capabilities of research managers, including the institute directors, department heads, regional station superintendents, etc. There is an urgent need to provide better trained research managers (superintendents, etc.) at regional and branch stations in view of the project emphasis on farming systems and on-farm research.

f. Information Services

Information services include the whole range of activities concerned with the collection, preservation, recovery and use of information.

One essential part of every institution in the agricultural research system is the library. Yet, of all the institutions visited, only one -- the Forestry Research Institute -- appeared to have a well organized, reasonably up-to-date collection of reference books, periodicals, etc., managed by a trained librarian. For obvious reasons, it has been impossible for the research libraries in Bangladesh to maintain subscriptions to overseas periodicals or to purchase up-to-date text books, reference books and technical handbooks.

There is provision in the project for a consultant on libraries to assist in developing a coordinated, cooperative agricultural library system. Funds are needed for subscriptions to the most essential journals. Library services are weak enough in the central laboratories of the research institutes and are even weaker at the regional stations. In order to improve the quality of research at the regional stations, it is necessary to improve library services to those stations. One way would be to have central subscriptions, with copies of tables of contents to be distributed to the regional stations and a way in which complete copies of needed papers can be provided.

Three years ago a library consultant reviewed the agricultural library system in Bangladesh and reported findings (39). This report can serve as a starting point but changes since it was made, especially the broadened program and increased emphasis on work at regional and substations, makes it essential to have a qualified specialist examine the library situation and make recommendations.

Related to, but in addition to libraries, there has been dramatic progress in the development of central documentation and information centers. Such centers can provide computer storage of scientific

literature references, abstracts or complete copies of technical papers, statistical information, engineering data, etc. Some of these are part of regional or national information centers while others are part of scientific organizations or business enterprises. Technically it is now possible, with a computer terminal and a telephone line, to have access to such information centers in any part of the world. Many countries are also developing their own central documentation and information centers as a central location for the collection, storage and retrieval of specific local information, and plans are underway for the development of such a documentation center in Bangladesh. A computer specialist should be involved in the assessment and planning for this center. Furthermore, development of such a computerized center should be coordinated closely with the development of libraries so that duplication can be minimized and the maximum amount of information made available at least cost.

There are two other parts of information services that need to be improved. One is the writing, editing, publication and distribution of reports. It now takes a long time for reports to be cleared for publication and to actually be printed and distributed. Editing, printing and distribution should be improved, as recommended by Breth (17).

The second part is public relations. This should include preparation and distribution of information to public leaders, but especially officers of all government departments whose policies and decisions affect agricultural research. The public relations function also could be responsible for visitor coordination and for providing answers to general inquiries.

Recommendation

Although additional facilities and equipment are needed, an immediate objective should be to use those now available more effectively. Maintenance of all kinds should be improved but a critical problem is service and maintenance of motor equipment and laboratory instruments. Trained and skilled technicians are needed and the difficulty of attracting and holding them in research institutes should be met by competitive pay and improved facilities. The problem of obtaining repair parts for imported laboratory instruments needs to be solved.

Information services -- libraries, publications and public relations -- need to be strengthened. Trained, experienced staff members are needed, as are better collections of periodicals and reference books in the libraries and better equipment for producing and distributing publications. Planning should begin for eventual development of a computerized information service and centralized data bases.

Farming Systems Research

Much of the world's agricultural research has been directed at a single crop or animal species. Research on wheat has involved mainly investigation of

wheat problems, such as developing new varieties, pest control, fertilization, etc. The advantage of "one crop" research is that it can be concentrated on a single species and can encompass all phases in the cultivation of that species. It is especially effective where an agricultural system consists mainly of one crop as in the wheat belt in the United States or the sugarcane area in Australia.

In Bangladesh agriculture, the "one crop" approach has some shortcomings. The Bangladesh farms are small. They do not involve large areas devoted to a single crop. Bangladesh agriculture is not primarily a market economy. With a high proportion of the population living on farms and subsisting from the products of the farm, only a small proportion of the output moves into the market. Thus a single farm produces several crops in order to be as nearly as possible self-sufficient.

Bangladesh agriculture encompasses traditional farming systems based on long experience, on local customs, on the specific crops and on the farming conditions. It is difficult for farmers to apply a "package" of high yield technology that may have been developed through one crop research to meet the needs of a predominately single crop economy.

Given these factors, it was realized that emphasis in Bangladesh agriculture research should shift from the one crop type of research to farming systems research. It was also recognized that to generate results that would meet important farm problems and could be applied on farms, much of the experimental work should be done on farms. Thus the emphasis on farming systems and on-farm research in project plans for Phase II.

There are three main needs that can be met by this kind of research: first, to solve the practical problems of farmers; second, to adapt, confirm and demonstrate on farms useful results that have been obtained in agricultural research; and third, to encourage and promote coordination among farmers, extension workers and research workers.

Inasmuch as several of the research institutions in Bangladesh are concerned with single crops (rice, jute, sugarcane), cropping system research will have to cross institutions lines in order to be broad enough to be effective. BARC, as the coordinating agency, will have to take the lead in developing the national program that will link the institutions and the crops for which they are responsible in a farming systems research program.

Farming systems research should use all of the useful information that is developed in the single crop research programs. It should use the best varieties and should take advantage of everything that is known about fertilization, irrigation and pest control that has been learned in other parts of the program. Farming systems research should make the best possible use of the existing research institutes, their regional stations and branch stations in all parts of the country. There is an excellent network of experiment stations representing almost all environmental and farming system areas in the country. These stations will provide physical facilities and need research staff and technicians who can plan and carry out farming systems experiments.

BARC will provide overall direction and coordination but planning for farming systems research should involve representatives of all relevant institutions. This would include, as necessary, the Member-Directors of BARC, directors of the research institutions, department heads, and superintendents of the regional stations. However, once the plans have been completed and the scope of the research program defined, institutions and individuals should be assigned specific responsibilities. Only by designating such responsibilities specifically will it be possible to make sure all elements of the program are properly carried out; that the results are dependable; and that these will be useful reports on the results of the work.

As a broad coordinated program, there should be defined procedures for implementation, monitoring, evaluation and reporting the results from the farming systems research program. There will be variations to meet local conditions but experimental designs should be standardized, so that results can be consolidated and summarized and subjected to the same statistical analysis. Time of planting and other cultural practices should be like those of farming systems in the region.

The policies and procedures for planning and carrying out farming systems research have been considered and are discussed and described in references 8, 27, and 37.

Recommendation

Farming systems research is one of the most important program areas. It will also be one of the most difficult because it will require participation of several institutions and close coordination by BARC. In addition to policies and procedures already prepared, there should be: specifically assigned responsibility for defined portions of the research; assurance that the research is directed at farming system problems of significance; high probability that the results can be applied on farms and will benefit farmers; and assurance that experiments will be installed and harvested on time and otherwise conducted in accord with good experimental techniques.

Economic/Social Science Research

Even though a considerable body of economic and social research has been done in Bangladesh, by and large it has not been applied in planning agricultural production research. The reasons appear to be that economic and social research has frequently not been planned in such a way that the results would be useful in planning and carrying out production research. Economic and social research followed developments in agricultural production research and usually consisted of analyzing the effects of changes in practices resulting from production research rather than providing guidance for production research.

The Phase II project provides an excellent opportunity for economic and social science research to precede and to assist in planning and carrying out agricultural production research. To do so there must be close coordination of the economic and social research especially with the farming systems and on-farm research. The principal way in which

conomic and social science research can contribute is to take a farming management approach.

There needs to be an inventory of farming systems and a description of current patterns of farming. What resources do farmers have? How much land? Is it contiguous or separated? What kind of soil? Is irrigation water available when needed? How much labor is available? Livestock -- for power and for food? Equipment? Such an inventory and descriptions will be built during the project, and an example is the 1981-82 annual report of cropping system research (12).

Having described current systems and inventoried farmer resources, the "comparative partial budget analysis" would examine alternative systems of management. This would provide the basis for identifying problems on which research is needed to evaluate the alternatives.

There are other economic and social research studies that can assist in planning farming systems and cropping systems research. For example, whether a farming system produces subsistence or cash crops can affect the importance of varieties in defining objectives for the research program. If a system involves production of cash crops, then the acceptability of the variety in the marketplace is important. If it produces subsistence crops, then the characteristics of the varieties that are important to the farmers themselves become of greater significance. Knowledge about farming systems would also be useful in planning pest control and fertilizer research. Subsistence farms are not likely to be able to afford heavy investments in fertilizers and pesticides.

As is well known, characteristics of land ownership and the size and fragmentation of farms in Bangladesh have an important effect on research planning and objectives. Farms are small; they are fragmented; and many farms are operated by tenants instead of by the owners. These factors are important in research planning. Tenant farmers are reluctant to invest capital in improving the land and improving the farming system unless they have an assurance of tenancy and an opportunity to share in the profits that may result from such an investment. Similarly, small-size and fragmentation of farms makes it impractical to adopt farming techniques that are suitable for large, contiguous areas.

Economic and social research can contribute to research planning by analyzing employment and workers on farms. What are the proportions of landless farmers and of landless workers who, nevertheless, depend on farm employment? What is the role of women on farms? How does the woman's role determine how farms will be operated, what they will produce and how the products will be used? Estimates of the size of these classes, of the effort each of them applies to farming, the economics of their contributions, even the way in which information about new farming practices can reach them are important considerations.

