

PD-CAI 191

REPORT  
of the  
EVALUATION TEAM

Project 391-0296  
Strengthening Agricultural Research  
in  
PAKISTAN

October, 1983

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We are also appreciative of the very helpful support from all of the AID staff, and especially for the patient and cheerful help of Mrs. Tina D'Souza who typed the report.

FACE-SHEET TO BE USED FOR EVALUATION REPORT

Basic Project Identification Data

1. Country Pakistan
2. Project Title Agricultural Research
3. Project Number (Grant and Loan where applicable)
 

	391-0296
	Loan 391-T-156
	Grant 391-17-110-296
  
4. Project Dates: April 30, 1974 to June 30, 1985
  - a. First Project Agreement June 30, 1969
  - b. Final Obligation 1982
  - c. Project Activity Completion Date (PACD) June 30, 1985
  
5. Project Funding:
  - a. AID Bilateral Funding (Loan or Grant)
 

	Loan	6,200,000
	Grant	3,962,000
Other	1. Mondale Rupees	20,314,000 = Rs.132,200,000
	2. FAA Sec. 204 Rupees	606,000
  - b. Other Major Donors
 

Government of Australia	\$800,000	
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  - c. Host Country Counterpart Funds
 

		15,685,000 = Rs.129,000,000
Total \$	800,000	46,767,000
  
6. Mode of Implementation (Specify contractual arrangements and numbers):
  1. ABRIS Ltd.
 

	PIO/T No. 391-0296-2001-00
	Contract No. 391-0296-20186
  2. Advisor to the D.G., NARC - Murray Dawson
 

	PIO/T No. 391-0296-3-20136
	Contract No. 391-0296-C-00-3011-0
  3. Don Minehart, Station Development Specialist
 

	PIO/T No. 391-0296-2-20186
	Contract No. PASA-Ag-Pak-0296-2054-12
  4. IRRI for short-term consultant and participant training
 

	PIO/T No. 391-0296-3-80109 A # 3 (
	391-0296-3-30310 (
  5. CIMMYT for short and long term consultant and participant training
 

	PIO/T No. 391-0296-3-60426 (
	391-0296-3-20212 (
  
7. Responsible Mission Officials:
 

a. Mission Director	Donor M. Lion
b. Project Officer	J. Raymond Carpenter
c. Mission Evaluation Officer	William D. McKinney
  
8. Previous Evaluation and Reviews (Include title, type and date):
  1. Review ADP Component of Agricultural Research  
John S. Marshall, SER/DM, February 16, 1982
  2. Pakistan Staff Appraisal Report on the Agricultural Research Project  
by World Bank, December 17, 1982
  3. Report of Joint Review Team for Agricultural Research in Pakistan in  
relation to the Loan Agreement Government of Pakistan and United States of  
America AID Loan No. 391-T-156, April 2, 1976
  
9. Cost of Present Evaluation
 

a. Direct Hire		
b. Contract	\$28,757	Rs.243,936
c. Other	756	

## I. EXECUTIVE SUMMARY

### 1. The Development Problem

Agriculture is the largest single sector of the Pakistan economy, accounting for 32 percent of the Gross Domestic Product (GDP) and employing 55 percent of the nation's labor force. It earns 80 percent of the country's foreign exchange through export of agricultural and agro-based commodities and provides sustenance to over 70% of the population directly and indirectly.

The country's population of 90 million is increasing at the rate of 3 percent per year. A major objective of the Fifth Five Year Plan (1978/79 to 1982/83) was to achieve a growth rate of 6 percent per annum in agriculture. This would not only keep pace with population growth but also permit increases in per capita consumption and would increase earnings of foreign exchange.

To achieve this goal the government took steps to make agricultural inputs and credit more easily available and provided incentives in the form of higher prices for major commodities. Allocations of funds for agricultural research were increased and major changes were made in organization and management of research at the federal level. Agricultural growth fell short of the 6 percent target, averaging slightly above 4 percent per year over the five year period, due more to increases in area than to increases in yield per acre.

The inadequacy of the Pakistan agricultural research system to support a high rate of growth in agriculture has long been recognized. At the time of Independence (1947) the very substantial agricultural research system of undivided India was left largely in India. Not one of the national institutes was located in territories which constituted Pakistan.

### 2. The Project and Its Evolution

The Government of Pakistan invited high level teams of U.S. scientists to work with Pakistani counterparts to review the Pakistani Agricultural Research System and suggest measures for improving the situation. Joint Pakistani-American teams undertook extensive reviews in 1968 and again in 1973. Beginning in 1969 AID entered into a series of Project Agreements with the Government of Pakistan for strengthening its agricultural research system. The initial agreement provided dollar and rupee grant funds to support the research program

of the then West Pakistan, and now Punjab Agricultural University, Faisalabad. This was followed in 1974 by a major program of loan and grant funds to the Pakistan Agricultural Research Council (PARC), based largely on the recommendations of the 1968 and 1973 joint Pakistan-American teams.

While the official starting date for this project is 1969, no significant activities for strengthening the research system were undertaken until the 1974 grant agreement, which focused on development of a national system through PARC. The purpose of the project was, and remains, "to establish a functioning centrally coordinated program of agricultural research for major agricultural commodities which effectively translates policy guidelines into specific research projects with achievable results". Specifically, the project provided support to PARC, the counterpart Pakistan agency responsible for implementing the project, to support development of coordinated national research programs for major commodities and disciplines, in cooperation with provincial institutes, and for construction of a National Agricultural Research Center (NARC) at Islamabad to undertake research in areas of national importance where such research is not currently being undertaken, or is seriously inadequate, and it can best be done at a well equipped, staffed and funded central institution.

Several problems arose early in implementation of the project, largely because it was initiated before adequate staffing and managerial resources had been established at PARC. Reviews in 1976 and 1977 led to a redesign of the project in 1978, giving higher priority to building an institutional base which could eventually support a comprehensive research program.

As a result of application of Section 669 of the Foreign Assistance Act, \$737,950 of the grant funds authorized in 1974 were not obligated. Then, in 1979 disruptions at the American Embassy caused resident technical advisors to be sent home. This severely reduced AID's ability to support and monitor the project for some time.

The project was again amended in April 1982, extending it for another three years and adding funds to complete construction of the NARC, equip the facility and further strengthen the managerial and research capabilities of the center. The 1982 agreement increased the rupee grant

component by Rs.29,700,000. Total USAID funds available to the project from its inception in 1969 amount to \$6,200,000 in development loan funds, \$4,792,000 in dollar grants, and Rs.155,200,000 in Mondale rupee grants.

### 3. Evaluation Purpose and Methodology

The purpose of this evaluation is to assess the impact of the project on strengthening the research capability of the Pakistan agricultural research system. A team of six persons was engaged for three weeks for the task. Prior to arrival of the team PARC carried out a comprehensive internal evaluation. Its findings provided the team with up to date information on progress by the project. The team also visited agricultural universities and provincial research institutes in Northwest Frontier Province and in Punjab and the National Agricultural Research Institute (NARC) in Islamabad. PARC officials provided relevant published documents and supplied additional information and clarifications in discussions with team members. Other recent assessments of the Pakistan agricultural research system, including studies by the University of Minnesota in 1982 and of selected aspects of the system by the International Services for National Agricultural Research (ISNAR) in 1983 were helpful to the team.

