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Report of the Review Team

Bangladesh Agricultural Research System

July 18, 1980

July 18, 1980

Major General (Retd.) Nurul Islam
Minister for Agriculture and Forests
Government of the People's Republic
of Bangladesh
DACCA

Honorable Minister:

We have the pleasure of submitting herewith the report of the Research Review Team, requested by the Government to assess the present status of agricultural research in Bangladesh. Our attention has been given to Agricultural Research Institutes within the Bangladesh network with special attention to the Bangladesh Agricultural Research Council which is the keystone of the national agricultural research system. Support from the USAID and the World Bank over the past four years has been focused on strengthening the total Bangladesh Agricultural research system.

The Team has had the assistance of numerous Bangladesh scientists and officials. We trust the Report reflects their wisdom and that it merits their support.

Respectfully submitted,

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SUMMARY AND RECOMMENDATIONS

A. Background

This review of agricultural research was undertaken at the request of Dr. Kazi M. Badruddoza, Executive Vice Chairman of the Bangladesh Agricultural Research Council (BARC) by letter dated 4 March, 1980 to Mr. Frank B. Kimball, Director of USAID, Dacca. The purpose was to conduct an indepth review of Bangladesh research in food crops prior to negotiating Phase II of the USAID-supported Agricultural Research Project.

Dr. Badruddoza suggested that the evaluation be conducted by a joint team of in-country and expatriate scientists. The International Agricultural Development Service (IADS) was requested, by Dr. Badruddoza and USAID, to select the expatriate members of the joint team and to be responsible for conducting the review. The biodata of the team members and the letter of 4 March 1980 (with Proposed Terms of Reference) are presented in ANNEX I.

B. Scope of the Review

As plans for the review were developed it seemed desirable to provide attention to both the Agricultural Research Project supported by USAID, and the Agricultural Research Project supported by the World Bank since these have been closely cooperative in supporting the Bangladesh Agricultural Research Council (BARC) and the Bangladesh Agricultural Research Institute (BARI) during the past four years. The team was selected accordingly.

On arrival in Bangladesh, the Team was advised to extend the review beyond the scope of research on food crops. The tentative schedule and itinerary, as presented to the expatriate members of the Team on arrival in Dacca on June 24-26 had been developed to provide for the more extensive contacts. The schedule, and contacts made by the Team, are presented in ANNEX II.

C. The Uncertain Status of BARC

On July 5, when the Team was at about the midpoint of its review, there was a news release in The Bangladesh Times and in The Bangladesh Observer, with reference to the announcement on Friday, July 4 of the first national Science Policy, which aims at bringing all research councils under one Ministry. In a press conference at the Atomic Energy Center auditorium the State Minister for Science and Technology, Dr. R. A. Ghani, said that "the existing research councils shall be reorganized into sectoral coordinating research agencies under the single guidance of the National Council for Science and Technology (NCST)."

One of the implications of the press release is that "NCST would control Research Bodies" including BARC. With respect to the status and functions of BARC, this is of serious concern to the Review Team. Indeed, team discussions with Dr. R. A. Ghani on July 9th, 1980, did not satisfactorily clarify the status of the relationship between BARC and the NCST. At the time of preparation of this report the issues were still to be resolved.

Since BARC is the central focus of both the USAID and World Bank Agricultural Research Projects, a change in its role must be a basic factor in any recommendations made by the Team. The review was diverted somewhat to this issue and this is reflected in the report, especially in Chapter III.

The recommendations of the Review Team are based on the assumption that BARC, or an organization of similar authority and with the same role in the national agricultural research system, will prevail. If this is not so, the Team would request that a reassessment of the situation should be made by the USAID and the World Bank, as principal supporters of BARC.

D. Focus of the Review

The review addressed the goals of the Second Five-Year Plan, the major factors to agricultural growth, and priority requirements for improved agricultural technology. Attention is given to further strengthening of the national research system and of research related services such as adoption of technology, information and communication services, library and documentation services, etc.

The Review Team addressed the question of performance and future potential of the International Staff Support and Coordination Cell (ISSCC). This unit is a matter of special concern to the USAID Research Project and the Government of Bangladesh in view of the agreements with respect to its future funding and its activities in BARC. The views of the Team are presented in Chapter V.

Because the review embraced the assessment of the USAID Research Project (the primary function of the Team), the World Bank Research Project, the broader research needs of agriculture in meeting the SFYP goals, and the uncertainties with respect to BARC, the outline of the report was modified substantially from that originally planned. Basic factors are considered in the body of the report. The assessments of the USAID project and the World Bank project are presented as ANNEX III and ANNEX IV. This was done to address each as an entirety and to permit a direct, discrete treatment of factors relevant to the respective projects.

E. Recommendations

The report includes recommended future support by USAID, Chapter VI, and recommended future support by the World Bank, Chapter VII. It will be noted that the recommended emphasis for future USAID support is placed on further strengthening of the institutional capabilities of BARC and BARI and on non-commodity problem areas such as farming systems, soil fertility and management, water management, plant disease and pest management, and agricultural economics/social sciences. This reflects the strong conviction of the team that commodity-oriented research has received strong support for many years but will face serious constraints in the future unless the new varieties and other improved technologies are adopted and fitted into the farming systems that farmers use.

The present research stations in Bangladesh are largely monocrop facilities. Regional multipurpose research stations should be developed so that combinations of new technology can be evaluated in relation to the needs and farming practices of the region. There should be a thorough survey and assessment of the research station facilities to determine what combination of good regional stations and substations would best meet the requirements of the various regions. The Government advised the Research Team of the need for improved research station facilities in the Northeast, and also--of high priority--a regional research facility for the saline lands of southwest Bangladesh.

Apart from stressing the need for an accelerated comprehensive training program and strengthening the linkage between Research and Extension, 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 Research Review Team, Strengthening the Bangladesh Agricultural Research System. The assessment of these recommendations is presented in the Report of the Special Committee Constituted by the Government to Examine the Report of Joint Research Review Team, dated March 1980. Much remains to be done in implementing the foregoing recommendations along the lines as indicated by The Special Committee. It is essential that the Program Planning and Review Board, as presented in the 1980 report, begin to function actively and dynamically.

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.

F. Bangladesh Agricultural University

The Review Team feels that the role of the Bangladesh Agricultural University is of such significance to the future development of the agricultural sector in Bangladesh that it should receive some special consideration as an institution that should be more closely allied not only to the training needs but also to the research of the national agricultural research system. A review of the situation by USAID or the World Bank, or both, is recommended. The university is discussed in ANNEX IX.

I. INTRODUCTION

A. Agriculture in Bangladesh

1. Agriculture in the National Economy

Agriculture is the most important sector in the Bangladesh economy, accounting for 55 percent of the gross national product, 85 percent of all employment, and 80 percent of the country's exports. Jute, tea, and hides and skins are, in order, the leading foreign exchange earners. Since agriculture dominates the economy and is so vulnerable to natural disasters, such as cyclones alternating with flood and drought, the overall rate of economic growth has been erratic--varying from less than one percent to eight percent per annum.

Approximately 22.5 million acres are under cultivation, at a cropping intensity of about 147 percent. Over 80 percent of all farms in Bangladesh are less than three acres in size. There are about one head of livestock and slightly less than two poultry fowl for every acre of cultivable land. In addition, the rural areas are dotted with water impoundment tanks of varying size which are used for irrigation, fish raising, and bathing.

The rural population, which is estimated to be about 75 million--living in 68,000 villages--comprises farmers, 59 percent; agricultural laborers, 25 percent; and others, 16 percent.

2. Land, Water and Climatic Factors

The land area of Bangladesh is 35.3 million acres, of which 5.7 million acres are state-owned forests. Of the total remaining, 2.4 million acres are denuded forest lands subject to shifting cultivation. About 90 percent of the land surface is flat alluvial plain and about 10 percent is hilly.

Bangladesh is situated on the delta flood plain of the Ganges-Brahmaputra river system, except for low hills in Sylhet (NE) and the largely forested Chittagong Hill Tracts (SE). Most of the country is less than 10 feet above sea level, with the highest point at 4,034 feet. The Ganges-Brahmaputra discharges, on the average, 700,000 cubic feet of water per second into the Bay of Bengal, depositing some 2,400 million tons of rich alluvium on the land and into the bay. Normally, about one-third of the cultivated land area is submerged during the monsoon. However, siltation over the centuries has shifted the delta to the east, while the west area has become drought-prone. During severe cyclones the funnel-shaped coastline in the Bay of Bengal receives tidal surges of 20 to 30 feet higher than mean sea level, which cause great loss of life and property. Cyclones occur especially in May and October. The annual rainfall ranges from 50 to 200 inches in the various regions of the country, with 70 percent falling during the monsoon season (June-September).

The total area of perennial inland waters is estimated at 4.0 million acres while the inundated crop fields, and other low lying areas that retain monsoon water for about six months, are estimated at 7.7 million acres of water surface. In addition, the Bangladesh coastline is approximately 250 miles long, with about 2.5 million acres of territorial waters.

There are about six general agro-ecological zones in Bangladesh, (1) the flooded high monsoon areas, covering some 6.0 million acres, (2) the flooded low monsoon areas, covering 1.5 million acres, (3) the non-flooded high monsoon areas, covering 6.4 million acres, (4) the non-flooded low monsoon areas, covering 3.7 million acres, (5) the hill tracts covering 4.2 million acres, and (6) the coastal zones, covering some [illegible] million acres.

The temperature in Bangladesh ranges from 40 degrees F to 108 degrees F. The months from November to February are usually dry and pleasantly cool.

3. Nutrition Levels

In general, the rural poor consume less than their minimum requirement of food, largely due to lack of purchasing power. The resultant malnutrition has led to a high level of susceptibility to sickness and disease. According to the Institute of Nutrition and Food Science at Dacca University, 75 percent of the rural children under the age of three suffer from second or third degree malnutrition. Twenty-five percent of children below 5 years of age die as a direct result of malnutrition.

Bangladesh as a whole has been a food-deficit area for 20 years. Although two rice crops a year are possible in the areas of low flooding, yields are only about one-third those of Japan. Since the bad harvest of 1972-73 and the great flood of 1974, one to two million tons of food grains, mainly wheat, are being imported each year. Food aid came to 35 percent of all foreign aid in 1978. However, malnutrition of the second and third degree has grown from 60 percent of the population in 1965 to 72.8 percent in 1978. The food rationing system benefits mainly government service holders, and less than one-third of the rationed food is supplied to rural areas. Little food reaches the rural poor.

On the whole, available studies tend to agree that the current nutritional status has deteriorated during the past decade.

4. Land Occupancy and Income

An extensive land occupancy survey was conducted in 1977 and again in 1978. Fifty-four percent of the rural population is landless, if all those who have less than one half an acre of land are included as well as those with other than agricultural occupations (especially petty trading, fishing, and handicraft making). The proportion of rural landless is growing at a rapid rate.

Four percent of the households own 32 percent of the land, while 45 percent of the households own 8 percent of the land. About 23 percent of the land is put out on rent or share cropping. The usual share cropping pattern grants half of the crop to the landowner and half to the actual tiller, who has to bear all the costs.

The real wages of agricultural laborers have been steadily declining over the past 15 years, as the pool of surplus agricultural labor expands, and are now 30 to 40 percent lower. Thus, the situation has deteriorated in spite of the 9 percent increase in foodgrain production and 6.5 percent in manufacturing output over that in 1969-70. Essentially, the post-liberation record shows moderate success in overall economic growth, but no improvement among the poorest elements of the population, and an increasingly inequitable distribution of the country's national income.

Although the average per capita income of Bangladesh, about U.S. $80, is not the lowest in the world, in quality-of-living indices, it is generally considered to be the poorest major country. Eighty percent of the people are estimated to be living below the poverty line.

Basically, rural unemployment in Bangladesh is more a matter of widespread under-employment rather than unemployment per se. It is estimated that some 60 percent of the rural population is fully employed. The annual increase in rural unemployment is about 2.4 percent.

5. Education

Only 22 percent of the rural population is literate. Among the rural people, males have a literacy rate of 31 percent and females only 13 percent. A disproportionate share of funds goes to higher education, where the economic elite are concentrated. Fully 42 percent of the children do not attain a primary level of education because the cost is too great in comparison with their contribution to family income. The Government has declared its intention to introduce universal primary education and also plans to strengthen agricultural training in primary and secondary schools.

6. Population Growth and Migration Trends

The population is estimated at 84.7 million people, making Bangladesh the eighth largest country in the world. The annual population growth rate is about 2.7 percent. With 1,500 people per square mile, Bangladesh has one of the highest population densities in the world.

Population control is a main target of the Government, in addition to the attainment of food self-sufficiency. In 1976-77 only 4.7 percent of the population were practicing family planning, in comparison with a 13 percent goal. Birth rates are probably not much lower than a century ago. It is estimated that the population will be 130 to 160 million by the year 2000 unless family planning practices change drastically.

The large numbers of persons who migrate as labor, both skilled and non-skilled, especially to the Middle East, are causing rapid social changes. The great influx of money has driven up land values phenomenally and promoted the import of luxury consumer goods. Little of the excess capital has gone into industrial investment. There has been a quick growth of urban, middle, and upper classes, without a corresponding economic growth in the countryside, where the majority lives. Economic advantages are increasingly concentrated in the urban elite, including absentee landlords who acquire rural land but do not cultivate it themselves.

B. Strategies for Agricultural Production

The Second Five Year Plan (SFYP), for the period 1979-80 to 1984-85, seeks rapid growth in agricultural production and productivity. The plan recognizes that without rapid change in agriculture there can be hardly any rural or national development in Bangladesh or significant reduction in poverty or unemployment. The plan emphasizes the urgency of efforts to give a major emphasis to raising agricultural production.

The principal constraints to increasing agricultural production not only in irrigated land, but also in rainfed areas, which will constitute some 70% of the cultivated acreage by the end of the SFYP period, may best be identified by the factors to receive priority attention in the Strategy for Agricultural Production, as presented in the SFYP. Among these are:

a) Self-sufficiency in foodgrains at a higher level of per capita consumption and with more balanced diets, through substantial increase in the production of oil-seeds, pulses, vegetables, fish, and poultry.

b) Proper institutional changes and appropriate policy measures relating to the supply of inputs and supporting services, viz, irrigation water, fertilizer, pesticides, improved seeds, credit, extension service, price-support measures, and marketing facilities. Food policy will be properly integrated with agricultural production.

c) Increased irrigation coverage combined with expanded cultivation of HYVs of rice and wheat, supported by intensive management. Irrigation coverage will be more than doubled during the SFYP, the priority areas being minor irrigation projects (such as LLPs, DTWs, and STWs), with full utilization of the capacity of existing and proposed irrigation facilities and provision of supplementary irrigation during Aus and Aman seasons.

d) The area under HYVs of rice and wheat will be expanded substantially and fertilizer use will be doubled during the SFYP. Availability of fertilizer will be assured not only by better utilizing the capacity of existing fertilizer plants but also by setting up new plants at an early date and by planned

imports. Better and massive use of organic manures will also be introduced. Seed multiplication and storage, both in public and private sectors, will be part of the production plan. Credit facilities will be increased, not only by making greater allocation of funds but also by administering them better so as to ensure better recovery. A major effort will be made to ensure adequate marketing facilities, including transport and storage, without which increased production will generate serious problems. Subsidies for inputs will be reduced on a planned basis, with a definite timetable for drastically reducing them within the next five-year period. Efforts will be made to initiate production of most of the inputs required for agriculture and rural development including fertilizer, implements, and tools.

e) Proper incentive prices for rice, wheat, sugarcane, and jute will be maintained. Procurement and storage efforts have to be greatly improved. Adequate bufferstocks will be assembled to tide over the difficulties of possible lean periods. If possible, a marketable surplus should be aspired to. Consistent demand management will be undertaken, and the rationing system eliminated progressively. General subsidies on fertilizer and other inputs will be selectively applied for definite periods as well-planned promotional efforts. Prices of major food items such as rice, wheat, edible oil, sugar, baby food, pulses, fish, poultry, milk, etc., may have to be stabilized through appropriate pricing, distribution, and production policies.

In addition to the above the plan explicitly describes the strategy in which the policy will be implemented in rainfed as well as irrigated areas.

C. Second Five Year Plan Production Goals

SFYP envisages increasing food production from a bench-mark figure of 13.5 million tons in 1979-80 to just over 20 million tons in 1984-85, Table 1. Most of the increase in production is expected to come from increasing the cropping index and from increases in crop yields. While the area under rice crops is expected to remain about the same, a major expansion of wheat and other crops is planned for the winter season. In 1984-85 the dominance of rice in total food grain production is expected to be reduced to 89 percent, compared with 94 percent in 1979-80. The changes in food grain production are expected to increase per capita consumption from 15.4 oz. per day to 17.2 oz. per day over the plan period.

Projected increases for sugarcane, potato, pulses, and other crops, as well as for livestock and fisheries production, are given in Table 2. In addition, it can be seen that oil seed production is to be increased by 135 percent, from 255 thousand to 600 thousand tons. This increase will help reduce the import level of total edible oil consumption, which currently stands at about 60 percent.

Table 1. Foodgrain Program in SFYP

	1979-80		1984-85	
	Area thou. acres	Production thou. tons	Area thous. acres	Production thou. tons
Rice				
Aus	7,795	3,103 (23%)	8,000	4,830 (24%)
Aman	14,260	7,422 (55%)	14,000	9,550 (48%)
Boro	2,703	2,239 (16%)	3,000	3,400 (17%)
Total	24,758	12,764 (94%)	25,000	17,780 (89%)
Wheat[1/]	900	716 (5%)	2,500	2,250 (11%)
Coarse grain	219	59 (-)	150	75 (-)
Total	25,877	13,539 (100%)	27,650	20,105 (100%)

1/ Wheat area and production variously estimated up to 1.4 million acres and 1 million tons, respectively.

Source: SFYP, page XII-24

Table 2. Selected Major Physical Targets in Agriculture in the SFYP

Item	Unit	1979-80	1984-85	Increase (%)
Rice (HYV)	Million tons	12.8	17.8	39
Wheat[1/]	Million tons	0.7	2.2	206
Jute	Million bales	5.4	6.5	21
Tea	Million lbs.	81.6	95.0	16
Tobacco	Million lbs.	109.6	135.1	23
Sugarcane	Million tons	6.7	7.8	17
Potato	Million tons	1.6	2.0	25
Oil-seeds	Million tons	0.3	0.6	135
Pulses	Million tons	0.2	0.4	101
Cotton	Thousand bales	4.0	263.0	large
Milk & Milk Products	Million tons	1.5	1.6	7
Meat	Million tons	0.3	0.4	22
Eggs	Million eggs	4.7	5.1	8
Timber & Fuelwood	Million cft.	99.8	126.8	27
Rubber	Thousand lbs.	157.0	560.0	256
Fisheries[2/]	Million tons	0.64	3.0	464

1/ Latest wheat estimate is 1.1 million acres.

2/ Recent adjusted target.

Source: SFYP, page III-7

Finally, the agriculture sector is expected to play a major role in increasing foreign exchange earnings and import substitution. Currently about 80 percent of foreign exchange earnings in trade comes from jute exports. Tea also generates foreign exchange. Production increases of 21 percent in jute and 16 percent in tea are planned over the next five year period.

The plan provides for expanded irrigation to play a critical role in increasing crop yields and employment. Net irrigated area (NIA) is to be increased from 3.7 million acres in 1980 to 7.2 million acres in 1985, Table 3.

Irrigation facilities are expected to provide water during the winter period and supplemental irrigation during the monsoon. In Bangladesh careful irrigation management is especially important as the monsoon and occasional winter rains are unreliable and controlled irrigation can greatly reduce risk and uncertainties.

In the past the major sources of irrigation have been 2 cusec cooperative low lift pumps (40% of NIA), cooperative deep tubewells (17% of NIA), and traditional methods such as dhoner and swing buckets (27% of NIA). By the end of the plan period it is expected that the types of irrigation methods will have been diversified considerably. The Bangladesh Water Development Board (BWDB) will provide 14 percent of NIA, mainly from canal schemes. Through planned increases 1 cusec cooperative low lift pumps will provide 3 percent of NIA, and shallow tubewells in the cooperative and private sectors will provide a total of 21 percent. As regards low lift and tubewell irrigation, which are expected to provide a total of 86 percent of NIA by 1985, most of the planned developments indicate a shift in technology toward more divisible units that are more suitable than larger units to the extremely complex hydromorphic, agro-climatic, and socio-economic conditions of Bangladesh.

The reduction of rural poverty is a dominant theme of the plan and most of the burden for providing nutritional needs, generating employment, and for supplying exports falls on the agriculture sector.

Currently it is estimated that 79 percent of all employment in Bangladesh is provided by crop production and non-crop activities, such as livestock and fisheries, in the agricultural sector. The capacity of non-agricultural activities to employ people gainfully over the next five years is slight compared with the national need for over 5 million additional jobs, Table 4. Even if these jobs are generated there will still be widespread unemployment or seasonal unemployment.

Achieving the employment goal is essential for development objectives in two ways: First, it is only through employment that the rural households who possess no land, or have less than 0.5 acres, can obtain an income and share in the benefits of increased output; second, employment for poor people is essential in order to generate enough purchasing power to create an effective demand for food grains. Without this effective demand, food prices will fall and food production will decline. In

Table 3. Irrigation Program in SFYP

	1980 Expected			1985 Target		
	No. (Thousands)	Acres (Thousands)	%	No (Thousands)	Acres (Thousands)	%
Public						
BWDB		240	7		1,000	14
BADC						
LLP 1 cusec	-			10	250	3
2 cusec	37	1,480	40	40	1,800	25
STW	15	150	4	90	1,125	16
DTW	11	605	17	25	1,500	21
HTW	50	20	1	300	90	1
Private						
BKB-STW	12	120	3	30	375	5
IRDP-HTW	120	48	1	200	60	1
Traditional	-	1,000	27		1,000	14
Total		3,663	100		7,200	100

LLP = Low lift pump, STW = Shallow tubewell, DTW = Deep tubewell, HTW = Hand tubewell

Source: SFYP, page XII-80

Table 4. Employment Expansion in SFYP

	1978-79		1984-85		Increase over SFYP
	Millions	%	Millions	%	%
Agriculture					
Crop production	12.40	49	14.41	47	16
Non-crop activities[1/]	7.59	30	8.80	29	16
Total	19.99	79	23.21	76	16
Industry	1.19	5	1.90	6	60
Other	4.12	16	5.37	18	30
Total employed	25.30	100	30.48	100	20
Population	90.25		100.79		12

1/ For example livestock, fisheries, procuring, marketing, and capital formation.

Source: SFYP, page VI-7

summary, the plan places great emphasis on labor intensive methods of improving farming systems and soil and water management practices in order to use scarce resources effectively, increase food production, and to generate employment in Bangladesh.

II. PRIORITY REQUIREMENTS FOR IMPROVED AGRICULTURAL TECHNOLOGY

The SFYP calls for substantial increases in production of food grains and selected other crops, including a 206 percent increase for wheat, 135 percent for oilseeds, 101 percent for pulses, and 39 percent for rice. While the target for rice may not seem large, it is a significant increase for a crop that has received special attention and support for research over the past decade. Goals of this magnitude will not be possible to achieve without substantial improvement in production technology. Priority areas for strengthened research and technology development deserve special mention.

A. High Yielding Varieties

Wheat. Wheat production has increased from less than 60,000 tons on 100,000 acres in the mid-1960's to an estimated 1.0 million tons from 1.4 million acres in the 1979-80 crop year. In 1979-80 HYV acreage approached 90 percent of the total. It is estimated that the acreage of HYV could be doubled in the future.

The varieties grown in Bangladesh are selections from the International Wheat Improvement Program of CIMMYT. Two varieties (Duel and Balaka) characterized by high yield and tolerance to leaf rust and drought were developed and released by BARI in 1979. Because of heavy infestation of leaf rust, two of the introduced varieties have been discontinued for further cultivation. The Bangladesh wheat crop is currently vulnerable to disease damage, especially leaf rust and leaf spot, since about 75 percent of the acreage is planted to the variety Sonalika. The breeding program for developing high-yielding, disease resistant varieties of wheat must be strengthened.

Rice. The rapid adoption of HYVs, expansion of irrigated acreage during all seasons, and use of minimal fertilizer application on most acreage constitute the rice production strategy for the SFYP. The deep-water rice breeding program is receiving special attention and is important to the development of higher yielding varieties for growing on the 4.5 million acres of deep-water rice land. However, a minimum of two or three years more may be required before an acceptable improved variety is available for release.

The rice crop is subject to damage from a wide range of insects and diseases so a continuing strong research program is necessary to protect the crop from serious losses. The agro-ecological conditions also provide a serious challenge. HYVs must be developed that tolerate drought stress for the Aus season, survive the floods for the Deep-water Aman crop, have photoperiod sensitivity and tolerance to cold and moisture stress at the reproductive stage for the transplanted Aman, and tolerance to cold temperatures at the vegetative stage for the Boro crop.

Pulse Crops. The yields per acre in Bangladesh of the pulses (grain legumes) are among the lowest in the world since these crops

(lentil, chickpea, black gram, mungbean, grasspea, peas, and pigeon pea) have received little national research attention. Traditional varieties are highly susceptible to various viral, bacterial, and fungal diseases and insect pests.

The pulses supply a significant portion of the protein in Bangladesh diets. But the per capita availability of protein--of animal as well as plant origin--has been declining in recent years. A coordinated pulse improvement project was initiated by BARC in 1975 and was extended in 1978 for a two year period. The project will be revised involving five or six pulses for continuation during the SFYP.

Oilseeds. Two new mustard varieties, which yield twice as much as older selections, have been released by BARI during the past year. A new oilseeds project has been established in BARI to give attention to mustard, sunflower, sesame, groundnut, and soyabean. Although soyabean is not at present an oilseed crop in Bangladesh--less than 3,000 acres are grown--interest seems to be rising. Substantial support has been furnished through BARC for soyabean research, with the coordinating leadership furnished by a staff member of BAU. A major technical problem, in addition to varietal improvement, is seed storage and viability. Most seed has to be imported annually from the U.S.

Vegetable oil production has not increased substantially in the past decade. This is due in part to more marginal lands being used for oilseeds--as wheat acreage increases--and also to the lack of impact, as yet, of the new varieties. The SFYP target of a 135 percent increase in oilseeds production would appear to be a substantial challenge.

B. Disease and Pest Management

As crop production increases, insect and disease problems proliferate. Scientists, extension workers, and farmers have become more alert to crop pests recently and are identifying insect and disease problems that previously had escaped their attention.

BARC reports that preharvest yield losses of agricultural crops caused by pests range from 10 to 15 percent, a monetary loss of about Tk500 crores (U.S. $333 million) annually. Rats are another less recognized source of crop losses. The Vertebrate Pest Section of BARI estimated the loss caused by rats in rice and wheat in 1979 at about U.S. $140 million. Rat control research is under way, strengthened by the USAID supported Vertebrate Pest Research Component, which was initiated in 1978. Effective control measures are not yet available but substantial information has been developed about the kinds of vertebrate pests that damage Bangladesh agriculture, including rodents, birds, jackals, feral pigs, elephants, fruit eating bats, and some primates.

1. Genetic Instability of Insect Pests and Diseases

Scientists learned several decades ago that diseases and insects do not remain genetically stable. By various biological means new races and

strains of crop pests emerge. The classic example was wheat rust in North America. Wheat varieties that were developed to resist the then prevalent rusts became susceptible to new races of rust. Breeding of wheat resistant to rust and other diseases has been strengthened and coordinated throughout the United States and no serious losses from rust have occurred since 1954.

Obscure rust pathogens suddenly multiplied at unprecedented rates in Pakistan in 1978 and caused such severe losses that Pakistan was forced to import more than 2 million tons of wheat that year.

The heavy infestations of leaf rust in Bangladesh on the wheat varieties Sonora 64 and Kalyansona resulted in their discontinuance. The potential emergence of a new virulent race that can destroy Sonalika (grown on about 75 percent of the wheat acreage in the country) is a serious hazard to the nation's wheat production.

The same situation prevails with insects, of which a rice pest--the Brown planthopper--is a good example. This insect damages the rice plant and is also the vector for grassy stunt virus. The constantly changing range of pests that cause serious crop losses requires a continuing research capability to protect and stabilize crop production.

2. Crop Pest Control

Crop pest control is a constantly changing and a seemingly endless undertaking. The scientific community of much of the world is cooperating in a collaborative attempt to minimize crop losses from pests. This effort involves international crops research institutes, national research programs, the private sector, the farming community, and many others. Because new pests appear at unexpected times and places, each nation must build a capability to deal with unexpected outbreaks. There is, as yet, limited research on crop pest forecasting and pest surveillance.

Integrated pest control has been widely discussed and there have been a few pilot trials and successes. Integrated control includes various combinations of breeding varieties for pest and disease resistance, minimum use of specific pesticides, proper land preparation, time of planting, various cropping sequences, cleaning fields of weeds, use of specific predators, pest surveillance, and climatological studies and pest incidence forecasting.

3. Specific On-Farm Problems

In general, farmers and the Village Extension Agents (VEAs) lack the skills to identify specific disease or pest problems on crops. This often results in applying the wrong pesticide or applying pesticide at the wrong time or at the wrong rate. As a result the target pest is not controlled. Supplies of the right pesticide are often not readily available to the farmer and small farmers frequently have credit problems in procuring pesticides.

4. The Role of Research Institutes

It is likely that rice is favored with the most competent pest management research and control programs. It appears that the wheat improvement program has too few well-trained plant breeders, pathologists, and agronomists. Since a major share of the rapidly expanding wheat acreage in Bangladesh is planted to one variety, the breeding of HYVs with resistance to rust and other diseases, from a diverse genetic makeup is a matter of special urgency. The plant protection competence for jute, sugarcane, tea, and fruits appears to be inadequate with respect to pest control scientists and extension workers.

5. Pesticide Supplies

Recently pesticide distribution has been turned over to the private sector in order to improve the system. Approved pesticides will be imported on government license. Established farm supply as well as new shops will be involved. Experience in other countries bears out that private dealers can be effective promoters of improved pest control practices, including pesticides, provided that they receive good training from qualified scientists and extension workers, and operate under clearly defined procedures.

C. Soil and Water Management

Among the constraints that account for low and unstable crop production in Bangladesh, soil and water management must be considered of high priority. BARC arranged for a special consultant to review this problem area in March-June 1979 and procedures for strengthening soil and water management research are now being considered by BARC. The development of improved soil and water management practices for the various farming areas of Bangladesh is considered of special importance and a comprehensive discussion of this subject area is presented in ANNEX V.

D. Farming Systems

Farmers are confronted with the complex management task of making most effective use of the soils, water, solar energy, labor, and natural or supplied inputs (fertilizers, seeds, pesticides, and credit, etc.) in order to achieve a maximum economic output of plant and animal products. The farmer develops an understanding of the combined natural and socio-economic factors that affect his production and attempts to achieve the greatest productivity possible within the limits of the factors he can control.

Research on farming systems, including verification trials on regional stations and substations, and further adaptive research via farmer field trials are essential to ensure that new technology will fit into the farmer's resource pattern. The research must combine attention to improved crop varieties; planting and cultivation practices; weed,

disease, and pest control; intercropping; the provision of feed and fodder for livestock; fish farming in areas where artificial or natural ponds predominate; and--of special importance -- the economic and social suitability of the packages of improved practices.