Recommendation

Economic and social science research can provide basic information about farms, farmers and farming systems that will assist in planning and directing other research programs. To do this it should be aimed at:

characterizing and evaluating farming resources; analyzing the effect of these on farming systems; identifying alternative systems; and defining problems on which research is needed to make the alternatives feasible and applicable.

Crops Research

Crops are by far the largest and most important component of the nation's agricultural production. In years for which data are available, the value of crops is from 75 to 80 percent of the total value of all agricultural production. (See Table 6.) Among crops, cereals are of overriding importance and are essential in the nation's food supply. There is a continued need for high priority on research to increase the production of cereals and to assure a stable supply to meet the nation's increasing needs.

The importance of crops has obviously been recognized for many years and is reflected in the comparative amount of research effort devoted to them. Figure 2 compares the relative value of commodities, as a percent of the total agricultural production, with the amount of research effort, as indicated by the recurring expenses of the several research institutions. It should be noted that INA research has contributed to increased crop production but there are no data to indicate the value of the increase.

Even though emphasis in Phase II of the agricultural research project is concentrated on farming systems and on-farm research, the importance of crops research should not be minimized and continued support should be provided.

What is needed is a review of accomplishments and an analysis of the part that crops will play in farming systems and on-farm research, and the best possible integration of the crops research with that in the farming systems area. It is also particularly important to identify those research components common to all crops and farming systems research that constitute non-commodity research. Specific examples are soil and water research and pest management research. These research areas have had relatively little emphasis, compared to the commodity research programs, and it is desirable to integrate them with farming systems research.

Around the world the greatest emphasis in crops research has been on the breeding and development of new varieties. Among the questions that need to be asked as a basis for future crops research planning in Bangladesh are the following:

- a. Are new varieties, especially of cereals, the most urgent need?

It has been reported (12) that many farmers say the cost of using new high-yield varieties is beyond their means. Perhaps emphasis should be on better ways to use varieties now available rather than continuing to breed more new ones.

- b. Do the varieties now available fit existing or potentially new cropping systems? Are they compatible with the other crops that may be used in the cropping system? Do they have weaknesses with respect to disease resistance?

Table 6. Gross value (value added) of agricultural production and its components at current prices, 1972-73 to 1977-78. Source: Table 18 in Ref. 3.

Component		1972-73	1973-74	1974-75	1975-76	1976-77	1977-78 ¹	Av.
		current prices						
Crops	million Tk	19,761	33,215	67,401	45,114	39,816	49,207	79.1
	percent	76	80	86	79	75	78	
Forestry	million Tk	1,240	1,728	2,311	2,094	2,112	2,112	3.6
	percent	5	4	3	4	4	3	
Livestock	million Tk	2,230	3,137	4,137	4,332	4,494	4,584	7.2
	percent	9	8	5	8	8	7	
Fisheseries	million Tk	2,869	3,421	4,774	5,799	6,893	7,086	9.6
	percent	11	8	6	10	13	11	
TOTAL		26,100	41,501	78,623	57,339	53,315	62,989	

¹Provisional

Rounded

Funding of research institutes, recurring only, 1979-80 *

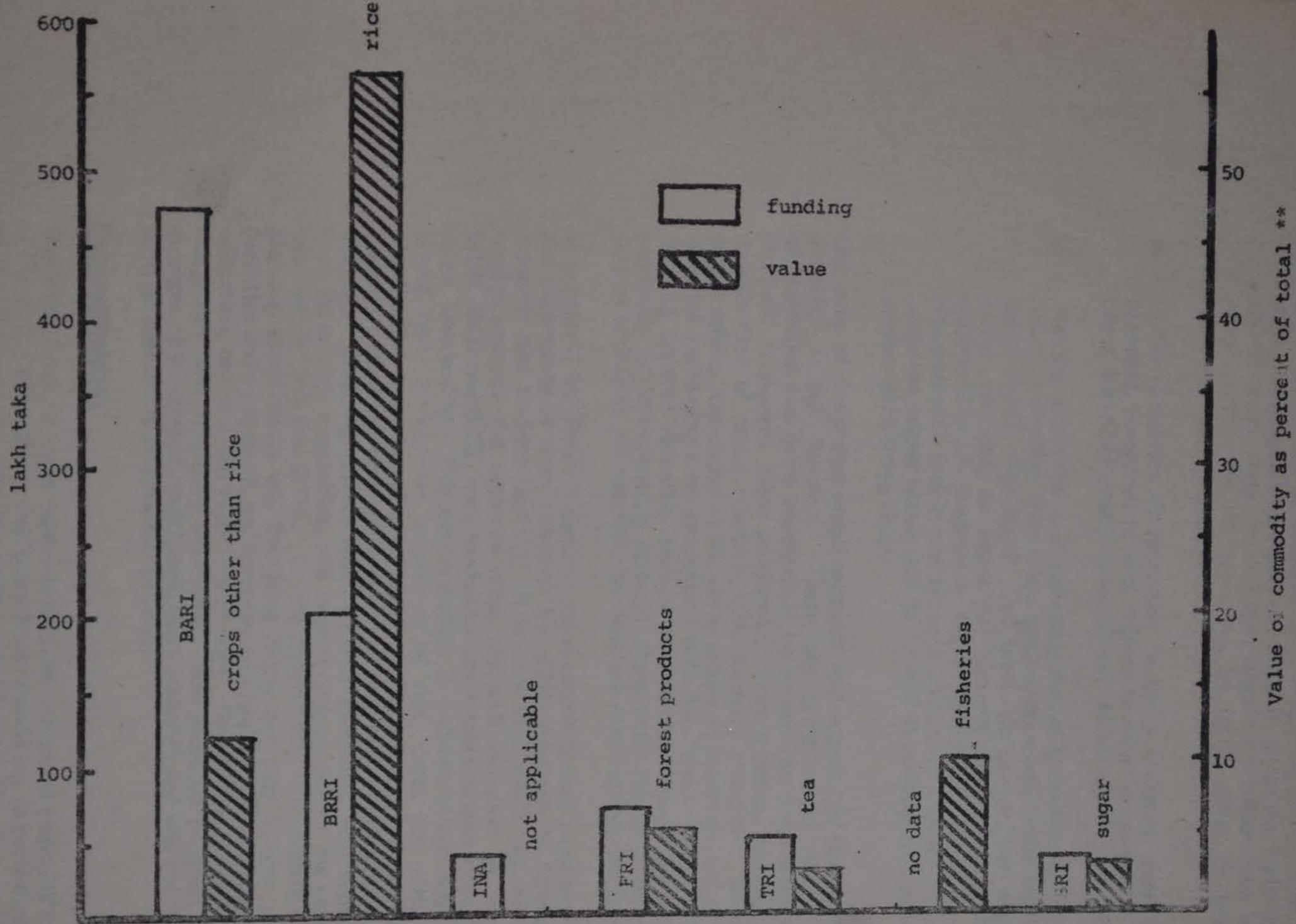


Fig. 2. Funding for research compared with relative value of product, 1979-80.

* Gill, G.J. Operational funding constraints on agricultural research in Bangladesh, BARC Apr. 1981

** Calculated from data in the Y book of Agricultural Statistics. 1979-80.

- c. What are the other elements in the farming system that are needed to obtain maximum production? That is, given the varieties available and assuming they are suitable, what contributions can be made by crop rotation, by intercropping, by fertilization, by irrigation, by improved pest control, etc.?
- d. Is the allocation of resources to crops breeding, especially cereal breeding, compared to that applied to other crops and to disciplines other than plant breeding excessive? About right? Not enough?
- e. Are the priorities and the comparative allocation of resources for research on other food crops (pulses, oil seeds, fruits and vegetables) about right? Too high? Too low? As has been emphasized in earlier sections, an important element in developing the farming system research program is the integration of individual commodity research with that of the systems research. Answers to some of the questions raised above will be helpful in making decisions needed to achieve such integration.

One area of integrated crops research that appears to have had almost no attention is agro-forestry. There are programs of reforestation and afforestation and some research is being done by the Forestry Research Institute to support these programs. There appears, however, to be no coordination of crops research with forestry research. There are real opportunities, especially in the early stages of reforestation or afforestation, for combining crop production with the forestry work. In planning farming systems research, serious consideration should be given to the possibility of incorporating forestry along with the usual farm crops, as well as with fruit and specialty horticulture crops (spices and beverages).

In summary, the Phase II agricultural research project in no way minimizes the importance of crops research but shifts emphasis to farming systems research and on-farm testing. It is here that BARC leadership will be needed because the separate crops research institutes as, for example, BRRI, SRTI and BJRI, have tended to concentrate, understandably, on their single commodity. This concentration is understandable because of the urgent need to increase production of rice, sugar and jute. Now the coordination and integration of each crop as a part of the system and the testing of these systems will require not only new thinking but new ways of working. Cropping system research that integrates say, sugarcane with legumes or with vegetables, will require cooperation of the research staff members in SRI and BARI. It will require not only common efforts in planning experiments and installing them, but may involve joint use of facilities and equipment, and certainly will require close cooperation in the collection, analysis and reporting of data. One of the essential factors in this effort will be strong leadership. The proposed program is a prime example of integrated, multidisciplinary research and will call for the best skills of specialists in a number of areas.

Recommendation

The importance of crops research justifies continued emphasis but because of Phase II programs in other areas there should be: a review and analysis of the high priority that has been given to breeding new crop varieties;

consideration of the integration of crop research with non-commodity research on soil and water and on pest management; integration of crops research with programs for farming systems research and on-farm testing; and development of at least modest programs of agro-forestry research through coordination of crop research with research on reforestation and afforestation.