### 4. Overall Assessment

The Team concludes that the Project has been highly successful, especially in the last five years, in realization of its objectives. Generally a sound base has been laid for an effective national research program for supporting agricultural progress.

Progress during the earlier years of the project was slow largely because the Council was not at that time staffed or organized to use aid well. It lacked leadership and had numerous organizational and administrative problems. Project reviews in 1976 and 1977 identified many of the problems. The Mission responded appropriately by redesigning the project in the 1978 project agreements.

Meanwhile, the Government of Pakistan has taken important steps for improving the structure of PARC and staffing it with competent senior officers and a good complement of junior support staff. The Ordinance of 1981 gave the Council a semi-autonomous status and authority to organize, plan and execute with greater freedom. Also the Chairman was given the status of Secretary to Government of Pakistan, Agricul-

tural Research Division, a step which the team believes significantly enhances his flexibility and effectiveness.

Physical progress fell far behind original targets. However, since the 1982 amendment progress has essentially met the revised schedule. At NARC, the training and conference center though inadequate in terms of future needs is essentially complete and in operation. Most of the staff residences have been constructed. The administration and office building and the main laboratory block including installation of furniture and equipment are well advanced and can be expected to be in operation by March of 1984.

The Farm Service Center has been remodelled and improved. Facilities have been developed for the plant genetic resources unit and for coordinating units of several national coordinated research programs. Good progress has been made on land shaping and development of the irrigation system for the portion of the 1395 acre site scheduled to have permanent irrigation.

National Coordinated Programs, the major vehicles for center/provincial cooperation on research projects of national scope and importance, have been instituted in nine areas. Coordinated programs on (1) wheat, barley and triticale; (2) maize, sorghum and millet; (3) rice; and (4) oilseeds are furthest advanced and are developing patterns of operation and performance which may, with appropriate modifications, be followed by other such projects.

Apart from a farming systems seminar and a livestock husbandry baseline study of selected barani area villages no farming systems studies have yet been initiated by NARC. A seminar on Farming Systems Research was held at NARC this past year. It was well attended and there was considerable interest but so far no worthwhile progress has been made in this area. At the present time NARC is inadequately staffed in agricultural economics and other social sciences needed to support a well rounded farming system research program. The project provides for technical assistance of a regional agricultural economist from CIMMYT who will be stationed here early next year. (Only 50 percent of this assignment is to be allocated to Pakistan).

The project has made some progress in developing stronger linkages with extension. Trials on farmer

fields are being carried out by most research institutions. PARC is involved in production maximization campaigns for major crops and the "travelling seminars" initiated under the national coordinated programs feature cooperation between scientists and extension workers.

Substantial amounts of laboratory equipment, vehicles and farm implements have been provided for NARC and the cooperating provincial centers. This should substantially enhance their research capabilities.

Manpower development has been an important feature of the project. 105 participants have been sent abroad for advanced degrees or for short-term non-degree training. Of these 78 have already returned to Pakistan and the additional 27 are currently undergoing training at U.S. institutions and the International Rice Research Institute in Manila, Philippines. Of these 27, 20 are in the U.S. and 7 at IRRI. With few exceptions, the returned participants are employed in their sponsoring institutions in the specialties for which they were trained.

The project also provides for advanced degree training of a large number of agricultural scientists at Pakistan agricultural universities. Until recently response to this opportunity has been poor, reflecting a general concern that local degrees have little value and that post graduate training in Pakistan needs strengthening. While the agricultural universities have some competent staff, several disciplines are not well staffed with trained scientists. They lack facilities, equipment and research funds for an adequate education, particularly at the M.Sc and Ph.D levels.

The project is nationwide in scope, but in reality has given relatively greater emphasis to development at the National Agricultural Research Center (NARC). This was necessary since, previously, the center was not in a strong enough position to provide leadership and support needed for a balanced national program. A good base is now emerging at the center. It will need further support to maintain the momentum and to strengthen its administration and management. In several disciplines such as agricultural economics, weed science, horticulture, dryland soil management and support services there remains a need to upgrade scientific competencies. Now a relatively greater emphasis should be given to building up the capabilities of the provincial institutes and agricultural universities.

##### 5. Project Design and Policy Implications

While the project began officially in 1969, the team considers the relevant start of the activity being project agreement of 1974. In the agreement the project focused on PARC as the responsible counterpart agency and spelled out a specific program for strengthening the national

system. It was a far too ambitious program considering that PARC was not at that time adequately organized or staffed to effectively use aid. Accordingly, progress was very disappointing and the option of cutting losses and terminating the project must have been considered. The 1976 and 1977 reviews acknowledged little progress but identified the major problems. The 1978 redesign made appropriate changes which helped the project survive the disruptions of 1979 and 1980. The 1982 amendment provided the additional support to assure a successful conclusion. The history of the project illustrates the importance of undertaking institution-building projects of this kind with patience and flexibility. A decade is not a long time in such a development process and AID should be prepared to allow at least that much time for satisfactory progress.

## 6. Lessons Learned

- a. Perhaps the most important lesson learned has been that in the development of institutions time, patience, perseverance and flexibility are of utmost importance. The decision to stay with it, but to modify and redesign to adjust to a very dynamic situation has been the key to success of this project.
- b. An improved system of national coordination in Pakistan for organizing and managing research as well as for setting research priorities is absolutely necessary to effectively mobilize scientific resources for solving agricultural production problems.
- c. A large number, though insufficient, of well-trained, committed individuals of all categories - scientific, technical, and administrative exist in Pakistan but require fair salary scales and good opportunities for advancement and responsibility, if they are to be attracted and retained.
- d. Adequate facilities and support services must be constructed to create an environment in which will-trained Pakistani scientists can conduct professionally satisfying research, this is an important incentive for attracting competent staff and encouraging production research.

- e. Research objectives cannot be followed up and achieved without adequate levels and continuity of research funding. This continues as a big problem in the Pakistan agricultural research context.
- f. Educational institutions in Pakistan cannot play an effective role in the agricultural research - extension - education network unless their scientific staff also regularly carry out mission oriented research, and unless these staff members also have excellent access to refresher training and to reference facilities.
- g. Pakistan's agricultural extension's input to research and education could be more effective if there were a more careful collection and a well-managed flow of information from farmers, through extension, to these bodies.
- h. Merger of Pakistan's agricultural research institutions with the agricultural universities is imperative to optimize resource use, minimize waste and maximize human efforts per unit investment.

## II. RECOMMENDATIONS

The following recommendations are grouped by major areas and arranged in priority order with each group.

### A. Organization and Administration

1. The administrative structure of NARC should facilitate its role as a national centre of excellence complementing and supporting provincial research and educational institutions. An organizational chart (page 39a) is proposed in which lines of responsibility will determine the kinds of competence needed in the major posts of the organization. The position of Director General has only recently been filled on an "acting" basis. The vital importance of this position requires that it be filled on a permanent basis with an individual who not only has exceptional competence and understanding of basic and applied sciences but also has outstanding ability for management, leadership and public relations (p. 38).
2. The staffing of NARC is especially weak in the following areas: horticulture, agricultural economics and other social sciences, entomology/integrated pest management, dryland soil management and weed control. Staffing of these sections be upgraded as soon as possible to provide minimum critical mass for intellectual interation (p. 7).