The complexity of the cropping systems of Bangladesh is shown in Figure 1. Bangladesh farmers practice intensive multiple cropping, relay planting, and intercropping, to achieve a land-use intensity of about 147. Multiple cropping or farming systems research has been under way in Taiwan, Thailand, the Philippines, and other Asian countries for many years. It has been under way for several years at BRRI, as part of the Asian Rice Cropping Systems Network centered at IRRI. BARI has recently initiated a cropping systems research program and BARC has appointed a technical working group to develop a Coordinated National Cropping Systems Program.

Research on cropping systems--or on farming systems that will include livestock and fisheries--is of special urgency and priority and is discussed more fully in ANNEX VI.

The foregoing commodity and problem areas indicate only part of the research needed to generate the improved technology essential to achieving SFYP objectives. Stronger, more effective research programs will be needed also to increase production of jute, sugarcane, tea, the coarse grains, (corn, sorghum, and millets), root and tuber crops (potato, sweet potato, etc.), and fruits and vegetables.

E. Economics and Social Sciences

In the agricultural research system, the most important research role for economics and social science is in problem diagnosis, planning, and technology generation. In the past, social scientists have often stood on the sidelines of the technology generation process and analyzed the work of scientists only after the event. In recent years, however, agricultural economists and social scientists have started to work with biological scientists in developing methodologies, which enables them to participate in and complement the work of applied biological and engineering scientists. The major topics in this new type of analysis, which has already started in Bangladesh are:

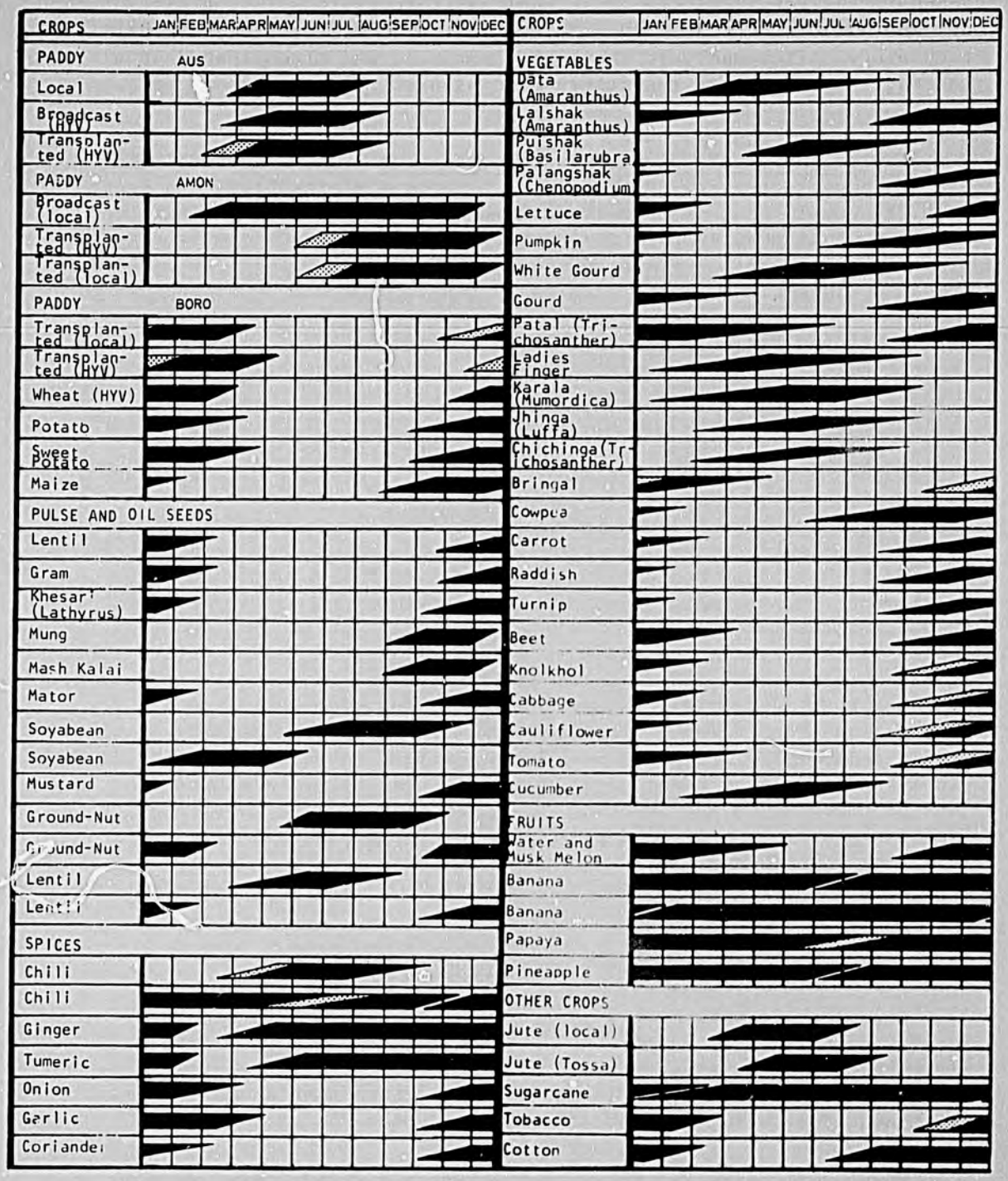
Process of innovation. Investigations into "formal" and "informal" processes of research, development, and adoption. Increasingly, it is being recognized that little is known about what types of research and development programs and processes have high pay-offs to investment in research in the Bangladesh culture. It is not clear why some programs worked well, while others have not. As this type of knowledge is necessary for the development of local research systems, it is recommended that these studies be expanded.

National and regional technology policy analysis. The First National Agricultural Research Plan is an excellent start to a process for selecting

Figure 1

CROP CALENDAR OF BANGLADESH

Existing Cropping Patterns



EXISTING CROPPING PATTERNS:

AUS/Jute + T. Amon
AUS + T. Amon + Khesari (Lathyrus)
Jute + Kalai (Pulse)
AUS and T. Amon Mixes

5. AUS + Mustard/Pulses/Rabi Vegetables/Tobacco/Cotton/Potato
6. AUS and Arhar (Cajanus)/Til (Sesamum) Mixed
7. B. Amon
8. AUS and B. Amon Mixed
9. Boro
10. Sugarcane
11. Summer Vegetables + Mustard/Pulses

national commodity and non-commodity technical research priorities in the light of (1) national economic and social development goals, (2) agro-climatic conditions in different parts of the country, and (3) socio-economic characteristics such as regional inequalities in the distribution of land and other productive assets. This type of inter-disciplinary technology policy analysis should be continued and strengthened in all the major agricultural institutes such as BARC, BRRI, BAU, and BARI, etc.

Interdisciplinary farming systems research. In BRRI, BARI, and BAU, to name just a few institutions, important starts have been made with the development of farm level agro-economic studies to diagnose problems of farmers as part of integrated on-farm and on-station research. This work is forward looking and should influence the research planning process. This close interdisciplinary research should be strengthened.

Rural and agricultural employment. Because of the overwhelming importance of the agricultural and rural sector for providing employment to small and marginal farmers as well as landless laborers and rural women, it is recommended that special attention be given to: (1) Agricultural and Rural Employment Analysis--a systematic collection and analysis of employment information at the micro, regional, and national level should be strengthened in order to influence policy making with respect to technological and institutional change in Bangladesh; and (2) Technology for the Landless Laborers and Rural Women--traditionally agricultural scientists have been concerned with generating technologies to solve the problems of "the farmer." Because landless laborers and farmers with less than 0.5 acres make up half of all rural households in Bangladesh, it is suggested that special emphasis be placed on investigating institutional-cum-technical issues involved in providing to the poor technology based on rural assets other than land. This program would promote research on, for example, providing low lift pumps to cooperatives of landless laborers, providing mechanical hullers to women's cooperatives, providing irrigating hand-pumps to landless laborers, leasing forage land on embankments and roads to landless laborers, the management of fish tanks by groups of landless laborers, and poultry and goat raising.

These issues are discussed in greater depth in ANNEX VII.

F. Livestock

Livestock is very much a part of the Bangladesh farm economy. In rural Bangladesh over 90 percent of the rural families are engaged in backyard poultry raising. Cattle are the most important source of power for plowing and transport. In addition, products such as meat, eggs, milk, and hides also contribute farmers' incomes.

Until now, livestock research has been fragmentary and has had little impact on livestock production. This situation is due to the meager support provided by the Government to the livestock sector, the absence of a national coordinated livestock research and development

plan, and the unnecessary professional conflicts among veterinarians and other animal scientists.

The opportunities for the livestock sector to contribute to the national goals of Bangladesh as spelled out in the Second Five Year Plan are:

primarily,

a) providing farm power for draft purposes

b) generating additional employment opportunities for landless laborers as well as rural women

c) producing high value protein food without sacrificing land used for food crop production

d) maximizing the use of farm resources

secondarily,

a) the production of meat, milk, and eggs for sale or home consumption

b) the production of animal by-products such as hides, feathers, bones, etc.

Thus, it is recommended that the efforts in generating improved livestock technology be initially focused on cattle, poultry/ducks, and goats. The suggested priority research objectives are:

a) To acquire detailed information on seasonal feed sources for livestock and on animal feeding and husbandry practices in representative villages

b) To determine the optimum alternative schemes of integrating the production of appropriate fodder crops (i.e. lucaena, napier, paragrass, etc.) into the village-level farming system to improve draft animals and raise the productivity of milk animals

c) To find ways to further improve the feeding value of farm wastes and by-products

d) To investigate the problems of draft power in relation to cattle size and various implements and harnesses

e) To develop a scheme for providing animal health cover for cattle as well as backyard poultry and goat raising

f) To develop a package of husbandry and health practices to enable landless laborers as well as marginal farmers to produce poultry or goats in their backyards

g) To do studies to develop an appropriate animal health policy for Bangladesh

h) To conduct socio-economic studies to ensure the viability of the improved livestock technology to be generated from the above-mentioned research thrusts.

The livestock sector will be able to effectively contribute to improving the farm economy of Bangladesh only if:

a) adequate support is provided for the implementation of the above-mentioned livestock research priorities.

b) the close working relationship among veterinarians and animal scientists is assured by Government to enable both the professions to contribute effectively in improving farm productivity.

c) an appropriate mechanism to mobilize, focus, and support livestock research throughout Bangladesh is created now.

Some suggestions for strategies (short-term as well as long-term) in upgrading livestock research in Bangladesh are made in ANNEX VIII.

G. Fisheries

Fish and fisheries have always been an integral part of life in Bangladesh. Traditionally, fishermen in Bangladesh subsist on capture fisheries, which essentially amounts to hunting for fish either individually or in family groups from the wild stock in open waters. About 80 percent of the annual catch comes from freshwaters.

The Bangladesh coastline has approximately 2.5 million acres of territorial waters. The commercial exploitation of sea fish from the Bay of Bengal is a relatively new venture, with much of the physical facilities and expertise yet to be developed. On the other hand, the total area of perennial inland waters is generally estimated at 4.0 million acres. In addition, over 7 million acres of water surface are estimated to be available each year in the innundated crop fields and other low-lying areas that retain monsoon water for about six months--enough to grow one crop of fish. At the present time, 97.6 percent of total fish production comes from capture fisheries while only 2.4 percent is contributed by aquaculture.

The Second Five Year Plan has put heavy emphasis on fisheries. During the plan period, the annual fish production is targeted to be increased by over four times from 0.64 million tons. In this massive undertaking, aquaculture has been pinpointed to play a major role. Accordingly, aquaculture is expected to increase its share of the total fish production tonnage to 39.0 percent at the end of the plan period. This is expected to be achieved through a marked increase in acreage devoted to aquaculture and an eleven-fold increase in productivity

through aquaculture technology adapted from abroad. While the fish production targets appear to be unrealistically high, considering current capabilities and resources, they highlight the major emphasis given to fisheries in general and aquaculture in particular.

Fisheries research, which has tended to be predominantly in the aquaculture area, has been undertaken primarily by Bangladesh Agricultural University in Mymensingh, with some investigations also conducted by the Freshwater Fisheries Research Station in Chandpur, the University of Chittagong, Dacca University, and the BCSIR laboratories in Dacca and Chittagong. In general, such fisheries research has tended to be fragmentary, uncoordinated, and largely of an academic nature.

In the Second Five Year Plan for the fisheries sector, the major research areas (in order of priority) are: adaptive studies in freshwater aquaculture, adaptive studies in mariculture, and studies on riverine capture fisheries. More specifically, the suggested priority research areas include:

a) A comprehensive survey of the fisheries resources of Bangladesh

b) Seed technology investigations for carps, Tilapia nilotica, prawn, mullet, hilsa, and freshwater shrimp

c) Adaptive research on pond engineering

d) Adaptive research on freshwater aquaculture systems

e) Adaptive research on mariculture systems

f) Aquaculture nutrition studies on natural feeds as well as artificial feeds

g) Investigations on plankton and zooplankton profiles of ponds and tanks in various major soil tracts

h) Cage culture studies on Tilapia nilotica, carps, snakeheads, clarias, and anabass

i) Development of improved gear and craft technology for riverine fisheries

j) Investigations on the appropriate integration of aquaculture in various farming systems (i.e. livestock-fish, crop-fish, etc.)

k) Production economics studies on various aquaculture and riverine capture fisheries systems

l) Marketing studies for domestic as well as export trade

m) Studies on post harvest technology for fish and crustaceans

n) Studies on the management of riverine (open water) resources

o) Development of appropriate technology delivery systems for fish farmers as well as capture fishermen

The National Aquaculture Research Center facilities at Mymensingh are expected to be completed and made operational at the end of 1980. With its completion, Bangladesh will have one of the most developed freshwater aquaculture research facilities in Asia. Thus, there is now an urgent need to mobilize the country's aquaculture research manpower and mold it into an effective tool for systematically addressing the priority freshwater aquaculture research problems in Bangladesh. In this regard the Government should consider a working mechanism whereby the Fisheries Department could directly make use of BAU fisheries research capability in the operation of an Aquaculture Experiment Station at Mymensingh.

As soon as possible, plans should be developed and implemented for strengthening the Chandpur fisheries complex into a research station for riverine (open water) fisheries and for creating a mariculture research station at an appropriate location, perhaps in Khulna district.

Since the marine fisheries research in Bangladesh is still in its infancy, and since marine capture fisheries do not command a high priority in Bangladesh fisheries, it may be premature to establish and develop a marine fisheries research station in the Chittagong district before the Third Plan period. It is important that the development of the research stations at Chandpur and possibly at Khulna be completed within the Second Plan period.

It is strongly recommended that BARC and the Fisheries Development closely collaborate in developing a Master Plan for upgrading the fisheries research capability in Bangladesh.

H. Forestry

About 13 percent of the GNP and 12 percent of the labor force in Bangladesh is employed in timber-related operations, while only 8 percent of the land is in productive forestry in a country that should have 25 percent of the land in commercial forestry. The national demands on the forestry sector may be classified as follows:

a) Bangladesh has 4 pulp/paper mills, 18 match factories, 5 plywood mills, 8 door/window factories, 10 kiln complexes, 2 hardboard plants, 100 small mills, 1 rayon mill, 5 boat plants, railway carriage factories, preservative and particle board plants, and rubber processing plants

b) There is a nationally recognized need to raise a forest belt along the Bangladesh shoreline for protection against devastating tidal waves

c) The high population of Bangladesh has a massive requirement for household fuel so that animal dung, other crop residues, and some 50 percent of what could otherwise be used as timber is necessarily directed to satisfy the fuelwood needs

d) Likewise, the high population growth has increased the need for land for food production and this has led to encroachment into land that should be in forest

e) There is a need to build up land area arising from siltation along the coast

The country's Forest Research Institute was established in Chittagong in 1955. Early emphasis at FRI was devoted to forest products research, but since 1965 forest management has gradually developed into a major research area. A number of productive divisions at FRI have emerged in the last decade or so that aim to characterize timber in terms of physical, engineering, and chemical properties and to determine alternative uses for timber and timber products. However, FRI has too heavy concentration in forest products utilization, a weakness in forest mensuration activities, and a lack of major effort in forestry economics.

Given the national problems faced by the forestry sector and the objectives indicated in the Second Five-Year Plan, the following are suggested priority research areas:

a) Development of a technology package that would establish, support, and sustain a village-based fuelwood production program

b) Development of appropriate agroforestry systems for the different hill tracts of the country

c) Studies on the selection, evaluation, and pilot plantation testing of fast-growing and high-yielding species

d) Development of nursery and plantation techniques to service large-scale plantation programs

e) Development of high-quality seed sources

f) Classification of forest soils and selection of appropriate tree species for different soil types

g) Economic studies in forest plantations, logging and transportation, and forest-based industries

h) Preparational inventory, growth, volume, yield, and ecological data for plantation and managed natural forests

i) The development and standardization of products, schedules, and processes with emphasis on the use of appropriate technology to reduce wastage

A 1971 study reported that out of 100 forestry research projects funded by FRI (up to 1965) at a cost of 83 million taka, a return on investment of 71 percent was realized from forestry research. However, it is interesting to note that in the recommended strategies, the Second Five-Year Plan stresses research, training, and system reorganization with no less than half of the recommendations directed at forest management and conservation, and yet only about 3 percent of the SFYP allocation to the forestry sector is earmarked for forestry research. There is therefore, need to stress the role of FRI in implementing priority research projects in forestry management, silviculture, and conservation.

Many of the problems in forest management and silviculture demand the competence and resources shared with other soil, plant, and plant protection scientists throughout Bangladesh. Thus, wise use of scarce resources could be ensured by setting up effective coordinated research programs and strengthening the national research network.

It is recommended that FRI and BARC collaborate in the development of a FRI Master Plan, which would provide a basis for orderly, long-range development of multi-disciplinary research, improvement of scientific manpower, and linkage with allied national and international research programs.

I. Agricultural Engineering

Agricultural engineering, here, includes farm implements, tractors, hand tillers, bullock harnesses, weeders, etc., but excludes irrigation and post-harvest technologies, which are covered in other sections.

In the past, agricultural engineering research has suffered from two sets of problems. On the one hand there have been those who have thought that "high level" technology can be easily imported and should be used in Bangladesh. For example, tractor and sophisticated hand tillers and their associated equipment have been emphasized. On the other hand there have been those who have advocated the importation and development of only "low level" technology.

Neither of these approaches is relevant to Bangladesh. What has been notably absent has been a problem-solving orientation to the development of suitable agricultural engineering technologies for Bangladesh. A farming systems and area economy approach should be used to diagnose the agro-economic problems of different groups of farmers, village blacksmiths, etc., in different regions of the country, and this diagnosis should direct the setting of agricultural engineering research priorities.

On-farm and on-station research by BAU on improved harnesses for cattle to help overcome draft power constraints and research on the modification of hand-weeders from the Comilla area to make it less costly for village artisans in other areas to manufacture them appear to us to be suitable new directions for research. In addition, surveys within Bangladesh to identify new agricultural technologies that are spreading in some areas but are not known in others will also lead to the identification of relevant technologies for development or promotion in other areas.

The BADC/BARC/Reading University village-level study on the use and impact of tractors and handtillers in Bangladesh should be complemented by similar village-level technical and socio-economic research on animal and human energy inputs into agriculture. When this is done, it will then be possible to set priorities for mechanization research and development for different regions of the country.

Another problem which has plagued the development of suitable agricultural engineering technologies in Bangladesh has been a lack of attention to the "backward linkages" as regards the manufacture, servicing, and repair of equipment. Again, a farming systems and an area economy approach to research and development would, we feel, lead scientists to address problems fundamental to the spread of improved engineering techniques.

Finally, we were concerned to find that available information is not being used. In spite of considerable efforts by BARC--especially the appropriate agricultural technology cell--to draw up lists and issue reports on research on agricultural engineering, on the capacity of private firms to manufacture tools and equipment, on the availability in Bangladesh of such items as small-scale rice and wheat threshers, hand-weeders, seed-drills, etc., we found that some government agencies and researchers claim that this information does not exist.

J. Post-Harvest Technology

At the village level, most post-harvest operations are performed by the poorest rural women--either unpaid, female household members or female wage laborers who work for farmers with larger holdings.

A recent survey of paddy operations from crop cutting to cooking has shown that total crop losses are only 5 to 8 percent depending on the season. For any single operation in the process the loss is no more than 2.5 percent and post-harvest engineers do not see any practical way to reduce this loss (Huq and Greeley, 1980).

In villages, mechanical hullers are spreading and displacing women from gainful employment because on a commercial basis it is cheaper for large farmers to use a machine. Post-harvest crop losses are not being reduced and are in some cases being increased. This example illustrates some of the complex technical and socio-economic issues involved when setting priorities for generation and promotion of post-harvest technologies. Some technologies merely displace labor without increasing output.

There are significant post-harvest losses in some crops, but programs already in progress will address many of these problems:

a) the planned FAO-funded surveys of village and commercial post-harvest paddy operations

b) the research programs of agricultural engineering departments at such institutions as BRRI, BARI, BARD and BAU

c) the farming systems and village-level research program as described in another section of this report

d) the integrated commodity research programs of the major agricultural research institutes, which include an analysis of post-harvest problems at the village level; in particular, legumes, potato, sweet potato and other root crops may receive special attention

It is beyond the scope of this review team to comment on the extent of food losses in trade and in public storage and distributions systems.

III. THE BANGLADESH AGRICULTURAL RESEARCH SYSTEM--JULY 1980

A. Historical Background

There are few countries of the world with a more urgent need for modernization and increased productivity than Bangladesh. The rapid and sustained growth of population, the continued need to import food supplies, the growing numbers of unemployed and underemployed, and the decline in nutritional status--especially among rural people--are complex issues facing the nation. Eighty percent of the people are living below the poverty line and real wages in rural Bangladesh have been on a declining trend in recent years.

The current worldwide inflation and energy crisis are especially damaging to the economies of countries such as Bangladesh. There is no evident early solution to these problems and they will undoubtedly persist through the Bangladesh SFYP.

Bangladesh farmers are not provided with the kinds of science-based technology that have enabled most countries of Asia to achieve increased agricultural productivity. In fact the yields per acre of sugarcane, pulses, and oilseeds have declined in recent years, while for almost all other crops--except wheat, potato, and tea--per acre yields have remained static.

A review of some of the factors that have contributed to the serious lag in performance of research in agriculture in Bangladesh--and the continued stagnation of the agricultural sector of the economy--seems most relevant to the efforts of the Review Team. Such a historical review is designed not to perpetuate excuses for current poor performance but rather to identify more clearly the significance of actions now under way and that must be taken in the future to remove present constraints.

1. Research in the Subcontinent to 1947

Prior to World War II, rapid strides were made in modernizing agriculture and increasing production in the United States, Western Europe, and Japan. The Indian Subcontinent also had an effective agricultural research and development system, with outstanding research institutes, excellent universities, and the Imperial Council for Agricultural Research, established in 1929.

During World War II, agricultural research was curtailed drastically in the Subcontinent and in most other countries of the world--particularly in Japan and Europe. However, research was strengthened in the United States during this period, to meet increased demands for agricultural products for allied nations involved in the war effort. This was an important factor in the emergence of the U.S. agricultural research system as a model for modernization of research in war ravaged and newly emerging nations after World War II.

2. Research in India and Pakistan after 1947

The struggle for independence from British Colonial rule immediately following World War II, culminating in the establishment of India and Pakistan in 1947, perpetuated the stagnation of agricultural research in the the Subcontinent, a situation that prevailed during the remaining years of the 1940's.

In India, the Imperial Council of Agricultural Research was renamed the Indian Council of Agricultural Research and continued to function primarily as a grant making and coordinating body. However, because of the reduced scientific capability, and uncertain leadership and management of research institutes and universities that occured when the British researchers departed, the grant making and coordinating activities of the new ICAR were rendered ineffective. There was inadequate research manpower to conduct effective, development-oriented research. And with a weak institutional structure of poorly directed, understaffed, and badly equipped research centers agricultural research in India was essentially non-productive by the early 1950's. The periodic, continuous review by Joint Indo-American Teams in 1955, 1959, and 1963 resulted in a restructuring of the Indian Agricultural Research System, with the following changes of special significance:

a) All research institutes were transferred to the ICAR.

b) The Director General of ICAR (formerly an Indian Civil Service Officer) was an outstanding agricultural scientist. Subsequently the Director General was given the rank and status of Secretary of Agriculture Research and Education in the Ministry of Food and Agriculture, to provide strong linkages within government and throughout agricultural research and education institutions of the country.

c) Research was restructured to the multidisciplinary, multi-institutional, problem-oriented "All India Schemes" that provided for integrated and coordinating use of scientific manpower, facilities, and other scarce resources.

d) The ICAR developed personnel policies providing for promotion of scientists on performance or productivity--on merit rather than seniority.

There were numerous other changes that combined to build ICAR, in a space of about 10 years, into a model agricultural research system for developing nations of the world.

In Pakistan, following independence in 1947, the Pakistan Council for Agricultural Research was established, also patterned largely after the former Imperial Council of Agricultural Research. Since the research capabilities and leadership of the research institutes and universities in Pakistan, as in India, were decimated with the departure of the expatriate scientists, the ARCP experienced a similarly unproductive

grant making and coordinating function. This was true for both the West Wing and East Wing, but perhaps it was more serious for the latter since the ARCP headquarters were in Karachi.

The decision by the Government of Pakistan to attempt to ease tensions between the East and West Wings of the country, by building a second Capital at Dacca, resulted in the loss of the Dacca Farm, the experiment station of the Central Agricultural Research Institute of the East Wing, in 1962. The resulting disarray of agricultural research in the East Wing, with make-shift, ill-equipped laboratories and offices, and woefully inadequate experimental fields, operated by personnel of low morale and low output, essentially brought the already meager research to a grinding halt for more than five years.

In 1968 the first Joint Pakistan-American Team reviewed agricultural research in the country, in both the West Wing and the East Wing, and developed recommendations for a strengthened ARCP, patterned along the lines of the emerging ICAR. For a variety of reasons, they were not effectively implemented before the outbreak of the war for Bangladesh independence in 1971.

Also in 1968, with support from the Ford Foundation through the International Rice Research Institute, an initiative was taken to establish an accelerated National Rice Research and Development Program, utilizing key staff members of the defunct ARI, providing training opportunities, and also equipment and vehicles.

3. Research Capabilities in Bangladesh After Independence

Following the establishment of Bangladesh, the Bangladesh Agricultural Research Council (BARC) was established in 1973 via President's Order No. 32. The leader of the current Review Team (who was a member of the First Indo-American Team in 1955, involved with the Third Indo-American Team in 1963, and a member of the first Pakistan-American Team in 1968) was in Bangladesh in February 1973, when the BARC ordinance was in its final draft stages, as the research specialist on an FAO/DANIDA Team that reviewed national capabilities and needs for agricultural development. The resulting report, Agricultural Research Needs in Bangladesh, took into account certain deficiencies in the draft plan for BARC (which was patterned much after the former Imperial Council for Agricultural Research) and presented recommendations for strengthening Bangladesh agricultural research along the lines of the revitalized ICAR, the newly established Malaysian Agricultural Research and Development Institute, the newly established Philippine Council for Agricultural Research, and the review and recommendations in 1969 for an Indonesian Agricultural Research Organization, now emerging (from 1974 World Bank support) as the Agency for Agricultural Research and Development.

The Bangladesh Agricultural Research Council Amendment Ordinance, 1976, incorporated most of the recommendations of the FAO/DANIDA report, and of the USAID Agricultural Research Review Team in 1974. The BARC Ordinance, 1976, furnished the critical authorities and management structure necessary for the Council to be effective.

Immediately following the independence of Bangladesh, action also was resumed in strengthening rice research, under the Bangladesh Rice Research Institute (BRRI), with continuing support from the Ford Foundation, the Australian Government, the Canadian Government, and other sources. BRRI has emerged during the past decade as the best staffed and equipped agricultural institute in the country.

In recognition of the urgent need to strengthen research on commodities and problem areas other than rice, the USAID provided a combination of grant and loan funds to develop the Bangladesh Agricultural Research Institute (BARI) and to assist BARC in strengthening the total agricultural research system within Bangladesh. USAID also subsequently furnished additional funding for a Vertebrate Pest Research Component and for development of the Ishurdi Regional Station of BARI. A summary of the USAID Project for Agricultural Research activated in 1977, is presented in ANNEX III.

The World Bank, in keeping with its awareness of the urgency of strengthening national agricultural research systems, provided funding for the Bangladesh Agricultural Research Project, which became effective on November 11, 1978. The project provided for improvement of BARI research facilities and equipment at three regional substations--at Jamalpur, Jessore, and Hathazari--and at the substation at Ramgarh. It also provided for the further strengthening of BARC, through funding construction of a headquarters building (scheduled for completion in December 1980), office equipment, and vehicles.

The World Bank required that a national research plan be developed to form the basis for investment in agricultural research. This plan was prepared by BARC, and was published in December 1979, and approved by the IDA. The bank provided U.S. $1 million to BARC for funding priority research projects in various institutions. The subject areas for research support were selected by Agricultural Research Planning Groups (ARPG) set up under BARC. A total of 39 research areas have been identified through this process.

The bank funds also support training of research scientists, including selected opportunities for Ph.D. level training abroad, Ph.D. and M.Sc. training in Bangladesh, and short-term career development courses. A summary of the Agricultural Research Project supported by the World Bank is presented in ANNEX IV.

In May 1978, the Ministry of Agriculture and Forests designated a Joint Research Review Team to prepare a basic document for (1) strengthening the Bangladesh Agricultural Research Council, and (2) reorganizing the National Research System. This review was conducted in July-August, 1978.

To ensure a thorough understanding of newly established and well-functioning national research organizations in other countries of Asia, USAID supported the travel of senior agricultural research and development administrators from Bangladesh to:

a) Observe the roles and functions of national agencies concerned with coordinating agricultural research.

b) Study the planning, budgeting, and coordination of agricultural research, and examine links between national councils, research centers/institutes, agricultural ministries, private agencies, extension bureaus, and the farmer.

Following this tour, conducted in October 1978, the initial draft report of the Joint Team was reviewed, revised, and circulated for assessment by concerned scientists and officials in Bangladesh. The finished report, Strengthening the Bangladesh Agricultural Research System, was published in April 1979.

The Ministry of Agriculture and Forests designated a Committee, chaired by Dr. S. D. Chaudhuri, Member (Agriculture and Rural Institutions) of the Planning Commission to assess the foregoing report. The Report of the Special Committee Constituted by the Government to Examine the Report of Joint Research Review Team was published in March 1980. This report endorsed the 21 recommendations, with a few modificiations, and presented some additional recommendations to strengthen the national research system. These were largely an expansion on the Joint Review Team recommendations, and included a number of proposals for effective action and operation of the Council.

A follow-up study of the Special Committee Report has been presented as a tentative paper by BARC entitled Implementation of the Special Committee Report Recommendations, April 1980. This calls attention to further steps necessary to put into effect the newly defined activities of BARC.

The foregoing review reflects the tortuous path followed over nearly four decades to build a more solid and stable base for a national agricultural capability to serve the farmers on the lands now within the independent nation of Bangladesh. Not all external assistance, from the many cooperating agencies involved in research has been mentioned since the principal focus of the current review is on the USAID and World Bank research projects, which have been directed primarily to BARI and BARC during the past five years.

B. Institutional Capabilities and Performance

The actions to strengthen the national research system of Bangladesh, through the establishment of the BARI and the strengthening of BARC, have been concentrated during the past five years. The time span for the development of the BRRI has been longer, extending--with some disruption in the early 1970's--for more than a decade.