Livestock Research

Livestock is an important component of total agricultural production amounting to approximately 7 to 8 percent of the total value. (See Table 6 and Fig. 2.) This understates substantially the complete value of livestock in Bangladesh because it does not account fully for livestock and poultry raised and consumed on the farm, nor for the value of farm power provided by livestock nor the value of manure from livestock used for fertilizer on farms. It includes the value of by-products, such as hides, but it is not clear whether full value is reflected.

Important as it is, there has been relatively little research effort devoted to livestock. In fact, in the tabulation of research expenditures and manpower (2), livestock research is not even included. The two main reasons little research has been done on livestock are: there has not been a national center for livestock research and there has been meager funding of what research has been done. Livestock problems that need research and recommendations for developing a better program were discussed at some length in the report of the review team on the Bangladesh Agriculture Research System (32).

One difficulty is that there is insufficient and unreliable information about livestock animals, their condition and their contribution to farming, as a basis for planning research (33). In order to at least begin to overcome this shortcoming, part of the economic and social science research program should be to develop better information about the characteristics of livestock production in Bangladesh as a basis for building a stronger research program. At least the following should be included:

- a. To survey the kind, number and uses of livestock. Uses would include farm power, on-farm food, livestock marketed for food, and for by-products.
- b. The identification of feed sources. By and large Bangladesh livestock appears to be underfed, and it would be useful to know the contribution to the feed source of crops, farm crop wastes, grazing in waste areas, grazing in forests, etc.
- c. It would be useful to have information on employment in livestock production. In general, it appears that livestock care is incidental to crop production, although the livestock is vital in providing farm power.
- d. There should be a study of the contribution made by livestock to farming systems in the form of manure for fertilizer, fuel and construction. It may be too early, but the question should at least be asked as to whether manure could be used for the generation of biogas.

Another difficulty is that there has not been a central leadership for livestock research and the goals for such research have not been carefully thought out nor clearly defined. For example, a draft of a five-year plan set 20 grams as the desirable per capita daily intake of protein from livestock in Bangladesh. An analysis of the number of animals required to provide this for the 90 million people in Bangladesh, and of the amount of livestock feed required and of the land to produce it, showed the goal to be completely unrealistic (24).

Two reports of consultants emphasize two facts which appear to be basic in considering livestock research: (1) livestock is integrated into the farming system and use is made of their by-products and (2) livestock is and will likely continue to be dependent on feed of low nutrient value (20, 33). Meat and milk are by-products of cattle whose main purpose is to provide draft power.

As much as the potential of cattle strictly for milk production is small, except in pockets around cities, research on breeding and feeding for milk production should have low priority.

The crucial importance of cattle as draft power and the fact that cattle have been used this way and breeds evolved for this purpose over a long period, suggest low priority for work on exotic breeds. Some work has been done on crossing exotic and local breeds and increases in milk production have been obtained (1). But should this line of work have high priority?

It appears that a much more important need is to improve the health and feeding of cattle used for draft power. Veterinary services for prevention and control of disease are inadequate and it has been pointed out that the training of veterinarians and the administration of veterinary services to farmers need improvement (13, 33).

Until now, emphasis seems to have been mostly on large animals. Goats, sheep, chickens and ducks provide substantial protein and it would be desirable to find out what factors may constrain increases or improvements in production of these animals.

The project should attempt to identify the main constraints on livestock production. Issues that merit investigation are: The effects of disease and parasites on the health and productivity of livestock. Conversations indicate that a large proportion of the cattle in Bangladesh are affected with parasites and infected with diseases. The suitability of breeds of livestock. The breeds now in use have undoubtedly evolved as a matter of trial and error and are those that can survive best and produce best under the conditions found on farms. Experience in other areas suggest that a program of importation of foreign breeds is not necessarily the best solution, but the question should be asked as to whether the breeds now used are the most appropriate or whether improvements could be made by direct introduction or by breeding. There should be investigation of the feedstuffs now used for livestock -- the kind, the quality, the nutritional value and the effect on the health and productivity of the livestock.

These issues suggest an additional one that has been considered but merits comment. Livestock is a part of Bangladesh farming systems but there has

been almost no research to improve livestock's contribution to the crop part of the system or to improve crop's contribution to the livestock part. So there is need to include livestock (and fish) in the farming systems research and to provide better integration and coordination of livestock and crop research. There have been several livestock research projects with overseas donor support and with foreign technical assistance. Valuable and useful as these have been, they appear to have been conducted in almost total isolation from other related research. In some instances, the livestock projects were apparently doing crops research including breeding varieties, fertilization research, etc. that duplicated the same kind of work being done not far away by other institutions within the Bangladesh agricultural research system. The opportunity for integrating livestock research into the total research system and improving the overall quality and usefulness of livestock research is a challenge for the project.

Recommendation

There should be an immediate effort to assess the current number of different kinds of livestock, production realized from each, and the general health of livestock, especially cattle. Even statistics based on sampling studies would be useful in planning research.

Building on information already in the record, there should be a critical examination of the organization, administration and relationships of the units responsible for research and training in animal husbandry and veterinary medicine.

BARC should, through an appraisal team, immediately reassess research needs and priorities for livestock. Even though information about the current situation is inadequate, there is sufficient to enable a clear definition of the most important problems and to designate those lines of research that are inappropriate. Several of these are identified in reports cited above.

Soil Management

Soil research has been an important component of research programs in Bangladesh research organizations for many years, though many problems remain unresolved. Much data has been obtained on soil classification, land use, and soil analysis, some of which is potentially useful. Project emphasis on farming systems research and on-farm trials offers an opportunity to use available soil data and maps as a basis for better integration and more effective application in farming. Among the main opportunities for additional research are the following:

- a. Extensive on-farm trials to confirm crop response in relation to kind and amount of plant nutrients supplied to benchmark soils.
- b. To correlate such response to fertilization with soil and plant analyses and with published soil survey reports.
- c. To conduct coordinated field trials on farms with economic analyses to determine realistic amounts of fertilization possible in the farming system. Many fertilization experiments are aimed at determining the

"response curve." Such experiments measure the added yield obtained for each increment of added fertilization. They do not always take into account whether the added yield can justify the expense for the fertilizer.

- d. Fertilizer trials on farms should be integrated with the cropping systems research. The effort should be to adapt fertilization to the entire cropping system, not just to individual crops. For example, does fertilizer applied under a certain system of cropping carry over and provide some nutrients to subsequent crops? How rapidly is fertilizer lost under alternative cropping systems? What systems of cropping make the maximum use of the fertilizer applied?

Most of the information available is concerned with the major plant nutrients -- nitrogen, phosphorus and potassium. The program should include monitoring for minor nutrient requirements. This can be done both by looking for symptoms of minor nutrient deficiencies as well as by some soil and plant analyses seeking to identify soil types or areas that may exhibit deficiencies in one or more of the minor nutrients.

There was for many years a unit known as the "Soil Fertility and Soil Testing Institute." Its purpose was to popularize the use of fertilizers. This unit became a part of BARI and its name was changed to the "Field Trials Division" in order to reflect change in functions and responsibilities, including conducting farmer field variety trials with a number of crops. As part of this unit there is a central laboratory and, though not always functional, there are regional laboratories with an extensive network of district and thana offices. It would appear that this unit should serve as the core for an expanded and integrated program of soil and plant analyses. There is a need in general to improve staff capabilities and laboratory facilities for routine soil and plant analyses. This should be done in coordination with the other parts of the soil management program and especially with the on-farm and farming systems research. As part of this program, it should be possible to consider standardizing sampling analytical and reporting methods.

Objectives, organization, and procedures for a coordinated soil-test-crop-response project are presented and discussed in the report by Dr. Sam Portch (35). This report identifies improvements needed in staff capability and in laboratory instrumentation and operation. It discusses the advantages and disadvantages of centralized compared to decentralized laboratories. It suggests a program of greenhouse and field research that should be carried out simultaneously with development of the laboratories.

Recommendation

The recommendations in the Portch report (35) should be carried out promptly and thoroughly.

Water Management

The climate and topography of Bangladesh make water management one of the most critical factors in agricultural production. The monsoon rains flood a substantial portion of the land, and are followed by long dry periods

luring which there is insufficient rainfall to support crop growth. This pattern results not only in severe problems but also in unique opportunities.

The key to rapid increases in agricultural production in Bangladesh could well be found in water management. As one drives through areas of Bangladesh during the dry season there are large expanses of uncultivated land, either bare or with a crop residue. Interspersed among these bare areas are patches of green. This is the boro or winter crop of rice and the question that naturally arises is, why isn't there more of it? Radiation is high, the lack of rainfall means that problems with some diseases are minimized, and yields of boro are said to be among the best of all the crops of rice. The obvious answer as to why there isn't more of it is that there isn't enough water, but there must be some water, and one sees pumps discharging water into distribution systems for application to the crops.

There are two urgent needs. One is to improve water management under rainfed agriculture and a first step is to compile information on improved technology used by innovative farmers. The second is to improve water management under irrigated agriculture, including development of more water for irrigation and more efficient use of that which is available.

The complexity of the problems and the opportunities for improvement have been thoroughly analyzed by a consultant who recently examined water management in Bangladesh (30). Dr. Levine's report considers many aspects of water management, especially those related to irrigation, starting with water rights, water development and laws, or the lack thereof, governing the transport and distribution of water. Some of the problems discussed in the report are broader and go beyond the scope of the water management research program area, but many of them are relevant and should be considered in planning and carrying out the water management area of the program.