3. A portion of the PARC Headquarters and NARC salaries and operating costs, in addition to construction, commodities and training, is funded under USAID and World Bank projects. In case of any follow-up activities USAID should concentrate its funding on development activities (p. 46).
4. Delays and uncertainties in release of funds by the Ministry of Finance (MOF) to PARC adversely affect operations of NARC and PARC funded projects. Firm commitment by MOF for regular release of GOP funds quarterly would correct this problem (p. 48).
5. PARC should review the lines of communication from PARC, through project coordinators and directors, to projects at institutes and universities, especially in communicating budgetary changes. After going through the annual budget process, each level should have plans for areas to be changed/modified in the event of budgetary increases or decreases to say 10%, 20% and 30% (p. 46).
6. PARC should consider initiating changes in its financial management system, and placing it in line with its other management improvements. This should include improving the accounting system, as recommended by the World Bank in 1981 (p. 46).
7. PARC and project coordinators should explore possibilities of increased use of staff members of research institutes and universities where PARC-funded projects are located. This would benefit the institutions and PARC by more efficiency in utilizing staff members. It would also reduce the need for releasing project employees in times of budget restrictions and provide additional research experience, especially for university staff members (p. 45).

#### B. Research Management

While the NARC Training Centre has provided a facility for conducting training much more needs to be done to provide NARC the capability in multi-media instruction of scientists, extension workers, farmers and teachers.

1. NARC now has good facilities for improving staff training programs. It should emphasize the in-service and pre-service curriculum, including social, economic and management courses for national and provincial staffs. It is not recommended that NARC establish degree programs (p. 15).

NARC may, however, initiate certificate/diploma courses later on in specialized fields for which adequate facilities can be provided.

2. In collaboration with the University Grants Commission, NARC should, as soon as possible, develop a section which provides for sabbatical research for in-country scientists and a locus for supervision of thesis requirements (pp. 15; 39a).
3. There is need for improvement of management skills at all levels. It is recommended NARC arrange for a series of short courses in management skills, communication and coordination for senior and mid-level managers (p. 18).
4. A very useful set of procedures for allocation of plots and services has been initiated by the Farm Services Division. These should be institutionalized as soon as possible (p. 17).
5. There is a shortage of competent laboratory and field technicians. It is recommended a training program be initiated at NARC to train personnel for such positions. Also a career program should be established for this level of staff that would allow career promotions and, for the most competent, opportunities for degree training and advancement to the scientist level (p. 16).
6. Proper and timely maintenance of laboratory and field equipment is a problem. It is recommended the training section, in conjunction with Laboratory Management and the Farm Services Division, develop well-trained teams in the required specialties which would be available for training and maintenance in critical areas at national and provincial centres (p. 17).

### III. Manpower Development

1. Improvement in the quality of in-country degrees should have high priority. Strengthening the research capability of the agricultural universities is essential. This will require additional funding by PARC for research equipment and facilities in the national agricultural research programs. PARC's role as advisor to the University

Grants Commission should be institutionalized to assist the Commission in raising minimum standards for degrees from these institutions (p. 35).

2. While ultimately Pakistan should be able to provide adequate MSc and PhD training at local agricultural universities in most disciplines, requirements for advanced degree training abroad will continue for several years. Donor organizations should continue to give this high priority. However, this should be preceded by an assessment of manpower needs at all levels by province, institute and discipline for scientific and support staff competencies. Training should be prioritized according to needs of the research network program (p. 35).
3. While participants sent abroad for training have generally met their training objectives, this program would be improved by more rigorous screening of candidates. The PARC Training Office should arrange within-country language training for those promising candidates who do not meet TOFEL standards for satisfactory college work (p. 35).
4. Scientists at many research institutes, especially in the provinces, are hampered by a lack of access to current scientific literature. Aid donors should consider providing essential books and journals to the provincial research institutes and universities and assist in developing arrangements for linking the new library facilities at NARC with the provincial libraries so as to provide scientists at all locations easy access to current scientific literature (p. 23).
5. Greater opportunities should be provided for scientists at research institutions to maintain communication with other scientists concerned with similar or related problems. This would include, first of all, participation in a stepped up program of seminars, workshops, conferences, etc. under NARC auspices. It should also include expanded opportunities for participation in international meetings and faculty exchange programs (p. 15).

#### IV. Outreach

1. It is recommended that PARC assign high priority to selection and appointment of (a) a Farming Systems Coordinator and (b) member (Social Sciences) This will contribute to and provide the support and direction needed for an improved outreach program and in getting farming systems research underway (p. 25).
2. PARC needs to increase its ability to convince the government at the highest level that continued research is essential to produce more, of better quality at less cost, to meet the needs of food, feed and fibre for the fast growing population on a progressively sustained basis and also ensure over-all economic development of the country. To this effect a series of reports including PARC's own experience of the maximization projects should be prepared and presented to the Government which clearly indicates that agricultural research is one of the best forms of investment as well (p. 31).
3. The travelling seminar system has proven useful. It could be developed as an especially useful means to achieve sustained consultation among research scientists and senior staff of the departments of agriculture. The program needs to be continued with particular attention to such interaction and be one that can focus on farmers' current production problems (p. 31).
4. Often the results of research do not get transformed into technology available to farmers until the private sector makes an effort and investment in production and marketing. The research institutions need to publicize accomplishments which have potential for commercial development. Such opportunities are clearly there for the seed industry and for manufacturers of farm implements. The private sector has a vested interest in research that leads to commercially viable technology and should be encouraged to provide financial support for agricultural research.

### III. INTRODUCTION

The goal of this project is "to increase agricultural production and improve the incomes of low income farmers." The project purpose is "to establish a functioning centrally coordinated program of agricultural research for major agricultural commodities which effectively translates policy guidelines into specific research projects with achievable results."

The purpose of this evaluation is "to provide information and data to assess the impact of the project on strengthening the research capabilities of agricultural research organizations (both federal and provincial), as well as the institutional infrastructure to develop research programs capable of effectively addressing problems which constitute serious constraints in agricultural production."

The sections which follow provide background information on the project and discuss accomplishments, constraints and lessons learned in implementing the various components of the project and offer recommendations for further strengthening the research system.

### IV. BACKGROUND

Agriculture is the largest single sector in the Pakistan economy. It accounts for 32 percent of the Gross Domestic Product (GDP), earns 80 percent of the country's foreign exchange, employs 55 percent of the labor force and provides sustenance to over 70% of the population directly and indirectly. The prosperity of the country is, therefore, intimately intertwined with efficient harnessing of its agricultural resources.

The country's current population of 90 million is increasing at the rate of 3 percent per annum. Government policy aims at increasing production not only to keep pace with the increase in population but to permit increases in per capita consumption and boost agricultural exports.

The average yields per acre of major crops are at present far below their production potential. There is a wide gap in per acre yields obtained by progressive farmers applying a complete package of proven technology and yields obtained by average farmers, and a further gap between maximum yields obtained under experimental conditions and yields obtained by average farmers.