Substantial progress has been made but much remains to be done. The comparative staffing and funding of some of the agricultural research institutions in Bangladesh, Table 5, gives some indication of the relative capabilities of the various organizations. But this does not furnish

Table 5. Comparative Staffing and Funding of Some Agricultural Research Institutions, Bangladesh

Institution	Staffing "Post in Position"[1/]			Average Yearly Investments in Research, 1975-77[2/] (million taka)[4/]		
	Technical Officer	Technical Staff	Total	Capital	Revenue	Total
Agr. Research Inst. (BARI)[5/]	500	705	1,205	39.80	11.80	51.60
Rice Research Inst. (BRRI)	142	[3/]	142	18.80	5.10	23.90
Jute Research Inst. (JRI)	63	123	186	1.40	1.00	2.40
Sugarcane Res. Inst. (SRI)	18	[3/]	18	3.60	1.60	5.20
Inst. Nuclear Agr. (INA)	23	[3/]	23	3.70	1.00	4.70
Livestock Res. Center	[3/]	[3/]	[3/]	2.00	0.80	2.80
Forest Res. Inst.	74	193	267	0.60	0.10	0.70
Fisheries Res. Inst.	17	[3/]	17	0.52	0.03	0.55
Tea Research Inst. (TRI)	40	108	148	0.22	0.20	0.42
Agr. Res. Council (BARC)	13	[3/]	13	[3/]	5.00	5.00
TOTAL	890	1,129	2,019	70.64	26.63	97.27

1/ Source: Agricultural Research Inventory in Bangladesh. Part I. BARC, July 18, 1978.

2/ Source: Strengthening the Bangladesh Agricultural Research System. Preliminary Draft Report of the Joint Research Review Team. August 1978.

3/ Not reported.

4/ U.S. $ = Taka 16

5/ Revised to reflect recent BARI staff survey.

a guide to the level of performance and output of the research units. The performance of BRRI, which has had essentially a decade of development, can now be identified and measured. The similar emergence of BARI will require additional time--seven to ten years--to build up the manpower capability, and the operational and management experience that comes only with experience.

BARC, like BARI, has only recently received its clarified mandate of functions and authorities. With the new headquarters facility, the awareness of the need for strengthening the Secretariat and staff, and the evolution of a good program-planning-and-review mechanism, BARC should steadily emerge to fulfill its essential role in the national research system.

A key factor in the restructuring of BARC, through the 1978-79 Joint Team review, was the establishment of the Program Planning and Review Board. It is designed to bring the leaders of major organizations concerned with agricultural research and development into the process of identification of research needs and priorities. It is essential that this board begin to function, actively and dynamically, in addressing the research necessary for meeting the goals of the SFYP. Similarly, the ARPG committees should become more effective--by reassessing their membership, responsibilities and procedures--as outlined in Appendix B of the BARC April 1980 "Implementation" paper. It must be remembered that BARC, with its rebirth essentially in 1979-80, will require some time to mature and it would be unfair to expect too much too soon from this young organization.

Performance of other research institutes and programs is irregular, ranging from good to very poor and essentially unproductive. It was not possible for the Review Team to assess the work of these organizations in sufficient depth to present objective, critical judgment regarding them. However, from meetings with representatives of some institutions, from discussions with Bangladesh personnel familiar with them, and contacts with technical assistance personnel of cooperating donor agencies, it is apparent that an intensive review of the work under way, the conceptual leadership, the direction and management, the servicing procedures for procurement of equipment, supplies, etc., and other factors should be undertaken. This best could be done by a joint team of external specialists together with experienced Bangladesh officers in a position to provide constructive critical analyses.

It is most unfortunate that some research institutes are not effectively utilizing many millions of dollars of external aid because of internal administrative and procedural constraints. This situation must be corrected if Bangladesh is to maintain the confidence of external cooperators and, more important, to receive the benefits that should accrue from such assistance.

C. Organization and Integration

1. Fragmentation of Research Capabilities

Reviews of research capabilities and opportunities for strengthening the national research system have consistently and rather emphatically pointed out, since 1973, that a major constraint to building a strong, effective, and efficient research system for Bangladesh is the dispersal of the research institutes and centers, with their substantial autonomy, throughout so many ministries. Figure 2 shows the fragmentation of institutions conducting agricultural research at the time of the Joint Team review in 1978-79. In spite of the strong recommendation by that team for consolidation and integration of national research institutions, the shifting and separation continues. The Jute Research Institute (JRI) has recently been transferred from the Ministry of Jute to the Science and Technology Division.

Sugarcane research, transferred from the Ministry of Agriculture to the Ministry of Industries, with the Sugarcane Research Institute (SRI) station at Ishurdi transferred to the Bangladesh Sugar and Food Industries Corporation (BSFIC) in February 1973, was performing less than satisfactorily in 1978. It is in a further deteriorated state in 1980 and there is every indication that the valuable assistance from Australia is being poorly utilized and will leave little, if any, beneficial effect.

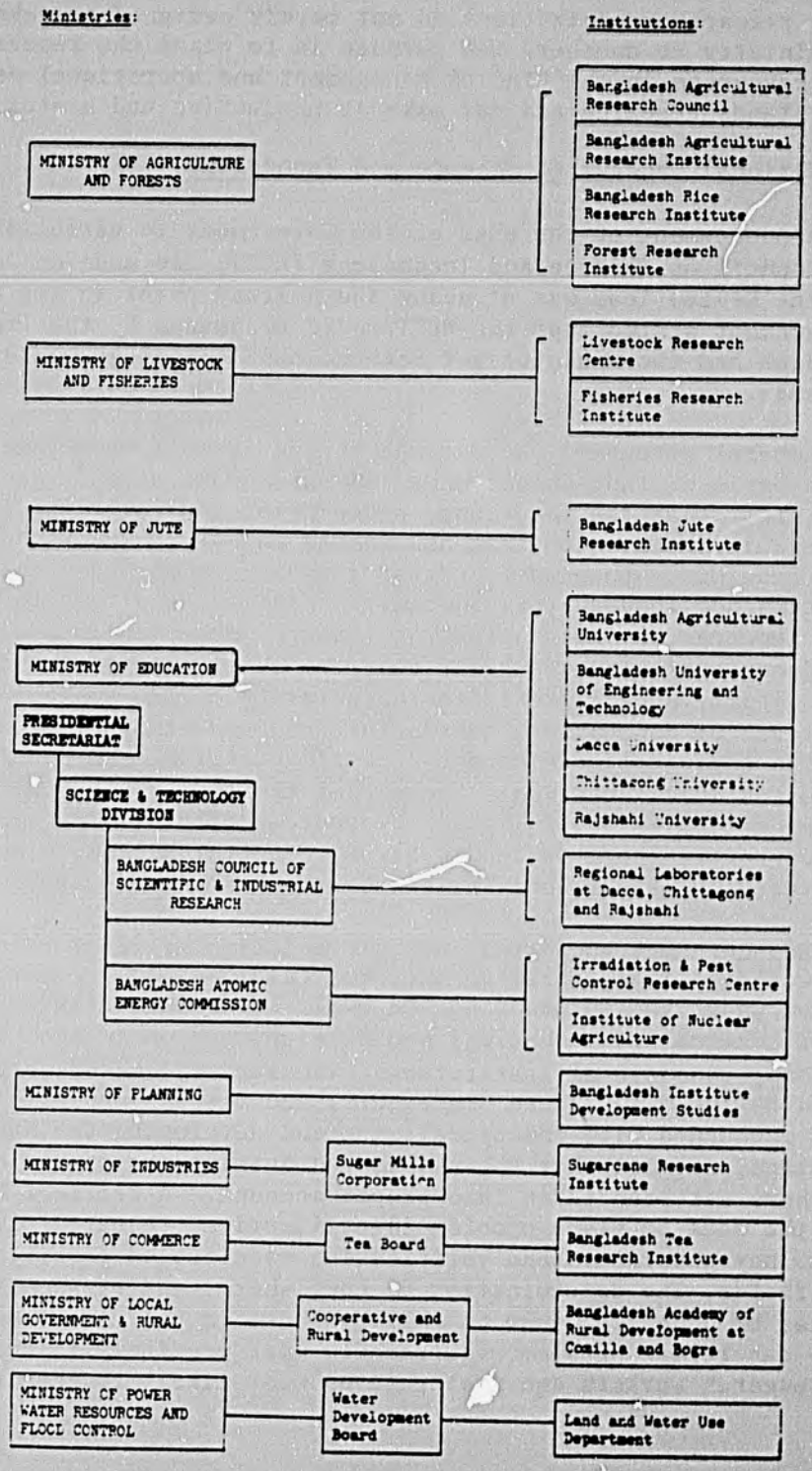
It is difficult to understand why such an obvious limitation to the national research capabilities is not being rectified in view of the absolutely urgent need for improved technology to meet SFYP goals.

As pointed out in Chapter II and ANNEX VI of this report, one of the most promising possibilities for increasing agricultural production is intensified applied and adaptive research on farming systems. This focuses the research on specific problems of the farmer, with adaptive trials on farmers' fields, and ensures not only the suitability of the technology but its rapid adoption.

Farming systems research involves not only crops but livestock, fisheries, soil and water management, integrated pest control, socio-economics, and engineering applied to all aspects of agricultural production and farm processing. If new technology is to be developed so that it can be used by the farmer in an acceptable package of improved production practices then the new technology should be developed in that integrated way. Bangladesh, primarily through BARC, is attempting to move into the modern patterns of integrated, multidisciplinary, multi-institutional research on a national and regional basis. But research workers and project coordinators are continuously constrained by bureaucratic institutional barriers.

It is highly desirable that serious consideration be given to the transfer and consolidation of the Sugarcane Research Institute, Jute Research Institute, Tea Research Institute, Institute of Nuclear Agriculture, and the Livestock and Fisheries research resources, under the

Figure 2. Institutions Conducting Agricultural Research in Bangladesh



Ministry of Agriculture and Forests. India undertook such consolidation of research institutes, under the Indian Council of Agricultural Research, in 1965; and Indonesia did so in 1974, through assistance of a World Bank loan, placing the many separate autonomous institutes under the Agency for Agricultural and Rural Development. The consolidation of Bangladesh research organizations is not merely designed to take a unit from one ministry to another. The purpose is to place the research manpower and resources in the kind of management and operational environment that understands research and can make it productive and useful.

2. The National Council of Science and Technology

The announcement of the plan of the Government to establish a National Council of Science and Technology (NCST) was made on July 5, 1980, as the Review Team was at about the halfway point in its assignment. The announcement stated that the NCST would be headed by the President of Bangladesh and the Minister for Science and Technology would be the Vice-Chairman.

The general structure and purpose of the Council have been elucidated, but on the basis of the announcement and subsequent discussions it is not fully clear what the functions, procedures, and authorities will be or how they will relate to those now vested in BARC. The principal purpose of the NCST--to ensure greater research support for subject or problem areas now inadequately funded--is most certainly in the national interest. However, recent reviews of research organizations both within and outside of agriculture suggest that the level of funding, particularly external support, usually reflects the priority of the subject area and also the level of conceptual, managerial, and operational leadership of the research organization. The disappointing returns from substantial external assistance investments because of the latter constraints must be assessed carefully and fully in the process of achieving balanced research support. There must not only be a better balanced input but also assurance of a reasonably balanced return on investments.

The announcement suggested that all existing national research councils would be reorganized as sectoral "coordinating" research agencies, to function under the guidance of the NCST. It further stated that the pursuit of science and technology would be undertaken in such research institutions, educational institutions, industries, and other places as determined by the NCST. These statements, and discussions with some officials concerned with conceptualizing and developing the NCST to the present stage, suggest that the nature and intricacies of agricultural research have not been taken into proper account. A critical basic issue is the need to place problem identification, research planning, and technology generation and verification as close as possible to the farmers' fields. The determination of how, where, and by whom the research should best be done also must be made by those in the direct operational line--who can relate problem requirements most precisely to the capabilities of research workers and institutions most likely to resolve them.

It seems that a serious assessment of the nature of the problems in agricultural research and technology development and of the intensive efforts to strengthen the institutional structure for the national agricultural research system of Bangladesh has not yet been made in the formulation of the NCST. It is increasingly appreciated that "coordination" is an ill-defined term used to designate a frequently overvalued function. Coordination does not create technology, it may improve cooperation and efficiency in a system, or--too often--it merely reshuffles resources. The futility of national councils concerned primarily with fund allocation and coordination is well documented in the experience of the Indian Council of Agricultural Research from 1947 to 1965, the Pakistan Council of Agricultural Research from 1947 to 1975 (and still persisting), and the Bangladesh Agricultural Research Council as set up in 1973, as reviewed earlier in this report.

3. The Future of the Bangladesh Agricultural Research Council

The meeting of the Review Team with Dr. Iqbal Mahmud, State Minister of Agriculture and Forests, on July 12 provided substantial clarification of the above issues and reassurance that the Ministry of Agriculture and Forests is fully aware of the importance of maintaining an organization with the functions and authorities of BARC. In discussing the proposal that the designation of "Council" may be dropped from BARC, the team called attention to the deleterious effects of such changes in well recognized and established research agencies in many parts of the world. An institutional name does carry stature and a change in name, rightly or wrongly, usually connotes a dissatisfaction with and a downgrading of the organization. The ministry is alert to this situation and indicated that if a decision were taken by Government to eliminate the term "Council" from BARC, it would seem appropriate to change the name to the Bangladesh Agricultural Research Authority (BARA).

A continuing weakness of BARC has been the undefined status of the Executive Vice-Chairman and Member-Directors of BARC vis-a-vis the Secretariat of various ministries, heads of divisions, the Planning Commission, and other agencies. This lack of clarity in the stature or level of authority of the Vice-Chairman of BARC is considered to be a principal factor in the poor attendance of such government officials at important BARC meetings. This seriously limits the effectiveness of BARC, not only in the review and planning of research, but also in keeping such officials well informed about priority problems in agriculture, progress in research, and, in general, providing a better mutual understanding of the total national agricultural research system.

The senior agricultural research and development administrators from Bangladesh who studied the research systems of Indian, Indonesia, and the Philippines in October 1978 were impressed with the nature of the linkage of the Indian Council of Agricultural Research (ICAR) with the Ministry of Agriculture. It is recommended that in view of the positive ICAR experience, the BARC Secretariat be elevated and established as a Research Division under the Ministry of Agriculture and Forests, with the Executive Vice-Chairman of BARC to serve concurrently as Secretary

for research and education within the Ministry of Agriculture and Forests. The head of BARC should be ex officio member of NCST in charge of agricultural sciences. This would be especially significant in:

a) Planning, integrating, and monitoring research among institutes or agencies of different ministries, to ensure maximum effective use of scarce research resources.

b) Developing plans, programs, and more effective liaison with the Planning Commission.

c) Coordinating, reviewing, and recommending to appropriate governmental authorities all external support proposals and projects for support of agricultural research.

The latter function is of special significance in giving effect to the following memorandum of the External Resources Division (No. ERD-7(2) IDA-88/77 dated April 21, 1979):

Government of the People's Republic of Bangladesh
Ministry of Finance
External Resources Division

No. ERD-7(2)IDA-88/77 April 21, 1979

OFFICE MEMORANDUM

The undersigned is directed to inform all concerned that the views and recommendations of the Bangladesh Agricultural Research Council (BARC) should have to be obtained before finalising any externally funded agro-oriented research Project. The above is necessary in pursuance to the provisions of the BARC ordinance.

Sd/=

(M. A. Malek)
Research Officer

Distribution:
All Officers of ERD.
Copy for information and kind compliance:
1. Member (Agriculture), Planning Commission.
2. Secretary, Ministry of Agriculture & Forests, Bangladesh Secretariat, Dacca.
3. Executive Vice-Chairman Bangladesh Agricultural Research Council 130/C, Road No. 1, Dhanmondi R/A, Dacca.
4. Mr. A. K. Seth, Agricultural Economist IBRD, Local Office, Dacca.

Sd/=

(M. A. Malek)
Research Officer

The foregoing actions (1) ensuring the continued identity and stature of BARC by redesignation as the Bangladesh Agricultural Research Authority (BARA) if Government takes the decision that the name "Council" must be dropped; (2) elevating the BARC Secretariat to the status of a Research Division in the Ministry of Agriculture and Forests; and (3) transferring the several research institutes and resources, as specified, into the Ministry of Agriculture and Forests would significantly strengthen the organization and integration of the Bangladesh agricultural research system.

IV. FURTHER STRENGTHENING OF THE NATIONAL RESEARCH SYSTEM

A. Program Planning and Priorities

Great strides have been taken in agricultural research program planning at both the national level and the research-institute level. This is evidenced by the various planning exercises undertaken by BARC culminating in the "National Agricultural Research Plan" published in December 1979; while a similar in-house planning exercise conducted by BARI led to the publication of the "Second Five Year Research Program of BARI" in January 1980.

The importance of research program planning and priorities had been stressed by the Joint Research Review Team in their report dated February 1979. A few months later, two consultants were brought in [under the IDA financed Agricultural Research Project (Credit No. 878-BD)]. One was engaged by BARC in March-April 1979 to advise on the initiation of a mechanism for national agricultural research program planning. The other was brought in by BARI in April-July 1979 to advise on the development of a Master Plan for the Bangladesh Agricultural Research Institute. The speed with which various aspects of the two consultants' reports were implemented underscores the importance research leaders in Bangladesh attach to research program planning. The research plan documents produced are now undergoing review, leading to the second stage of refinement. Thus, it would be necessary to undertake the plan refinement stage soon in order to ensure that research programs during the Second Five Year Plan period address relevant research and development goals.

1. National Research

Planning for the agriculture sector was started in April 1979 with the formation of the basic planning units for the national agricultural research program--the Agricultural Research Planning Groups (ARPG), which were constituted by BARC in collaboration with the Planning Commission and in consultation with the heads of BAU, BARI, BRRI, JRI, and the other research institutes. Thirteen commodity-oriented and nine non-commodity-oriented ARPGs were formed. Each of the ARPGs, headed by a leader, was composed of various members responsible for each of the identified disciplines or specialty areas. A meeting was held on 3 May 1979 at BARC with representatives from the Planning Commission, research institutes and centers, universities, and other organizations concerned with agricultural research and planning. The meeting was also attended by the State Minister for Agriculture and Forests. During the succeeding months, eight regional research meetings were held, two each in Dacca, Ishurdi, Jessore, and Comilla. A 2-day national workshop on the draft agricultural research plan was held in August 1979 followed by another meeting of the research leaders on 16 November 1979 to critically examine the plan before presenting it. The urgency behind the planning exercise was the December 1979 deadline set by the Planning Commission for the national agricultural research plan to be considered and incorporated in the Second Five Year Plan of the Government. Considering the methodology

used in the planning exercise and the amount of work put into the process, the National Agricultural Research Plan can be considered an important first stage document and a major forward step for the national agricultural research system of Bangladesh.

Since planning is a dynamic process, it is important to build on the strengths and profit from the weaknesses of the previous exercise. In a spirit of constructive critique, the following observations regarding the implementation of the first stage planning exercise are put forward:

a) Because of the limited time available, the stepwise methodology outlined in the consultants' report "Agricultural Research Planning in Bangladesh" (by Dr. J. C. Madamba, April 1979) was not closely followed and some major "short-cuts" and departures had to be made from the recommended methodology

b) Selection of the members of the ARPGs was not carefully done and in fact was left solely in the hands of the ARPG leaders who probably did not understand the critical need to fit the appropriate scientist to the specific discipline representation called for in the ARPG

c) The participation of members of some ARPGs was superficial as indicated by the absence of the discipline-oriented papers they were to prepare

d) The contribution of problems and ideas from the regions was rather slim even though two meetings were held in each regional site

e) There appears to have been hardly any participation from farmers at the regional meetings

f) The needed periodic consultation and interaction among the ARPG leaders, the sectoral leaders, and the Program Planning and Review Board did not occur

g) The organization of the planning exercise appeared to be a one time event, with no evident mechanism for continuity.

In light of the experience gained from the first stage, planning for the second stage should be initiated soon. More efforts should be made this time to start with regional consultation in order to ensure that meaningful regional research priorities result. Such regional priorities are critical for mapping the programs to be undertaken at the various regional research stations and substations. Also, the second-stage planning exercise should continue through the various phases suggested in the methodology outlined in the research planning consultant's report.

2. Institute-Level Research

Planning undertaken by BARI during the latter half of 1979 was essentially an in-house exercise. Four multidisciplinary Task Forces

were appointed by the BARI Associate Director for Research, each covering areas on which programs were developed. The membership of each Task Force represented different scientific disciplines in the various BARI divisions coming from the central and regional experiment stations. The terms of reference provided to each Task Force were based on the terms in the BARI Master Plan report by the consultant Dr. R. L. Cushing. The output of the planning exercise clearly differentiated a research objective from a research program, a research project, and an experiment. The methodology used appears to have been well-executed and included an indication of constraints, research needs, priority status, divisional responsibility, manpower and fund requirements, duration, and adoption potential.

The only reservations regarding this in-house planning exercise are the lack of farmer feedback, regional problems and ideas were not adequately represented, and potential agency linkages were not clear.

Ideally a complete national agricultural research plan should have been available together with regional research priorities so that the institute scientists could clearly identify their roles in addressing national and regional research priorities.

3. Determinants of Agricultural Research Priorities

Many factors influence the establishment of agricultural research priorities and the organization and management of formal agricultural research systems for generating improved technology.

Agro-economic problems of users of technology. One influence is the users of agricultural technology in Bangladesh. These are the large, small, and marginal farmers as well as the landless laborers, village artisans, and rural women. Their "technical" problems can only be diagnosed and possible solutions found through well focused, regional socio-economic surveys and multidisciplinary research planning.

National development goals, policies, and strategies. The second set of influences are national goals and development plans. These are critical for determining technical research priorities. Only through the application of national development objectives can the problems of different groups in the rural society be ranked by importance, facilitating the allocation of scarce research resources to one set of activities rather than to another.

Special interest groups. The third set of influences are the special interest groups, including research scientists with their career objectives and foreign donors with their preferred areas for research support. The degree to which foreign technology and research methods are promoted with little regard to their suitability in Bangladesh is especially important. Special political and institutional interests also weigh heavily in determining the priorities for generating agricultural technologies.

Prior to the recent emphasis BARC has given to research program planning it would appear that there was in Bangladesh a strong "supply push" approach to agricultural technology generation, with the major influence for deciding priorities coming from special interest groups (Figure 3). Symptoms of this situation were the limited spread of technology from some institutes that have been in existence for many years, the proliferation of inefficient research institutions and research stations, the lack of coordination in research, the lack of incentives for problem-solving researchers, and, as regards national goals, the lack of active research on labor-intensive techniques to raise productivity.

The relationships, however, are changing to the situation as shown in Figure 4 where the major influences on research priorities are the agro-economic problems of users and national development goals. The influence of special interest groups is reduced. In any country these three major forces are always at work; it is important in allocation of scarce research resources that the influences are explicitly recognized and that a desirable balance is maintained.

B. Research Manpower

1. Requirements

Trained scientific manpower is the foundation of research and development. Although agricultural research in Bangladesh dates from long before independence several seriously disruptions have occurred. The need for more and better scientists is now more acute than ever.

Bangladesh is strengthening its research competence and developing an enlarged national research network. The central research station at Joydebpur is in operation. Four regional research stations are being developed. Other research facilities and programs are in the planning and development stages.

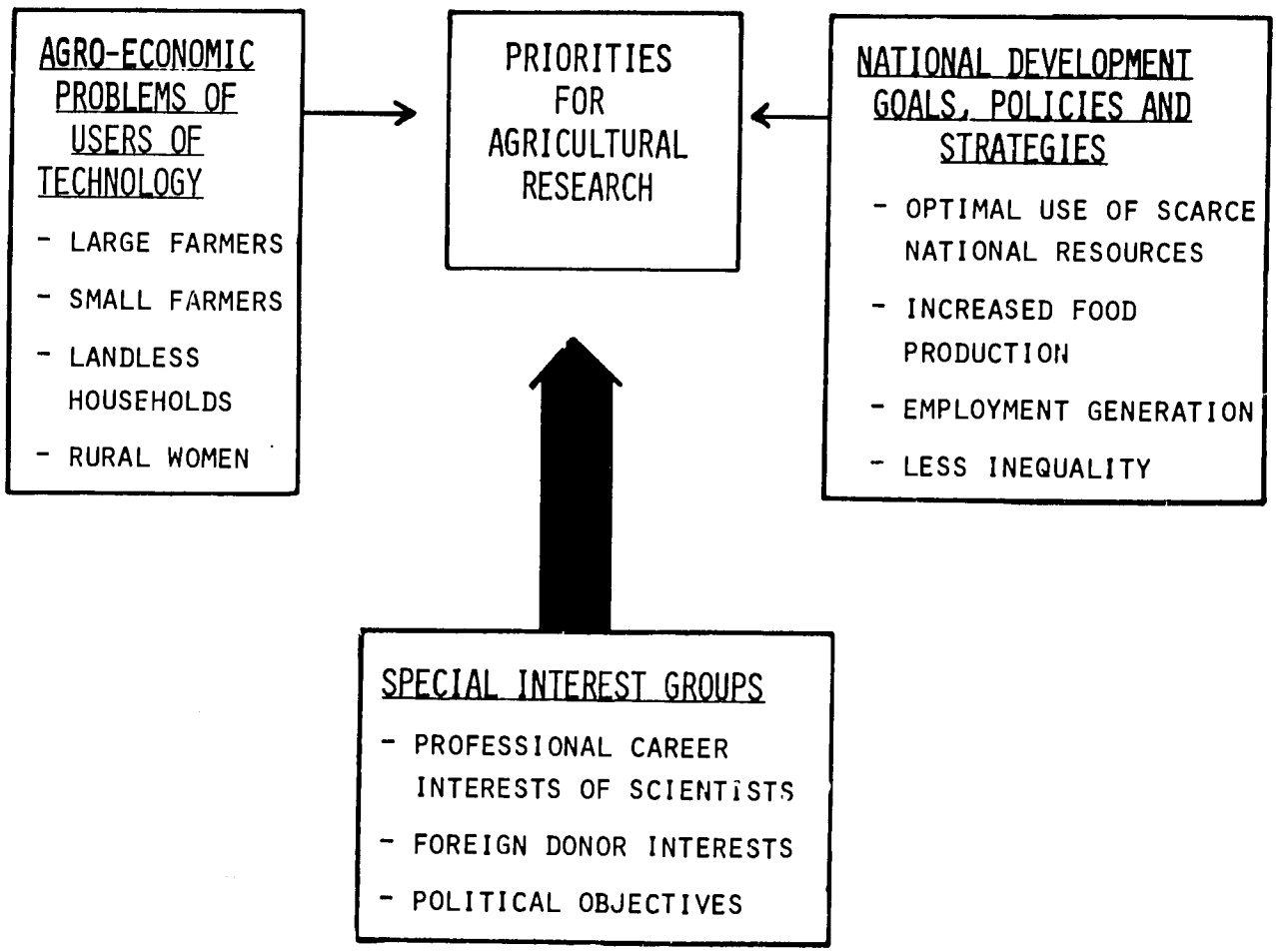
But it appears that planning for and providing an adequate quantity of scientifically trained manpower has not matched the physical development stages. There are some 20 institutions and universities conducting agricultural research (and this does not count the research sub-stations).

The team did not have opportunity to study the manpower situation in depth. However, the report of the Joint Research Review Team published in April 1979 states (page 33) that BARC on July 18, 1978, published a paper entitled "Agricultural Research Inventory in Bangladesh," which summarizes the scientific and technical manpower of agricultural research. The distributions are shown in Table 3 of that report. Furthermore (page 33), "According to the Directory of Agricultural Scientists in Bangladesh mentioned in the BARC inventory of July 18, 1978, there are about 779 persons in agricultural research with graduate training. The graduate degrees include 132 Ph.D., 42 M.S., 434 M.Sc./M.Ag., and 161 B.Sc./B.Ag., and there are at present 43 research administrators, 233 senior scientists,

FIGURE 3

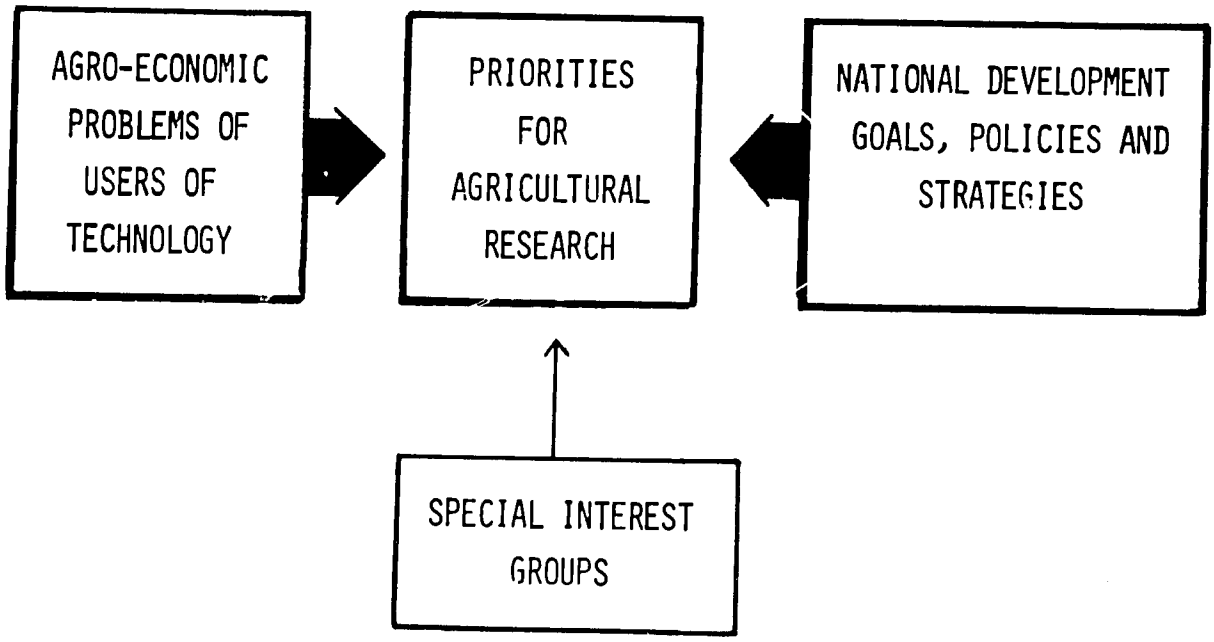
DETERMINANTS OF AGRICULTURAL PRIORITIES

CURRENT SITUATION



NOTE: SIZE OF ARROW DENOTES RELATIVE INFLUENCE

FIGURE 4
DETERMINANTS OF AGRICULTURAL PRIORITIES
DESIRED SITUATION



NOTE: SIZE OF ARROW DENOTES RELATIVE INFLUENCE

and 503 scientists working in agricultural research including forestry, fisheries, and livestock."

Table 1 in the August 1979 Master Plan for the Bangladesh Agricultural Research Institute shows that in 10 institutions, including livestock, fisheries, and the larger institutes, there were 890 technical officers and 1,129 technical staff. The largest of the institutes, BARI, reports a roster of 500 technical staff. The staffing at BAU is reported in ANNEX IX, below.

The report of the Special Committee Constituted by Government to Examine the Report of the Joint Research Review Team addresses the scientific manpower situation in strong terms (Chapter III):

> The quantum and quality of research depend primarily on the knowledge, skill, and competence of research staff engaged in research. Similarly, expected pay-off or productivity in research is directly correlated with the competence of the personnel of the quality of scientists engaged in it.... Recruitment of human material for research establishment, therefore, has to be carefully done, so as to ensure that only young researchers with good academic background and excellent motivation are appointed.