Among specific problems that should be considered are: First, the social, political and economic factors in water use. These include such basic questions as the ownership of water, both above ground and under ground, the rights to its use, ways in which it may be distributed, and how the costs of development, distribution and use should be shared. Second, there are the problems of individual farm water management. Given a specific quantity of available water for a farm, how can it be used most effectively? What crops can use it to best advantage? How can it be distributed most efficiently? How can losses from leakage, spillage and seepage in irrigation systems be minimized? Third, are the problems of community and cooperative water management. If an area, which involves a number of individual farms and owners and operators, has a limited amount of water available, how can such water be developed, managed and distributed for the greatest good to the greatest number of farmers? Fourth, is water conservation and use, and this issue is related to those stated above. It should concern the matter of how water can best be conserved and how waste can be minimized and how use can be maximized. Fifth, is irrigation, and this would involve investigation of alternative methods, comparative costs and the efficiency and benefits of different methods. The economic and social science research capabilities can be used in studying existing irrigation methods, costs and returns, and analyzing the potentiality for improvement that can be made within

affordable costs. This area of study would also involve the farming systems research approach in order to maximize the utilization of water, not just by a single crop, but by an entire system of farming that might use several crops. Sixth, as part of a long range study, there could be an assessment of the possibility of additional water developments. This would include evaluation of the technical feasibility and an estimate of the relationship between costs and benefits. Seventh, the feasibility of new systems, such as buried pipe, should be investigated even if on a modest scale.

Research has been done on ways in which land can be utilized during the dry winter season. Wheat, oil seeds, pulses and potatoes are the major crops that can be grown during this period in order to increase total productivity of the land. Ways should be sought to maximize the use of land and water and the production of useful crops on it throughout as much of the year as possible.

It is recognized that the costs of further water development can be enormous. Dams for storage, canals and ditches for distribution, pumps for lifting and ditches for draining are expensive in terms of capital and operating expense, requiring large amounts of manpower, equipment, cement and other materials. The challenge is to seek ways in which the resources can be mobilized in order to increase the productive use of available water.

Recommendation

The importance of water, the number of agencies involved in its development and use, and the policy questions that do not even concern research make water management a difficult and challenging problem. It also offers an opportunity for BARC to assert its leadership in defining problems, setting priorities and coordinating the work of the agencies that will be involved in solving them.

There are still opportunities for improved water management under rainfed agriculture but the prospect of big gains is in irrigation. A good guide to organizing and carrying out irrigation research is the report and recommendations made by Dr. Levine (30). These should be considered in planning water management research program.

Pest Management

Almost all over the world in recent years, the term "pest control" has been replaced by the term "pest management." This isn't really helpful, because the aim is still to control pests, but there are two understandable reasons for the change. First, control implies the use of toxicants and, in many parts of the world where the environmental movement has been strong and vociferous, the use of toxicants is unpopular and, therefore, anything implying toxicants is assumed to be bad. The other reason is that, coupled with the opposition to the use of toxicants, has been the development of what is called "integrated pest management," (which used to be known as integrated pest control), meaning that instead of relying on a single control method, all available methods were applied. This would include toxicants where necessary, habitat control, control of alternate hosts and environmental control.

cept for a project on rat control under Agricultural Research Project Phase I, pest control research has been the responsibility of the individual research institutions. The Phase II project provides an opportunity for a coordinated, integrated research program that would cut across institutional and crop lines.

There would be three main parts of the pest management program. First would be identification of pests and estimates of damages and loss. This would have a high priority. Although it is known generally what pests are present and that they cause substantial damage to growing crops and to the products in storage after the crop is harvested, there is insufficient information on the extent of the damage and the amount of the loss. Estimates of this kind are sometimes difficult to obtain but they are important in establishing the significance of damage caused by pests and in justifying research on methods of control.

Second would be the development of systems for monitoring the occurrence and severity of insect, disease, and vertebrate pest outbreak. Individual farmers are aware of infestations and outbreaks of pests, but their observations are frequently not coordinated with those of other farmers, or are they passed on to those who have responsibility for administering the control measures. New or unknown pests can appear and begin to cause damage without the farmer being aware of the infestation. He may not recognize it for what it is nor realize the potential for damage it may cause. The emphasis on the farming systems, on-farm research approach in Phase II should make it possible for the pest control specialists to establish networks of observers who have had at least minimum training on identification and evaluation. The distribution of workers should cover enough of the important crops to provide a basis for an integrated, coordinated system of observers who would monitor and report through a centralized clearing house.

The third part of the program would be coordinated research on integrated pest management. The emphasis on farming systems and on-farm research could be used in establishing the pest control research program so that control methods could be linked to cropping systems. This would be especially significant in the integrated pest management because biological and management control methods are closely linked to the cropping systems and the kinds of plants that occupy the land at any one time or in sequence.

Recommendation

The pest management program should include three areas of emphasis: identification of pests on major crops and estimates of damage caused; establishment of a system for monitoring and reporting outbreaks of pests; and research on simple, safe and inexpensive methods of pest control that can be integrated with research on farming systems and on-farm research. Results from the first area would be the basis for organizing and setting priorities in the other two.

Increases in production and reduction of losses after harvest can be obtained more quickly through effective pest control than by almost any other means. Every possible step should be taken to identify the most serious pests and to apply intensive research effort toward their control.

D. Program Areas Not Included in the Project

I. Forestry

Forestry is not included specifically in the list of Phase II programs. By inference, forestry can be included under Crops Research, under Farming Systems Research and under Soil Management, because each of these research areas can impinge upon forestry.

Forestry is important in Bangladesh because forests occupy about 8 percent of the land area and forest products make up about 5 percent of the total value of all agricultural products. Forests provide wood for construction, furniture, and other uses, and for fuel, but forests are also important in protecting land against erosion and in making it possible to obtain some useful products from land that would otherwise not be productive because of topography, lack of rainfall, lack of fertility, etc.

There is a Forestry Research Institute. It has two main divisions --forestry management and forest products. The Institute has a set of physical facilities, including buildings and some experimental fields that are in reasonably good condition and are adequate to carry out its research program. It is short of trained experienced manpower and needs improvement in the equipment, instruments and supplies for some of its programs.

In forest management, the Institute has programs that cover all of the essential phases from the introduction and evaluation of new species to breeding improved varieties of forest trees, methods for reforestation and afforestation, the control of pests of forest trees, etc. In forest products, it has programs for investigating ways in which products can be used most efficiently for development of new products, and for new methods of utilizing forest trees.

The forestry research program needs strengthening by improvement in existing staff through training and through changes in policies that will make it possible to recruit and retain strong, well-trained staff members. It needs strengthening through the supply of new and improved equipment in its products laboratory and instruments throughout its research laboratories.

Another way the forestry research program can be strengthened is by improving the linkage between the Forest Research Institute and the other institutions in the agricultural research system. The forestry research program would benefit if it could be served by central research support services, including library services, information services, equipment and instrument repair and maintenance and, probably, by computer services. The forestry research program also could benefit through integrated research programs, especially in the area of farming systems. As was discussed previously under farming systems, there is an opportunity to include agro-forestry research within the farming research systems program.

For reasons that are not clear now, in most parts of the world forestry management and forestry research have been administratively separate from agriculture and agricultural research. One reason may be that forests

occupied mainly government owned lands and therefore the management of forests and the research to support that management involved the government as an operator rather than individual farmers and owners. However, it appears that it would be important in Bangladesh to achieve a closer relationship between forestry research and agricultural research, even though the ownership and management may be organized differently.

Recommendation

Although forestry research is not a specific part of the Phase II project, BARC should plan to immediately integrate forestry into farming systems research. For the longer range, the Forestry Research Institute should be strengthened and it should be considered an essential unit in the agricultural research system.

Fisheries

Fisheries, like forestry, is not included as such in the Phase II project but is also incorporated by reference in some of the farming systems research.

Fisheries, including both marine (ocean fisheries) and aqua-culture (fresh-water fisheries) is important in the economy of Bangladesh. Fish production accounts for almost 10 percent of the value of all agricultural production. It provides not only food for the people of Bangladesh, but it provides a significant contribution to foreign exchange earnings and it also provides significant opportunities for employment.

While there has been some fisheries research, it has been scattered, largely uncoordinated and has not been directed at specific priority problems in fishery production and utilization. There should be a comprehensive review of the existing fisheries research, the institutions where it is being done, the adequacy of their physical facilities and equipment, the adequacy of the research staff, and a review of problems and programs.

Pending completion of such a review, it would nevertheless be desirable to improve the linkage of existing fisheries research with that being done in other institutions. Fresh-water fisheries should be included in the farming systems research. In addition to linking fisheries research with that being done in other research institutes in Bangladesh, there appear to be real opportunities for integrating and coordinating the fisheries research with that being done in other Southeast nations. There are regional programs in fisheries research, especially marine fisheries, and just as cooperation with the international agricultural research institutions, Bangladesh should cooperate with the international fisheries research organizations.

Recommendation

The recommendation of the 1980 Review Team (32) is repeated and endorsed that, ".... BARC and the Fisheries Development (Board?) closely collaborate in developing a Master Plan for upgrading the fisheries research capability in Bangladesh."