TABLE I                      YIELD GAP OF VARIOUS CROPS (1980-81)

CROP	YIELD POTENTIAL (maximum yield under experimental condi- tions)      (kg/ha)	NATIONAL AVERAGE YIELD (kg/ha)	YIELD GAP BETWEEN POTENTIAL AND NATIONAL ACREAGE (kg/ha)	UNACHIEVED POTENTIAL (Percent)
Wheat	6,425	1,643	4,782	74
Paddy	9,489	1,611	7,878	83
Maize	6,944	1,273	5,671	81
Sugar Cane	182,780	39,215	143,565	79
Cotton (ling)	1,400	339	1,061	76
Rape/Mustard	2,743	605	2,138	78
Potato	38,128	10,403	27,725	73

SOURCE: Ref. 28

A major objective of the Fifth Five Year Plan (19-8/79 to 1982/83) was to achieve a growth rate of 6.0 percent per annum in agriculture. To achieve this the government took steps to make agricultural inputs such as improved seeds and fertilizers more easily available to farmers, credit was provided on easy terms, and incentives in the form of higher prices for major commodities were provided. The role of research in improving agricultural technology was also recognized. Allocation of funds for research was increased and major changes were made in organization and management of research at the federal level. The Pakistan Agricultural Research Council (PARC) was given greater autonomy and an Agricultural Research Division was created in the Ministry of Agriculture, headed by Chairman, PARC.

The agriculture sector achieved the following growth rates over the Fifth Five Year Plan period.

TABLE 2                      GROWTH RATE IN AGRICULTURE

<u>YEAR</u>	<u>RATE OF GROWTH (percent)</u>
1978-79	3.5
1979-80	6.7
1980-81	4.0
1981-82	4.0
1982-83	4.9 (estimated)

SOURCE: Ref. 28.

The Pakistan Agricultural Research Council (PARC) had its origin in the Imperial (later Indian) Council of Agricultural Research (ICAR), which was established in undivided India in 1929. Government of India established a number of world famous central research institutions; unfortunately all were left in India at the time of Partition. There was not a single central institute of the ICAR located in the territories which now constitutes Pakistan. The only research institutions at the time of independence were provincial research stations.

The need for a central research organization was recognized. The Government of Pakistan invited high level teams of U.S. scientists to work with Pakistani colleague counterparts to review the Pakistani Agricultural Research System and to suggest measures for improving the situation. Joint Pakistani-American Agricultural Research Teams undertook extensive reviews in 1968 and again in 1973. Their recommendations were approved by the Presidential Cabinet with minor modifications.

Beginning in 1969 AID entered into a series of Project Agreements with the Government of Pakistan for strengthening its agricultural research system. The initial agreement provided funds to support the research program of the then West Pakistan and now Punjab Agricultural University, Faisalabad. This was followed in 1974 by a major program of loan and grant funds to the Pakistan Agricultural Research Council (PARC), based largely on recommendations of the 1968 and 1972 joint Pakistani-American teams.

The project as described in the 1974 agreement provided support for development of coordinated national research programs for major commodities and disciplines, in cooperation with provincial institutes and for construction of a National Agricultural Research Center (NARC) at Islamabad.

Several problems arose early in implementation of the project, largely because it was initiated before adequate staffing and managerial resources had been established. Reviews in 1976 and 1977 led to a redesign of the project in 1977 (approved in 1978), giving higher priority to building an institutional base which could eventually support a comprehensive research program.

The project was again amended in April 1982, extending it three years and adding funds to complete construction of the National Agricultural Research Center, equip the facility and further strengthen, through technical assistance and training, the managerial and research capabilities of the Center.

As the project evolved over more than a decade its purposes remain as they were: "to promote the advancement of technology which will increase agricultural production and to establish a functioning centrally coordinated program of research for major agricultural commodities which effectively translates policy guidelines into specific research projects with achievable results."

The project seeks to accomplish the following before it terminates in 1985:

1. Construction, equipping and staffing a National Agricultural Research Center Complex, including a Farm Center, an experimental farm and specialized laboratories.
2. Establishment of a Station Development and Farm Operations Division at the Center.
3. Development of Coordinated National Research Programs for major commodities.
4. Initiation of a farming systems research program.
5. Development of on-farm trials and linkages with extension.
6. Development of an engineering section in PARC trained to supervise construction and maintenance..

7. Training of management and research staff at federal and provincial agricultural research institutions.
8. Improvements in organization, procedures and management of the research centers.

V. NATIONAL AGRICULTURE RESEARCH CENTER (NARC)

Background

This facility being established jointly by the Government of Pakistan, USAID and the World Bank is the national research and training arm of the Pakistan Agricultural Research Council (PARC). Its objectives are to:

- Provide services to provincial and other national research centers on problems national in scope and that require facilities and expertise not otherwise readily available.
- Provide analytical and computation services of a highly technical level.
- Provide technical staff from their talent pool to work on special provincial problems.
- Provide laboratory equipment maintenance service.
- Conduct appropriate pre-service and in-service training courses of short and intermediate duration in technical and socio-economic disciplines. These may be conducted at a province or regional level where there is a large demand.
- Acquire, classify and disseminate scientific information to provincial institutes and individual scientists.
- Provide laboratory and field facilities not otherwise available on special research problems.

Under construction are an administrative block, library, documentation and reproduction facility, two laboratory blocks and six senior staff houses. These facilities, which are 80 to 90 percent finished, have an expected completion date of March 1984.

Construction completed includes a training center with hostel and cafeteria and the farm service center, including offices, storage, service bays, roads, land modifications, irrigation and drainage channels, two reservoirs, and two tubewells.

An additional hostel of the same design is being built with World Bank funds.

A Plant Introduction Center and the national unit of the Plant Genetic Resources Center will be located at the Farm Service Center.

Off campus 98 category V houses have been constructed for PARC and 30 for NARC. Six category II and six category III houses are under construction at NARC. Total projected NARC construction costs were Rs. 74,873, 000 plus Rs. 7,262,000 for PARC housing under the 1982 project amendment. ABRIS LTD., USAID's consulting engineer, projects a total cost of Rs. 89,407,000, Rs., 9,143,859 for PARC category V houses.

### Construction

With the posting of a new management team in mid-1982 the problems of engineering supervision have been greatly reduced, resulting in acceptable quality and good progress in construction. Priority has been placed on the training center and farm operations division. These buildings are essentially complete and are in use.

The training center includes two teaching laboratories and two seminar rooms with a total capacity of 80 students. Other facilities include audio visual equipment, a common room for large meetings and lounging, dormitory facilities for 50 students in 26 rooms; offices for the principal and staff; and a cafeteria with a capacity to serve 140 people in two shifts. The World Bank is building an additional 26 room hostel with 40 student capacity to be completed in June 1984. The design is functional and esthetically pleasing. The quality of construction is variable, some of it being quite good. Initial plans are for pre-service training of PARC and other provincial agricultural staff in short courses in a wide variety of disciplines.

There are several deficiencies in the design and construction of the farm service division buildings, making it necessary to redesign and remove some buildings. The farm service complex includes a large, secure service yard; a repair shop with 10 service bays; crop processing facilities; storage for inputs and grain; spare parts storage and distribution areas; offices for 42 staff; and a large meeting room. Two reservoirs and two tubewells are available for irrigation and other water uses.

Additional construction is planned for the farm service area, including a 324' machine storage shed with 100' wings at each end. Also planned are a petrol station, overhead water storage, an electricity sub-station and repairs to existing poorly constructed buildings. A new machinery request has been submitted to cover missing components and to provide spare parts for old equipment.

The Agriculture Machinery Institute will have new facilities constructed adjacent to the service center.