The team fully supports the quotations cited above. Assessment of adequacy of scientific staff numbers in any institution and their competence is a continuing process, which should be done by BARC.

The team believes that staffing in some disciplines is out of balance; some disciplines may be overstaffed and others understaffed. Furthermore, donor influence has been one cause of the existing scientific staff configurations. Nevertheless, the job at hand is to develop a procedure to cope with the ever changing needs as the national research station network is developed.

New research programs requiring more scientific staff and, in some cases, a new approach to research are being developed. Farming systems research is an example. This research will study clusters of farms in all important aspects. The focus will be on helping the small farmers use their meager resources to improve their incomes and quality of life. Scientists from the basic disciplines will be called on to do this research, but in teams and under village conditions, not in controlled experiments on research stations.

2. Development and Training--BARI Capabilities

The central research station of BARI at Joydebpur is the largest and best equipped station in Bangladesh. Four additional BARI regional research stations are in the early stages of development. Four of the major crops plus forestry, livestock, and fisheries have their own institutes/centers, leaving BARI responsible for cereals (other than rice), pulses, oil seeds, fruits, vegetables, minor fiber, potatoes, and tobacco. Feed and fodder crops research is being added.

Whether BARI becomes an effective and prestigious agricultural research institute will depend on how well it plans and executes its programs and applies its resources to the country's stubborn agricultural problems.

The team was impressed by the high quality of the physical plant at Joydebpur. There also seems to be a longer term opportunity to develop an integrated campus atmosphere which would include BARI, BRRI, and CERDI.

Among all the research institutes, the central headquarters at BARI has the largest number of agricultural technical officers and supporting technical staff. Research is under way on a variety of agricultural problems. The staff was contacting farmers to observe and help solve their problems and test new technology on farmers' fields. The scientists participated in a limited way in training programs for extension workers and actively participated in CERDI training programs. BARI is the headquarters for the "on-farm research program."

Although the Central Station of BARI is still developing a research program and its public services program, it is the team's judgment that it will be, if it is not already, a very strong research and training institution. It deserves full support.

3. Performance, Incentives, Merit Promotions

The April 1979 Joint Research Review Team identifies the need to establish personnel policies for scientific personnel. Its report stated (page 35), "attention should be given to classification of positions to establishing suitable grades and standards for respective research and research leadership posts and improved procedures for recruitment, promotion, and terms of service. Special considerations are needed to development of criteria and methods for promotions on basis of performance and merit, with less emphasis on seniority as a promotion factor." The statement also calls for "salaries, advanced training opportunities, perquisites, etc., that would equalize compensation for research scientists--in the different institutions and programs."

The report of the Special Committee Constituted by Government to Examine the Report of the Joint Research Review Team states (Recommendation 1(a) Chapter III), "Selection of initial recruitees through a nationally constituted selection board composed of leading scientists is therefore a prerequisite. Besides, personnel policy with regard to scope for promotion, advanced training, and professional growth--play a very important role to attract and retain good scientific staff."

The team endorses the statements from both reports.

C. Facilities--The National Research Station Network

Research stations and laboratories have improved markedly in the past decade, with BRRI, BARI, and other institutes have developed first-class

facilities. The state of development of several of the central and regional stations has been observed by the Review Team and recommendations for further attention and support to the national research station network can be considered.

1. The Joydebpur Research Center Complex

The recent decision by the Government to develop the Joydebpur Campus as the Central Experimental Station for BARI and BRRI, as well as the CERDI Training Unit, has led to an impressive physical plant. There is an urgent need to review critically the complete physical facilities at the Joydebpur Campus, including research, education, services, and laboratory and farm equipment. The assessment of physical plant and facilities would aim to determine for the entire Joydebpur Campus which resources might be shared among institutes or which need development, purchase, or construction.

Shared resources at Joydebpur. Among the campus facilities that should be evaluated for sharing are:

a) National Agricultural Library and Services

b) Repair and maintenance facilities--Laboratory; Farm equipment

c) Procurement, maintenance, and repair of expensive laboratory equipment

d) Rodent Control Center

e) Documentation and Data Processing Center (or centralized services under BARC)

f) Soil and Plant Service Laboratory Center

g) Training Resources Center

h) Schools and shopping facilities

i) Athletic and Entertainment Center

j) Security/Police

Joydebpur Campus authority. It would seem appropriate that in the assessment of the Joydebpur Campus a Director and Deputy Director be appointed for the entire Joydebpur Campus. One alternative would be to designate the senior-most director of a Campus Institute as Campus Director. He would head a standing committee of shared facilities. The role of the Campus Directorate would be to plan, coordinate, monitor, and provide management control of all buildings and facilities of the Campus, with special reference to those shared by the Campus scientific officers and families.

2. Other Major Central Research Facilities

In addition to BARI and BRRI, a number of institutions are concerned with research on major commodities or problem areas, including:

Bangladesh Jute Research Institute (BJRI)*
Sugarcane Research Institute (SRI)*
Institute of Nuclear Agriculture (INA)*
Tea Research Institute (TRI)*
Livestock Research Centers**
Fisheries Research Institute**
Forest Research Institute**

The facilities of these organizations, most of which are receiving assistance from bilateral aid agencies, were not assessed by the present Review Team, but were visited by the Joint Research Review Team set up by the Ministry of Agriculture and Forests to consider the strengthening of the Bangladesh Agricultural Research System. The Team Report of April 1979 recognized the need for improvement in facilities and equipment for those organizations.

3. Regional Research Stations

There has been an increasing awareness of the importance of conducting research on the complex of conditions facing farmers in the various agro-climatic regions of Bangladesh. In doing so researchers become familiar with the conditions that confront farmers, including socio-economic factors. This is essential if regional extension and technological information is to be generated.

The strengthening of research on farming systems, as discussed elsewhere in this report, is essential for meeting production goals of the SFYP. Farmers must apply new technology in combinations that are compatible and productive. The research to develop, verify, and make available adapted technology should embrace all commodities (crops and livestock), farming practices, soil and water resources, and economic and social conditions in the locality.

The recommendation in Chapter III that certain research organizations now scattered throughout many ministries should be placed under the Ministry of Agriculture and Forests is designed to facilitate farming systems research throughout Bangladesh. The development of multi-purpose regional research stations to work on the natural resources and crop and livestock problems of the area should be given immediate attention. The support of USAID for improving the regional station at Ishurdi, and of the World Bank to develop the regional stations at Jamalpur, Jessore, and Hathazari (and the Ramgarh Substation) is most significant in building the base for multi-purpose, farm-level research.

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*Semi-autonomous organization. **Government organization.

4. The Role of Bangladesh Agricultural University (BAU)

The many excellent laboratories and good experimental field facilities of the BAU should be utilized more effectively. The campus has 1,080 acres and is located on the banks of the Brahmaputra, 72 miles north of Dacca. The Institute of Nuclear Agriculture (under the Atomic Energy Commission) and the Aquaculture Experiment Station (operated by the Fisheries Department) are on the campus.

The laboratories and research fields appear to be underutilized. The location of the BAU, the research facilities, and the cadre of trained staff furnish a special resource that should be used in the national research system--in addition to the educational role of the BAU.

5. Rationalization of Regional and Substation Needs

Most research stations in Bangladesh are mono-crop or commodity stations, as shown in Figure 5. It is essential to have a sufficient stations for evaluating new technology under variable farming conditions. However, an excess number of small, understaffed, poorly-equipped mono-crop substations that are often poorly located is ineffective, inefficient, and costly.

There should be a thorough assessment of the agricultural research stations to determine where additional stations may be needed, which stations should be closed, and what combination of good regional stations and substations would best meet the needs of the various regions. There is already an awareness that research station facilities should be strengthened in the northeast and in the saline lands of the southwest.

D. Organization and Management

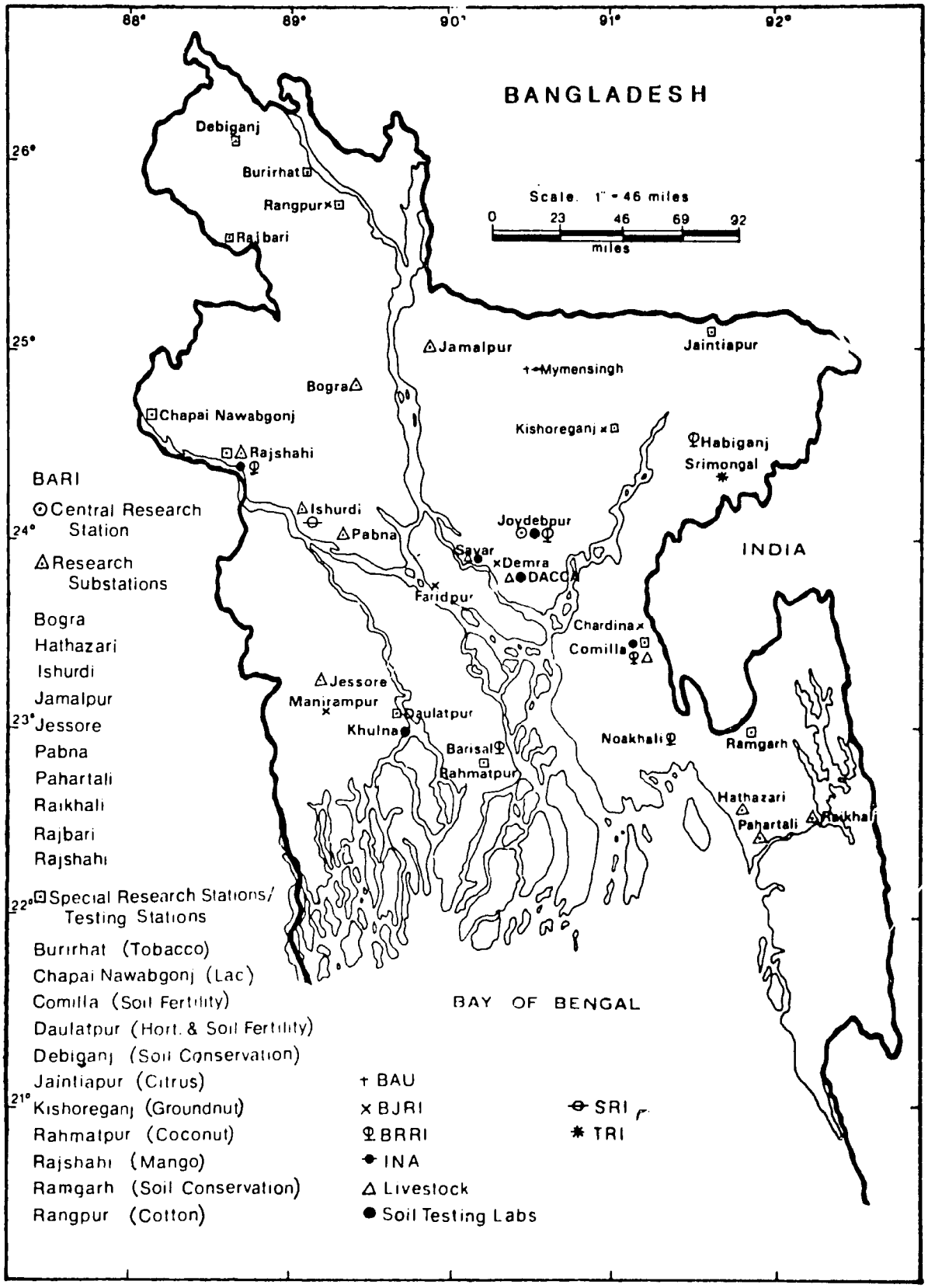
1. Integration of Agricultural Research Resources

The excessive fragmentation of research resources in Bangladesh among many different ministries and organizations has been discussed in Chapter III. The consolidation of the research organizations, as indicated, into the Ministry of Agriculture and Forests is a critical factor in developing the cohesive teamwork and professional scientific atmosphere essential to productive research. Also, unless the scientists have an institutional bond they will continue to work on a piecemeal basis, which is inconsistent with the needs of farmers for integrated combinations of new technology.

2. Proliferation of Additional Research Centers and Cells

The Review Team was alerted to proposals by a number of organizations that they planned to undertake research within their facilities and stations because they were not satisfied with the availability, or suitability, of the varieties or other new technology expected from the research

FIGURE 5. Agricultural Research Station Network in Bangladesh



organizations. It would be duplicative and wasteful for the Bangladesh Agricultural Development Corporation (BADC), or the Bangladesh Council for Scientific and Industrial Research (BCSIR) to undertake research for which BARI, BRRI, or other recognized research institutions are responsible. On the other hand, BARI, BRRI, etc., should not move into research areas that are the responsibility of BCSIR. There must be better communication among research organizations and development organizations to ensure awareness of each others needs, activities, and interrelationships. Similarly, it would be counter-productive for well-funded commodity research programs to be split off into separate institutes.

Of equal concern is the uncertainty with respect to the "research" function of the Bangladesh Extension and Research project supported by the World Bank. Increasingly, these types of projects are backing into the research function, under the notion that "adaptive" research should be handled by extension workers. The discussion elsewhere in this report emphasizes the need for multidisciplinary, problem-oriented research to be conducted within a farming systems framework, at multipurpose regional stations and substations, as well as on farmers' fields. This is essential for verification of suitability of the new technology for farm conditions. The job of generating new technology, verifying its suitability under various regional agro-climatic conditions, and then adapting it to specific local farm sites is the job of the trained research specialists. If the new technology does not suit the requirements of the BADC or the extension workers it is evidence that the researchers have neither completed their work nor fulfilled their obligations to the farmer.

3. Improving Management Procedures

There is continuing concern about the constraints to research from cumbersome and restrictive management procedures. This problem has been emphasized by previous reviews and the following recommendations of the Joint Research Review Team, in their report of April 1979, Strengthening the Bangladesh Agricultural Research System, are still relevant:

> Recommendation 11. BARC should appoint qualified and capable staff members to serve as "research system development officers" in furnishing leadership for such activities as: (1) program planning and budgeting, (2) manpower development and personnel management, (3) research facility planning and development, (4) evaluation and application of technology, (5) information, library, and documentation services, and (6) coordination of external support. These duties require special qualifications, with training and experience beyond that customary in the usual scientific disciplines.
>
> Recommendation 20. Administrative and technical support services should be improved throughout the national agricultural research system. This includes attention to a) development of data processing facilities and central records of research to be maintained in BARC, b) improved procedures for procurement of equipment, supplies, and materials, c) expeditious handling of personnel action, d) improvement of transport and communications services, and e) the development of

library and documentation services that would facilitate maximum availability and extended use of scarce and costly books, journals, and reports. Special Officers should be appointed to the BARC staff, as required, to develop these improved procedures and services.

The Special Committee constituted by the Government to examine the reports of the Joint Research Review Team stated, with respect to Recommendation 11, "This is considered to be highly important. The Council should lay down leadership in research system activities." With respect to Recommendation 20 the Special Committee stated, "Recommendation is endorsed and action suggested for BARC, accordingly."

Action by BARC on the foregoing matters should be prompt if the national agricultural research system is to function as it should in meeting the SFYP goals.

4. Coordination and Evaluation

The many conceptions of the term "Coordination" have become an escape hatch--to avoid making the hard decisions to integrate fully the research resources of Bangladesh to get farm-level, problem-solving research done. Coordination is not acceptable if it is construed as control or dominance by a given leader or institution. It is not effective if it is handled by a person who is not participating in the actual research, who lacks in-depth understanding of the roles, capabilities, and performance of the participating cooperators, and who serves merely as a chairman of infrequent meetings.

Coordination of multidisciplinary agricultural research involves a mutually respected, loose association of individuals--highly trained in their special fields or disciplines--who work in an integrated manner to tackle the constraints to production that each of the individuals is best able to resolve. It is a working association, with each participant having a role in identification of the problem, the planning of the joint attack, the conduct and monitoring of the experiment as it progresses, the evaluation of the results, and the development of reports and recommendations. Such loosely linked but closely involved working teams are usually impossible to assemble if the participants must climb the bureaucratic ladder of separate institutions and then descend again before they can pursue their roles in the joint undertaking.

5. Research Program/Project Evaluation

The procedure for evaluating research programs, as differentiated from research projects, should be clearly spelled out. In this connection, the following suggestions are made:

a) Research program evaluation should be the responsibility of the members of the concerned ARPG as they meet annually to evaluate relative importance of new research program proposals and review/analyze progress as well as gaps in the nationwide implementation of the research program which their particular ARPG is supposed to monitor.

b) Evaluation of new research project proposals should be implemented through a flexible mechanism through an ad hoc project evaluation committee (always chaired by the ARPG leader) with membership of one or two scientists with appropriate expertise to cover the research disciplines concerned (possibly one from within the institution of the proponent and one from outside). The role of the ARPG leader is important to provide coordinative continuity and ensure that research projects tie in with the national research program in a given commodity or non-commodity program area.

The Joint Research Review Team (April 1979) presented the following recommendations with respect to coordination and evaluation in the national agricultural research system:

Recommendation 9. The PPRB and the technical committees of BARC should give greater emphasis to coordinated national problem-oriented research projects, with multidisciplinary and multi-institutional participation, to ensure the effective involvement and efficient use of the limited manpower and other research resources of Bangladesh.

Recommendation 10. The staffing of BARC should be reviewed to ensure that the number of scientific and support staff is adequate to carry out the responsibilities of BARC. The officers must be highly qualified, respected scientists in their fields, capable of furnishing analytical, conceptual, and planning leadership in implementing the work of BARC.

Recommendation 13. BARC, through the PPRB, should evolve a uniform project structure that would describe the research work underway in the national agricultural research system and that would clearly define the units of work as a basis for program planning, for establishing research priorities, for budgeting, and for accounting. The project structure should provide a record of objectives and plans of work for guidance of the research staff, a basis for direction and management of research, a framework for the regular reporting of progress, and for evaluation of performance of research units and of individual research workers.

Recommendation 18. Priority attention should be given to the direction, implementation, and monitoring of research programs. This will require the designation of capable program or project leaders who would continuously evaluate research underway, identify limiting factors or constraints, and arrange for an annual review to assess progress and to plan ongoing research.

The Special Committee noted that action on Recommendation 9 is under way. With respect to Recommendation 10, the "Special Committee recommends a revised structure (of BARC) to ensure such a staff." In assessing Recommendation 13 the Special Committee noted, "Such a uniform project structure is under preparation and will form the basis for submission of all future projects." The Special Committee comment on

Recommendation 18 was that "this is already in practice but will be further strengthened as per recommendations." With the solid endorsement of the Special Committee, the Review Team hopes that BARC will actively pursue the implementation of the above recommendations.

6. Role of BARC Member-Directors and ARPG Leaders

There is some uncertainty about the role of the BARC Member-Directors and the Agricultural Research Planning Group (ARPG) leaders with respect to coordinated programs. The Joint Research Review Team (pages 67-69 of the 1979 Report) proposed:

a) The technical committees or working groups should preferably be chaired by a person outside of BARC who has a major responsibility for the commodity or program area--the Director of BRRI for rice, the Executive Director of BJRI for jute, etc.

b) The head of the appropriate Division of BARC (the Member-Director) would serve as the convenor for the committee or working group and would be responsible for keeping abreast of the subject area, for special in-depth reviews, for preparing working papers for the committee or working group, and for follow-up action on committee decisions.

c) With respect to national coordinated research programs it was proposed that the coordinating leadership be handled by the relevant institute--BRRI for rice, BJRI for jute, etc.--or by highly qualified persons from other participating institutions. The latter proposal was based on the assumption that properly qualified scientists would not be available from the major responsible institute--or that there should be a selection among "equals" in the field.

The Joint Research Review Team also (page 69) suggested:

Serious consideration should be given to implemention and provision of such coordinating leaders by BARC since this would help to preclude any special bias toward one of the participating institutions if the coordinator were selected from such institutions. Joint appointments of coordinating leaders, with BARC and one of the other participating organizations sharing salary and support costs, would be another alternative.

The foregoing statement may have created some confusion regarding the role of the BARC Member-Directors. It was not intended by the Joint Research Review Team that they should serve as coordinators. The suggestion rather related to the merits of the hiring of a special member by BARC--an outstanding and respected scientist with the essential coordinating leadership qualification--to handle the role. Again, this was assuming that there was no "relevant institute" or organization to be identified. This question arises, for example, in non-commodity programs such as soil management, water management, farming systems, etc. In any event this is an area of program management where good judgment and goodwill must play a part.

V. STRENGTHENING RESEARCH-RELATED SERVICES

A. Adoption of Technology

Though successful adoption by farmers of improved technology depends upon such factors as its potential profitability, risk and uncertainty, transport, and availability of supplies, the technology itself is extremely important. The suitability of improved technology for the farmer's resources and aspirations is a major influence on the farmer's willingness to adopt it.

This suggests that adoption has much to do with the scientist who generated the new technology. Did he accurately diagnose the problems? Ask the key questions? Design the right experiments and communicate the pertinent message? If science begins with defining the question and technology with understanding the limits of its use, then farmers must communicate to scientists. Too often, however, the communication is one way--scientist to farmers. Farm testing must be a two-way process where scientists validate research and where farmers not only answer the scientists' questions but also tell researchers whatever is on their minds about their farming system. Research priorities properly focused on the problems of the farmer (identified by feedback involving farmer, extension personnel, and agricultural scientists) result in research that produces readily adoptable technology. It is here that extension workers need to be drawn into the research system as partners--to help study existing systems, and the multiple purposes and real difficulties of small farmers, to help select objectives for research, and to monitor change in the adoption process. The knowledge system must involve farmers--not merely as the targets of advisory exhortation, like pupils at training centers or as passive victims of development. Farmers have much to tell about soils, weather, crops, animals, diseases, and pests as well as their own purposes and difficulties.

Until newly generated improved technology has been successfully adopted by the farmer, the agricultural scientist's task is incomplete. Packaging of research results into variety of publications directed at specific audiences facilitates adoption. Research at the local experiment stations may involve packaging latest information on varieties, pest control, engineering, and economic management.

Bridging the gap between research results and farmer practice falls mainly upon the extension services. But it is not always recognized that once the bridge has been established, the traffic over it should be encouraged to flow in both directions. Research done in response to specific questions from farmers is likely to be more readily adopted than research that leads to farmers being told what to do. Indeed, critical observations by farmers form an essential part of the system for advancing agricultural knowledge. With so many interacting factors, it is impossible even in multidisciplinary studies for researchers to cover every possible combination of circumstances through experiments. Hence, observations by farmers must continually be fed back to the re-

search worker who can explore and interpret them and, where appropriate, incorporate them into future experiments.

Research workers need the stimulus of farmers just as much as they require the results of resarch. Accelerated adoption of improved technology will follow.

B. Information and Communications Services

An effective technology transfer program for any research and development institution relies heavily on a strong information and communications system. It enables the institution to package and deliver in meaningful form its technological products to various audiences that are in policy, extension, research, and production roles. It also enables workers in the research system to be in touch with each other and with those in other systems.

For the national agricultural research system in Bangladesh, the team recommends that a capability be developed in BARC, as soon as possible, to produce a "Bangladesh Recommends" series of recommended technology packages for extension workers, technical bulletins, specialized media services, audiovisual briefing sets, and a "Farm Technology Advances" series. Later, as the farming systems-based research scheme evolves, BARC may consider adding a "Farming System Techno-Guide" series and a "Radio Farm News" service.

"Bangladesh Recommends" series would be produced as follows: The works of the various experts in the several institutions working in a specific topic should be collected, compiled, and collated by BARC. A subject-matter specialist familiar with the topic would then be assigned to write a draft that integrates the pertinent information into a package of recommended practices. The draft is written in plain language that is understood by extension workers and others.

Technical editing would then be done by a technical editing committee organized under the ARPG leader concerned. The membership of the technical editing committee would be multidisciplinary and drawn from the most talented individuals in the country irrespective of the institution they may come from.

The primary objective for the "Bangladesh Recommends" series would be to avert conflicting recommendations by the extension staff (who often belong to different institutions, thus confusing the farmer). Consequently technical differences should be revolved and clarifications incorporated during the technical editing procedure.

The technical editing mechanism would result in a uniform package of alternatives/recommendations, which the extension worker can refine to suit location-specific and situation-specific conditions. And the farmers would then be in a better position to assess and make use of the technology.

As a practical matter, the publication might be put into loose-leaf form so that when a new technology emerges only those pages that need updating have to be replaced.

Very often, the information put together and the work involved in fleshing out the publication would be the collective effort of several national institutions--hence the name "Bangladesh Recommends."

Technical bulletins would be aimed at research and technical workers and would cover specific research and development advances for an individual commodity or specialty.

Media services would carry (on an irregular basis) news, policy statements and analyses, and other farming and agribusiness stories related to individual commodities.

Audiovisual briefing sets would cover aspects of a given commodity industry as deemed necessary to promote the research and development activities being undertaken.

"Farm Technology Advances" would consist of publications issued periodically and containing items of interest to managers, supervisors, policy makers concerned with an individual commodity, both in government and the private sector.

C. Library and Documentation Services

The purpose of scientific libraries and documentation services is to provide a cost-effective method for the communication of information between different groups of people. In Bangladesh, weak library and documentation services penalize the country's scientists, planners, and university students. The problems are lack of library facilities, journals, books, etc., poor coordination between libraries and documentation services, and, most important, the failure of many scientists, planners, and students to recognize the importance of using and referring to written material in their work as well as the necessity to publish articles, reports, etc., which would then be stored and used in libraries. There are three information networks in which written material and libraries play a major role.

Communication Between Scientists. Articles and reports on recent research results are a necessary condition for scientific progress in any country. In the past, the lack of international and local journals as well as regular report series, monographs, etc. from the major research institutions in Bangladesh has meant that new research was often started with little or no reference to existing international and local knowledge already available. As a result, research often duplicated previous studies or used techniques of analysis that were not viable or cost effective in Bangladesh. This situation has been changing recently and several journals are starting to appear. In addition, various departments of universities and research stations have started preparing useful

research reports and papers for national and international seminars. These healthy developments should be encouraged.

Communication Between Scientists and Development Planners. Misunderstanding of research results wastes the time of senior government officials. Timely communication of information through "Newsletters," information bulletins, etc. could resolve these problems. In addition, many senior researchers and administrators have to spend enormous amounts of time "briefing" development agency personnel who would be better prepared if current background material in the form of reports were kept available.

Communication Between Scientists and Students. One of the most important problems to the agricultural research system is the universities' lack of current scientific information from the research institutions in Bangladesh. The universities still rely considerably on outdated and irrelevant textbooks, which should be replaced by current information from various strong research programs in Bangladesh.

BARC should take a major role in promoting the above types of journals, publications, numbered report series, workshop proceedings, newsletters, information documents, teaching materials, etc.

To help ensure that this information is available and used, we support the proposal that the National Agricultural Library and Documentation Center be established in BARC. In addition to the normal role of this type of facility, it is suggested that special emphasis be placed on:

a) actively searching out and collecting Bangladesh development and research documents relating to the agricultural sector; and

b) providing a documentation and lending service to the scientists and other staff of regional research stations and the universities.

D. Research Program and Financial Monitoring

The operation of national agricultural research system in Bangladesh is complicated by the dispersal of responsibilities for research among several ministries of the Government. Nevertheless, the activities of the research institutions must be evaluated regularly to ensure that programs are being competently executed and that the results are useful to agriculture in Bangladesh.

Under its ordinance, BARC has authority to monitor and evaluate research programs at the national level and to recommend necessary changes in research priorities. However, research program monitoring has yet to be established as a major activity within BARC.

The individual institutes issue annual reports containing simple tabulations of research findings and they compile proceedings of commodity

workshops designed to facilitate exchange of information among agricultural scientists. But publication of these reports and proceedings is frequently delayed, preventing the timely production of a collated report. Because international and bilateral assistance agencies require progress and evaluation reports, BARC should implement its own regular monitoring process, which would facilitate continuous evaluation of research and the identification of constraints to progress. Research program monitoring should be directed by the Agricultural Research Planning Group (ARPG) leaders working in close consultation with their ARPG members who should undertake annual reviews of their respective commodity or non-commodity programs. Likewise each research project should be evaluated and reviewed in situ by the ARPG leader concerned, assisted by one or two scientists, allowing expertise in specific research areas to be used. The BARC Member-Directors should coordinate ARPG annual reviews covering their respective fields. On-site and annual ARPG evaluations should be completed before research budgets are reviewed and approved. Thus, the review would be a decision-making process and would involve the scientists concerned. Recommendations for strengthening, ending, or redirecting research should be made to the appropriate authority. This regular analysis of research programs would help fulfill the requirement for an overall assessment of the developmental impact of nationally coordinated research programs.

Monitoring of the physical implementation of projects supported by the Government and international assistance agencies is usually straightforward with indicators of progress being clearly identified and reported quarterly. The timely use of project funds is critical for the success of development projects and this cannot be achieved without adequate budgetary and financial planning. With the involvement of an increasing number of international assistance agencies, each with specific rules governing disbursement, and the emergence of complex national coordinated projects involving the integrated efforts of several institutions, the budgetary planning and financial management processes have become increasingly complex. The administrative systems of the major institutions are being strained by increased demands and the workload associated with greater availability of funds from different sources. Administrative procedures, especially for procurement and accounting, should now be reorganized and streamlined. Steps should also be taken by the Government to allow for annual release of funds, instead of the quarterly release as practiced at present.

E. International Staff Support and Coordination Cell (ISSCC)

Under the Research Project Agreement with USAID, BARC established an International Staff Support and Coordination Cell (ISSCC) for the administration of certain technical assistance activities. The administrative and supporting staff of the Cell were locally recruited in permanent positions. For the first three years, expenditure for establishment of ISSCC is covered from the USAID grant, with no financial liability to the Government of Bangladesh. Subsequently, however, the ISSCC should "function as a permanent setup of BARC with Government financing for the administrative and financial support staff of ISSCC."

It was intended that ISSCC would initially support the expatriate scientists under the USAID Grant, but would evolve into a section of BARC through which all foreign donors to agricultural research could channel their resources. It was anticipated that other donor agencies would give grants for various research projects. The funds made available for contracting local research and technical assistance would be placed directly at the disposal of BARC and be managed by BARC with the assistance of donor agencies through ISSCC.

1. Specific Objectives

In order to effectively coordinate and serve expatriates and their respective donor agencies in agricultural research the following objectives for ISSCC were identified:

a) To establish administrative and operational guidelines that will facilitate efficient support of expatriate personnel and effective utilization of foreign assistance.

b) To support and service expatriate personnel in all aspects of living and working in the host country.

c) To coordinate all support including expatriate consultants and funding provided by external donors.

d) To manage budgetary transactions, cash flow for local requirements, preparation of vouchers, and follow up reimbursements from donor agencies.

e) To provide in-service training, coordination with the BARC administrative unit, and continued evaluation of office procedures to improve support efficiency.

2. Activities

To accomplish the foregoing, the ISSCC would help to:

a) Provide logistic support to expatriate specialists/consultants.

b) Conduct financial management of contract funding.

c) Develop linkages between donor agencies and Government agencies.

d) Monitor the progress and activities of donor-supported projects.

e) Provide logistic support for Bangladesh scientists to attend international conferences and workshops.

f) Implement training arrangements for Bangladesh scientists.

Experience acquired by the staff now enables the ISSCC section of BARC to provide many support and backstopping services required of agri-

cultural research donor agencies and expatriate consultants. Moreover, since ISSCC operates within the Government system it can manage the time-consuming intricacies otherwise often burden individual expatriates.