Implementation

Plans not implemented can be as bad as no plans at all. For one thing, time and effort are wasted in doing the planning. Even worse, the existence of a plan can give the impression that "something is being done," whether it is or not. While progress has been made in implementing some plans, the reality of achievement has fallen short of the goals. As noted in the introduction, there is no shortage of plans for Bangladesh agricultural research. But, almost every plan, every consultant's report and every review of plans emphasizes that plans have not been carried out fully.

There is no formula for implementation, but there are a few basic organizational and structural principles that help. The main thing that is required is leadership. There have been volumes written about leadership, but one simple definition is that, "leadership is getting people to do things faster and better than they believed possible." Implementation and leadership recently have been thoroughly reviewed (23, 36) and so the following section will mention briefly some of the principles that should be observed in carrying out the plan for the Agricultural Research Project, Phase II.

It will be apparent that these principles have been discussed before, mainly in the section on Research Management (pp. 36-44). However, they are so important that they are summarized and reemphasized here.

I. Organization

Successful implementation requires an effective research organization, although good organization cannot ensure implementation and bad organization cannot prevent it. A good organization makes it easier for the research program to be carried out successfully but good people, recognizing the job that has to be done and having the will to do it, can overcome defects in any organization. Less emphasis should be put on the specific type of organization than on getting on with the job.

A good research organization has a hierarchy of offices with different levels of authority and responsibility. There should be broad policy and budget responsibility at the top, through decreasing breadth of responsibility and authority at each level, down to specifically assigned projects and experiments at the lower levels. This hierarchy does not suggest that one level is more important than the other; it simply is a way of delegating authority so that decisions can be made and carried out promptly.

There is an inverse ratio between breadth of responsibility and amount of detailed information that is required. Sometimes research directors burden themselves with too much specific information. They cannot possibly know every detail, because the breadth of their responsibility is so great that the amount of information encompassed cannot be mastered. They should know a little about a great many things. Conversely, research scientists must know a great deal about a few things. Their responsibility is just as important as that of the research director; it just covers a narrower range.

An essential characteristic of any organization is that authority and responsibility should be clearly defined and designated. Every officer must know what program and staff he is responsible for and to whom he is

responsible. Every research officer must know the extent of his responsibility and the limits of his authority for programs, staff and budget. Every research officer should know the assigned responsibilities of other officers and his relationships to them. The best way to do this is with an organization chart and for Bangladesh there would have to be several; one for BARC and one for each of the research institutes and for the units within them. There should also be a staff handbook, containing brief, clear statements on the organization, its policies, rules and obligations to its employees.

Objectives, Programs, Projects and Experiments

The relationships among these elements of a research program have been analyzed previously and will not be repeated here in detail (19, 23). In summary, problems must be identified, objectives stated, programs developed to reach the objectives, priorities established for programs and then, under programs, projects and experiments planned and carried out.

Responsibility

There should be specific assignment of responsibility for programs, projects, and experiments. The hierarchy of program responsibilities may be different from administrative responsibilities. Interdisciplinary research programs invariably require the skills and capabilities of staff members who may be administratively located in different departments or units. However, program responsibility, as distinguished from administrative responsibility, can be assigned to a program leader or a task force leader who would have the responsibility for carrying out the program and directing the work of the team members.

Delegation

While ultimate responsibility always rests with the officer at the top, he cannot possibly manage everything and so must delegate parts of the responsibility to those officers who report to him. There are three main areas for delegation: First, within approved policy, the development of programs, projects and experiments should be delegated to the appropriate officers in the organization. Second, within approved institution budgets, authority to spend funds should be delegated to the appropriate level, including the individual research officers who are responsible for experiments. Third, within approved institution program and project policies, authority to assign duties, to require attendance and performance, to evaluate, commend and discipline employees should be delegated.

Accountability

The corollary of delegation of authority and responsibility is accountability. The responsible officer must account for the effort of those research officers responsible to him and for the funds spent on the project.

Accountability for research programs and projects is achieved through reports. These may be progress reports, monthly, quarterly or annual reports. A caution. It is desirable to have the amount of detail in reports fit the purpose of the report. At the experiment level, reports need to be

detailed to provide an adequate record of exactly what was done and what was found out. But as the report of the work filters up to the director of the institution, it must become briefer and much detail must be eliminated. Too many reports and too much detail in reports can interfere with the research work in two ways -- first, the amount of effort required of the research officer to prepare the reports and then the amount of time and effort required by those who are responsible for evaluating the reports.

In the use of public funds there must be appropriate procedures to ensure proper use of the funds. Those who have the authority for obligating funds must know the limits of their authority. Procedures have to be available for the research officer to obligate funds and for the accounting officer to keep track of how much has been spent to render a periodic accounting so that the administrator knows the overall state of the institution's finances and the individual research officer knows the condition of the budget for which he is responsible.

Support Services

Good plans, good organization, and good programs can be frustrated by inadequate support and services. This includes physical facilities, equipment and instruments, communication, supplies, information, computer services, analytical services and labor. It is important in the planning and budgeting to make sure that adequate provision is made for support services. As a rule-of-thumb, it is generally considered that no more than two-thirds of the total budget should be for salaries and wages. The other one-third should provide for purchase of equipment, supplies, travel, transportation and outside services. The appropriate proportion will differ somewhat according to the kind of research, but this rule-of-thumb has been found by experience to be about right for agricultural research organizations.

One of the essentials of support services is that they must be available on time, when needed. If a fertilizer experiment needs an application on a specific date, the experiment is essentially lost if the research officer cannot obtain the fertilizer and apply it on time. Similarly, research is impeded if instruments and equipment are not available when needed or are not kept in operating condition through regular servicing and maintenance.

Successful Adoption

The purpose of agricultural research is to discover new principles, develop new information, improve varieties and cultural practices, etc., but the ultimate aim should be "successful adoption." Not all developments and results will be adopted but the aim should be to ensure that those which make real improvement possible will reach the farm and be used.

The essential steps are:

- a. Communication. Results must be reported to a variety of audiences, especially those responsible for the following steps. (See par. C, 1, e and the Breth report, 17.)

- b. **Verification.** Results of laboratory and field experiments must be verified or confirmed by additional experiments.
- c. **Adaptation.** Varieties, cultural practices and methods found desirable at one location may have to be modified to be useful at other locations with different soils, climate, farming systems, etc. This is the reason for emphasis on farming system and on-farm testing in Phase II of the project.
- d. **Extension.** Literally extending results and developments that have been confirmed and adopted to farms. This step requires the cooperation and coordination of research institutions and their staff members with extension services and their staff members, because it is critical in achieving successful adoption. (See Report of the Review Team, Ref. 32, Chapter V, Sec. A.)
- e. **Adoption.** If the verification, adaptation and extension steps have been done well and leading farmers begin to use the improved varieties, practices, etc., widespread adoption will follow. This assumes that the new varieties, practices, etc. are, in fact, improvements. If they are not, then some of the preceding steps have not been done well.

Recommendation

Implementation of plans for the Phase II project will require good programs, staff improvement, and availability of physical facilities. It will also require best possible use of research management principles and skills. These include the following, each of which should be reviewed, evaluated and, if necessary, strengthened: an effective organization, defined objectives and programs, assignment of specific responsibility, delegation of authority, procedures for accountability, adequate and effective research support services, and means to achieve successful adoption.

V. CONSTRAINTS

Considering the relatively brief period since independence and the difficulties under which the work has been done, there has been good progress in agricultural research. This has contributed, along with other factors, to some increased agricultural production. For example: area in rice did not change significantly, but production in 1971 was 10,968,000 tons compared to 12,536,000 tons in 1980; area in wheat increased from 311,000 acres in 1971 to 1,071,000 in 1980 and production increased from 110,000 tons to 810,000 tons; and jute yield in 1971 was 3.03 bales per acre compared to 3.18 in 1980 (9).

The total national agricultural research effort in 1979-80 was estimated to consist of 3,302 scientists supported by an annual expenditure of 380 million taka (\$24 million). About 60 percent of the funding was domestic and 40 percent foreign assistance (25). This represents a little over 4 taka per capita and less than one-half of one percent of the Gross Disposable Product from agriculture.

Even though the effort is substantial and has been increasing, progress has been slower and results less than expected. Why?

The answer can be found in several constraints, which individually and in combination, prevent the agricultural research system from being as effective and productive as it could be. These constraints have been identified and analyzed repeatedly and recommendations to ameliorate them have been offered time and time again (3, 9, 15, 17, 21, 25, 26, 28, 30, 31, 32, 34, 36). In fact, the 1980 report of the Research Review Team said, "... no special list of RECOMMENDATIONS is presented in this report. It would be necessary to essentially repeat all of the 21 recommendations in the April 1979 report of the Joint Review Team, Strengthening the Bangladesh Agricultural Research System." Some of these, as well as other, recommendations have been allowed but as recently as February 1982 there was still need for action on many of them (10).

Why aren't recommended changes carried out fully and promptly?

To avoid the risk of repeating once more what has already been said, the main constraints are:

Decision and Actions

An observer of United States universities observed that, "Faculties would rather talk a problem to death than make a decision." There seems to be some of this in the Bangladesh research system. It is evidenced by the multitude of reports and papers on planning and procedures and by what appears to be an inordinate amount of time spent in meetings.

Study and planning is necessary but there comes a time when a decision must be made and action started. It is tempting to say that "more study" or "more planning" is needed. While this is sometimes true, too often what it really means is that a decision, deliberate or not, has been made to do nothing. The director of planning for Indonesia said, "It is really a problem of effectiveness and efficiency. We always have to try to balance this out. And we should always be careful that finally the objective is reached at the least cost and there are all kinds of costs! No decision is sometimes worse than the not right decision." (40, emphasis added.)