At the 1395 acre research farm, 113 acres have been precision leveled; 3.1 miles of irrigation channels and 4.2 miles of drainage channels have been constructed; and 15 miles of road have been built.

The administration, library and laboratory blocks are considered to be 80 to 90 percent finished, with a completion date of March 1984 planned. This will require good winter weather and continued timely work and availability of funds and construction materials.

The administrative block has 14 offices, a 200 seat auditorium and large attractive reception areas. The attached first floor library will have space for 100,000 volumes and spacious reading rooms. Documentation and reproduction facilities, including photography, printing, recording studio and a publication section will be on the ground floor. These facilities are connected by covered walkways on two levels to the two laboratory blocks, which have a capacity of 28 labs, 70 offices and 8 seminar rooms. Office, library and laboratory equipment have been ordered and are expected to be on site by the time basic construction is complete.

Planned laboratories cover 13 disciplines. They are: soil salinity, soil microbiology, plant analysis, soil chemistry, mineralogy, virology, pathology, cytogenetics, tissue culture, nutrition and food technology, biochemistry, toxicology and weed control.

### Staffing

There has been some staffing provided for by the deputation of some provincial scientists to NARC. This is being augmented by recruitment of graduates from the three Pakistan agricultural universities and by selection of candidates for participant training abroad.

As can be noted from the following table the staff now includes a large number of disciplines. A major shortage exists in the social sciences. Staffing is also weak in integrated pest control and weed control sections. There is also a shortage of field and laboratory technicians. There are only 54 such support staff. This is well below the requirements for a major research institution with over 150 scientists.

STAFFING

<u>OFFICE</u>	<u>PROFESSIONAL STAFF</u>	<u>SUPPORT STAFF</u>
1. Director General	3	10
2. Administration	6	18
3. Accounts	12	6
4. Transport	2	7
5. Security	2	9
6. Landscape/Nursery	2	2
7. Procurement	1	4
8. Library Equip./Maint.	2	4
9. Engineering Services	7	-
10. Farm Ops. & Sys.	3	19
11. Farm Machinery Inst.	17	25
12. Wheat	16	7
13. Water Measurement/Control	1	2
14. Fruit	3	5
15. Tissue Culture	8	3
16. Honey Bee Management	5	6
17. Vegetables	3	4
18. Pulses	9	5
19. Oilseeds	14	14
20. Plant Genetics	4	4
21. Pest Management	5	1
22. Virology	5	3
23. Sugar Crops	3	3
24. Maize	9	9
25. Organic Recycling	3	-
26. Soil Fertility	3	-
27. Biological Nitrogen Fixation	3	2
28. Fodder and Forage	6	11
29. Soil Science	4	3
30. Weed Control	2	1
31. Rice	7	9
32. Plant Introduction Center	2	-
33. Barani H <sub>2</sub> O Mgt. & Conser- vation	5	15
34. Horticulture dryland		
35. Soil Management		

### Specialized Laboratories at the Research Center

Construction of the office block for the director, administrative services, library and documentation auditorium, socio-economics, computer center and the first block of specialized research laboratories are well along. It is anticipated that they will be finished, furnished and equipped in time for the inauguration now scheduled to take place March 21 - 23, 1984. On inspection of these buildings, this schedule appears realistic and quite likely will be attained.

Temporary research laboratories have been established in a renovated service building formerly housing a portion of the livestock unit. These will be replaced with new research labs now under construction and will be housed in the laboratory block. These labs are financed under this project and a second laboratory block is being financed under the World Bank loan. The laboratories currently operating in the temporary quarters include those for tissue culture, virology, organic re-cycling, soil fertility and salinity, microbiology, biochemistry, and animal nutrition. These laboratories will be moved into the new laboratory blocks when construction is completed and other laboratories will be activated.

A nucleus staff for these laboratories is in place. They presumably will be augmented when space and facilities are more nearly adequate. The team was advised that a major portion (99 percent) of the equipment for these laboratories as provided for in the project has been received and it is expected to be installed by March, 1984.

The 1983 directory of PARC scientists and technicians lists the following numbers of scientists with MSc. or Ph.D. or equivalent degrees posted at NARC;

Plant Breeders	24
Agronomists	17
Soil Scientists	12
Bio-Chemists & Chemists	9
Plant Physiologists	5
Plant Ecologists	2
Botanists	5
Biologists	11
Microbiologists	3
Horticulturalists	7
Tissue Culture Specialists	3
Food Technologist	1
Plant Pathologists	7
Entomologists	10
Animal Breeders	3
Animal Physiologists	1
Animal Nutritionists	5
Veterinary Scientist	7
Economists & Social Scientists	4
Statisticians	2
Agricultural Engineers	5

These scientists are assigned to various programs including plant genetic resource center, national coordinated schemes, agricultural machinery institute, crop and animal science field research as well as to the specialized laboratories referred to above.

Training Center

The training center, with its classrooms, offices, hostel, and canteen has been completed and is in operation. Equipment for the canteen kitchen remains to be installed. A substantial number of seminars, training courses conferences and workshops has already been held. Note below the list of functions already held or planned for 1983 in the center.

The training center appears headed toward developing into a very important nerve center for the NARC. Training of various types will be a very significant future activity of NARC. As mentioned elsewhere in the report, expansion of facilities and functions of this unit may merit future consideration.

Schedule of Training Courses, Conferences, Seminars, Symposium and Workshops.

National Agricultural Research Centre 1983

<u>DATE</u>	<u>SUBJECT</u>	<u>PARTICIPATION</u>
Jan. 22-29	Management Skills Development	Senior Research Officers from Administration & Finance. NARC & PARC 15-20 participants.
Feb. 6-10	Mechanics of FMI developed reaper	Mechanics 10-15
Feb. 15-21	Beekeeping	Agr. Officers & researchers 30-40
Feb. 22-24	Organic recycling	Agronomists & Soil. Scientists 15-20
Feb. 27- March 1	Wheat Pathology	Wheat breeders and pathologists 15-20
Mar. 3 - April 3	Traveling Wheat Seminar (Final sessions at NARC)	Agronomists, breeders, pathologists - 20-30 including 2 from CIMMYT
March 12-24	Regional Workshop on least cost ration formulation	30 from different countries
March 19-25	Traveling Seminar and Training course on chickpea diseases	Agronomists, breeders, & pathologists 15-20

<u>DATE</u>	<u>SUBJECT</u>	<u>PARTICIPATION</u>
March 27- April 10	Range Management and forage production	
March 29-31	Seminar on Rice Research and Production	
April 3-5	National experts on tissue culture.	
April 6-21	Maize research management	Extensionists & researchers 15-20
April 19-21	Animal Health	Veterinary surgeons and researchers 15-20
April 23-27	National Manpower Develop- ment Workshop - Training needs for Dairy Sector	Heads of Departments of private & public sector institutions - 30
May 14-24	Rice production	Extensionists and researchers 15-20
July	National Workshop on manufacturing of agri- cultural machines	
July 24-26	Livestock Feeding Management	Extensionists 15-20
Aug. 1-4	Problems in Animal Production	Veterinary Surgeons
Aug. 7-11	Weed Control	Extensionists and researchers 15-20
Sept. 4-6	National Symposium & Field Workshop on maize, sorghum & millets	
Sept. 10- Oct. 9 (4 sessions)	Management of Agri. Research	Senior Agri. Research administrators
Sept. 11-15	Rape & Mustard Production	Extensionists & Researchers 15-20
October	National Workshop on Oilseed Crops	