Consistent with its mandate to coordinate all agricultural research, BARC invites multilateral and bilateral agencies to develop a memorandum of understanding with BARC and, in so doing, to utilize the services provided by ISSCC to facilitate all forms of donor assistance to agricultural research.

The ISSCC has been evolving well and is playing an important and essential role in servicing the IADS specialists as well as some other consultants. However, the level of competence of the staff and its ability to handle its current functions need to be raised before additional responsibilities are assumed.

In order to ensure that the ISSCC can fulfill its intended role the following actions should be taken:

a) Select and appoint a fully capable Bangladeshi, with proven administrative capability, to serve as the Chief Administrator.

b) Upgrade the competence levels of the personnel responsible for the various specific functions of the unit, through training or recruitment of new staff.

c) Change the name of the ISSCC to the International Projects Service Office (IPSO), to more clearly identify it as a service and support unit of BARC.

d) As the BARC Secretariat is established, in accord with the recommendations of the Joint Research Review Team and Special Committee, the appropriate linkage within the Secretariat should be arranged. The unit should have the necessary delegated authority to carry out its functions with a minimum of clearance and approval from top-level BARC executive officers.

e) In view of the recognized inadequacy of financial management of donor agency funding, this aspect of the unit should be strengthened immediately.

f) In order to assist with the urgent improvement of the financial management and monitoring function--which must be done if the World Bank Research Project support is to be utilized as intended, and if other donor agencies are to be encouraged to utilize the services of the unit--an expatriate consultant should be brought in to work with the unit.

The concept of an international projects service unit is basically sound and the immediate task is to ensure that it can carry out the stated objectives effectively.

VI. RECOMMENDED FUTURE SUPPORT BY USAID

Agricultural research is a proper and wise investment for USAID in Bangladesh. Only a sound research system can generate technology to enable Bangladesh to intensify its agriculture and to raise production and rural incomes. Dramatic "breakthroughs" in agricultural research are rare; most advances are incremental and must be based on sound research and verification in farmers' fields.

The support of USAID and the World Bank for agricultural research is beginning to bear fruit. This support, in a substantial and meaningful effort, has been in effect only in the past three years. Focused support must be continued to ensure that past investments can be capitalized upon.

A. Institutions

Efforts to strengthen BARC and BARI have yielded reasonably satisfactory results. The Joydebpur Research Station of BARI is developed to the point where a significant research program can continue to build and strengthen. The Ishurdi Station will be a key link in the network of regional stations being supported by USAID and IBRD.

Other research institutions, such as BRRI, BJRI, SRI, etc., also are in need of continuing support, but they are receiving support from other cooperating donors.

Bangladesh has not developed strong research system on a nation-wide basis, in part because support has been applied to limited projects--to a commodity or problem area. Without the institutional base for such activities, they have little or no lasting impact. The continued support by USAID and the World Bank for the national research system infrastructure will, therefore, be of significant benefit to various donor agencies as well as to Bangladesh.

B. Problem Areas

Chapter II presents brief resumes of priority requirements for improving agricultural technology essential to meeting the goals of the SFYP. Areas for special consideration by USAID, as identified by the Review Team, are:

1. Soil and Water Management Research

The SFYP identified soil and water management research as a major national priority in research. Also, irrigation was identified as a major area of investment for improving agricultural production. BARC has organized a series of interagency Task Forces that have prepared a list of priority research areas for soil and water management and have proposed

a National Coordinated Program in Soil and Water Management. USAID support in the form of technical assistance for the national program, and in funding of certain high priority research areas, would be most productive.

2. Farming Systems Research

Bangladesh scientists must be familiar with farm problems. Farming systems research can assist in assessing the status of current farming practices, identify and work on priority problems limiting yields or performance, and design technology for "real world" conditions. A BARC Task Force on Cropping Systems has prepared a proposal for a National Coordinated Farming Systems Program. In addition, USAID in its Agricultural Research Phase I Project organized a cropping systems program at BARI. This program needs technical assistance and guidance in becoming operational and effective. The Ishurdi Station and other regional research centers will be focal points for farming systems research in each region. On-farm testing needs strengthening throughout the country and farming systems research provides a means to achieve this.

3. Pest Management Research

The Vertebrate Pest Research Program at BARI has made outstanding progress in a brief time. The research is relevant and useful. The discovery that pre-harvest losses caused by rats and other pests may equal or even exceed post-harvest losses adds to our understanding of the nature and extent of the crop loss problem. Pest management and crop protection research in general in Bangladesh needs strengthening and the research on plant diseases is a critical area for greater support.

4. Agricultural Economics and Social Sciences

There is increasing awareness that specialists in agricultural economics and social sciences must be more fully involved in problem diagnosis, planning research, monitoring, and interpreting results relevant to farm conditions. Considerable progress has been made in the USAID technical assistance support to date. A trained Bangladeshi was recently named Acting Head of the Division of Agricultural Economics, taking over from the IADS consultant who had been requested to occupy this post while the division was set up.

The forgoing list is not meant to be restrictive and there are other problem areas, as reviewed in Chapter II, that might also be considered for priority research--either through technical assistance or through funding to BARC and BARI.

C. Types of Support

1. Institutional Support

BARC and BARI will need continuing support as these institutions begin to make use of their new facilities and manpower. BARC will

especially benefit from such support in carrying out its authorities and responsibilities as determined in the Joint Research Review Team Report of April 1979 and assessed by the Special Committee in their Report of March 1980.

2. Technical Assistance

Several expatriate scientists will be required to furnish guidance to special problem and program areas. The following are recommended for priority consideration of full-time, longer term assignments.

Project Supervisor/Adviser. This position, now filled by Dr. Murray D. Dawson, should be continued.

Farming Systems Research. This is a relatively new topic in Bangladesh research. BRRI has a good program under way, BARI has recently initiated one, and other institutions have various activities under way.

Soil Scientist/Fertility Management. The problems in soil fertility and management are complex and widespread and require special competence to guide research.

Water Management Specialist. Most irrigation systems are designed for conducting water to farmers' fields. But farmers rarely get help in using water efficiently. This is a significant and potentially productive area in guiding production efforts in the SFYP.

Agricultural Economist. There is need for more than one agricultural economist and social scientist as an advisor in the national agricultural research system. It would be desirable for USAID to continue to furnish one and to work with organizations such as the Agricultural Development Council and others with special interest in this field to furnish complementary technical assistance personnel.

Plant Pathologist. The Canadian Government may supply a plant pathologist to work on the wheat rust problem--a situation that could become explosive because Bangladesh has three fourths of its wheat acreage under one variety. In addition, there is need for technical assistance to build research capabilities for the many other crops (except for rice, which is handled by BRRI), and to build the Division of Plant Pathology at BARI.

Administration Specialist. The International Staff Support and Coordination Cell (ISSCC) is taking shape, but it needs continuing direction and assistance to bring it to a stage where it will be an effective unit of BARC, funded by the Government of Bangladesh, as intended. The Review Team recommends that this unit be redesignated as the International Projects Service Office (IPSO) to eliminate the confusion now attendant to the term "coordination."

In addition to a longer term administration specialist, there is an urgent need for a special management consultant to improve the financial

management systems of BARC and BARI, as reviewed in Chapter V and ANNEX IV of this report.

Short-term Specialists. The provision of short-term technical assistance personnel should continue. Such specialists are critical in specific problem areas as BARC and BARI emerge as national institutions and as selected research program areas are expanded.

3. Training

Training, including academic and in-service training--domestically and abroad--will be urgent in the next 10 years, to build a research staff commensurate with needs for improved technology in Bangladesh.

4. Commodities

Commodity needs will expand as the new facilities and programs of BARC and BARI take form. The Research Review Team has not attempted to identify cost or support figures for commodities. They must be developed through the knowledgeable staff of the institutions concerned, primarily USAID, BARC, and BARI.

D. Bangladesh Agricultural University (BAU)

In addition to the forgoing support recommended for the national agricultural research system, the Review Team would urge that USAID give further consideration to strengthening the BAU. This institution is of critical importance, but its program must become more relevant to farmers' needs and produce graduates more familiar with problems of Bangladesh agriculture. Its research program needs strengthening, and the institution needs an academic and research program Master Plan that it can use to guide it in the future. BAU also needs better ties to the agricultural community. Expatriate guidance in goal setting and program development, support in finding ways to transport and direct students to on-farm experiences, and guidance in improving village-level extension work in the two districts for which BAU is responsible for extension programs would be very helpful. Brick and mortar is not needed at BAU. What is needed is a vision and realistic program for the future that will be relevant to the needs of the country.

Further discussion of BAU is presented in ANNEX IX.

VII. RECOMMENDED FUTURE SUPPORT BY THE WORLD BANK

Future support by the World Bank for agricultural research in Bangladesh will depend on the requirements of the Government and on the successful conclusion of the IDA-supported Agricultural Research Project. Any proposal for IDA support would be coordinated with other projects funded by the Government and foreign aid agencies. BARC would have primary responsibility for project preparation.

A. Problem Areas

At this stage, project components can only be tentatively identified, the final package will depend on detailed discussions with the Government. However, the following problem areas could form the basis of a future project.

1. The Regional and Sub-Station Network

In order to satisfy their own requirements, individual research institutes have established separate series of regional and substations, thus imposing on Bangladesh a system in which sub-stations do not constitute a unified network. Many of the existing sub-stations now service the exclusive needs of research programs conducted on a single commodity. Some rationalization of the roles and functions of regional and substations is required.

As a first step, regional research problems should be analyzed and the type and number of research stations needed to support the resulting research programs should be determined. This study should be completed during project preparation, but if this is not possible because of financial or time constraints, it should be financed under the project. The report would form the basis for the selection of sub-stations to be developed as multi-crop and multidisciplinary stations able to provide facilities to all research institutes. It would also help to identify sites where new stations should be built and others where stations should be closed. The success of any rationalization scheme will depend on the cooperation of the research institutions concerned, and their agreement to share the facilities of the substations selected for development. It seems likely that at least two new regional stations will be required: one in the saline areas and another in the northeast.

2. Support for Research Institutes

In spite of the support for research from the Government and foreign aid agencies, certain institutes and research programs of high national importance have been neglected and now need assistance if the aims of the Second Five Year Plan are to be met. Further research is justified on fisheries, on animal production, and on the production of fuel-wood.

3. Linkages between Research and Extension

It has been proposed that the training and visit system of agricultural extension, at present in operation in northwest Bangladesh, should be introduced throughout the country. This system depends on ready access to up-to-date information and improved technology. Links with the research services are therefore essential. These linkages should be institutionalized using the regional stations as the points of contact between the two services. Possible action that might be taken are:

a) Appointment of a senior officer at the research station to be responsible for linkages.

b) Holding workshops for research and extension staff at which regional problems of farmers are discussed and translated into research programs and at which the extension message is refined in response to research results.

c) Designation of research staff to help extension officers design field demonstrations on farmers' fields and seed farms.

d) Regularization of visits to research stations by farmers and extension staff.

e) Allocation of research staff time for training and advising extension staff.

f) Adoption of selected villages by the research staff, where with the assistance of extension officers, they would apply their own recommendations.

4. Manpower Development

The lack of trained manpower is a frequently cited constraint in the agricultural research sector. Additional overseas training opportunities at Ph.D. and M.Sc. level and some short-term career development courses are required. The number of fellowships to be provided should be determined by an overall manpower survey in which training requirements are related to the recommendation of the National Agricultural Research Plan. Overseas training is expensive and it should be justified in terms of national need.

5. Development of the BARC Headquarters Complex

The first phase in the development of BARC headquarters complex will be completed under the IDA-supported project. Site development and facilities for documentation and publication are now required. A library and a data processing center are also required, but there is justification for locating them at both BARI and BARC. Therefore, an in-depth study of available resources should be made, and future demands for these services assessed at all research institutes, before a site is selected.

6. BARC Research Grant Scheme

As BARC becomes established as the national coordinating, planning, and financing authority for agricultural research in Bangladesh, the demand for funds to finance both ad hoc and national coordinated research projects is expected to increase. Already the number of sub-projects submitted for evaluation exceed the financial capacity of the scheme. Provided that the ongoing sub-projects are successful, the research grant fund should be substantially increased.

B. Implementation Agency

BARC would be the project implementation agency for any future IBRD-supported research project, it being official Government policy to channel all funds for agricultural research through this organization.

The chief aim of the on-going project was to help establish BARC as the apex research institution in Bangladesh, and a condition for further IBRD involvement in the sector would be that BARC continue as a viable agency of the Government, operating within the Ministry of Agriculture.

Although funding would be through BARC, other research institutions, such as BARI, Forestry, Fisheries, would be expected to benefit substantially from project investments.

C. Types of Support

No cost estimates have been produced. The project proposal would include the following components:

Capital development. (1) The provision of residential, laboratory and farm buildings at two regional stations and some, as yet unspecified, substations and research institutes (fisheries, forestry, livestock). (2) Necessary land development on research farms. (3) Completion of the BARC headquarters complex, a documentation and publication facility, a national library, and data processing center. (4) Provision of facilities required to develop linkages between extension and research. (5) Necessary vehicles, equipment, furniture, and operating expenses.

Training. Overseas training at M.Sc. and Ph.D. level and short courses for career development.

Research grant scheme. An allocation of funds to the research grant scheme and the provision of short-term technical assistance, to be used at the discretion of BARC, for the preparation of National Coordinated Research Programs.

Staff salaries. Incremental staff salaries and allowances at research institutes and BARC.

ANNEX I

MEMBERS OF THE RESEARCH REVIEW TEAM AND TERMS OF REFERENCE

Bangladesh Members
Dr. S. D. Chaudhuri
Dr. M. A. Mannan
Dr. B. Karim

Coopted Members
Dr. M. H. Mondal
Dr. M. D. Dawson

Expatriate Members
Dr. A. H. Moseman
Dr. D. L. Plucknett
Mr. A. J. Pritchard
Dr. J. C. Madamba
Dr. S. D. Biggs
Dr. A. A. Johnson

Dr. Saifud-Din Chaudhuri was born October 17, 1917, graduated from Presidency College, Calcutta, B.Sc. (Hons), with graduate degrees from Imperial College of Science & Technology, London, D.I.C., 1941, and Ph.D., University of London, 1942, and advanced training in Plant Breeding and Genetics in the U.S.A. Between 1976 and 1980 served as a Member of the Bangladesh Planning Commission, Regional Agriculturist F.A.O. Bangkok 1974-75, and Executive Chairman BARC 1974. Between 1972-74 was Chief of the Agricultural Division, Planning Commission, Bangladesh, from 1969-72 Special Officer for Jute Production and Vice-Chancellor BAU for two years; was Director of Agriculture, Government of East Pakistan Research Extension and Education. From the period 1942-1951 held various positions as Agricultural Botanist and development work on the Sub-continent.

Dr. M. A. Mannan received his M.Sc. (1954) in Soil Science from Dacca University, M.S. (1958) in Agronomy and Ph.D. (1965) in Agricultural Chemistry and Soil Fertility from the Texas A & M University (U.S.A.). He served at BTRI as Head of the Agronomy Botany Division, Reader in the Department of Soil Science, Bangladesh Agricultural University, Secretary of the National Science Council of Pakistan, and has been serving as Member-Director (Soils & Water) in the BARC. Dr. Mannan is associated with a number of national and international Learned Bodies/Professional Associations. He is a Member of the Bangladesh Country Team, SEARCA, Philippines and Bangladesh Country Liaison Officer of an FAO Project on Organic Recycling. He visited Philippines, Malaysia, and India studying their National Agricultural Research Systems. Dr. Mannan has also visited a number of international institutes including ICRISAT (India) and AIT (Thailand).

Mr. B. Karim graduated in Agricultural Engineering in the year 1947 and later received an M.S. from the University of Wisconsin, U.S.A. He served for a long time as Chief Engineer of power pump irrigation project of the Government. Was a member of the Board of Directors of Bangladesh Agricultural Development Corporation and in that capacity was in overall charge of its irrigation projects. Now serving as a Member-Director (Agriculture Engineering) in Bangladesh Agricultural Research Council. Present age about 54 years.

Dr. Albert H. Moseman, Representative, International Agricultural Development Service, has studied national agricultural research systems of Asia since 1950 when he served as the research specialist on the three-man team sent by the U.S. Department of State to review potential cooperative support under the then-pending legislation for point IV (now USAID). The visit to 11 countries included substantial time in Pakistan and India. Dr. Moseman was a member of the First Joint Indo-American team (1955) and was involved with the 1963 Research Review Team that designed the renewed Indian Council of Agricultural Research. He was on the First Joint Pakistan-American Research Review Team (1968) and, as a consultant to FAO/DANIDA, prepared the report, Agricultural Research in Bangladesh (1973). Dr. Moseman was a member of the Joint Research Review Team of 1978-79 which prepared the report and recommendations for strengthening the Bangladesh Agricultural Research System (April 1979). He reviewed agricultural research needs and assisted in planning the Malaysian Agricultural Research and Development Institute (MARDI), the Philippine Council for Agriculture and Resources Research (PCARR), the Indonesian Agency for Agricultural Research and Development, the Pakistan Council for Agricultural Research, the Agricultural Research System of Thailand, and was leader of special team that conducted the Study of Hill Agriculture in Nepal and designed a Nepal Council for Agricultural Research, and National Agricultural Research System for Afghanistan. Outside of Asia, he was leader of the team that developed a master plan for the Agricultural Research Council of the Sudan, and was on the appraisal team for World Bank Phase I support to the National Agricultural Research Organization of Brazil (EMBRAPA). Dr. Moseman has served as Director of crops research of the U.S. Department of Agriculture, Director of the Rockefeller Foundation Program in the Agricultural Sciences (at the time the Rockefeller and Ford Foundations collaborated to plan and establish the International Rice Research Institute (IRRI)). He was Assistant Administrator for the Office of Technical Cooperation and Research--later the Technical Assistant Bureau--of USAID in 1965-67, and an associate of the Agricultural Development Council (ADC) from 1967-73. His publications include the ADC monograph, Building Agricultural Research Systems in the Developing Nations (1970).

Dr. Donald L. Plucknett, Professor of Agronomy and Soil Science at the University of Hawaii, is currently on secondment to the Agency for International Development as Chief of Agriculture and Rural Development in the Asia Bureau. His research interests are tropical soil management, tropical production, weed science, farming systems, tropical root crops, and tropical pastures. Long associated with international agricultural development work; he has participated in building of agricultural research systems in Egypt and the South Pacific, and has been involved in a number of reviews of research programs in the international agricultural research centers. He is President of the International Society for Tropical Root Crops and Secretary of the Asian Pacific Weed Science Society. He is editor of a series of books on Tropical Agriculture published by Westview Press and the author or editor of 10 books on tropical root crops, tropical crop production, and weed science.

Dr. A. J. Pritchard is presently employed as Senior Agriculturist in the South Asia Region of the World Bank with special responsibility for the design and supervision of World Bank-supported agricultural research projects in India, Bangladesh, Nepal, and Pakistan. Previous experience: (i) Scientific Adviser to the Secretary of the Agricultural Research Council, London, which included service on Ministry of Agriculture research advisory boards and committees as well as the monitoring and overall administration of the Council's research institutes; (ii) Adviser to the Government of Spain on the establishment and equipping of an institute for research on cereals and grain legumes and on initiating research programs on soybean, chickpeas, and lentils; (iii) Head of Plant Breeding and Genetics Section of the CSIRO Division of Tropical Agronomy, Brisbane, Australia, directing research on forage grasses and legumes, sorghum, and soybean; and (iv) Plant Breeder in Uganda working on coffee and cocoa.

Dr. Joseph C. Madamba's experience spans a wide latitude of developmental areas. These include: research management, agricultural development planning, development and management of livestock agribusiness systems, university administration, livestock and agriculture research and development planning, coordination of national resources for agricultural development, and international consultancy on agricultural research and development. He has been involved in the planning, establishment, and management of various systems and institutions of national and international character. Among these are: the Philippines Council for Agriculture and Resources Research (PCARR), the Animal Production and Health Commission for Asia (APHCA), and the Asian Institute of Aquaculture of the South-East Asian Fisheries Development Center. At one time or another, he has served as head of each of these institutions. At the international level, he has served as member of the Technical Advisory Committee of the Consultative Group for International Agricultural Research; was member of the Technical Advisory Board of the Food and Fertilizer Technology Center based in Taiwan; and is currently member of the Board of Trustees of the International Council for Research on Agro-Forestry based in Nairobi, Kenya. For the past nine years, he has been tapped by various international and national institutions as well as agribusiness enterprises for consultancies or technical missions. His involvement with the University of the Philippines at Los Banos spans 17 years of teaching and research in animal science and university administration work. He has served for five years as Adviser to the Philippines' Minister of Agriculture.

Dr. Stephen D. Biggs is a Fellow, Institute of Development Studies at the University of Sussex, U.K. He is an economist interested in agricultural and rural development planning and in the application of interdisciplinary research methods to the planning and generation of agricultural technologies to reduce rural poverty. Special interests are in production and research problems in irrigation, agricultural engineering, and crop improvement programs. He has worked for several years in Bangladesh with the Ford Foundation in connection with strengthening the Bangladesh Agricultural Research System. This involved, amongst other things, having close contact with BARC, BRRI, and other

agricultural research institutes and the Ministry of Agriculture. Recently he has been based in Delhi as a regional economist for the International Maize and Wheat Improvement Centre (CIMMYT) working with National and Sub-National Crop Improvement Programs in Asia. The assignment mainly involved working with on-farm research programs of trials and surveys, and the development of methods to strengthen the flow of information between on-farm and on-station research activities.

Dr. Alvin A. Johnson, Professor of Plant Breeding, Department Chairman, and Director of Extension at Cornell University. His early work was adaptive research, extension, and forage crop seed marketing research. He was named Fellow of the American Society of Agronomy, and in 1962 received the Agronomic Education Award of the American Society of Agronomy. He has been awarded an Honorary Doctor of Agriculture degree from North Dakota State University. International agricultural work includes the following: 1948 team member for American Aid to Greece; Fulbright Lecturer at University of Salonica, Greece, in 1953-54; member, Ford Foundation food production team, India, 1959; led development of National Seeds Corporation, India, on behalf of Rockefeller Foundation, 1960-61; from 1967 to late 1975 headed Ford Foundation Program in agriculture in India and Sri Lanka where he led a multidisciplinary team of experts. Primary work in India was making and monitoring grants to Indian Universities and Indian Council of Agricultural Research in water management, economics, agricultural engineering, and rice production. Since 1974, he has been a consultant in some 10 countries focusing on organization and management of agricultural extension and research.

ANNEX I

REQUEST TO ESTABLISH THE TEAM

BANGLADESH AGRICULTURAL RESEARCH COUNCIL
35 (new), 130-C (old), Dhanmondi R.A., Road No. 1
Dacca-5

DATE: 4 March 1980

From:
Kazi M. Badruddoza
Executive Vice-Chairman
BARC

To: Mr. William Kimball
Director
USAID
Hotel Purbani
Dacca, Bangladesh

Dear Mr. Kimball,

Prior to negotiating Phase II of the USAID-suported Agricultural Research Project, it is my considered opinion that an in-depth review of Bangladesh research in food crops be conducted. I suggest the evaluation be conducted by a joint team (to be appointed) consisting of both in-country and expatriate scientists.

I have enclosed proposed terms of reference for such an evaluation which provide guidelines as to what should be evaluated and how the appraisal might be conducted.

With your concurrence, I respectfully invite USAID to initiate a review of research in food crops and tubers consistent with the Research Contract Project. I shall accordingly communicate with the Ministry of Agriculture requesting such institutes as BARI, BRRI, and BADC for their cooperation to participate in such an exercise.

Thank you for your anticipated cooperation.

Sincerely,

Sd/=

KAZI M. BADRUDDOZA
Executive Vice-Chairman
BARC

TERMS OF REFERENCE

A. Nature of Evaluation

Overall, the evaluation would address the degree to which agricultural research capability can efficiently and effectively solve priority farm problems that result in increased production and improved rural welfare. Three types of research system assessment are suggested:

- Performance appraisal which focuses on individual/manpower achievement.
- Management audit concerned with effectiveness and economy on the use of resources giving special reference to the efficiency of individual institutions with their respective mandates.
- Impact assessment which focuses on the effect of research results on food production, utilization/markets employment, and income.

B. Scope

The functions of the national agricultural research system which deserve evaluation are:

- Institutional planning in identifying opportunities for advances in productivity/profitability and potential impact.
- Capability to establish national and local goals and strategies to achieve them.
- Progress in developing and testing improved cropping systems and component practices/varieties/technology and resource conservation.
- Provide evidence in both development and transfer of improved technology/cropping systems that are locally specific for farmer adoption.
- Success in identifying and making known improvements in supply services.
- Progress in training of staff, extension, and farmers.
- Communication among Expatriate Donor Agencies and National Agricultural Research System in terms of resource duplication or enhancement of Programs.

C. Implementation/Indicators

An inventory and assessment of implemented commodity production projects, defined-area campaigns, and synchronized support services which significantly accelerate agricultural development should be done.

Identified constraints and resolution strategies based on this assessment are needed. Comments on such an evaluation should include:

- Evidence of national focus; government and private participation in establishing goals, identification of priority problems and reviewing progress.

- Soundness in the technological base for all Station and on-farm research as well as information passed through Extension Research linkage.

- Leadership competency in Commodity Programs and on area campaigns.

- Cooperation among organizations and individuals including producer groups and involvement of local people.

- Evidence of successful task forces to coordinate and inject continuity in project implementation.

- Strength of Research administrative leadership, control, delegation of authority, and effectiveness of Research organization.

- Evidence for progress towards increased yield, crop production, improved income, and/or rural welfare.

- Documentation of improvements in manpower competency, equipment and facilities, increased Government investment in Agricultural Research.

- Evidence of Bilateral and Multilateral Donor assistance that assists the National Agricultural Development efficiently, effectively, and significantly.

In carrying out the evaluation the team should review the following matters, among others, with significant results being incorporated into the report:

- Policies and programs of the Government of Bangladesh which directly and indirectly influence food crops production and the wise use of Agricultural resources.

- Projects being implemented, or considered by donors, which are involved with food crops production which would have implications for USAID Second Phase Agricultural Research Support.

- The prospects for increases in food crops production through research and technology transfer in the foreseeable future, not only agronomically but also in terms of Government policy, market prices, available support services, and Institutional capability.

- Problems which might arise as a result of HYV commodity specialization such as consumer preference, displacement of other crops or systems, and occurrence of endemic diseases/pests, etc.

- Trends in the proportion of food crops utilized locally, marketed, or exported.

- Problems and potentials that may exist in seed production, quality, storage, and distribution both by the farmers, BADC, and private industry.

- Qualified manpower, training needs, and instruction equipment/ facilities.

- Linkages between National Institutions and donors and effective communication among different donors to the Agricultural Research and Development Program.

- Provide justification for proposals and recommended strategies in terms of their potential usefulness and value to increased food crops production, rural income, distribution, and welfare.

- Present criteria indicators against which annual evaluation of progress for proposed specific projects and activities can be made.