What the director meant is that a prompt decision, followed by action, is more productive than no decision and no action, even if it is found later that another decision might have been preferable. Delay is almost always costly and in agricultural research it can be disastrous. Successful farming depends on timeliness -- soil must be tilled at the right moisture content, seed must be planted at the right season, pests must be controlled before they multiply and crops must be harvested when ripe. The same is true of agricultural research. There are reports of on-farm field experiments that yielded less than adjacent farmers' fields -- because the experiment was planted too late. This is damaging in two ways. The effort was wasted because the data are useless and should not even be reported. Worse, the credibility and capability of the research organization is damaged in the eyes of the farmer.

Another essential principle is that decisions once made should not be changed lightly. Capriciousness can be as damaging as no decision. Obviously, there are times when decisions must be changed and a new course set but there should be sound reasons and everyone concerned with the project should be informed of the changed decisions and the reasons behind them.

There are several reasons for the apparent difficulty in getting prompt and firm decisions followed by effective action. They have all been identified and analyzed in previous reviews and plans but they are restated here with special emphasis on the principle that, ".... no decision may be worse than the not right decision."

Recommendations

Every way possible should be sought and put into effect to facilitate and encourage prompt decisions and actions. Structural and organizational barriers that block or impede prompt decisions and effective action should be removed.

Diffuse and Overlapping Responsibility

There are several ministries that have responsibility for institutions that do agricultural research. Additional agencies, such as finance, planning, and the public service commission, have authority that affects or even controls each of the institutions doing agricultural research. Within those agencies that have direct responsibility, there is further dispersion, with several autonomous or semi-autonomous research institutes or centers, each with its own "governing" board and with sources of funding that enhance independence (18, 19, 28, 32).

There are historical reasons. Agricultural research in Bangladesh evolved through a series of changes in government and in organization of the institutions in the system. Other factors, such as chronic shortages of funds and a shortage of trained, experienced research officers, contributed to the situation. But, the result was that research in all areas of agriculture was fragmented and coordinated poorly, if at all. National objectives were not stated clearly. Priorities were not established effectively. There was duplication of facilities and research programs. There was diffuse and overlapping responsibility.

These shortcomings were recognized and an effort was made to improve the situation by founding BARC under Presidential Order No. 32 of 1973. BARC did not meet the expectations that had been held out for it and almost immediately was the subject of a study by a select committee appointed by the government. Recommendations of the committee were incorporated as an amendment to Order No. 32, published as BARC Amendment Ordinance No. LI on July 5, 1976 (14, 28).

The ordinance appears to give BARC the responsibility and authority to coordinate, supervise, monitor and evaluate all agricultural research in Bangladesh. Reviews made subsequent to the order, however, confirm that the reality is quite different from the appearance and that many of the conditions that led to establishment of BARC still prevail (5, 21, 28, 32). Authority and responsibility are still diffused.

There appear to be three main structural reasons for this: First, the charge to the Council (ORD. LI, July 5, 1976, par. 5, subparagraphs a through s) is too specific in some respects and not specific enough in others. It specifies in great detail some of the functions the Council shall carry out: "identify," "scrutinize," "evaluate," "prepare," "guide," "advise," "recommend," etc. On the other hand, it fails to specify the authority the Council has to do these things. For example, the Council, ".... shall identify problems in various sectors of agriculture" (Various means, "of several kinds, diverse.") So which sectors? All of them?

Just some of them? What about identification of problems being done by the research institutes themselves? It shall, "... scrutinize and approve research proposals of various research institutes and experimental stations" Various again! Does this apply to all institutes or only some? Which ones? In the absence of specificity and by use of words like "various" how do the Council and the Institutes know which one has the authority and responsibility to "identify," "scrutinize," "evaluate," etc.? The answer is clear -- they don't.

The second structural reason is that identical responsibility has been given to different agencies. One example, consisting of three paragraphs, is enough to illustrate the point:

"set up research centres, substations, project areas and farms in different regions of the country for carrying out research on various problems of agriculture;"

"establish, or assist in establishing, research institutes, research centres, experimental stations, libraries, etc.....;"

"establish research centres and substations in different regions of Bangladesh for carrying out research on different problems of rice;"

Except for the word "rice" in the third paragraph, each of these seems to confer broad authority to set up research centres, etc. The first is from Ordinance No. XII, Aug. 2, 1976, establishing BARI. The second is from Amendment Ordinance No. LI, July 5, 1976, to President's Order No. 32 establishing BARC. The third is from the Parliamentary Act in June, 1973 establishing BRRI. Similar duplication and overlapping exists in other provisions of the three acts.

If it was intended that BARC should have broad responsibility over all agricultural research, then the authority of the other research organizations should have been amended accordingly. If that was not intended, the specific limits of BARC authority should have been defined. As it is, it appears, that BARC has overall authority but the paragraphs quoted above, and events themselves, show that it does not.

The third structural reason which has been ameliorated to some extent, is that ultimate responsibility for agricultural research organizations was scattered through several ministries. Under recent changes, BARC's relationship to some institutes has been clarified. BARC can do several things to make it more effective.

BARC should define the ways it can assist the other organizations: by improving coordination, through staff development, through a document or information center, through computer services, through granting of donor funds for specific purposes, and through all the other ways available to it. BARC must take the initiative in carrying this information to the research organizations. Not by sending out an announcement but by Member-Directors going to each organization, meeting with its Directors to discuss programs and needs, and thereby identifying ways in which BARC can help. The burden of improved communication is on BARC. It should try to shed the image that seems to be developing that it is just another layer of bureaucracy, expanding to serve its own purposes. BARC should deliberately restrain increases in size of its permanent staff. One way would be to co-opt research officers from the several organizations to serve

in BARC for a year or so, after which they would return to their posts. Alternatively, staff members could be seconded to BARC without physically moving and without leaving their regular post completely. This could be done by a parttime BARC assignment to carry out specific responsibilities for coordination, evaluation, or whatever was needed. This should improve communication and understanding on both sides. BARC should restrict its role to that of an overseer and coordinator. It should be concerned with national problems, priorities, allocation of resources and quality in the agricultural research system. It should have confidence in the research institutes' abilities to handle detailed planning, implementation and reporting. To the extent BARC injects itself too far into details it will decrease its effectiveness proportionately as the broad coordinator. BARC should deliberately and consciously develop its role as the policy leader in agricultural research. If it is seen as a competitor in doing research, whether by planning, funding, etc., it will be more difficult for BARC to effectively carry out its role as leader and coordinator. As a corollary, competition within BARC -- for programs and funds -- should be minimized. Obviously, there will be competing needs and compromises will have to be made but they should be decided in the national interest, not on the basis of narrow program interests.

In order for BARC to carry out these functions, it must establish and maintain effective coordination and leadership within its own organization. The essential element in doing this is thorough and frequent communication among the member-directors and the executive officer of the Council.

This communication can be carried out both in formal meetings and informally. In the kind of work BARC is supposed to do, informal communication is more important and will accomplish more than formal meetings. There is no formula for establishing such communication because it depends upon the style of the persons concerned and upon each of them having a clear understanding of his responsibility. That responsibility is to make sure that everyone concerned with the program is at all times informed of what is being done, of what problems have arisen, of results that have been obtained and of anything else germane to the program.

The means of the informal communication can be a telephone call, a casual conversation, a penciled note, a shared cup of tea or a meal, or a field trip. The reason informal means of this sort are effective is that they do not have to adhere to an agenda, there is mutual stimulation and they can be short and to the point. They deal with pertinent subject-matter. Formal meetings frequently become involved in procedure at the expense of exchanging information about the subject.

One essential in maintaining communication internally is for all concerned to have a clear understanding of the entire program as well as detailed knowledge of the part for which each is specifically responsible. There must be control over the amount of detailed information, lest the member-directors become swamped by more detail than they need for sensible decisions and maintenance of coordination.

Another essential is the alertness and initiative of the member-directors and the executive officer. They must be able to recognize the significance to the entire program of each individual piece of information. They must recognize the persons and places in the system that need the information. And they must take the initiative in transmitting it to them directly and promptly.

Recommendation

There appear to be two ways to minimize problems arising in diffuse responsibility. One would be to eliminate it by redefining and centralizing authority and responsibility. For several reasons -- historical, practical, political, economic, geographic -- this would not be satisfactory. The other way is to acknowledge the diffusion but to seek ways to make it work to the advantage of the system. While not stated in this way, that was one of the basic reasons for establishing BARC -- to maintain the diversity, independence and creativity of the separate research institutions, with BARC to provide integrated national leadership. This is BARC's challenge and the discussion above suggests ways that will help BARC meet it.

Centralized Program Planning and Direction

With the project emphasis on farming system and on-farm research, responsibility for planning, directing and carrying out the programs should be decentralized to put these functions as close as possible to the site of the work. As discussed earlier, broad problems of national concern have to be identified and the priorities for funding established by a central agency. Once this is done, guidelines can be set within which responsibility for organizing and carrying out the research should be delegated. It should be delegated first to the institutions and, within institutions, to departments, task forces, regional stations or branch stations.