<u>DATE</u>	<u>SUBJECT</u>	<u>PARTICIPATION</u>
Oct. 9-13	Soil Fertility Training Course	Agri. Dept. Extensionists
Oct. 24-27	Soil and Water Conservation	Researchers and soil conservationists 15-20
Nov. 20-24	Saline Agriculture Training Course	Extensionists 15-20
December	National Conference on Saline Agriculture	
Dec. 11-15	Seed Production Tech- niques in Cool Season Vegetable Crops	
Dec. 26-29	Agro-meterology	Extensionists and researchers 15-20

## Constraints and Recommendations

### (a) General Policy

An excellent facility for national, centralized research and training is being constructed. The buildings and land are most suitable. If equipped and serviced as planned, the facility has considerable potential for meeting the planned goals and objectives of a national research center. It should be kept in mind that this is a national institution and primarily a support and service organization for the provincial research entities. Only highly specialized work requiring laboratory or field equipment not generally available or of country wide application should be accomplished at this station. The station cannot fulfill its primary service function if it is competing with or duplicating work that can be done in the provinces. NARC should be accomplishing, and be recognized for doing, research of a more sophisticated and basic nature than is normally accomplished in the provinces. This also places on NARC the responsibility for keeping the provinces duly informed of research being done and of the ensuing results. They also must be prepared to assist with problems not readily solved in the provinces or that concern agriculture nation-wide. This may require the temporary posting of NARC experts in a province, or the posting of province scientists at NARC to have access to specialized equipment and technical staff.

### (b) Training Component

The recently completed training center will, when fully equipped, provide good facilities for pre-service and in-house training. These are two essential training activities required for posting and maintaining a competent research staff at both the scientist and the technical levels. NARC will have access to the talent, library, laboratory and field facilities to accomplish this training. Of high priority should be the institutionalizing of regular pre-service and in-service training programs to insure that new staff are properly oriented to agricultural research policies and procedures and that incumbent staff are regularly updated in their technical competence.

Discussions are already being heard of making NARC a degree awarding institution. As long as there are three agricultural universities awarding degrees in Pakistan which are underutilized and still require considerable upgrading, establishing a degree program at NARC should have low priority. Instead, resources should be made available to make first class institutions of the three

existing universities and concurrently develop the pre-service and in-service capability at NARC. It is in this area that NARC can provide the greatest service in the near and mid term.

In collaboration with the University Grants Commission NARC should eventually develop a research section which provides for sabbatical research for in-country scientists and a locus for thesis research.

NARC should be prepared to provide training not only in technical agriculture but in social sciences and management as well.

A number of donor agencies such as USDA and the World Bank provide short courses in various socio-economic analytic skills and can also arrange senior and mid-level management training courses which, with proper NARC staff training, could be incorporated into NARC's training curriculum.

Another area of staff development and training that is inadequate is that for laboratory and farm service technicians. There is too wide a gap between the scientists and the laborer who does most of the physical work. The scientist cannot always be on the job supervising a particular calculation or experiment. Accurate measurements and attention to detail are essential for statistically sound research. This is true in field research as well as laboratory experiments. A moment of inattention in calculation, weighing or mixing and a season's research is rendered worthless. This essential attention to detail is the mark of a professional and cannot be attained by uneducated untrained staff. Of the 25 separate programs listing staff, only two laboratory or field technicians were listed as being diploma holders. In total, only 54 technicians were assigned to the Centre. The training of technical staff is an area where the NARC training center could make a major contribution to agricultural research. However, a career program for technicians needs to be established that could make it an attractive vocation. The career program should also provide opportunities for those with high aptitude to enter degree programs and become scientific officers.

(c) Farm Services Division

This division has made good progress with farm development, building construction and equipment procurement. Though further development will continue, they are now in a position to render essential services to the scientist

conducting research and to increase appropriate improved seed on land not being used for research.

However, as indicated in Don Minehart's paper Farm Services, presented at the Agriculture Research System Workshop (25), full appreciation for organization and co-operation in conducting research has not yet been established at this station. This is not unusual at a new station any place in the world. Until management procedures are established by the service division and accepted by the researchers difficulties will occur. A new station, with many new scientists being assigned presents a good opportunity to work out mutually agreeable procedures without undue difficulty. Mr. Minehart has made an excellent start in this process with his "Farm Services/Operations, Functions, Policy and Management" paper (19). With procedures of this type institutionalized on a station the researcher receives much better service. Furthermore, his research is more valid and the Farm Service Division can function in a much more professional manner to provide more efficient service with the available but limited resources. A Farm Service Committee is assisting with the allocation of farm plots to researchers. Formalized service request sheets record all services provided to the plots and maintain a plot history necessary for determining future use.

A further step in achieving this optimum service goal is to provide the necessary training to all field staff. This can help assure that they know the correct operation and maintenance of the machines and how to achieve proper land and seedbed preparation, fertilizer and spray equipment calibration and application, weeding and harvesting results and irrigation water application. Some appropriate training along these lines is also necessary for the scientists so they may better understand prerequisites in achieving valid results from their research. Only with this knowledge on the part of both researchers and field staff can truly professional results occur.

As in the laboratory a team of highly skilled field staff will be necessary to provide the training in operations and maintenance. This team should also be available to the province research stations in order to receive the same results of fully valid research.

#### (d) Management Training

There is excellent evidence that the current advisors to NARC have developed good relationships with their counterparts, are technically competent and respected and that the current management of NARC has improved. Yet there is

considerable question whether their influence actually reaches into mid and lower level management function to improve and change these operations.

What is lacking in NARC operations at all levels are the basic concepts of modern management and the institutionalized incentives in the organization required to motivate staff to learn and use modern management methods.

Technical competence in the organization is good. However, in developing their technical competence the staff has not been exposed to improved management skills. Except at the very top levels Pakistani Government, officials do not have an opportunity to learn new management techniques.

The provision of an advisor to the Director General of NARC and to the Farm Service, Engineering, Wheat Maize and Rice Directors will not provide the Council with sufficient management capability. To begin with, the advisors are primarily technical scientists and not management specialists teaching management concepts. Though they are good managers, and their counterparts will benefit, the necessary institutionalizing of the use of improved management concepts and the organizational incentives required to insure their use will not be in place when they leave Pakistan.

Don Minehart pointed out, in his paper presented at the Agricultural Research Systems Workshop (16), the problems of getting the cooperation of scientists in land and irrigation allocations. If recorded, the list of such instances of difficulty would be extensive in a year's time.

What is required is a series of management training exercises by management experts that will give NARC staff an opportunity to learn modern management skills. At least two levels of training would be required: One encompassing the director to assistant director level and one for mid-level managers in the organization. It also would be well to include provincial research institute directors and coordinate with management training institutions in Pakistan. The improvement in relations with the provinces and the insights provided by local practitioners would be very worthwhile.

AID has had experience and success in a number of countries with this type of training. It has markedly increased communication and cooperation within and between agencies of government. Senior and mid-level management training in Turkey in the early 1970's is an example of a successful endeavor in a difficult environment.

(e) Private Sector Involvement

In the team's tours of research stations and laboratories, an impressive array of practical research accomplishments was demonstrated. Much of this research has been developed at considerable cost to the Government of Pakistan. It has practical commercial adaptation and value and will be made available to the private sector essentially without cost.