ANNEX II

SCHEDULE AND CONTACTS

June 1980

24 (Tu)	Arrival of Team Members
25 (W)	Meeting with Dr. Monwar Hossain, Chairman, Bangladesh Institute of Development Studies
	Dinner, Review Team at Mr. Charles H. Antholt's residence
26 (Th)	Meeting at BARC, including:
	Dr. Kazi M. Badruddoza, Executive Vice-Chairman Dr. M. A. Mannan, Member-Director Dr. Ekramul Ahsan, Member-Director Mr. B. Karim, Member-Director
	Meeting with Mr. Charles H. Antholt, Chief, F/AGR, USAID
27 (F)	Meeting with Dr. M. D. Dawson, IADS
	Mr. Arnold J. Radi, USAID
	Meeting with:
	Mr. Alexander Storrar, The World Bank Mr. Alan Dennis, "
	Mr. Richard Harman, Australian Aid Program
	Meeting with IADS Team Members at BARC
30 (M)	Meeting with Dr. M. A. Mannan, Director, CERDI
	Meeting at BARI including:
	Mr. M. A. Khaleque, Project Director, Oil Seeds Research Project Mr. M. Jahir Uddin, Principal Scientific Officer, Agronomy Dr. M. M. Rashid, Head, Horticulture Division Dr. M. H. Mondal, Associate Director, BARI Dr. Ayubur Rahman, Associate Director, BARI Mr. K. U. Ahmad, Project Director, Potato Research Center, BARI

June 1980

30 (M)

Dr. C. G. Swenson, IADS/BARI
Dr. John Bolton, IADS/BARI
Mr. B. Karim, Member-Director, BARC

Mr. A. J. Radi, Agriculture Officer, USAID
Mr. Mike Sullivan, Assistant Program Officer, USAID

Tour of BARI Campus

July 1980

1 (Tu)

Meeting with:

Dr. Frank W. Sheppard, Jr., IRRI Representative and IRRI Staff
Dr. S. M. H. Zaman, Director, BRRI and BRRI Staff

Tour of BRRI Staff

2 (W)

Meeting with:

Dr. A. Q. Ahmed, Director, BJRI

Dr. K. A. Ahmed, Director, Institute of Nutrition, Dacca University
Dr. Amirul Islam, Department of Soil Science, Dacca University

2 (W)

Dr. William Fuller and
Dr. M. E. Hanratty, The Ford Foundation

3 (Th)

Meeting with:

Mr. M. A. Samad, Chairman, BADC
Mr. A. Hashem, General Manager (Seed), BADC
Dr. R. Lawrynowich, Expatriate, BADC

Dr. A. Rashid, Director, BTRI

Dr. K. A. Hasan, Member, Bangladesh Tea Board

Mr. B. R. Chowdhury, Deputy Director, Livestock

Mr. Paul E. Myers, Director, MCC

4 (F)

Meeting with:

Mr. A. M. Anisuzzaman, Secretary, Ministry of Local and Rural Development

Dr. A. M. Chowdhury, Chief Conservator of Forests

July 1980

5 (S) Meeting with:

Mr. Kazi F. Rahman, Secretary, Ministry of Education

Dr. N. A. Khan, Executive Vice-Chairman, BCSIR
Mr. Ahsan A. Biswas, Officer-in-Charge, BANSDOC, BCSIR

Dinner at the Arnold Radi's Residence

7 (M) Meeting with:

Mr. Karim, Director (Acting), BSRI
Australian Team Members working at BSRI

Dr. Zainal Abedin, Principal Scientific Officer, BARI

Mr. S. M. Rahman, Principal, AETI

8 (Tu) Meeting at UNDP including:

Dr. E. W. Hein, Officer-in-Charge, FAO's Office, Dacca
Mr. Gary Gabriel, Sr., Assistant Resident, Representative, UNDP
Mr. A. Latif, Assistant Resident Representative, UNDP
Mr. J. Canagaratnam, FAO, Planning Assistance to Ministry of Agriculture and Forests
Dr. A. K. Auckland, Project Manager (Plant Breeder, Jute Project)
Dr. C. Johansen, FAO, Plant Physiologist, Jute Project
Mr. J. S. Gutierrez, Agricultural Statistician, FAO, BGD/76/008
Mr. J. J. Douglas, FAO Supply, demand and sector strategy for forestry
Mr. E. T. Hammermastem, FAO Village Forest Inventory
Mr. D. K. Misra, Officer-in-Charge, Strengthening Nations Expt. Projects, FAO/UNDP
Mr. R. Zijsvelt, FAO, Soil Survey Interpretation
Mr. F. O. Valera, Project Manager, FAO Fertilizer Demonstration and Distribution Project
Mr. A. N. Gupta, Credit Training Specialist, FAO
Mr. L. H. Gorey, Project Manager, FAO, BGD/80/001
Mr. A. Ratsundaram, Construction Engineer, FAO, TCP/BGD/8905
Dr. P. C. George, Fishery Adviser, FAO/UNDP Fishery Advisory Service Project
Dr. A. H. Moseman, IADS, New York--Research Review Team
Dr. A. J. Pritchard, Agriculturist, World Bank
Dr. D. L. Plucknett, Chief, Agric. & Research Division, Asia Bureau, AID, Washington

July 1980

8 (Tu)

Dr. J. C. Madamba, President, Dev. Specialists Inst. (Member of Review Team)
Dr. S. D. Biggs, Economist, Institute of Development Studies, Sussex
Dr. A. A. Johnson, Research Review Team
Dr. M. D. Dawson, Adviser/Planner, BARC/BARI

9 (W)

Meeting with:

Mr. A. Haque, Director of Fisheries

Dr. R. A. Ghani, State Minister for Science and Technology

10 (Th)

Meeting at BAU including:

Mr. M. U. Ahmed Choudhury, Vice-Chancellor, Bangladesh Agricultural University, Mymensingh
Dr. Akbar Hossain, Dean, Faculty of Agriculture
Dr. Z. H. Bhuiyan, Head, Department of Soil Science
Dr. M. A. Wadud Mian, Head, Department of Plant Pathology
Dr. Monawar Ahmed, Head, Department of Entomology
Dr. Choudhury Abdur Razzaque, Head, Department of Genetics and Plant Breeding
Dr. A. A. Mainul Hossain, Dean, Agricultural Engineering and Technology
Mr. A. K. M. Abdun Nur, Librarian
Dr. Sheikh Gulam Mahboob, Coordinator, CASR
Dr. Moazzem Hossain, Head, Department of Agricultural Marketing and Cooperative
Dr. Md. Ashraf Ali, Dean, Faculty of Agricultural Economics
Dr. Mozibur Rahman, Head, Department of Rural Sociology
Dr. A. K. M. Aminul Haque, Dean, Faculty of Fisheries
Dr. Md. Asadur Rahman, Head, Department of Fisheries Technology
Dr. M. S. Rahman, Dean, Faculty of Animal Husbandry
Dr. A. Latif, Head, Department of Poultry Science
Dr. A. Hasnath, Head, Department of Animal Breeding and Genetics
Mr. Abidur Reza, Head, Department of Animal Nutrition
Mr. Mozammel Haque, Head, Department of Animal Science
Dr. Hefazuddin Shaikh, Head, Department of Parasitology, Dean of Faculty
Dr. T. I. M. Fazlay Rabbi Chowdhury, Head, Department of Microbiology and Hygiene
Dr. Anwarul Islam Khan, Head, Department of Physiology and Pharmacology

July 1980

10 (Th)	Dr. Manik Lal Dewan, Head, Department of Veterinary Pathology Dr. A. Rahman, Head, Department of Veterinary Medicine and Surgery Mr. Md. Afizuddin Mia, Head, Department of Anatomy and Histology
11 (F)	Dr. Madamba and Plucknett meet INA staff Dr. Johnson visit the BAU Library Dr. Biggs visit Department of Agricultural Economics
12 (S)	Meeting with: Dr. Iqbal Mahmud, State Minister for Agriculture and Forests Dr. Kazi M. Badruddoza, Executive Vice-Chairman, BARC Mr. Shahidul Islam, Director of Agriculture (Extension and Management) Visit to the Savar Dairy Farm
16 (W)	Dinner at the Dawson's residence
17 (Th)	Meeting with: Major General (Retd.) Nurul Islam, Minister for Agriculture and Forests Mr. A. Z. M. Obaidullah Khan, Secretary, Ministry of Agriculture and Forests Dinner hosted by the BARC
18 (F)	Meeting with Dr. Kazi M. Badruddoza, Executive Vice-Chairman, BARC

ANNEX III

ASSESSMENT OF USAID PROJECT FOR AGRICULTURAL RESEARCH

A. Background of the Project

1. Status of AID Support to the Project since 1974

AID's first major effort to assist the BDG in the field of agricultural research took the form of a $4,000,000 loan and a $2,561,000 grant which were authorized in FY 1976. Additional grant funds for $830,800 and $1,000,000 were authorized in FY 1978 and FY 1980. Therefore, the total amount of grant funds in Phase I was $4,391,800. The background of this phase of the project is fully described in the Project Paper, Bangladesh--Agricultural Research (No. 388-0003). The Project Paper recognized the inadequacy of Bangladesh's resource base in terms of its rapidly expanding population and the resulting need to intensify agricultural production, particularly by means of diversifying crops and developing new and improved varieties. Consequently, agricultural research was viewed as a key subsector of agriculture.

An AID appraisal team had concluded in 1974 that rice and jute, two high-priority crops in Bangladesh, were receiving adequate research attention from BDG with donor assistance. The AID Phase I project was designed to focus on crops other than rice and jute, viz. wheat, food legumes, oilseeds, and vegetables. Research in these areas were the responsibility of the Bangladesh Agricultural Research Institute (BARI) which therefore became the primary focus of the AID-BDG first phase effort.

At the same time, both AID and the BDG recognized the need to support and strengthen the national agricultural research system, a responsibility that had been assigned to the Bangladesh Agricultural Research Council (BARC), which came into being under a BDG Ordinance in 1973. Therefore, the second emphasis of the first phase effort was designed to strengthen the BARC as the research coordinating body in Bangladesh, as well as the institution responsible for linking Bangladesh's agricultural research program with that of international research efforts.

With respect to BARI, the AID funds were intended to help the BDG to complete the basic physical facilities on the main research station at Joydebpur and the regional station at Ishurdi to enable adaptive and applied research to begin at these sites and to initiate a staff development program using both Bangladeshi staff and selected scientists from abroad. To this end, the AID credit was to finance the necessary laboratory equipment, farm development, the farm building complex, residential units and site development at Joydebpur. AID has also provided an additional $1,000,000 in grant funds for the development of the Ishurdi Regional Station.

AID support to the BARC has been in the form of a grant package, which included technical assistance, training, the support for important BARC activities, such as fellowships for in-country research and funds for subcontracting research activities to other institutions (e.g. universities). An important part of the AID support was earmarked to establish within BARC an International Staff Support and Coordination Cell (ISSCC) intended (1) to provide logistical and administrative support for foreign agricultural research technicians, (2) to act as a focal point in BARC for developing linkages with the international centers, and (3) to coordinate technical assistance to BARI and selected institutions so as to optimize the use of foreign technicians. To establish the ISSCC with the BARC, the project contemplated a grant to an international organization or a U.S. university pursuant to which the contractor would recruit foreign technicians and scientists to be assigned to BARC and BARI.

2. General Project Goals--Progress and Problems Under Phase I

Construction. In 1975 the project was designed for 3 years of AID funding with all phases of the project to begin in FY 76 and physical completion to occur by the end of three calendar years. From the start it was realized that this schedule was unrealistic. However, AID/W regulations at that time forced the project to be designed for a 3-year period. However, due to AID policy changes and amendments to the Project Paper, the terminal disbursement date of the loan was extended to October 31, 1980, and the final contribution date of the grant is now December 31, 1980. All of the building construction works at Joydebpur have been completed and the residential quarters at the Ishurdi Regional Station have also been completed. The final laboratory equipment and farm machinery orders are being processed, and the only other work remaining under the loan is installation of an irrigation system and the remainder of the land development. All of this work is expected to be completed by the end of 1980.

Technical Assistance. Under the International Agricultural Development Service (IADS) contract with BARC and BARI, all of the positions were filled by May 1979.

In November 1977 the BDG through the BARC and BARI signed a contract with the International Agricultural Development Service (IADS) to provide the technical assistance to the project for 3 years. The first scientists and technicians arrived in June 1978 and the last of the technicians, the agricultural engineer, arrived in May 1979. Even though work under the contract started 8 months after the signing, much progress has been made from June 1978 to September 1979.

By August 1979 IADS, through a short-term consultant, assisted BARI in completing and publishing a "Master Plan" for the institution. This document provides a blueprint for future progress at BARI and acts as a "catalytic guide" in subsequent plan/program development for all divisions and sectors within BARI.

Under the terms of the contract IADS has the responsibility of assisting the BARC in setting up the ISSCC. As of the end of June 1980 local staff in place is approximately 70 percent of the budgeted manpower required. All of the needed office space has been secured. Relatively low salary scale based on BDG standard rates has been the main problem in filling all of the positions. There is a high turnover of personnel due to people leaving for better jobs in the Middle East. However, support of the IADS staff members and short-term consultants has been rendered effectively. Coordination with the BARC administrative branch still needs improvement. The ISSCC will continue to support and service the expatriate personnel and will work for BARC in logistics support for its national agricultural research planning project.

Internal linkages among divisions of BARI to plan and implement multidisciplinary research has been encouraged and is most evident in the wheat and potato research programs. Preliminary research on cropping systems has strengthened links with scientists at the institutes responsible for research on sugar, jute and rice. Cropping systems research offers an opportunity for strengthening interinstitutional research, which is being planned and coordinated through BARC. Linkages which remain to be strengthened include (1) BARI scientist-counterpart relationships with IADS expatriate researchers in field experiments and (2) coordinated commodity research in grain crops and pulses with institutions like the Bangladesh Agricultural University and the Institute for Nuclear Agriculture.

Under strong encouragement of the BARI Director and the Executive Vice-Chairman of BARC, considerable progress has been made in strengthening the links with international centers such as ICRISAT, CIP, SEARCA, IRRI, and CIMMYT. In addition, relationships with research institutes in India (IARI) and Thailand agricultural universities have been strengthened. These linkages have included career training, exchange of plant germplasm, and scientist exchange programs, including short-term consultancies.

Staffing and Training. Under the first phase of the project, AID assistance for training and manpower development has been mainly directed to BARI. AID funds were allocated for nine Ph.D. candidates and twenty short-term participants. Of the nine Ph.D. candidates one returned because of poor health and another could not meet the academic standard set. Three of the candidates will be completing their studies and receiving their degrees by the end of 1980. Of the short-term candidates one was extended for an M.Sc. program and received his degree in June 1978. To date 20 short-term participants have completed training.

With both BARC and BARI under the leadership of Dr. K. M. Badruddoza, the role of the IADS team will be to assist with the development of a plan for manpower training which includes academic and career development together with effective in-country training programs at BARI/BARC.

Research Programs. One of the most significant contributions made by the technical assistance team in collaboration with senior BDG agricultural research officials was the formation of a joint Research Team. In April 1979 the team finalized a report, "Strengthening the Bangladesh

Agricultural Research System," which made 21 recommendations of which 13 are related to research planning activities of BARC. The BDG, through the Minister of Agriculture, has emphasized the importance of this document and has sanctioned some of these recommendations for immediate action. In collaboration with the Planning Commission and based on a work plan prepared by Dr. J. Madamba, BARC has been given and has accepted a leadership role in preparing a National Agricultural Research Program. This plan will be incorporated into the Planning Commission's new Five Year Plan beginning in 1980.

Concurrent with the development and implementation of the National Agricultural Research Program, BARC development coordinated programs in Soil and Water Management, Cropping Systems, Socio-Agricultural Economics, and Appropriate Technology-Agricultural Engineering.

In connection with the research activities of BARI, in the IADS/USAID Contract To Assist BARC/BARI Progress Report II, Dr. Murray D. Dawson states, "Ongoing research projects meanwhile have been reviewed with appropriate BARI/IADS scientists at both the Central Station and Regional Experiment Stations. Research Programs in Soil Science, Agronomy, Pulses/ Oilseeds, and Breeding as well as the Soil Fertility Institute were rather carefully scrutinized. As a result of these Program Reviews, numerous modifications were made in Research Projects which have since been implemented."

Farmer Testing and Demonstrations. The Soil Fertility and Testing Institute was started in 1957 to popularize the use of fertilizers. The purpose of the institute was to determine the nutrient status of soils in farmers' fields by running appropriate analyses and to demonstrate the potential returns from the use of commercial fertilizer. Because of its extensive network of district and thana offices, the institute has been drawn into functions and services other than the ones originally programmed. For the last 4 years it had been conducting farmer field variety trials with rice, wheat, mustard, pulses, and sugarcane. In "A Master Plan for the Bangladesh Agricultural Research Institute" dated August 1979, Recommendations IV. 13 on page 61 states,

> The purposes of what was once the Soil Fertilizer and Soil Testing Institute have changed. This was recognized in the recent change of the name to "Field Trials Division." The purposes should be redefined to reflect the services the division is now providing and the additional ones it could provide. The capability of the staff should be improved by adopting strict standards for new hires and by immediately starting a series of intensive, practical, in-service training programs for district and thana officers. Quality farmer field tests should be emphasized over quantity and supervision over siting, and conduct of such tests should be improved. Physical facilities--offices, laboratories, and transport--should be improved as rapidly as possible. A systematic, planned program should be developed to fully integrate this unit in the transfer of research results to farms and the flow of farm problems to the research divisions.

The Field Trials Division is now a standard division of BARI and its functions are those stated in the above recommendation.

3. Funding

The Financial Plan indicated that a total of $19,444,550 was required for the fiscal years 1976 through 1982, of which approximately $3,965,000 was to be in U.S. dollars to be used for foreign exchange and $15,479,550 to be used as local currency.

The sources of financing of the Project were AID grant and loan funds and a BDG contribution. The total AID grant was $4,391,800 of which $4,224,100 has been obligated. The remainder of $167,700 which is programmed for the Vertebrate Pest Research Component ofthe Project will probably be carried over under the second-phase funding for agricultural research. The AID loan of $4,000,000 was totally obligated in FY 1976 and will be totally dispersed by the end of calendar year 1980. The BDG's contribution toward the project is $11,052,750 in local currency for the years 1975 through 1982. The current status is:

(1) Loan

(000)

	Item	Obligation	Expenditure	Disbursement
i.	Farm Site Development	$ 223	$181	$ 42
ii.	Lab Equip., Furniture & Farm Machinery	960	600	360
iii.	Farm Bldg. Complex	153	---	153
iv.	Research + Admin. Complex	134	---	134
v.	Professional Fees	85	35	50
vi.	Residential Quarters	2,445	---	2,445
	Total	$4,000	$816	$3,184

(2) Grant

	Item	Obligation	Expenditure	Disbursement
i.	Technical Assistance	$2,157	$ 657	$1,500
ii.	Commodities	238	38	200
iii.	Training	579	179	400
iv.	Vertebrate Pest	195.8	90	105.8
v.	Ishurdi Regional Station	1,000	1,000	0
vi.	Contract Research (BARC)	222	192	30
	Total	$4,391.8	$2,156	$2,235.8

(3) BDG Taka Cost for Project

	Obligation	Expenditure	Disbursement
BARI & BARC	$11,052	$408	$10,644

B. Terms of the Project

1. Original Grant and Loan

As stated above, both the grant and loan were initially limited to 3 years of AID funding, beginning in FY 1976, with physical completion scheduled for mid-1979. With amendments and changes to the original project, the terminal disbursement date of the Loan has been extended to October 31, 1980, and the final contribution date of the grant is now December 31, 1982. The final date of completing all work and activities under the grant will not change. However, there will probably be a need to extend the TDD of the loan for one more year (October 31, 1981) in order to complete the installation of the irrigation system at Joydebpur. This delay has been caused by late placement of purchasing orders for irrigation equipment. However, this will not cause any serious problems with the overall schedule and program.

2. Amendments to the Project Paper

Vertebrate Pest Research Component. This component was added to the Project in FY 1978, increasing the original AID Grant by $830,800. The purpose of this addition to the research activities was to establish a Vertebrate Pest Section within BARI with a full staff of well-trained scientists to disseminate simple, effective, economically beneficial, and safe vertebrate pest management methods to farmers. The section will develop methods suited to the needs of small farmers, which will measurably reduce crop losses caused by vertebrate pests, mainly rats, in farmers' fields. To date the BDG has not finalized the establishment of the Vertebrate Pest Section of BARI. However, unofficially the section was established and functioning by August 1979. Within 6 months of starting construction work, a Vertebrate Pest Control Laboratory building was completed at the BARI central station at Joydebpur. This laboratory was in full operation by September 1979. The head of the section left for Ph.D. studies in the U.S. in December 1979 and is expected to return by December 1982. Two scientific officers are scheduled for M.Sc. degree training in the Philippines. One person left in May 1980 and the other is scheduled to depart in October 1980. One other person has already completed 4 months of short-term training in the Philippines.

One long-term consultant has been assigned to the project since December 1978. He is assisting the section in developing vertebrate pest management methods suited to the needs of small farmers under Bangladesh conditions. AID has a PASA (Participating Agency Service Agreement) with the Denver Wildlife Research Center (DWRC) to provide the technical assistance to this component of the project. In addition to the full-time consultant, DWRC is providing 15 person-months of short-term consultants with technical expertise in research planning, biometrics, pharmacology, toxicology of rodenticides, vertebrate behavior and physiology, chemical residue analysis and electronics (biotelemetry), and remote sensing.

BARI Regional Station, Ishurdi. Amendment No. 2 to the Project Paper provided an additional $1,000,000 in grant funds specifically for the development of the BARI Regional Station at Ishurdi in Pabna District. These funds will be used to completely develop and equip the regional station by December 1982. This includes the farm site development (drainage, roads, irrigation, land leveling, etc.), construction of farm buildings, additional residential quarters, laboratory/administration complex, fencing and electrification, and water distribution system. When the facilities are completed and equipped, the BARI Regional Station will be able to fully implement the overall objectives of crop research. The total financial requirement for the development of the BARI Regional Station at Ishurdi is the equivalent of $1,325,000. The Grant Agreement Amendment which provides the $1,000,000 from AID was signed with BDG in May 1980. Therefore, implementation of this phase of the project is just beginning.

C. Factors and Constraints Affecting Implementation of the Project

Both BARI and BARC share common constraints, some of which have largely been overcome but some of which still persist.

1. Facilities

Office, laboratory, and experimental field facilities were limited and inadequate at the time the technical assistance personnel arrived in Bangladesh in July 1978. These problems were overcome gradually, but the move to the new BARI facilities at Joydebpur during the last quarter of 1979 disrupted activities somewhat. There should be consistent improvement as the BARI facilities take shape and as the new BARC headquarters (scheduled for completion in December 1980) becomes available.

2. Definition of Program

The role of the agronomist--to develop national problem-oriented, multidisciplinary research programs on wheat, pulses, vegetables and oilseeds, and various alternative cropping systems--was modified significantly since, by the time the project was initiated, and when the agronomist and assistant agronomists arrived in July 1978, multidisciplinary programs were already in existence for most commodities. There was confusion caused by uncertainty with respect to the role of BARI in these programs and the wider role being played by BARC in coordination. Because the existing programs were in various stages of development, it was not possible for the agronomist to immediately take up the type of leadership role to assist in developing them, without creating considerable stresses and antagonisms. Other external donors apart from USAID were involved in some programs, with both finance and technical assistance, and it was not desirable to encroach on their operations. Although one of the two assistant agronomists was to work in horticulture or vegetable crops, it was determined that this would be undesirable because of the heavy involvement and aid (including advisors) from the Japanese "Citrus and Vegetable Project." It was, therefore, decided that the

assistant agronomist for horticulture should work not on vegetables but on pulse crops within the Agronomy Division rather than in the horticulture or breeding divisions.

The national interdisciplinary programs for wheat, potatoes, pulses, and oilseeds were within BARI, and all were receiving external assistance and expatriate technical support from a number of sources, as follows:

Wheat	--	CIMMYT, Ford Foundation, BRDC, USAID
Oilseeds	--	SIDA
Pulse Crops	--	IDRC, ICRISAT
Potatoes	--	Holland, CIP

However, BARC also had projects in operation in which BARI was involved (e.g. in summer vegetables, pulses, soyabeans and oilseeds). It wa decided therefore that in view of the foregoing situation the Agronomist would become involved in the planning of new coordinated projects with BARC staff on pulses and cropping systems. Since the weakest point in most multidisciplinary programs was in agronomy (rather than in breeding, selection, nutrition, pathology, etc.) in developing a package of practices to produce maximum yields, taking into account the limited resources of small farmer, th activities of the agronomist were concentrated within the Agronomy Division of BARI, linking up with the wheat, pulse, and oilseeds projects.

Since there are a large number of external agencies involved in a multitude of projects in agriculture in Bangladesh, it is most important that donor agencies assess the needs and roles of their technical assistance personnel not only at the time the project is planned but also at the time of activation, before specialists are recruited. (In this case, the initially conceived projects had received substantial aid from other sources in the intervening period.)

Of more significance is the need for Bangladesh institutions to avoid requesting or receiving assistance from a multiplicity of donors for the same field of work, resulting in conflicting relationships and inefficient use of scarce technical assistance funds. The vesting in BARC, by the directive of April 21, 1979, from the External Resources Division of the Ministry of Finance, of authority for review and recommendations relative to all externally-funded agro-oriented research projects, should be carefully implemented.

3. Trained Manpower

There is insufficient trained manpower in both subject matter disciplines and in research management. An intensive academic training program supported by both bilateral and multilateral agencies is under way. The status of training, beginning in 1977, is shown in Table 6.

BARC has not followed up on the establishment of a training component, as recommended by the IADS Training Consultant in May 1979. The Joint Research Review Team, in their report of April 1979, made the following recommendation:

Table 6. Status of Training Beginning 1977

Name	Field of Training	University/ Institute	Training Started	Expected Comp. Date	Funds Oblig. ($)	Training Status
A. Academic/Long-Term Training						
Md. Jahiruddin (PIO/P 60054)	Agronomy-Cropping Systems (PhD)	Kansas State University	12/29/77	-	6,525	Discontinued
Najabat Islam (PIO/P 60055)	Plant Breeding-Pulses (PhD)	Oklahoma State University	1/14/77	-	11,200	Discontinued
A. K. M. Amzad Hussain (PIO/P 60058)	Horticulture-Veg. Production (PhD)	Cornell University	1/14/77	12/80	37,329	
Sufi Mohiuddin Ahmed (PIO/P 60059)	Plant Breeding-Wheat (PhD)	North Dakota State University	1/23/77	8/80	35,599	
M. A. Hannan (PIO/P 60056)	Soil Science (PhD)	Ohio State University	3/2/77	12/80	37,650	
Mushtaq Ahmed (PIO/Ps 80003 & 90102)	Ag. Economics (PhD)	Cornell University	1/19/78	8/81	27,397	
Ameerul Islam (PIO/P 60057)	Agronomy (PhD)	UPLB (Philippines)	6/2/78	6/81	8,200	
Abdul Hamid (PIO/P 80079)	Agronomy-Cropping Systems (PhD)	Kansas State University	1/2/79	4/30/82	16,215	
Harunur Rashid (PIO/Ps 70081 & 90131)	Ag. Engineering (Land and Water Management PhD)	Colorado State University	6/10/78	12/82	31,416	Transferred from M.S. to Ph.D.
Md. [illegible]zlul Huq (PI[illegible] 60051)	Crop Production (M.Sc.)	Texas A&M	1/21/77	6/2/78	17,205	Completed

B. Non-Academic Training

Abul Khair (PIO/P 60047)	Crop Production Multiple Cropping	IITA (Lagos)	2/22/79	1/80	7,800	Completed
Md. Akmal Hossain Md. Mafizul Hoque Nurul Haque Basunia (PIO/P 90132)	Veg. Production and Breeding	Kasetsart University (Bangkok)	5/6/79	9/5/79	10,386	Completed
A. M. Mazherul Islam Khan (PIO/P 60049)	Farm Machinery Design	Seoul National University	4/21/78	10/27/78	8,600	Completed
Mrs. Zebun Nahar Huq (PIO/P 80048)	Ag. Research Methodology	USA	6/4/78	-	4,910	Completed
Dr. M. H. Mondal (PIO/P 90142	Ag. Research	USA	6/11/79	10/5/79	11,048	Completed
Syed Ali Hussain Abdur Rashid Shah (PIO/P 90143)	Agronomy	Bangkok	7/1/79	2/80	14,507	Completed
Md. Omar Hayder M. A. Malek Mia (PIO/P 90156)	Research Management	Manila	8/29/79	11/79	9,121	Completed
Azizur Rahman A. M. M. Mosiul Haque (PIO/P 90159)	Cropping Systems	Manila (Los Banos)	9/10/79	3/80	3,600	Completed
Jamaluddin Ahmed, BARI Abul Khairat Majumder, BARI Mansoor Ali, BARI Md. Habibur Rahman, BARI Abul Hussain, BARI Anwar Karim, BARI (PIO/P 90164)	Cropping Systems and Pulses	Chiang Mai (Chiang Mai)		5/80	32,000	Completed
A. K. M. Habibul	Agriculture	IRRI	9/10/79	3/10/80	4,800	Completed

Recommendation 11. BARC should appoint qualified and capable staff members to serve as Research System Development Officers, in furnishing leadership for such activities as: (1) program planning and budgeting, (2) manpower development and personnel management, (3) research facility planning and development, (4) evaluation and application of technology, (5) information, library, and documentation services, and (6) coordination of external support. These duties require special qualifications with training and experience beyond that customary in the usual scientific disciplines.

The Special Committee that examined the Joint Review Team Report stated, "This is considered to be highly important. The Council should lay down leadership in research system activities."

In view of the critical limitation to effective research caused by the lack of trained manpower--a situation that will become more apparent as the new facilities at BARI are available--it is essential that BARC should take requisite follow-up action.

Improved training is urgently needed to improve research compentence. While planning and organizing research is important, in the final analysis success depends on the competence of researchers in the field. By and large this is now lacking. Many experiments are worthless because of poor basic agronomy, untimely use of inputs, inadequate recording, etc. Even when experiments are reasonably well done, they are often not reported satisfactorily. Standards of written English are poor.

4. Publications

The BARI Annual Report should be a major production but those which have appeared do not do justice to the amount of information actually available. The 1977-78 report only appeared in an abridged form. All annual reports should be in comprehensive form published regularly.

Few scientific papers are written by BARI staff in relation to the number of staff involved. Improvements will inevitably be slow and will depend partly on the amount of help that can be given by expatriate staff. The IADS team spent much time with individuals trying to help produce papers, reports, and newsletters.

5. Inadequate Budget Management and Dispersal of Funds

The lack of administrative support services is frequently the major impediment to research. Research requires the timely procurement of equipment, supplies, and materials, as well as personnel services that ensure availability of technicians and laborers. These functions are often handled by persons unfamiliar with research and not appreciative of the importance of timeliness in the various support services. The situation in Bangladesh has been noted repeatedly by review teams but still persists. The situation with respect to the World Bank project is illustrative. Annex IV of that report states the case:

Budgetary and Financial Planning and Management

Experience with both BARC and BARI indicates that neither has planned its procurement, budgets, or financial management adequately. BARI has ordered equipment by item rather than by allocating funds on a priority basis and has now had to curtail its procurement list and may have to eliminate all development at the Ramgarh Substa ..i. Building costs at BARC headquarters have escalated from Tk. 76 lakhs to Tk. 122 lakhs in spite of approval of the lower estimate by both BARC and IDA. The cost of research grant scheme is estimated at $1.8 million instead of the appraisal estimate of $1.0 million. IDA has now proposed an examination of all civil works programs by a qualified engineer, and a financial analyst is to be engaged to examine the plans for the utilization of project funds. It is likely that assistance will be required from a management consultant in order to reorganize the financial management systems in BARC and BARI.

The Joint Research Review Team, in the April 1979 report, recommended:

Recommendation 20. Administrative and technical support services should be improved throughout the national agricultural research system. This includes attention to a) development of data processing facilities and central records of research to be maintained in BARC, b) improved procedures for procurement of equipment, supplies, and materials, c) expeditious handling of personnel actions, d) improvement of transport and communications services, and e) the development of library and documentation services that would facilitate maximum availability and extended use of scarce and costly books, journals, and reports. Special Officers should be appointed to the BARC staff, as required, to develop these improved procedures and services.

The Special Committee stated, "Recommendation is endorsed and action suggested for BARC, accordingly."

The common lament when this is discussed with government, including some at high levels, is, "It is most unfortunate but this is a legacy of British days." The time that has elapsed since 1947 seems ample to have developed corrective measures--especially when administrative management and services must be redirected so positively and urgently to development objectives.

The foregoing are representative of some of the basic problems that have hindered the project to date and will become even more serious in the future as the newly emerging research capabilities of the national research system will be expected--rightly--to produce.

D. Impact Assessment

The Research Contract with IADS provides project objectives against which impact assessment can be made, as follows:

a) Establishment of a well supported and staffed agricultural research system for non-rice crops and cropping systems.

b) Development of appropriate technology that would be adapted to the local socio-economic conditions of Bangladesh.

c) Development of national problem-oriented multidisciplinary research programs on wheat, pulses, vegetables, oilseeds, and various cropping systems.

d) Improvement of delivery systems to transfer technology from research station to farmer.

A well-supported and well-staffed agricultural research system for crops other than rice has not yet been achieved. But if investment in in-service, short-term, and academic training is any guide, then the future holds promise. Training means needed research manpower is temporarily otherwise occupied. Support services at both BARI and BARC as yet have not been appreciably improved, though the Master Plan provides the blueprint for such improvement.

As a result of inventories of on-farm socio-economic and agronomic conditions by joint BARI/IADS efforts, improved technology is being generated. On-farm validation trials have been somewhat strengthened for such crops as wheat, potato, and mustard.

Multidisciplinary research programs have been developed, but implementation of these through research projects and experiments remains an urgent agenda for 1980.

While considerable understanding of the problems, working papers, na and plans have been developed, improvement of systems to effectively transfer technology remains to be implemented.

E. General Assessment of the Project

A critical aspect of a project aimed at establishing a strong agricultural research system is the degree to which the project has established communication links and interrelationships with Government, individual institutions, the contract agency, and expatriate donors.

1. Government of Bangladesh

The project has received cordial and sympathetic Government support. Institutional constraints (largely inherited from an archaic colonial system and not yet discarded), scientific manpower, and research management deficiencies have been mutually addressed by the BARI and BARC Directorate on a frank and constructive basis. Relationships of the external technical assistance staff with the Executive Vice-Chairman of BARC and Director of BARI in developing strategies to resolve these constraints have been professional, if not always successful. In contrast to the disappointing

progress in strengthening the support services, budget management control, establishment of a Field Experimental Division at BARI, and a sound comprehensive training program at BARC, considerable progress has been made in (1) multidisciplinary research programs, (2) coordination among the Bangladesh research institutes, and (3) executing meaningful field trials at the various experimental stations. Commitment and dedication by the Executive Vice-Chairman of BARC, Director of BARI, and the Agricultural Ministry to achieve goals shared by the Government of Bangladesh, USAID, and contract personnel have been superb.

2. USAID

The effectiveness of any contracting organization depends considerably upon the understanding, support, and competence of the funding agency. The research project has been indeed fortunate in this respect, primarily due to the efforts of USAID Agricultural Project Officer Mr. Arnold Radi. His sustained interest and knowledge of the research project since its inception 6 years ago has been a large factor in developing an effective interrelationship between the Government, USAID, and IADS. The USAID Mission in Bangladesh has shown considerable interest in the Agricultural Research Project in perspective to their larger program of agricultural development assistance.