There are three main reasons for decentralizing control through delegation. First, the persons in the best position to identify problems are those who are in the field doing the work. C. E. K. Mees, long-time director of research for the Eastman Kodak Company, once said the best person to decide whether a piece of research was worth doing was the person who would do it. He said a committee of vice presidents was in the poorest position to decide. Obviously, by "a piece of research" Mees meant a problem or a project that fell within the broad policy and directions set for the laboratory. Second, centralized control limits flexibility to change to meet new and changing needs. The larger and more complex the organization, the more difficult it is to change direction quickly. Third, the importance of timeliness was mentioned earlier. The closer to the place of work decisions can be made, the more possible it is for the work to be done on time.

Decentralization through delegation does not mean loss of accountability. Control and accountability are essential but they can be exercised as well through delegation as through centralization. What is needed is clear definition and statement of objectives, coordinated guidelines for programs needed to reach the objective, clear and specific delegation of responsibility for the programs, and a system for reporting progress on the work done under the assigned programs.

Recommendation

Within program guidelines and priorities, responsibility for planning, organizing, carrying out and reporting on research should be decentralized through delegation of responsibility. BARC's role should be to establish program guidelines and priorities, in consultation with the research institutions, to minimize duplication by identifying the best qualified institutions to do the work and then to coordinate delegation of responsibility for doing it.

Confidence and Trust

For decentralization and delegation of responsibility and authority to work successfully, there must be a large measure of confidence and trust. Directors must have confidence in those to whom they report and in the staff members who report to them. The staff members must have confidence in their administrators, in their colleagues and in themselves. Experience has shown that research is most creative and productive when it is done under broad delegation of responsibility and when there is a maximum of freedom. These conditions are most likely to prevail when there is mutual confidence and trust -- among the research officers and between them and their administrators.

Centralized control and administration, rigid and detailed rules on personnel and on handling of funds usually suggest some lack of confidence and trust. And there is usually some basis in history or in fact for such lack. Yet there are many research organizations where it exists and where it provides the basis for freedom and responsibility. How can it be developed?

Two of the underlying principles, which go together, are teamwork and performance. Whether it is an athletic team, a business, or a research organization, when the members work as a team and turn in a good performance confidence is built. Confidence improves across the board -- in oneself, in colleagues and in the leader.

Curiously, while confidence and trust are needed in order to justify delegation of responsibility and authority, it is precisely through delegation that mutual confidence and trust can be built. A director, department head or superintendent may say to one of his staff, "I am going to assign responsibility for project Z to you. Here is authority to spend up to X taka during the next six months. I want a progress report at the end of six months but until then you do not need to report back to me unless you run into a problem you can't solve. If you do I will be ready to help." The staff member realizes that his supervisor has confidence in him and trusts him to do a good job and, if he has the right stuff he will do his best to justify that confidence by superior performance.

When the assigned task has been completed successfully, confidence and trust has been increased on both sides.

An administrator has an obligation to select and prepare his successor. This requires not only some training but constant testing and evaluation. The testing is by assigning responsibility because this is how the administrator finds whether his potential successor can do the job. It also is only through accepting and successfully discharging responsibility that the potential successor can improve in his skill, capability and confidence.

Recommendation

There should be an effort to build confidence and trust among staff members, between staff members and administrators, among administrators and between the several institutions in the agricultural research system. Such confidence and trust are essential in achieving successful decentralization through delegation of responsibility and in minimizing the effects of onerous regulations and procedures. It is also essential in building capable administrators for the program.

VI. GENERAL SUMMARY

The Phase II Research Project program areas have been discussed and recommendations made with respect to them. It seems appropriate to consider briefly some issues that apply to BARC in general. No organization, especially one with the complex and broad mandate given to BARC, can be expected to emerge full-blown and off-and-running. Yet the ordinance establishing BARC was published in 1973 and sufficient time has elapsed to permit an assessment. There were thorough reviews made in 1978 and 1980.

Credibility

In discussions with some of those close to BARC, it has been suggested that BARC, "... needs to develop credibility." This implies that it is now lacking or is not sufficiently present. Credible means "believable or worthy of belief" so if there is insufficient credibility, there may also be a lack of esteem or respect.

How can credibility and respect be gained?

They must be earned. They can be earned only by performance; by doing things and doing them well. So, if BARC is to improve its credibility, it must first examine its performance. Even though it has been in existence only a relatively short time it must appear, at least to some, that there has been enough time for it to have achieved more than it has. If this is so, why has performance fallen short of expectations?

1. Expectations may have been too high. When a new organization is created to solve a problem, great things are usually expected of it. Sometimes the organization itself helps build up the expectations. It is not uncommon for unrealistic goals or timetables to be set.
2. Resources may not have materialized. Goals and timetables are based on estimates of available resources -- manpower and money -- and if they are not provided in the amount and on the schedule used in setting the goals, performance suffers.
3. The organization may not have used its resources effectively. The term organize means "to give orderly structure, bring into working order, to make arrangements." If the structure is not orderly or the order chosen for the organization is not appropriate to the task, the organization will not be fully functional. An organization consists of people, some of whom may work better within an "orderly structure" than others, but if the people do not work according to the structure, the organization will not function smoothly.

If BARC's performance has been less than expected, leading to a lack of credibility, probably all of these factors have been involved.

Perhaps the mandate to the Council was too ambitious in proportion to the resources. The list of functions assigned to the Council (pp. 4 and 5) is long and comprehensive and, as pointed out earlier, contains some that are identical to those assigned to other organizations. Thus duplication, which BARC is supposed to minimize, may in fact have been fostered by some of the provisions in the ordinance creating BARC.

It has been suggested that BARC has not carried out effectively its main responsibility, which is to coordinate the work of the institutions in the agricultural research system. Also that it has not made an up-to-date, comprehensive, systemwide inventory of manpower resources as a basis on which to identify gaps that need to be filled by recruitment or training. Instead, it has been said, BARC has become "busy" with minor issues and a variety of ad hoc projects. One comment was, ". . . after seven years, BARC is still at the starting point." Rather than speculate about what factors may have contributed, the objective should be to now seek ways of improving performance and credibility.

Recommendation

The member-directors should undertake, themselves, the following steps:

1. Make a thorough appraisal of BARC's achievements in relation to its goals.
2. Examine current activities and ask whether they are really effective in carrying out BARC's main responsibilities.
3. Make realistic estimates of current and probable future resources.
4. Re-examine and reorder priorities in respect to BARC's main responsibility, its available resources, and the effectiveness of its organization in applying them.
5. Examine the structure itself and ask whether it is sufficiently orderly. Are lines of authority and responsibility drawn clearly? Is there clear and specific delegation of responsibility? Is there accountability? What corrective steps are taken when responsibilities are not carried out satisfactorily? Is there the internal discipline that makes an orderly structure work?

Management of Time

Member-directors of BARC, directors of institutes, department heads and scientific officers should not be burdened with too many meetings, too many visiting consultants, etc. Some of this is essential, of course, but there is an impression that there is a very large amount of it in Bangladesh. The same applies to paper work. Again, some is essential and can't be avoided, but it looks as if current procedures and some of those suggested for project proposals, monitoring, evaluation, and reporting are and would be burdensome. Paper work that becomes too detailed and cumbersome and too many meetings get in the way of doing administrative and field and laboratory work. They can also contribute to delay and thus interfere with getting things done on time.

Recommendation

Consideration should be given to sending one (or more, but at different times) officers to one of the many short courses on management. Assistance should be sought in developing a management information system.*

ven before that is done, BARC should adopt an internal rule that each and every document should bear the name of the person who prepared it and the date.

Support Services

Without exception, every agricultural research institution in Bangladesh that has been visited has problems with two essential support services: library and instrument maintenance and repair.

For understandable reasons, mainly the disruptions that the institutions have been through and the shortage of foreign exchange, libraries lack current subscriptions to journals and essential reference books and handbooks. They also, generally, are without a trained librarian. Cost of journals and books has skyrocketed, so even if it were possible it would be wasteful to indulge in duplication. BARC would perform a truly coordinating and valuable service if it can find a way to centralize, and thus minimize, acquisitions, and then find a way to distribute the necessary material to those institutions that need it.

Although some laboratories need additional or improved research equipment and instruments, a serious constraint is that those already in place are frequently inoperable. Sometimes the cause is known but the necessary repair part is not available or foreign exchange is not available immediately to purchase it from overseas. Sometimes the cause is not known and there is no skilled technician available to diagnose and cure it. Sometimes the equipment or instrument is so old that parts for it are no longer made. A solution to the problem is made more difficult because of the great variety of sources of instruments; different countries, different manufacturers, and different distributors. Moreover, the pace at which instrument technology has developed in recent years has resulted in almost "instant obsolescence." A solution must be found if research is to be done as fast as it should be. A start would be for BARC to establish a central instrument shop. It would need one or more trained technicians (and a way would have to be found to keep them in the face of stiff competition from higher paying jobs), the appropriate tools and test instruments, and a minimum stock of the most commonly used spare parts. The operating plan should also provide foreign exchange funds for quick purchase of needed parts from overseas (and a procedure for prompt clearance of customs). Some instruments could be brought to a central shop; others would have to be repaired in place and the technician would have to travel with his tools to the site. Eventually, it might be feasible to have a mobile shop, but that should wait until there has been some experience with a central facility. The central shop, once it gets going, should also offer short training courses to selected research officers from the scattered institutes so that they can better diagnose problems when calling on the shop for help.

Recommendation

BARC should investigate ways of establishing and operating a centralized system for acquisition of journals and books and of distributing the information in them that is needed by the research workers in the institutes. It should establish a central instrument repair shop staffed with one or more trained technicians and supplied with essential tools and stock of parts.