This is a generally accepted practice in most countries. However, in most countries there is a greater involvement and contribution by the private sector in the development of new commercially viable technology. This is not to dismiss the contribution of machinery and agricultural chemical manufacturers or the cotton and tobacco interests. However, Pakistan agricultural research institutions have reached a level of accomplishment where they should promote and advertise their accomplishments. They have the ability to provide even more research service. Improved plant seed, either by tissue culture or more traditional multiplication, improved animal breeding and already accepted improved machines are just three areas where research has provided accepted commercialized technology. Consequently, the research community is justified in receiving grants to do contract research for the private sector or to receive payment for certain technologies that could be licensed.

Agricultural research institutions currently are greatly restricted in their operations by a shortage of rupees. This is a result, among other reasons, of the government's constraint on total rupees in circulation as recommended by the I.M.F. However, even small inputs of rupees from the private sector into agricultural research would not effect levels of currency in circulation but would be of great assistance in increasing agricultural research.

Another avenue to increase revenue for research that would be anti-inflationary would be to extend the collection of agricultural cess to additional crops and divert this revenue to research, as was originally intended.

An activity that had a social rate of return of over 30 percent between 1947 and 1975 (ref. 30) should not be limited by a shortage of rupees. Given the rate of technological development and its adoption since 1975, this rate of return would be expected to continue or increase.

In order to inform the private sector of the agricultural research community's capabilities and accomplishments, appropriate agri-business associations should be provided with promotional literature. Representatives would be invited to special laboratory and field station tours. Demonstrations could be made of developed or potential technologies particularly suitable for private sector commercialization.

There should also be greater private sector representation on research evaluation and review boards to inform them of research progress. This would be a good forum to obtain ideas on appropriate research for the private sector. Greater use should be made of private research foundations and, if needed, appropriate legislation be passed to attract investments into private foundations.

The seed industry in Pakistan is probably in greatest need of private investment. Demand is exceeding the ability to supply government resources. New technology is available as in the case of vegetable and potato seed. Farm machinery and agriculture chemicals are in an expanding demand phase and considerable new technology is being developed in livestock and fisheries. All of these areas have private sector potential. However, it will take a selling job on the part of PARC and NARC to involve the private sector in participating, either by grants or investment, in the further development and eventually commercialization of these technologies. Only as research results are made available for the general use of the population are expenditures of resources justified for additional research.

## VI. COORDINATED NATIONAL RESEARCH PROGRAMS

National Coordinated Research Projects constitute the major PARC funding vehicle currently being utilized to mobilize provincial talent and resources into a cooperative national program. They are designed to develop the agro-technology necessary for removing the constraints to enhanced productivity of the agricultural commodities or sectors listed below.

1. Wheat, triticale, and barley.
2. Maize, sorghum, and millet.
3. Rice.
4. Oilseeds.
5. Pulses or feed legume.
6. Fruits and vegetables.
7. Fodder and forage.
8. Sugar cane.
9. Honeybees.

10. Sheep.
11. Cross-breeding of cattle.
12. Reproductive physiology of buffaloes.
13. Livestock nutrition.

The national coordinated program on wheat was one of the first to be developed and is perhaps most firmly established. Its general structure and method of operation appears to be setting a pattern for developing the others and thus is reported herein as illustrative. It was analyzed to some extent by the ISNAR team which visited Pakistan in November, 1982, and from whose report much of the following is drawn, supplemented by an updated report on the project.

Wheat is grown extensively in all four provinces. Most of the wheat acreage is under irrigation, but substantial amounts are grown under barani (rainfed) conditions in the Punjab and Northwest Frontier. Most of Pakistan's wheat is grown in the plains, yet significant amounts are produced at higher altitudes in the Northwest Frontier and Baluchistan. Most are "spring wheats", but "winter" (vernalization - requiring) wheats are useful in some higher altitude areas.

The wheat NCP includes research at the following locations:

Coordinating Center, National Agricultural Research Center (NARC), Islamabad

Ayub Agricultural Research Institute, Faisalabad, Punjab

Agricultural Research Institute, Tandojam, Sind

Cereal Crops Research Institute, Pirsabak, NWFP

Agricultural Research Institute, Sariab, Quetta, Baluchistan

Cereal Diseases Research Institute NARC, Islamabad and Murree

University of Agriculture, Faisalabad

Nuclear Institute of Agriculture and Biology, Faisalabad

Summer Wheat Nursery, Kaghan, NWFP

The objectives of the NCP for wheat are stated by the coordinator as follows:

- 1) Collection, multiplication, preservation, and distribution of germ plasm.
- 2) Varietal improvement/development for better yield, quality and disease resistance suitable for various agro-climatic regions.
- 3) Breeding drought resistance and salt and cold tolerance.
- 4) Studies on triticale and barley.
- 5) Development of package of cultural practices both for irrigated and rainfed areas. This includes agronomic studies to find out the most economically acceptable cultural practices, judicious use of fertilizer, and detailed studies on weed control.
- 6) Seed multiplication for wide testing.
- 7) Uniform testing (NUYT).
- 8) Short and long term academic and practical training of wheat scientists within country and abroad.
- 9) Screening for rusts, bunt, and powdery mildew. Also isolation and maintenance of rust races. Supply of inoculum and monitoring of disease epidemics.
- 10) Introduction/development of appropriate wheat machinery. i.e. seeding drill, reapers, threshers, etc.
- 11) Training and education of extension staff and farmers.
- 12) Dissemination of research information.

Wheat Summer Nursery, Kaghan

- 13) Enhancing of generation of wheat breeding material.
- 14) Screening for disease reaction.
- 15) Winter X Spring wheat crossing.
- 16) Multiplication of promising lines.

PARC provides the coordinator and the expenses of the coordinating cell and coordination center now located at NARC. It also supplements resources of the cooperating units with limited funds, equipment, and staff training opportunities. The AID project provides the services of counterpart scientists through a contract with CIMMYT. The coordinating agency's role is stated to be as follows:

- 1) Provide effective linkage between national and international wheat institutes.
- 2) Provide broader base of germ plasm source for wheat scientists.
- 3) Organize on-site and travelling seminars/meetings/workshops to observe and review results and programs, joint and cooperative activities, and tests.
- 4) Provide funds, literature, laboratory and field equipment and technical and support staff as required.
- 5) Arrange for short- and long-term academic and practical training of wheat scientists within the country and abroad.

Tables 3 and 4 (following) indicate the staff and budget involved in the program as of the latter part of 1982.

In addition to the work at the main centers listed above, the wheat NCP through these centers has a network of tests in different agro-climatic zones. This reflects the range of specific problems and opportunities for improvement in each zone. Each year, for the past three years, the wheat scientists from the various centers and disciplines, together with several representatives of extension and one or more representatives of CIMMYT tour the main locations as a group. They also observe some farmer trials to gain first hand knowledge of the total program of work. This is followed by a workshop wherein the cooperating scientists present and discuss research findings and implications and then plan programs of work for the following season.

The results of this program have been impressive. Since 1978, when wheat production for the country fell below eight million tons as a result of a serious rust epidemic, resistant varieties have been developed and/or identified and promoted, along with the appropriate inputs and production technology indicated by the research. Production has now risen to more than twelve million tons.