3. IADS

Although the research contract with IADS was signed on November 21, 1977, it was not until June 23, 1978, that the project supervisor and the first member of the IADS field staff commenced their assignment with the Bangladesh Government. Other members of the IADS Team--the agronomist, agricultural economist, administration specialist, and agricultural engineer--arrived on July 25, August 30, July 25, 1978, and May 31, 1979, respectively. The three junior scientists joined the IADS Team on July 1978 (and the CIP potato specialist, supported by the World Bank, joined on November 26, 1979). In addition, upon request from the BARC Executive Vice-Chairman, IADS has engaged the following short-term consultants:

Name	Dates	Assignment
Dr. A. H. Moseman	July 21-August 4, 1978 September 15-17, 1978	Strengthening the Agricultural Research System
Dr. D. S. Athwal	July 21-August 4, 1978	
Mr. S. M. Katz	September 24-29, 1978	Budget management
Dr. F. C. Byrnes	April 24-May 1, 1979	Training/communication
Dr. G. Klassen Mr. D. Finfrock Mr. D. N. Sharma	September 23-29, 1978 October 7-16, 1978 January 13-21, 1979	Experiment station development

Dr. R. Cummings, Jr.	April 16-20, 1979	Agricultural economics
Mr. M. Shearer	September 18-October 16, 1979	Irrigation and water management
Dr. R. L. Cushing	March 16-April 27, 1979	BARI master plan

4. Relationships with Other Sectors

Agricultural research in Bangladesh is supported by numerous multilateral and bilateral programs, foundations, and voluntary agencies. Primarily through the office of BARC, and in particular the International Staff Support & Coordination Cell, the Agricultural Research Project has assisted in the coordination of expatriate projects and in the logistic support of consultants. In concert with the BARI Director and BARC Directorate, the project staff has been helpful in arranging seminars, workshops, and meetings with have focused on agricultural research topics and proposals for foreign assistance. There has been an especially close liaison between the two major donors, USAID and the World Bank, in projects aimed at strengthening the Bangladesh Agricultural Research System.

Strengthened linkages with the international agricultural centers and the Bangladesh research institutes have been enhanced during the period of the research project contract.

Junior scientists, acquired in a subcontractual arrangement with the Mennonite Central Committee, have been particularly successful in assisting senior IADS scientists to implement programs in agronomy and agricultural engineering (land development) in the BARI station network.

As the private sector generates more activity in support of agricultural development in Bangladesh, representatives of many worldwide agricultural chemical companies and some manufacturers of agricultural equipment are contacting BARC. These links are desirable and are being strengthened.

The Research Review Team appreciates the kinds of problems and constraints that have been encountered in the early years of the project. They are not unusual in efforts to establish agricultural research systems in societies generally lacking in understanding of the role of science and technology in agricultural development.

The team considers the progress on the project as acceptable and commendable, and deems the project worthy of continuing support.

ANNEX IV

ASSESSMENT OF THE WORLD BANK-SUPPORTED AGRICULTURAL RESEARCH PROJECT

A. Background

The Bangladesh Agricultural Research Project became effective on November 11, 1978. The project aims to strengthen applied and adaptive research in Bangladesh by improving BARI research facilities at three regional research stations and one sub-station, and by strengthening BARC to permit it to fulfill its crucial role in planning, coordinating, and monitoring research. The total project cost was estimated at $7.4 million and the IDA credit was for $6.0 million.

The project was designed to complement the activities of USAID, the Extension and Research Project, and other donor agencies that were already involved in developing the agricultural research system in Bangladesh. In consultation with the Government of Bangladesh and USAID, it was agreed that no residential expatriate experts would be provided under the project and that any necessary advice and assistance during implementation would be provided by advisers recruited under the USAID project. Likewise the preparation of the report of the Joint Review Team on Reorganizing Agricultural Research in Bangladesh and its acceptance by Bangladesh Government was a covenant of the IDA Credit Agreement although financial support for guidance and assistance in the preparation of this report was provided by USAID. From its inception the project has been under continuous supervision by the Dacca Regional Office of IBRD.

B. Project Status

Up to the present the progress of implementation of the project has been satisfactory.

1. Civil Works

A new headquarters building for BARC and laboratory, housing, and farm buildings for the VARI Station were provided under the project. The headquarters building in Dacca is scheduled for completion by December 1980. Construction work has started at the BARI regional stations at Jamalpur, Jessore, and Hathazari. There have been difficulties in obtaining bids for construction work at Ramgarh in the Chittagong Hill Tracts, and financial overruns at the other three stations might result in the cancellation of development at this station.

Research farm development plans for the BARI stations have been produced by a consultant specialist. The implementation of these plans is scheduled to begin in October 1980 under the supervision of the consultant.

2. Equipment

Vehicles and farm and laboratory equipment were provided under the project. Some vehicles and office equipment have been purchased by BARC. BARI has awarded contracts for the provision of farm and laboratory equipment, but none has yet been delivered.

C. The Research Grant Scheme

A total of $1.0 million was made available to BARC for financing research projects in other institutions and also the National Coordinated Projects (NCP). To generate the research topics under NCP, technical working groups were established to review ongoing and past research and recommend areas requiring additional study. These working groups received assistance from the IADS team and from expatriate experts financed under the project and were established for soil and water management, farming systems, agricultural economics, and appropriate technology. A total of 39 sub-projects have been generated as a result of this work. IDA review and approval of 20 percent of these projects is required, but as yet no details of the projects have been received.

1. Research Planning

A national research plan was required to form the basis of investment in agricultural research. The services of a consultant were obtained to provide the methodology for the production of the plan. This was subsequently published in December 1979 and approved by IDA.

2. Training

The project originally provided for 20 overseas Ph.D. courses; 25 M.Sc.; and 5 Ph.D. courses in Bangladesh and 30 short-term career development courses. Funds were also provided for short-term training courses in Bangladesh. No progress has been made with in-country training and it is now proposed that a reduced number of M.Sc. courses should be made available on a regional basis. Arrangements have been made for 20 students to take up Ph.D. courses in USA, UK, New Zealand, Australia, and Denmark. In the absence of a training officer and adequate experience at BARC, the services of the U.S. Department of Agriculture and the British Council were used in finding places for these students. Another six students are expected to take up their Ph.D. courses before 1981. A total of 29 candidates have been selected.

BARC is responsible for the training program. IDA has expressed concern only with regard to one candidate who was registered to study disease infection on pine needles; it is being considered that this topic was inappropriate to Bangladesh.

Nine senior research staff are attending research management courses in USA, to be followed by visits to research establishments.

D. Current Problems

1. Staff

The staffing of BARC is causing concern. The posts of Member-Director Livestock and Training Officer have remained vacant for many months, and four Principal Scientific Officer (PSO) posts were vacant in May 1980.

A total of 43 incremental staff were provided under the project, but only about 25 percent of these positions have been filled. BARC is therefore inadequately staffed for the provision of the support to the proposed research grant scheme and to the many committees now operating under its aegis.

2. Budgetary and Financial Planning and Mangement

Experience with both BARC and BARI indicates that neither has planned its budgets or financial management adequately. BARI has ordered equipment by item rather than by allocating funds on a priority basis and because of financial constraints, has had to curtail its procurement list and may have to cancel all development at the Ramgarh sub-station. Building costs at BARC headquarters have escalated from Tk.76 lakhs to Tk.122 lakhs in spite of approval of the lower estimate by both BARC and IDA. The cost of the research grant scheme is estimated at $1.8 million instead of the appraisal estimate of $1.0 million. It is likely that assistance will be required from a management consultant in order to improve the financial management systems in BARC and BARI.

E. Funds for Research

The allocation of project funds to the research grant scheme was made on the expectation that the Bangladesh Government would continue its support of this scheme. This has not occurred. Government funds have been reduced so that more than half of the original research projects supported under the scheme have had to be cancelled. USAID funds were sought to support others. These cancellations have reduced BARC's credibility as a financing agency and the Government's commitment to the research grant scheme is uncertain.

F. Research Monitoring Consultant

To monitor the progress of the research grant scheme and to ensure that the research sub-projects were responsive to the needs and constraints facing Bangladesh agriculture, provision is made under the project for the employment of an expert to visit Bangladesh annually and report to BARC. This expert has not been recruited even though this is a condition for disbursement against expenditures on BARC research sub-projects.

ANNEX V

SOIL AND WATER MANAGEMENT RESEARCH

Bangladesh faces a tremendous challenge in meeting its future food and fiber needs. Bangladesh has no option but to increase production on existing land. It has been estimated that only 2 percent of unused cultivable land of the country could be brought into cultivation. Thus, the country must gain its needed growth in agricultural production by intensifying production on existing land. To do this will require significant improvements in flood control, irrigation, fertilizer use, cropping intensity, and standards of farming. Such changes will place great pressures on land and water resources, not to speak of human resources, in order to meet production and equity goals. They can only be achieved through an effective national research system that can focus on urgent problems and needs of the country.

Intensification of the type envisaged for Bangladesh will require a strong program of research in soil and water management. Because soil and water management needs are frequently site-specific, a coordinated national program which places emphasis on the regional and local diagnosis of problems will be required to make best use of scientific manpower, facilities, and operating funds.

A. Rationale for a National Soil and Water Management Research Program

The farmers of Bangladesh face probably the most difficult land and water management problems of any country in the world. The location of the country in the delta of the great rivers, Ganges and Brahmaputra, results in 90 percent of the land area being mostly flat alluvial plain. The total area of perennial inland waters amounts to 4 million acres. The country has six major agro-ecological zones:

Zones	Acres
flooded high monsoon	6 million
flooded low monsoon	1.5 million
non-flooded high monsoon	6.4 million
non-flooded low monsoon	3.7 million
hill tracts	4.2 million
coastal	2.4 million

Many inland areas are flooded for long periods during the monsoon season. An estimated 7.7 million acres of water surface inundate crop fields and other low-lying areas that retain monsoon water for about 6 months. Thus during the monsoon season many farms are completely or partially flooded, and only deepwater aman rice can be grown.

Cropping systems and sequences, as well as planting dates for most crops, are directly dependent upon the supply and amount of rainfall, surface water, or groundwater available. Farmers whose lands are flooded

during the monsoon may experience severe drought during the dry season or during breaks in the monsoon. If the monsoon fails, even partially, as it did in 1979, then the whole country may experience severe droughts. A farmer may have to contend with floods during the monsoon and still have to rely on residual soil moisture during part of the year, combat droughts, and practice irrigation, all in the same year! The Bangladeshi farmer faces a never-ending series of unpredictable changes in water availability and in soil moisture. The risks and uncertainties which make up the day-to-day life of rural people are enormous. In addition, the farmer grows a multiplicity of crops, many in mixtures, in part as a hedge against uncertainties. Each soil moisture condition calls for adjustments in sowing date, sowing depth, fertilizer use, crop choice, etc.

To serve the farmer adequately, soil and water researchers must find ways to rationalize the multiplicity of land and water conditions extant in the country. An excellent start has been made by the preparation of the national and regional land use maps. These maps can be used to help select target areas and to plan regional on-farm studies and research station studies that will address major agricultural problems. Other pragmatic applied research mapping studies have been already used to guide supplemental irrigation during the drought in 1979. In particular, soil fertility and soil testing research should be tied to major land use units and cropping patterns.

Soil and water management research in Bangladesh in the past appears to have been oriented mostly toward conventional studies. A notable exception is the fine work of the Soil Survey Department of the Ministry of Agriculture which has completed a detailed reconnaissance survey of the soil resources of the country. Additionally, the department has worked out agro-ecological maps on a national as well as regional and thana basis, giving land use capability information such as location and amounts of land suited for certain crops or cropping systems. This is an outstanding achievement, and Bangladesh is one of the few developing countries that has such land resource maps. This work should provide a basis for organizing a field- and action-oriented national program to improve soil and water use for the millions of fragmented farms in Bangladesh.

B. Soil Science Research

Soil science is a necessary part of every national research system, yet in many cases soils research information is poorly used in meeting farm needs. Sometimes this is due to the fact that there are inadequate linkages between the research program and extension services, but frequently soils research is rather basic and difficult to use in a systematic way to improve agriculture. Bangladesh cannot afford to waste any efforts in soil research. It needs to understand what soils it has, where they are, and how they can be used (the work of the Soil Survey Department has done an admirable job here). With that done, it needs to understand the major physical, chemical, and biological properties of each major

soil type in order to work out factors affecting management at farm level.

The country has a bewildering number of institutions that conduct soils research. These include Soil Survey Department, BARI, BRRI, BSRI, BTRI, BJRI, INA, BAU, Dacca U., BFRI, BUET, and BWDB. In most cases the research has not been published or is difficult to find. There has been much duplication of effort and little coordination or cooperation in the research. Also, many research programs appear to have little relation to real problems faced by farmers. More work needs to be summarized and put in usable form for professional agriculturists or national planners in meeting needs of the country.

BARC, seeing the need for coordination of the soil and water research, has organized a series of inter-agency Task Forces in Soil and Water Management, and a report has been prepared (BARC, 1979, Soil-Water Management Research Inventory and Problems in Bangladesh). A number of problems and priority research topics in soil research were identified in this report, including need for more emphasis on soil physics and water relations, tillage, and hardpan problems (see Brammer, 1980), and reclamation of salt-affected soils in the coastal zones. The report focused mostly on soil-water needs and did not emphasize needs in soil fertility (although a separate proposal for a national coordinated program in soil testing and crop correlation was submitted separately to BARC and it is understood that it will begin this year), soil conservation and protection (an estimated 2.4 million acres of the country consists of denuded forest land), microbiology, or cropping systems.

It would appear that tillage, cropping systems, soil fertility, and fertilizer use, and water management on different soils of the country should receive priority, in order to serve the farmers better. All of these need to be tied to regional stations and linked to the farming systems research programs. Emphasis should be placed on use of multidisciplinary teams including soil scientists, agronomists, and economists, in order to ensure best use of soils information at farm level. In these studies explicit emphasis should be given to problems faced by different groups of farmers. Often larger farmers have the best land, which is also less likely to be flooded or exposed to other risks.

BARC should quickly mobilize a task force of senior soil scientists and agronomists to assess the status of soil science knowledge in the country by publishing critical reviews (state-of-the-art analyses) of each area of soil science. When these are completed, a "Bangladesh Recommends" should be prepared using the state-of-the-art reviews as the major resource. Every effort should be made to make use of past research findings so as to provide a firm scientific base for future research.

The Soil Testing and Crop Correlation project has a vital role to play. The national coordinated program in Soil Test/Crop Correlation can be very important to the country, but it could also run into problems of relevance and timeliness unless a sense of urgency and a strategic, coordinated deployment of scientific resources at various institutions

are adopted as the modus operandi. There have been 12 soil testing laboratories and 260 associated soil scientists working on soil testing in the past. It is important to learn as much possible from that experience--both positive and negative--before major investments are made in a new research program on soil testing.

C. Water Management Research

The Government of Bangladesh has concluded that irrigation will play a "pivotal role" in meeting the targets of its Second Five Year Plan (SFYP). Resources devoted to irrigation in the SFYP amount to almost 15 percent of total expenditure, a figure almost half that of the resources devoted to agricultural development (32.3 percent). The goal is to increase irrigated area from 3.1 million acres to 7.2 million acres by the last year of the plan. To do this the Government proposes development of more small irrigation systems, especially pumps and tubewells.

In its agricultural research priorities, the SFYP sets high priority on soil and water management, evaluation of most intensive cropping systems, and improvement of cropping systems.

The SFYP points out that controlled irrigation which is practiced on only a small portion of cultivated land now, when coupled with flood protection and drainage, could encourage the practice of transplanted Aus instead of broadcast Aus, as well as increase Boro rice and wheat.

The SFYP also points out the need for excavating canals, rivers, roadside canals, and so on, in order to improve traditional irrigation systems. It states, "Water resources development, particularly irrigation, will be the main instrument to bring about a radical change in agricultural practices and productivity." Biswas, 1979. Conserve Water Before It Goes Out of Grasp (mimeographed) called for similar efforts to examine ways to conserve water from the monsoon in small reservoirs and farm ponds, and in small rivers, creeks, canals, khals, etc., by the use of bunds equipped with sluice gates.

The main objectives of the SFYP in water resources are:

- Develop and control surface water resources to provide dependable and timely irrigation for winter crops

- Protect coastal areas from saline water inundation and control flooding

- Reduce dependence on cash resources for water development--self-help, etc.

- Achieve effective and efficient water use; better village and farmer organizations

- Training

Table 3 (Chapter I) shows the overall acreage and irrigation goals for the SFYP, which emphasizes that increased production is dependent on efficient water use at the farm level. To achieve this will require integration of extension services, more focused and effective research, training for farmers and operators of irrigation equipment, and strengthened irrigation groups.

D. Irrigation Research

Research and development work on irrigation in Bangladesh is scattered among a number of institutions including BARC, BARI, BAU, BMD, BRRI, BUET, BWDB, IRDP, INA, and BADC. Some of these institutions operate their own irrigation research stations, e.g. BWDB has four research stations devoted to irrigation research, yet research information gained on these stations is not permitted to be published. The number of institutions involved in water research perplexes the person interested in research organization and management. BARC has attempted to overcome the duplication of research and lack of communications between research units by forming a Task Force on Soil and Water Management. This group has produced a report (BARC, 1979, Soil-Water Management Research Inventory and Problems in Bangladesh) that should lead to a national coordinated program in soil and water management. Every effort should be made by the Government to support BARC in its efforts to carry out the aims of this research plan and to make water management research an effective tool in meeting national needs and objectives.

A word of caution is called for in planning water management research. What is needed is not a long series of experiments on consumptive use of water by various crops. Rather, what is needed is a program that will:

- Identify when and where rainfall and water supplies are likely to occur, or to become in excess or in short supply (i.e. collect good meteorological data and use it)

- Identify major problems affecting water management at the farm level, fully taking into account the institutional-cum-technological nature of the problem for different types of large and small farmers

- Use the agro-ecological maps of the Soil Survey Department to identify major irrigation problem areas that will lead to necessary research programs at policy or research station level

- Assemble multidisciplinary teams--irrigation engineers, agronomists, sociologists, agricultural economists--to work at the farm and village level to identify major problems and potentials of irrigation

- Collate, evaluate, and assess the status of irrigation knowledge in the country, including the considerable body of knowledge possessed by the farmers themselves, and publish this in a "Bangladesh

Recommends" or similar fashion. This exercise must be an ongoing process as problems, knowledge, and perceptions of problems change

- Under BARC sponsorship hold periodic national meetings to assess current knowledge in water management and to serve as a forum for scientific debate on the progress of irrigation in the country

From the information on irrigation research in the study, it would appear that potential gaps that may exist include:

- Knowledge of traditional systems of irrigation. Perhaps more than one-third of irrigated lands are served by dhones and swing baskets, yet little appears to have been done (except at BUET) to understand these systems, or the farmer's reasons for using them. These systems should also not be seen as alternatives to "modern" techniques; rather, parts of these well-tried systems might be integrated into modern schemes.

- Knowledge of and pumps and hand tubewells. Research, including joint technical-cum-economic and sociological studies, should assess potentials for increasing their use and effectiveness through alternative "package" of technologies and institutional arrangements. The improvement and expansion of the "rower pump" (a special-action hand pump) would appear to have promise.

- The reasons for the less-than-satisfactory operation of deep tubewells. These appear to have been designed to irrigate much more land than is being served. This research should be done by multidisciplinary teams which can examine engineering, agronomic, and socio-economic factors, including rural institutions, that are determinants of water use at farm level.

- Knowledge of irrigation schemes where water is being used optimally and very high command area development potential is being achieved. The practical solutions to many water management problems may already exist in some locations in Bangladesh.

E. Dryland Farming

An area of research that appears to have promise is dryland farming. Most farmers in Bangladesh rely on rainfall and rising flood waters during the monsoon to grow their crops. Great uncertainty exists each year as to the date of the onset of the monsoon, reliability of rainfall, depth and length of flooding, soil moisture status at given critical periods such as sowing, transplanting, tillering, etc.

Dryland farming research is not just water research. It is a combination of soil-water relationships, tillage practices, crop selection, timing of sowing and other factors, plant population, etc., and it can only be approached realistically in a coordinated cropping systems or

farming systems research approach. It must be multidisciplinary and should be carried out in the region for which the research is designed. Hence, dryland farming research programs should be centered around regional research stations established within each major region. On-farm studies can be carried out from these regional centers in order to verify research results and speed up adoption.

Before research station studies begin, surveys of farmer practices, problems, and innovations in dryland farming should be carried out.

ANNEX VI

FARMING SYSTEMS RESEARCH

Agricultural research in Bangladesh will benefit greatly from close association with the farmer and his knowledge of the problems that face him. Research planned and initiated on experiment stations without contact with farmers is often inappropriate. The challenge for BARC, BAU, BARI, BRRI, and other research institutions to ensure that their research is relevant and useful to farmers, and has a good chance of being adopted. Crop yields obtained at research stations are, in general, much higher than those obtained by farmers growing the same crops in the same general agro-ecological environment. This often indicates that information is not reaching the farmers, or if it does, that some deficiency exists in the research process in meeting the needs of farmers.

The Review Team suggests that a farming systems research (FSR) approach be adopted within the research organizations of Bangladesh to ensure that scarce manpower and financial resources are utilized efficiently in overcoming problems facing farmers, and in achieving national food production, employment, and other agricultural sector goals.

Some of the ideas in farming systems research are not new to Bangladesh. BRRI has an effective cropping systems program that is a part of the Asian rice cropping systems network coordinated by IRRI. BARI is in the process of developing a cropping systems program that ultimately will be part of a national coordinated cropping systems program. BARC has appointed a Task Force on Cropping Systems that has produced an excellent proposal for a coordinated national cropping systems program (BARC, 1979, Resume of Activities of Farming Systems Technical Working Group and Project Proposal). This proposal calls for a national system of on-farm trials and surveys on cropping systems only, and includes a number of research institutions including BRRI, BARI, BJRI, BWDB, BAU, and BSRI. The decision to limit the program to cropping systems is probably wise, but the Review Team suggests that the program consider a whole-farm approach to assessment of existing farming systems for different size of holding groups, and in assessing potential of new cropping patterns and their effect on the whole farm.

Also, the team suggests that FSR is broader than just on-farm trials and surveys for individual commodities, and that an understanding of the different activity areas of FSR would assist the coordinated national cropping systems program to reach its goals, as well as to utilize the strengths of numerous single commodity or factor research programs and institutions in Bangladesh in the national cropping systems program.

FSR and cropping systems research (CSR) are often misunderstood, and many misconceptions exist concerning what FSR or CSR really are, how they can be or should be carried out, and so on. In part, the confusion is understandable, for FSR in its modern versions is more multidisciplinary

and farm-oriented than the work of some of the traditional disciplines of agricultural science. Yet FSR must rely on the products of good disciplinary research.

It may be useful to discuss some of the concepts of FSR that were presented in a report prepared for the Technical Advisory Committee (TAC) of the Consultative Group for International Agricultural Research (TAC Farming Systems Research Report, 1978). This study is being applied in farming systems research programs at some of the international agricultural research centers and in some national programs. Some of the principles and statements from this report will be useful in laying out a conceptual framework for FSR in Bangladesh.

What is FSR? There seems to be no end to attempted definitions of what constitutes a farming system. The TAC report suggested the following:

> A farming system (or farm system or whole-farm system) is not simply a collection of crops and animals to which one can apply this input or that and expect immediate results. Rather, it is a complicated interwoven mesh of soils, plants, animals, implements, workers, other inputs, and environmental influences with the strands held and manipulated by a person called the farmer who, given his preferences and aspirations, attempts to produce output from the inputs and technology available to him. It is the farmer's unique understanding of his immediate environment, both natural and socio-economic, that results in his farming system.

In other words, the farming system includes the whole farm and its activities. FSR then is concerned with the whole farm; cropping systems research then is directed at one or more cropping systems of a farm, while livestock systems research is directed at one or more livestock production systems of a farm. Therefore, cropping systems research and livestock systems research are components of FSR.

How does FSR differ from conventional discipline-oriented research? Some of the major characteristics or principles of FSR are as follows:

- Requires team effort through a multidisciplinary approach, including both social sciences and applied natural sciences (FSR depends for its success on maintaining the integrity of the relevant disciplines, yet the researchers representing the different disciplines work as teams, each complementing the other)

- Seeks to understand better the problems and needs of the farmer

- Seeks to improve the efficiency of agricultural research by focusing research on the priority problems and needs of the farmers so as to develop relevant improved technology

- Takes into account both the interactions between technologies themselves and between technologies and the environment, and thereby improves the relevance of generated technologies

- Seeks to ensure that new technologies contribute to the long-term maintenance and enhancement of agricultural productive capacity

- Facilitates the linkages between research, extension, delivery systems, and the farmer

- Seeks to assist in the formulation of development policies and methods that address the problems of the farmer

An ideal FSR program would aim to meet the following interrelated objectives:

1. To understand the land (including climatic) resources and socio-economic environment within which agricultural production takes place. Areas of concern on the resource side include agro-climatic (sometimes called agro-ecological) zones and, where appropriate, identification of agro-climatic analogs which may yield information of value for a particular system and guide the selection of benchmark sites. It would seem fundamental to the success of FSR that accurate and reliable data on the land resources and particularly on factors of soil and climate are made available and well understood. It is especially important in the selection of benchmark sites to have sufficient data to ensure that the benchmark site is representative of the larger area under study. The refinement of agro-climatic mapping has an important bearing on the selection of desirable agronomic characteristics in crop improvement programs. On the socio-economic side, necessary information will relate to population density, the distribution of land between agricultural households, details of local markets for inputs and products, income levels, food consumption patterns, infrastructure, and broad cultural characteristics.

2. To evaluate existing farming systems in specific physical and socio-economic environments, in particular the practice and performance of these systems; and to improve our understanding of the farmer in different size-of-holding groups, his skills, preferences, and aspirations. These studies can be considered as essential baseline studies within benchmark situations. It is not expected that BARI or BRRI will understand and address all the problems of all farming systems of the country. However, it is essential for them to assess farm systems that are representative of major production areas, and to develop local methods for evaluating performance of existing farming systems. In many cases such evaluations will yield early results in that new technologies developed by farmers can be verified quickly and recommended to extension services for promotion.

3. To improve problem identification (target areas, target size of holdings, bottlenecks, etc.) in existing farming systems and thereby to better focus the research activities and programs of BRRI, BARI, BAU, BJRI, BSRI, etc., on key problems which limit production, the generation of farm income, or the stability of production.

4. To enhance the capacity of research organizations in Bangladesh to conduct research on priority farming systems problems so that they are better able to design new and/or improved production systems.

5. To conduct research on new or improved practices, principles, system components or subsystems within an FSR context, and to evaluate these for possible testing on farms.

6. To evaluate new or improved practices, or systems components, on farms in major production areas. Here a major need is to measure farmer reaction to new technology.

7. To assess the benefits of improved technology on farms where baseline studies have been conducted, in order to obtain information on the impact of technology, especially on small farms. Impact studies can also identify second- or third-generation problems, thus providing the necessary feedback to research institutes and policy makers.

It should be pointed out that while the above seven objectives imply a full range of FSR activities, not all of these objectives would be likely to receive full or equal attention in a given FSR program. Too, all seven objectives are interrelated and their attainment would automatically involve feedback and feedforward effects between them.

The seven objectives constitute a logical, methodical basis for FSR, which, if followed, could extend from an assessment of the natural resource base and an evaluation of different representative farm systems, to implementation of a research program that focuses on problems of different groups of farmers. The steps can be summarized in three fairly distinct interrelated "activity areas" which may be referred to as Base Data Analysis, On-Farm Studies, and Research Station Studies. To some degree these three activity areas may be sequential and cyclical, but more generally will develop concurrently with joint interaction and feedback effects.

Base Data Analysis. This involves the collection, collation, and understanding of the many factors characterizing the environment of a region. Much such analysis will entail land resource mapping and evaluation, and in large part can be done at research stations or in head offices mostly relying on secondary data. However, where such data are inadequate or unreliable, initially there will be a relatively greater involvement by research organizations in data collection. In addition to the physical resources data, there is also a need for socio-economic data on population, size-of-holding distributions, sharecropping practices, and other types of relationships between rural households, farming systems practiced, production and income levels, and various aspects of the infrastructure.

The aim of base data analysis is to learn as much as possible about the land and water resources of a region and the variations in those soil and climatic factors which mainly influence agricultural production, as well as to determine key socio-economic factors that determine why

agricultural resources are used in different ways. The normal end product is a series of maps depicting agro-climatic zones, land/soil units, and land use (farming/commodity systems). Such information can then be used to assist identification of potential target zones for on-site study and to determine the best locations for experimental stations or benchmark sites, as well as provide a basis for later studies on research impact. In general, Base Data Analysis will seldom involve detailed on-site investigation except where larger non-farm units (for example, villages) are the object of study. Institutions in Bangladesh that could be used as key resources in Base Data Analysis include the Soil Survey Departments, BWDB, BAU, BARI, and BRRI, as well as BIDS and other social science institutions.

Bangladesh is fortunate that some major steps in Base Data Analysis have already been made. An Agro-climatic Survey of Bangladesh (BRRI/IRRI, 1976) has been published, and an excellent soil classification program of the Soil Survey Department has characterized and mapped the soils of the country. Further, the soils have been classified in terms of land use capability and crop suitability. Agro-ecological maps have been prepared on a regional and national basis which present gross land areas suitable for different crops. Bangladesh is one of the few developing countries of the world that has such detailed land use maps, and these will be of inestimable value in planning and carrying out FSR activities. These maps should be on the reference shelves of every FSR worker in the country.

On-Farm Studies. Studies on the farm can be aimed at both "upstream" and "downstream" activities of FSR. "Upstream" activities are those which work first at farm level to identify problems and to focus research on the major constraints. "Downstream" activities are those where new technologies generated are passed to the farmer through the research/extension linkages of a country.

The major factor in on-farm studies which distinguishes it from base data analysis relates both to the location and purpose of the research. Thus surveys of existing farms (an upstream activity) would be considered as an on-farm studies activity, and a major output of this work would be information for base adta analysis. However, village-level studies aimed at understanding the socio-economic framework of a given community rather than the farm itself would be considered as a base data analysis activity.

In addition to this type of survey activity, on-farm studies also involve experimentation (physical, biological, or socio-economic) on the farm. Such research can be considered as a downstream activity and may involve exploratory, innovator, and other types of special purpose surveys or the development or testing of new technology or practices at farm level. On-farm studies may involve differing modes and degrees of control and may include research under full researcher control, joint research/farmer control, or full farmer control. On-farm studies will also include studies of technology adoption, technology generation by farmers, the monitoring of changes in farming systems, and assessment of

the impact of new technology. Further, by their nature, on-farm studies must often necessarily involve (and provide a fruitful opportunity for) cooperation with other national institutions.

Research Station Studies. These are seen to involve a focused research program to generate new technology, design components for new systems, or modify existing systems. Such research differs from conventional disciplinary research in that it is designed to fulfill a need in the context of a given farming system. Sometimes it may be convenient to distinguish different classes of research station studies. For example:

- Exploratory, development research aimed at solving specific problems. Once the problem is defined in an FSR context, its solution may have a largely discipline-oriented basis.

- Integrative studies, where component parts are assembled and tested in a holistic framework, i.e. the synthesis of research results into applicable systems and management practices.

Subdivision of FSR into the three activity areas listed above can help persons understand just where particular FSR programs or program activities are focused or oriented. For example, many studies of factors affecting multiple cropping, experimental tillage practices, soil and water management, or principles affecting pest management practices or components, when improved, could be evaluated in on-farm studies. Indeed many FSR programs are centered mostly on research station studies, with much less resource being devoted to on-farm studies. One exception to this is BRRI, which has initiated a comprehensive program in on-farm studies.