Leadership

Bangladesh agricultural research institutions have leaders but they need more and they need to prepare for succession. Nothing is more essential in agricultural research, or any enterprise, than leadership. Plans and schemes are of no consequence unless they are carried out and carried out effectively. That

is where leaders are required -- leaders with vision, initiative, imagination, integrity and confidence. The leader must not only be confident himself, but must instill confidence among his staff. He must define goals, set a steady course and keep the organization moving on that course. He should create a sense of urgency and he should build a sense of obligation and self-discipline among his staff. When self-discipline breaks down, as it will, malfeasance, negligence and dereliction of duty must be dealt with promptly.

Leadership is developed not so much by training as it is by testing. Not testing in the abstract but on the firing line, by defining authority and responsibility and then delegating it, with support. When such delegated responsibility is carried out well, confidence and leadership develop. When it is not carried out well, another person is tested. One of the obligations of a research manager is to prepare his successor. There is no blueprint for doing this but the essential elements are the testing, the building of mutual confidence and respect and the gradual delegation of more and more authority and responsibility.

Recommendation

BARC should, by example and by assistance, ensure that each of the agricultural research institutions recognizes the importance of leadership and actively carries out its development.

Budgeting and Funding

The limit to which the government can budget for agricultural research and provide the budgeted funds is recognized and understood. Yet, as a matter of policy, the government wants and needs an effective, productive agricultural research system. On the other hand, some government procedures and practices impose constraints that inhibit effectiveness and productiveness. Once a budget is approved, research plans are made according to the budget, on the expectation that the funds will be released. If all, or a portion, of the budgeted funds are not released or are not released on time, a whole program or project or experiment may be lost, along with all the effort and money that may have gone into it.

Agricultural research is like farming (one Bangladeshi research officer said, "Agricultural researchers are just doing educated farming."). The operations must be done on time. Thus, non-release or delayed release of funds can mean that essential materials cannot be bought in time for proper use or that a field operation may not be done on time. This can cause the loss of a year's time and mean that effort already applied is lost and wasted.

Recommendation

BARC should inform and impress on government officials responsible for budgeting and funding for agricultural research the absolute necessity of prompt release of funds. If budgets must be reduced, that can be understood and plans changed accordingly, but if budgets on which research plans have been made are not fulfilled, the government is defeating its own purpose.

VII. REFERENCES

- . Ahmed, Nazir (Chairman BARC Livestock Task Force)
Impact of breeding program of local and crossbred animals under village conditions. 29 pp. BARC Dhaka, May 1981.
1. Anon.
Agricultural research inventory in Bangladesh, Part I: Finance, manpower, physical facilities. BARC, Dhaka. 38 pp. mimeo., revised Sept. 7, 1978.
1. Anon.
National agricultural research plan. Bangladesh Agricultural Research Council, Dhaka. 95 pp. plus appendices, Dec., 1979.
1. Anon.
Second five-year research programme. BARI, Joydebpur, Dhaka 67 pp., Jan., 1980.
- i. Anon.
Implementation of the special committee report recommendations (Tentative), Dhaka. 5 pp. plus appendices, mimeo., April, 1980.
1. Anon.
Project grant agreement between the People's Republic of Bangladesh and the United States of America for Agricultural Research - Phase II (USAID No. 388-0051), Dhaka. 7 pp., plus appendices, June 5, 1981.
- . Anon.
Contract between the government of Bangladesh acting through Bangladesh Agricultural Research Council and the International Agricultural Development Service for technical services for the agricultural research project - Phase II, Dhaka and New York. 16 pp. plus appendices, June 25 and July 21, 1981, and amendment No. 6, July 17, 1982.
- . Anon.
Cropping system research methodology for national coordinated cropping systems research program. BARC, Dhaka. 42 pp., Sept., 1981.
- . Anon.
Agricultural research organization and policy in Bangladesh. Ms. 43 pp., 1982.
0. Anon.
Working paper -- project advisory committee meeting for Feb. 15, 1982: 1. action of special committee 21 recommendations; 2. final report Phase I recommendations; 4, report on training; 5. status on contract research. Dhaka. 1982.
1. Anon.
Programs in the agricultural research project Phase II (USAID No. 388-0051) BARC, Dhaka. 36 pp. plus annexes, no date.

- . Anon.
Coordinated national cropping system research program. Annual report (1980-81). 81 pp. BARC Dhaka.
- . Anon.
Expert consultation on clinical veterinary services for small farmers organized by commonwealth secretariat, at NDDDB, Anand, India. Oct. 1980.
- . Badruddoza, Kazi M.
This is BARC. Bangladesh Agricultural Research Council, Dhaka, 50 pp. revised. Dec., 1980.
- . Badruddoza, K. M. and M. D. Dawson.
Final report, Bangladesh agricultural research project (USAID No. 388-0003) Phase I: 1978-81. BARC, BARI, IADS, Dhaka. 43 pp. 1981.
- . Batugal, Ponciano A.
Research monitoring manual. BARC. 44 pp. July (?) 1982.
- . Breth, Steven A.
Report on the publications program of the Bangladesh Agricultural Research Council. 16 pp., July 30, 1982.
- 1. Chaudhuri, S. D., et al
Report of the special committee constituted by the government to examine the report of joint research review team, Dhaka. 41 pp., Mar., 1980.
- 1. Cushing, R. L.
A master plan for the Bangladesh Agricultural Research Institute. IADS/BARI, Dhaka. 118 pp. plus appendices, Aug., 1979.
- 1. Davis, C. H.
Conclusion and recommendations second annual seminar on "Maximum Livestock Production from Minimum Land." 4 pp. mimeo. Undated.
- . Dawson, M. D.
Research systems management to accelerate development. Bangladesh Science Conference, Dhaka. 12 pp. mimeo., Jan. 30, 1982.
- 2. Dawson, M. D.
A working paper on agricultural research with donor support through BARC, Dhaka. 11 pp. plus annexes, mimeo., Feb., 1982.
- 3. Dawson, M. D. and M. V. Ahmed
Management, monitoring and evaluation of agriculture projects supported with an information system. BARC, Dhaka. 15 pp. plus annexes, Feb., 1982.
- 1. Freeland, Guy G.
Twenty grams of protein per capita per day. 8 pp. mimeo. Dhaka, June 14, 1980.

- . Gill, Gerard J.
Operational funding constraints on agricultural research in Bangladesh. BARC Agr. Ec. and Rural Soc. Science Papers No. 9, Dhaka. 30 pp., April, 1981.
- . Haque, A.K.M. Aminul.
Constraints and strategies for development of Bangladesh. General President's Address to 6-7th Annual Bangladesh Science Conference. 27 pp. Joydevpur, Feb. 7-11, 1982.
- . Harwood, Richard R.
Report on farming systems research, BARC. 25 pp. plus appendices, April, 1982.
- . Islam, M. Amiral
Strengthening the Bangladesh Agricultural Research System, Report of the joint review team, Dhaka. 82 pp. plus annexes, April, 1979.
- . Lake, J. V.
Selection, monitoring and evaluation of research projects. Report to BARC. 7 pp. plus appendices, June, 1982.
- . Levine, Gilbert
Report of consultation visit on water management, Dhaka. 20 pp. plus appendix, Jan. 23-Feb. 5, 1982.
- . Madamba, Joseph C.
Agricultural research planning in Bangladesh. Report to BARC under IDA financed agricultural research project. (Credit No. 828-BD), Dhaka. 35 pp. plus annexes, April, 1979.
- . Moseman, A. H., et al
Report of the review team, Bangladesh Agricultural Research System, Dhaka. 148 pp., July 18, 1980.
- . Odend'hal, Stewart.
Past, present and future research on livestock in Bangladesh with particular emphasis on draft power and mechanization. 21 pp. Ford Foundation Report No. 49. Dhaka, July 1978.
- . Oswal, M. C. ed.
Soil-water management research inventory and problems in Bangladesh. BARC, Dhaka. 71 pp., 1979.
- . Portch, Sam
Report to BARC on soil fertility. BARC. 27 pp. plus appendices, July (?) 1982.
- . Rahman, Lutfur.
Leadership in research management for accelerating development in Bangladesh. BAU, Mymensingh. 18 pp. mimeo., undated but appears to be Feb., 1982.

1. Rahman, M. M.
Cropping system research methodology. BARC, Sept., 1981.
2. Semmes, Raphael, III
Proposed operational annual plan, Bangladesh Agr. Res. Proj. Phase II, Jan. 1-June 30, 1982, Dhaka. 13 pp. plus appendices, mimeo., Feb. 10, 1982.
3. Sokerak, John M.
Report of Library Consultant. 54 pp. mimeo. Undated but apparently December 1979.
4. Widjojo, Nitisastro
Quoted in Far Eastern Economic Review, May 16, 1980.

APPENDIX A

Organizations Responsible For Conducting
Agricultural Research in Bangladesh

<u>Acronym</u>	<u>Name</u>	<u>Main Location</u>
BARI	Bangladesh Agricultural Research Institute	Joydebpur
BRRRI	Bangladesh Rice Research Institute	Joydebpur
BJRI	Bangladesh Jute Research Institute	Dhaka
FRI	Forestry Research Institute	Chittagong
INA	Institute of Nuclear Agriculture	Mymensingh
BTRI	Bangladesh Tea Research Institute	Srimongal
SRTI	Sugarcane Research and Training Institute	Ishurdi
	Directorate of Fisheries	
	Directorate of Livestock Services	Dhaka
BAU	Bangladeshi Agricultural University	Mymensingh