It can be seen in the seven objectives listed previously that FSR can be used in both an "upstream" as well as a "downstream" sense. Some persons consider FSR to be important in the "downstream" sense, in which information is taken from the experimental program and attempts are made to find a place for the new technology level. This is certainly important, but the "upstream" function is just as important, if not more important. Here FSR can be used to determine constraints and identify problems at farm level and to perform subsequent analyses, in order to help research institutions to focus more clearly on key problems facing producers and to assist policy makers in the formulation of agricultural development policies. FSR here links commodity researchers, e.g. plant breeders at BRRI or BARI, with farmers for whom they are producing improved varieties. Such collaboration, with its two-way communication flow that starts with the farmer when FSR is used in the upstream sense, can help to ensure that research results are relevant.

FSR would appear to offer unique opportunities for Bangladesh. The country has a number of single commodity research stations--jute, tea, sugarcane, rice, livestock, fisheries--that produce technology for their respective industries. Yet it was stated again and again to the Team that farmers are not involved in just one crop or enterprise. Rather

they produce a number of crops as well as livestock on their land, often in complex and closely scheduled sequences or companion relationships. (This point is also made in the report of the BARC Task Force on Cropping Systems, 1979.) Complex rotations, sequential cropping, inter-cropping, relay cropping, and related systems all require technology designed to fit into carefully structured seasonal or annual needs. Thus jute varieties need to fit with rice or other crop patterns. Varieties developed without taking existing production systems into account may never find a use on the farm, no matter how high yielding or high quality they may be. In Bangladesh the importance of size of holdings and of the differential access of resources by small or large farmers also means that FSR has to take these factors into account in designing technologies for different groups of farmers.

Another benefit could be in situations where on-farm studies show a large number of landless laborers or marginal farmers, where an FSR approach would lead to technology priorities in the areas of livestock, poultry, and fisheries. Here improvements in technology might enable this group of poor households to increase their nutrition or earn income from livestock fattening, poultry production, and fisheries. These types of alternatives may be especially important for rural women.

The development and improvement of regional stations should provide a unique opportunity to implement an FSR approach in developing regional research programs. BARC, BARI, and BRRI, among others, may wish to plan their cropping systems programs using the regional stations as bases of operations. Table 7 presents the major cropping patterns of the areas surrounding 22 of the 41 agricultural research stations and sub-stations of the country. The wide range of major patterns among these stations illustrates the need to regionalize FSR programs to meet the local needs. Here FSR can be used to focus regional research programs on priority needs.

BRRI is conducting commendable on-farm studies on rice-based cropping systems. However, BRRI does not work only with rice in its cropping systems program. It includes wheat, pulses, potatoes, and other crops that the farmer grows regularly. Linkages must be strengthened through FSR with commodity programs conducting research station studies at BARI, BAU, JRI, the Sugarcane Research Institute, and the Tea Research Institute. BARC, through its national coordinated cropping systems research program, can foster and enhance cooperation.

FSR is not a panacea, but it is an approach to research whereby the component parts of the farming system can be analyzed, problems can be identified, and research activities can be focused on major problems facing the farm family. Structuring and stimulating a national research system to think and plan in a way that is directed toward whole farm needs can not only improve research relevance and adoption, but it can lead to great satisfaction and professional rewards for agriculturists who serve the rural community.

Table 7. Cropping Pattern Adjacent to 22 Agricultural Research Stations and Sub-Stations

Location of Station or Sub-Station	Cropping Pattern
Joydebpur (Dacca)	Aus followed by T. aman. Boro followed by T. aman.
Jamalpur (Jamalpur)	Aus/Jute followed by T. aman followed by wheat. B. aman followed by pulses/oilseeds/wheat. Boro followed by T. aman.
Ishurdi (Pabna)	Aus/Jute followed by T. aman/pulses/oilseeds/wheat. B. aman followed by pulses/oilseeds/wheat.
Jessore (Jessore)	Aus followed by pulses/oilseeds/wheat.
Hathazari (Chittagong)	Boro followed by T. aman.
Bogra (Bogra)	T. aman. Aus/Jute followed by T. aman followed by wheat.
Rajbari (Dinajpur)	T. aman. Aus/Jute followed by T. aman followed by wheat.
Rajshahi (Rajshahi)	T. aman. Aus/Jute followed by T. aman or wheat.
Burirhat (Rangpur)	Aus/Jute followed by T. aman followed by wheat or tobacco.
Chapai Nawabganj (Rajshahi)	T. aman. Aus/Jute followed by pulses/oilseeds/wheat.
Comilla (Comilla)	Aus/Jute followed by T. aman followed by wheat. Boro followed by T. aman. B. aman followed by wheat, potato.
Daulatpur (Khulna)	T. aman. Boro followed by T. aman.
Jointiapur (Sylhet)	Hilly area, grows some fruits & rice. This station conducts research on citrus.
Kishoreganj (Mymensingh)	Jute/Aus followed by T. aman. Boro.
Rahmatpur (Barishal)	T. aman. Boro followed by T. aman.
Rangamati (Chittagong Hill Tracts)	Hilly area grows fruits, rice, and vegetables.
Faridpur (Faridpur)	B. aman followed by wheat/pulses/oilseeds. Aus/Jute followed by Rabi crops.
Habiganj (Sylhet)	Boro. Aus followed by T. aman.
Srimangal (Sylhet)	T. aman.
Chandina (Comilla)	B. aman followed by wheat, pulses/oilseeds/potatoes.
Noakhali (Noakhali)	T. aman. Boro followed by T. aman.
Demra (Dacca)	B. aman followed by pulses/oilseeds/wheat. Aus/Jute followed by rabi crops.

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ANNEX VII

ECONOMIC SOCIAL SCIENCE RESEARCH

A. General Macro and Micro Analysis

In the context of technological change in the Bangladesh rural and agricultural sector, economics and social science analysis can be divided into ex-post and ex-ante types of research:

Ex-post (Historical) Research
a) Socio-economic Consequences and Impact Studies
b) Processes of Innovation
   i) Informal systems of research, development, extension, and adoption
   ii) Formal systems of research, development, extension, and adoption

Ex-ante (Planning and Implementation) Research
a) National and Regional Technology Policy (macro analysis)
b) Farming Systems Research (research at the household and village level)

1. Ex-post (Historical) Research

In the past, many social scientists have concentrated on one type of ex-post research where they have, for example, analyzed the impact of "green revolution" technologies on increased food production and the flow of benefits to different socio-economic groups within the society and to different groups in the international arena. Historical analysis has also included estimating rates of return to investments in formal technology improvement programs. High and low rates of return have been found in different technologies in developed and developing countries.

More recently a complementary type of historical analysis has been receiving increasing attention. These are studies looking at the process of technological innovation in informal and formal (institutionalized) systems of research, development, extension, and adoption. These studies seek to understand what types of decision-making processes, what allocation of funds to different types of research activity, what communications and linkage systems, etc., give rise to new and improved technologies that are relevant to and viable in the societies for which they have been designed. Equally important are studies which analytically diagnose the reasons for why public sector investments in research and development activities and institutes have not given rise to the expected benefits, the basis on which the program was justified.

In Bangladesh there is a great need for this type of study as lessons from past research and development experiences could be a very important ingredient in the design and content of future agricultural and rural research systems in Bangladesh.

This type of analysis could best be done by universities and social science research institutes such as BIDS, and it is suggested that BARC actively encourage this type of analysis. Case studies in formal and informal systems might include wheat, rice, hand pumps, paddle threshers, farmer-developed agronomy practices, and water management techniques.

Because this is a new type of analysis and because capacities for science and technology policy research need strengthening in Bangladesh, there is a role for external assistance in this area. However, if external research organizations are involved in this area, the work should be done in coordination with BARC; otherwise it is unlikely that Bangladesh will fully benefit from such studies.

As a means of facilitating this type of activity, BARC might establish a coordinated research program on rural and agricultural technology innovation, which would include social scientists, technology researchers, and extension personnel.

2. Ex-ante (Planning and Implementation) Research

The second major area of research for social scientists lies in the area of planning agricultural technologies and in participation in the dynamic and iterative process of technology generation. This is another new area for economists and social scientists. New methods and techniques are being developed so that social scientists can make a constructive and timely input in influencing the direction of technological change.

Broadly speaking, the involvement needs to be at a macro--technology policy--level and the micro--household and farming systems--level of analysis.

National and regional technology policy analysis. The first Bangladesh National Agricultural Research Plan (BARC, 1979) is a significant start for multidisciplinary analysis to determine what types of improved agricultural and rural technologies are relevant to meeting Bangladesh's national goals of reducing poverty, taking into account national resource endowments, institution structure, and the position of Bangladesh in the world economy.

For institutes which specialize in specific commodities and non-commodity areas, the Second Five-Year Research Program for BARI (BARI, 1980) illustrates a start to the systematic application of agro-climatic and socio-economic criteria in setting priorities for technology research, and for justifying against national goals the allocation of scarce research resources to different technology programs and activities within those programs.

This type of involvement at the macro level should be strengthened and resources should be allocated to enable social scientists to be fully integrated into this type of technology policy research. This will involve the participation of social scientists on technical working groups and the development of practical methods and tools of analysis

which enable economic, employment, land tenure, and other issues to be taken into account when deciding on the direction of improved technology generation. Lists of criteria for selecting research projects have already been used by BARC and BARI. Research justification checklists to help in setting technology priorities should be further developed. The checklist should give attention to quantitative measures of expected maximum and minimum estimates of the projected results of the research. For example, the area of land to be affected, the increases in yields, the increases or decreases in person days of men or women employed, the amount of foreign exchange saved or earned. These and other types of practical analytical tools can be one of the ways of reconciling trade-offs between the possible contributions of different technology improvement to different national development goals.

At the regional research stations, similar types of macro technology policy analysis should be used to rank the types of technological improvements that are needed to meet the needs of different regions. The Madamba report (1979) describes the process by which regional requirements may be fed into a national plan for technology generation.

It is suggested that BARC actively encourage multidisciplinary macro technology policy analysis and that a coordinated program be established to look into the development of research methods in this area. Participation would include social and applied natural scientists of the major research institutes and centers of technology generation. The coordinator should be from one of the major centers.

Farming systems research. In recent years different types of research methods have been developed to enable economists and social scientists in multidisciplinary projects to identify priority problems of rural households and help direct the generation of technologies to meet these problems. In Bangladesh, these methods have been used through constraints studies, on-farm research programs of surveys and trials, cropping systems projects, etc. These types of studies should be encouraged and the multidisciplinary involvement strengthened by further development into a farming systems approach (see the separate section on this topic). The focus of farming systems research, constraints research, etc., should be within institutions, such as BRRI, BARI, BAU, that are engaged in technology generation and in monitoring of technological changes taking place at the village level.

B. Technology Improvement for the Landless and Rural Women

In addition to the general set of principles and types of analysis described above, two areas of major national importance should get special emphasis for economic and social science analysis within the agricultural research system: (1) employment for landless households and marginal farmers, and (2) employment for women.

The reason for this special emphasis is twofold. First, traditionally agricultural technology improvement has been concerned primarily with

the problems of "the farmer." While recognizing the unquestionable need to address farmers' problems in Bangladesh, the national goals and the Second Five-Year Plan place great emphasis on the agricultural and rural sectors for providing gainful employment to the estimated 54 percent of rural households who are landless or cultivate less than half an acre.

The second reason for this special emphasis within the agricultural research system is that new institutions will have to be developed around specific types of technology improvement programs if poor rural men and women are to be the primary beneficiaries of technological change.

The types of schemes of interest to BARC should be dominated by the specific technology involved. The recent suggestion of providing low-lift pumps to cooperatives of the landless, which would sell water to farmers, is an example of a strongly "technology-based" rural development research. Women's cooperatives formed around a paddy huller, the promotion of fish tanks managed by landless laborers, cattle fattening, and the keeping of poultry and goats by the poor are all strong "technology-based" rural development programs. In addition to the need for improved technologies for these activities, a substantial amount of research effort will have to go into developing and testing suitable institutional arrangements with rural people. It is not suggested, however, that BARC or any of the major technical research institutes get into the full field of institutional development research, such as those at BARD or the work of the Economic Department at Chittagong, which did research and development work in generating credit schemes from commercial banks for landless households.

Finally, to complement the work of other areas of employment analysis, it is suggested that a rural and agricultural employment coordinated project be established to analyze the impact of current and future agricultural and rural technology policies from the standpoint of the landless, marginal farmers, and rural women. The coordinator should be based in the agricultural economics department of BAU because of the wide range of agricultural disciplines which can be called on there.

ANNEX VIII

LIVESTOCK RESEARCH

In rural Bangladesh, livestock is considered an integral part of most farming systems. However, there is a general realization that the feed supply is grossly inadequate to support current livestock numbers, that serious disease problems exist, that livestock support services are poor, and that livestock productivity is low. This situation is a serious constraint to improving output under almost all farming systems practiced throughout Bangladesh. Since livestock are well integrated into farming systems, livestock health and performance has a direct effect on the nutrition, income, and welfare of most farmers, and particularly the small farmer. The growing of pasture and fodder crops is severely limited by direct human demand for food.

Livestock research in Bangladesh has been fragmentary and has had relatively little impact on productivity. Although various livestock studies have been undertaken in the past decade or two, little reliable data or baseline information in relation to livestock is available.

A. Constraints

A number of constraints have prevented the livestock sector from effectively contributing to the farm economy of Bangladesh:

a) the meager support provided by the Government to the livestock sector

b) the absence of a well-thought-out and relevant national coordinated livestock research and development plan

c) the unnecessary professional conflicts among veterinarians and other animal scientists

d) scarcity of trained scientific officers who are motivated to work in rural areas

e) gross inadequacy of diagnostic laboratories

f) chronic unavailability of support services such as transport, budget, and supplies

B. Opportunities for Livestock

Given the current situation in Bangladesh agriculture and its attendant constraints, where human population density is among the highest in the world, floods and other natural disasters are common occurrences, literacy level is low, and rural poverty is pervasive, a

number of opportunities for the livestock sector to provide a meaningful contribution to the national goals of Bangladesh begin to emerge. These are:

Primary

1. providing farm power for draft purposes

2. generating additional employment opportunities for landless laborers as well as rural women

3. producing high-value protein food without having to sacrifice land used for food crop production

4. maximizing use of the total available resources on the farm

Secondary

1. the production of meat, milk, or eggs either for sale or for home consumption

2. the production of livestock by-products such as hides, feathers, bones, etc.

Thus, it is strongly recommended that the effort in generating improved livestock technology be initially focused on cattle, goats, and poultry.

C. Research Objectives

The suggested initial priority research objectives are:

a) To acquire valid and reliable information on detailed seasonal on-farm feed sources for livestock as well as on animal feeding and husbandry practices in selected representative villages

b) To determine the optimum alternative schemes of integrating the production of appropriate fodder crops (i.e. lucaena, napier, paragrass, etc.) into the village-level farming systems

c) Studies to further improve the feeding value of farm wastes and by-products

d) To investigate the problems of draft power in terms of cattle size as well as variously designed implements and harnesses

e) To develop an appropriate scheme for providing animal health cover for on-farm cattle as well as backyard poultry and goat raising

f) To develop an appropriate package of husbandry and health practices to enable landless laborers as well as marginal farmers to effectively produce poultry and/or goats in their backyards

g) Studies leading to the development of an appropriate animal health policy for Bangladesh

h) Socio-economic studies to ensure the viability of the improved livestock technology to be generated from the above-mentioned research

D. Available Research Manpower

The manpower in Bangladesh engaged in livestock research activities is reported to total 128 professionals: 23 with Ph.D.; 88 with M.Sc.; and 17 with B.Sc. training. The following table describes the relative capacities of institutions in Bangladesh that are involved in livestock research (BANSDOC, 1978).

	Ph.D.	M.Sc.	B.Sc.
Bangladesh Ag. University, Mymensingh			
Dept. of Anatomy and Histology	1	10	-
" " Physiology and Pharmacology	4	5	-
" " Pathology	1	4	1
" " Parasitology	2	4	1
" " Microbiology and Hygiene	3	24	-
" " Vet. Medicine and Surgery	2	7	-
" " Animal Breeding and Genetics	3	5	-
" " Animal Nutrition	1	4	-
" " Poultry Science	4	4	-
" " Dairy Science	2	6	-
" " Animal Science	-	8	-
Livestock Research Institute, Dacca	-	2	9
Animal Husbandry Institute, Comilla	-	5	6
TOTAL	23	88	17

In addition, there are a few other individuals doing some aspects of livestock studies in other departments of BAU, at the BCSIR laboratories (Dacca and Chittagong), at Bangladesh Academy for Rural Development, at the German-supported project of Savar Farm, at the DANIDA-supported project in Noakhali, at the Australian-supported project in Sylhet, and at the U.K.-supported project in the Livestock Department. However, by and large, Bangladesh Agricultural University is overwhelmingly the major institution (in terms of number and quality of staff) engaged in livestock research.

E. Research Projects

Some 193 livestock research projects have been reported as either ongoing or completed within the last 5 years. Of these, 124 are in veterinary medicine and 69 are in the field of animal science. The following table shows the number of research projects at various institutions in Bangladesh (BANSDOC, 1978).

	Vet.	Husb.	Nutr.	Others
Bangladesh Ag. University, Mymensingh				
Dept. of Anatomy and Histology	16	-	-	-
" " Pathology	39	-	-	2
" " Parasitology	6	-	-	1
" " Microbiology and Hygiene	6	-	-	1
" " Vet. Medicine and Survery	26	1	-	1
" " Animal Breeding and Genetics	-	1	-	-
" " Animal Nutrition	-	-	11	-
" " Poultry Science	-	-	1	4
" " Dairy Science	2	2	14	11
" " Animal Science	-	2	4	2
Livestock Research Institute, Dacca	4	-	-	-
Animal Husbandry Institute, Comilla	18	4	1	1
TOTAL	124	15	32	22

In addition, there are a number of livestock-related studies undertaken in other organizations and in various projects supported by foreign donors. Nevertheless, over three-fourths of all livestock-related studies in Bangladesh are conducted by BAU scientists.

A rough review of the types of studies undertaken reveals that while only one-third of the completed livestock research at BAU may be considered relevant to the current problems of the Bangladesh livestock industry, some two-thirds of ongoing BAU livestock studies can be considered as relevant. This is a welcome indication that BAU livestock scientists are beginning to move away from "academic-type" studies to more relevant problem-solving investigations.

F. Recommended Short-Run Strategies

a) BARC should take advantage of the livestock research capability of BAU which is obviously the lead institution in Bangladesh engaged in livestock research.

b) BARC should likewise try to bring into its livestock research scheme the research activities of the various aid-supported livestock projects in Bangladesh.

c) The four ARPGs constituted by BARC (ruminants, poultry, animal feeds/nutrition, animal health) should be strengthened and even reorganized, if necessary, and made to act accordingly in evolving and monitoring the research programs concerned.

d) Funding for livestock research should be increased to its appropriate level of support for relevant priority research projects.

e) The appropriate authority in Bangladesh should bring the leading veterinarians and animal scientists together and ask them to convey to their colleagues the message that Bangladesh can no longer afford the "luxury" of having its livestock research capability polarized by chronic bickering and professional jealousies.

f) BARC, in collaboration with the Directorate of Livestock Services, should immediately inventory current livestock research programs, resources, and support services.

g) Likewise, BARC in collaboration with the Department of Livestock Services should develop an inventory of on-farm feeding, husbandry, veterinary, and overall livestock services management activities.

G. Recommended Long-Run Strategies

It is strongly recommended that after the inventory of livestock research programs, resources, and support services have been completed, the Government of Bangladesh appoint a Joint Livestock Research Review Team (expatriate and in-country) to:

a) scrutinize and analyze the completed inventories

b) establish priorities for livestock research

c) identify the appropriate livestock research network and resource needs

d) develop a livestock research master plan

ANNEX IX

BANGLADESH AGRICULTURAL UNIVERSITY

The team had beneficial discussions at Bangladesh Agricultural University with the Vice-Chancellor, Dr. M. U. Ahmed Chowdhury, as well as deans, department chairmen, and senior professors. The team also toured the research facilities and field plots. Construction and furnishing of the physical plant are nearly complete. This is an attractive, well constructed campus with its surrounding research fields. Laboratories and classrooms appeared to be in good condition.

The BAU Prospectus 1978/79 reports that:

> Based on the recommendation of the Commission on National Education and other expert bodies, the Bangladesh Agricultural University (BAU) came into being by Legislative Act in 1961/62. The main function of the University is to provide for instruction in agriculture and such branches of learning connected with agriculture as the University may think fit to provide at the degree and post-graduate levels and make provisions for research and for the advancement and dissemination of knowledge in those subjects.

The University encompasses 1,080 acres and is located on the banks of the Brahmaputra, 72 miles north of Dacca. The Institute of Nuclear Agriculture (operated by the Atomic Energy Commission) and the Agriculture Experiment Station (operated by the Fisheries Department) are both located within the campus on land donated by the university.

The university functions under authority of the University Syndicate and the Academic Council. The Vice-Chancellor is the Chief Executive and Academic Officer. The academic program of the university is engaged in teaching--graduate and post-graduate levels, research, pre-service and in-service training in extension, refresher courses for extension and bank officers as well as lower-level teachers in rural science, and short courses.

A. The Faculty

The following faculties are functioning, with the departments noted under each:

Faculty of Veterinary Science--anatomy, physiology and pharmacology, medicine and surgery, pathology, parasitology, microbiology, and hygiene.

Faculty of Agriculture--agronomy, soil science, plant pathology, entomology, horticulture, crop botany, agricultural chemistry, biochemistry, agricultural extension and teachers' training, genetics and plant breeding, mathematics, physics, chemistry, zoology, Bengali, and English.

Faculty of Animal Husbandry--general animal science, animal nutrition, poultry science, and dairy science.

Faculty of Agricultural Economics and Rural Sociology--cooperation and marketing, agricultural statistics, and agricultural finance.

Faculty of Agricultural Engineering and Technology--agricultural engineering and basic engineering, food technology, and rural industries, irrigation and water management.

Faculty of Fisheries--aquaculture and management, fisheries biology and limnology, and fisheries technology.

On the campus there is also a Graduate Training Institute and an Evaluation Projects Office.

B. Evaluation of Research and Teaching

Based on the April 1979 Report of the Joint Review Team, the Special Committee Constituted by Government to examine the report of the team recommends, No. 14, "BARC should undertake a thoroughgoing survey of research manpower requirements," and, No. 15, "There should be a thoroughgoing assessment of the curriculum, syllabi, and training offered at BAU," etc. It was reported to the team that BAU has started self-examination. In any event, both recommendations were accepted and studies are under way.

The faculty numbers approximately 270. Of these, about 70 hold Ph.D. degrees (most of these were awarded in the last 10 years) and 210 have training to the M.Sc. level or equivalent.

On the basis of the number of Ph.D staff, the animal sciences, agronomy, soil science, plant pathology, entomology, horticulture, crop botany, genetics, and plant breeding would likely be in the best position to train post-graduate students.

C. Training, Post-Graduate Students

BAU has an active program of confering M.Sc. degrees. During 1964-76 the university lists 831 research projects done by masters' degree students. In the period 1975-1977, 210 research projects were conducted by masters' degree students.

The team did not have an objective way to judge the quality of the research work done by the masters' degree students. The departments with the largest number of B.S. students dominate the masters' degree training programs as well. An examination of the thesis titles suggests that the research done was sometimes superficial and secondary data was widely used.

The recent introduction of the one-year masters' degree program was widely discussed. In a meeting the team had with the Committee for Advanced Studies and Research, the members present said that faculty and students offer strong arguments for such a program, though many concede that a strong masters' degree requires at least 2 years of study and research. It is, in fact, alleged by some faculty members that it takes the majority of students 2 years to complete a masters' degree. The team subscribes to a regular 2-year masters' program which requires 6 months of residence and appropriate thesis research.

D. The Student Body

Table 8 shows the number of students admitted and passed since 1974/75. Total admissions since 1974/75 were 739. The erratic numbers of students that were admitted and passed during 1976/77 and 1977/78 is due to student unrest, which required closing the university for several months. BAU is now busily at work on the backlog of examinations.

Table 9 shows the number of masters' degrees awarded up to 1976 and the enrollment for the years 1977 and 1978. Eight departments dominate the program of awarding M.Sc. degrees, with agronomy, agricultural economics, entomology, horticulture, and soil science being the leaders.

From 1972 to 1980, three students earned the Ph.D. degree. At present five students are enrolled in Ph.D. programs in four disciplines.

E. The Teaching Program

At the B.Sc. level, all students in agriculture follow a uniform curriculum. They take standard courses offered by the faculties listed earlier. Eight to ten subjects are studied each year. A mix of theory and practicals is the standard procedure. In appropriate disciplines practicals are reported to include fieldwork. Writing of comprehensive papers is also a requirement.

F. Institutional Capabilities and Performance

Based on the size of the faculty, its level of training, its physical plant, and general mandate, BAU has the potential of being a very strong university. However, BAU has faced the political and economic problems common to Bangladesh. It is yet to develop fully the capabilities that match its full potential. On its visit the team, however, found a growing spirit of dedication, commitment to public service, and eagerness to be in the mainstream of agricultural research and development activities.

It should be recognized that BAU is the source of most of the trained agricultural scientific manpower in the country. Given a period of economic and political stability, BAU has the potential to improve its research and training program across the board and excel in selected areas.

Table 8. Bangladesh Agricultural University: Students Admitted and Passed Out Since 1974-75

Course	1974-75		1975-76		1976-77		1977-78		1978-79		1979-80	
	Admission	Passed out	Admission	Passed out	Admission	Passed out	Admission	Passed out	Admission	Passed out	Admission	Passed out
B.Sc.Ag. (Hons.)	119	226	130	241	-	121	250	Result not yet published	362	Exam yet to be held	323	-
B.Sc.A.H. (Hons.)	50	57	46	41	-	37	64	"	93	"	55	-
B.Sc.Ag.Econ. (Hons.)	46	29	58	53	-	25	65	"	70	"	57	-
B.Sc.Ag.Engg. (Hons.)	42	62	45	56	-	25	92	22	82	"	103	-
Cond.B.Sc. (Vet.Sc. & A.H.)	31	17	-	33	-	20	-	Result not yet published	-	"	-	-
D.V.M.	71	52	98	71	-	27	144	37	116	"	102	-
B.Sc.Fisheries (Hons.)	47	29	48	34	-	24	98	Result not yet published	129	"	99	-
TOTAL	406	472	425	529	-	279	713	59	852		739	

Table 9. Masters' Degree Students, Bangladesh Agricultural University

	Passed out up to 1976	1977 enrolled	1978 enrolled	Total
Agriculture Faculty	636	47	95	838
Animal Husbandry Faculty	96	8	31	135
Veterinary Science Faculty	104	19	20	125
Fisheries Faculty	55	34	12	110
Agricultural Engineering Faculty	5	1	-	7
Agricultural Economics Faculty	190	52	26	268
TOTAL	1132	153	193	1478

BAU has been engaged in a unique self-improvement exercise. A careful analysis of its potential comparative advantage in research would yield rich dividends.

BAU should not attempt to compete with Bangladesh research institutions that are already preeminent in certain research areas--for example, with BRRI in rice or with BARI in wheat. In these research areas, its role would clearly be supportive. Rather, BAU should channel a major proportion of its resources--manpower and funds--on problem areas that have not had much research attention. This would include oilseeds and pulses, livestock, freshwater aquaculture, socio-economic studies in support of various commodity and non-commodity programs, and agricultural policy-oriented studies such as in the area of agricultural employment; in such areas they probably should have a "more leading" role. In this case, coordinated projects are under way at BAU. Farming systems research also presents an opportunity for BAU. The large and well-trained BAU staff could be the pacesetter in this relatively new field of work. It has many disciplines to draw on and could become the premier training center for "farming systems" extension and research staff.

G. Organization and Coordination

The Bangladesh Agricultural University is affiliated with the Ministry of Education. Since it is an agricultural university, this dual situation creates problems of funding, mission orientation, and communications. Since BAU is primarily a teaching institution, questions are raised as to the quality of the practical agricultural training the students receive. In fairness to BAU, it should be pointed out that the nature of its affiliation with the Ministry of Education has restricted access to the farmers' fields and community. There are exceptions, though. The university has had a research program on rural cooperatives in nearby villages for at least 7 years. Steps are being taken to improve direct contact with the rural community by having BAU accepting responsibilities in research and development in areas of Mymensingh. It is leading and studying integrated rural development in several Paras (i.e. neighborhoods or parts of villages) and whole villages as well. BAU is making a special study of the problems of the district. Though it has limited facilities, the faculty is moving out into the countryside to study the problems of rural people. Students are also taken on field trips and are assigned to develop case studies on specific farmer problems. The faculty responded to farmer and extension requests for advice in solving disease and other problems. Faculty members supervise "on-farm trials" and surveys and gather data pertaining to the district situation. The Team commends BAU in taking a special interest in the districts in the zone surrounding Mymensingh.

BARC is the national funding and coordinating agency for agricultural research, including that conducted at BAU. The level of BARC support to BAU research has precluded mounting a research program equal to the capacity of its well-trained staff and large number of post-graduate students. With some justification BAU is viewed as primarily a teaching

institution; also, the shortage of funds for all research in Bangladesh is recognized. However, the fact remains that the relatively well-trained professional staff at BAU has not been fully harnessed by the national agricultural research system.

The faculty expressed to the team that inadequate communications between BARC and BAU were due to a variety of reasons and that steps should be taken to improve the situation. BAU staff participated in preparation of several of the BARC-sponsored project proposals.

BAU lists 73 ongoing research projects. Most of the projects are funded for 1 year, and a few are funded for 5 to 8 years. The sources of funds are often temporary and are provided from scarce BAU resources. Nationwide fund shortages mandated 1980 cutbacks in BAU research as in other institutions. The titles of the projects indicate that they are generally concerned with practical farm problems. The total BAU research budget approximates Tk. 6,000,000. However, the long range (5-6 years) of projects such as the coordinated BARC and university funded rice, pulse, and soyabean research make up some 80 to 85 percent of the total budget. Hence the budget cannot be compared to the one reported on page 30 in the April 1979 report, Strengthening the BAU Research Systems.

ANNEX X

SELECTED REFERENCES RELATING TO THIS REPORT AND THE HISTORY OF THE AGRICULTURAL RESEARCH SYSTEM IN BANGLADESH

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Acronyms

ARCP	Agricultural Research Council of Pakistan
ARPG	Agricultural Research Planning Groups (Research Program Developers)
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BJRI	Bangladesh Jute Research Institute
BRRI	Bangladesh Rice Research Institute
CCBS	Central Cattle Breeding Station (Bangladesh)
CERDI	Central Extension Research Development Institute
CGIAR	Consultative Group for International Agricultural Research
FAO	Food and Agriculture Organization of the United Nations, Rome

GOB	Government of Bangladesh
IBRD	World Bank
ICAR	Indian Council for Agricultural Research, New Delhi
INA	Institute of Nuclear Agriculture
INFS	Institute of Nutrition and Food Science
PCARR	Philippine Council for Agriculture and Resources Research, Los Banos
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Los Banos, Philippines
SRI	Sugarcane Research Institute
TAC	Technical Advisory Committee of CGIAR
TWG	Technical Working Groups (Project Sub-Project Task Forces)
USAID	U.S. Agency for International Development