The pattern outlined above is now being adopted in the other cooperative coordinated programs. The procedure with maize is quite similar but involves a different growing season, a different distribution of production within the

country, and somewhat different production and utilization problems and objectives. The maize project has recently completed its second annual travelling seminar.

The rice coordinated scheme is not yet quite as far advanced as are those of wheat and maize but is showing encouraging progress. Its first travelling seminar is just now being completed.

While these programs are being established in a basically sound pattern, they are hampered by a number of constraints that appear common to all the research programs. These include:

- Limited and undependable funding. Allocations fluctuate from year to year and, as in 1983-84, sharp cutbacks are sometimes made during the year.
- Insufficiently flexible funding to accommodate seasonal variations in requirements.
- Lengthy and cumbersome procedures for the purchase and procurement of supplies
- A general shortage of appropriate laboratory and field equipment.
- Insufficient access to scientific literature for the scientists. Coordination of information among disciplines is inadequate.

It is recommended that levels of funding for agricultural research be increased and that allocations and release of funds be made with more certainty or predictability.

It is recommended the provincial institutions be provided essential library facilities and periodicals and that arrangements be made for linking outlying research stations with the library and documentations facilities being developed at NARC.

## VII. FARMING SYSTEMS RESEARCH

### Questions for the Evaluation

PARC's research in farming systems will be a key element in determining whether the organization will show direct benefits to the farmers of Pakistan. The social science terms of reference for this evaluation stressed that USAID is concerned that by assisting PARC

TABLE 3

Locations, staff categories, and numbers of wheat research personnel (1982).

Province	Institute	Staff Categories	Numbers		
			Province	PARC	Total
Punjab	AARI, Faisalabad	Director Ph.D. (Gr.19)	1	-	1
		Cereal Botanist, M.Sc. (Gr.18)	1	-	1
		*Wheat Botanist (Gr.18)	-	1	1
		*Agronomist (Gr.18)	-	1	1
		Pathologist (Gr.18)	-	1	1
		Cereal Technologist (Gr.18)	1	-	1
		Asst. Botanist (Gr.17)	6	1	7
		Asst. Technologist (Gr.17)	1	1	2
		Asst. Research Officers (Gr.17)	16	4	20
Total	26	9	35		
Baluchistan	ARI, Sariab	Wheat Botanist (Gr.18)	1	1	2
		Asst. Scientist (Gr.17)	6	4	10
		Total	7	5	12
NWFP	ARI, Pirsabak	Agronomist (Gr.18)	-	1	-
		Pathologist (Gr.18)	-	1	-
		Cereal Technologist (Gr.18)	-	1	-
		Asst. Botanist (Gr.17)	-	1	-
		*Asst. Research Officer (Gr.17)	-	3	-
Total	n.a.	7	n.a.		
Sind	ARI, Tandojam	Wheat Botanist (Gr.18)	-	1	-
		*Agronomist (Gr.18)	-	1	-
		Pathologist (Gr.18)	-	1	-
		Asst. Botanist (Gr.17)	-	2	-
		Asst. Physiologist (Gr.17)	-	1	-
		Asst. Soil Chemist (Gr.17)	-	1	-
		*Asst. Research Officer (Gr.17)	-	3	-
Total	n.a.	10	n.a.		
PARC	NARC, Islamabad	Coordinator (Gr.19)	-	1	1
		Agronomist (Gr.18)	-	1	1
		Economist (Gr.18)	-	1	1
		Asst. Agronomist (Gr.17)	-	1	1
		Asst. Breeders (Gr.17)	-	2	2
		Total	n.a.	6	6
	CDRI, Murree	Plant Pathologists	-	2	2

Vacant.

TABLE 4

FUNDS PROVIDED BY PARC FOR THE WHEAT NCP (Rs. 000)

INSTITUTION	PARC/NARC	AARI	A.R.I.	A.R.I.	CCRI	A.R.I. · CCRI			
INSTITUTION	PARC/NARC	AARI	A.R.I.	A.R.I.	CCRI	CORI	SWN (PARC)	Univ. of Agr.	NIAB
YEAR		FAISALABAD	TANDOJAM	QUETTA	PIRSABAK	(PPR)	KAGHAN	FAISALABAD	FAISALABAD
1979-80	170	204	223	175	350	-	-	-	-
1980-81	259	56	120	109	128	-	112	12	10
1981-82	1,047	271	314	300	254	-	331	50	50
1982-83*	910	270	270	290	270	764	290	50	50
	(379)	(89)	(43)	(80)	(126)	-	-	-	-
1983-84	1,450	510	480	450	450	-	510	80	80
(Proposed)									

Budgeted: figure in parenthesis is amount released in the first four months of the year.

1  
2  
1

07

- (1) research is supported which is relevant to farmer/small farmer needs;
- (2) research planning and selection of research priorities are based on a knowledge of existing farming systems;
- (3) interdisciplinary work on farmer/small farmer agricultural systems takes into full account the combinations of variables affecting these; and
- (4) agricultural research and this project have discernable, beneficial effects on farmer/small farmer production, cropping patterns, household income, and on all household members including women. (Appendix A, section B: 1-3,8.)

#### Background to PARC's Research in Farming Systems

PARC and related institutions are aware of the importance of the points listed above, and are carrying out discussions and pilot research which will lead to a research system serving these concerns. This awareness is particularly strong at the policy-making and administrative levels, a circumstance which encourages a judgment that concern will be translated into research practice. Much of the interest has come about through the efforts of USAID under this and related projects.

The development by PARC of methodologies and of institutional structures to assure effective research in farming systems is in many cases just beginning. This is not surprising for a new institution still growing and being organized.

PARC's work in farming systems research will be especially important in view of Pakistan's agricultural goals. Consistently, two major national goals have been given strong emphasis: increased production of basic food-grains in order to meet home consumption needs; and increased production of commodities for the international market, as a means of earning foreign exchange (14). Given these complex goals, it is especially important that a field research program be in place and active which looks closely at existing farms of all sizes and which places emphasis on the interaction of many determinants in the farming enterprise.

### The Goal of Farming Systems Research

A major goal in farming systems research is to understand the interactions in the smallest unit of production, so that scientists will be able to choose crucial points from which to bring pressure from outside - by plant breeding or by institutional means, for example - that will enable the farm unit to move to a higher level of productivity and return.

To assure proper identification of potentially successful interventions it is important to involve physical and biological scientists from the very beginning in planning and carrying out farming systems research. Because constraints preventing the farmer from making the system more productive are often social organizational and institutional, it is also very important to involve other social scientists such as anthropologists and sociologists in farming systems research.

### Importance to Small Farmers of Farming Systems Research

Farming systems research is particularly important for improving the lot of the small farmer. Average farm size in Pakistan is decreasing (Appendix F. Table 5) Both small and medium farmers have much less room for manoeuvre, experimentation, and adjustment than do large farmers. The smaller the enterprise, the greater the risk attendant on any change. By the same token, major improvements in the system can mean a relatively greater improvement in living standards for small farmers, if access to the new technology is assured.

IN analyzing the farming system the contribution and the probable effects of change on all household members including women - whether or not they actually work in the field - and children should be considered.

### Need for Social Scientists to Participate in PARC's Farming Systems Research

Farming systems research is a multidisciplinary effort, in which physical, biological, and social scientists all take part. It is important to note, however, that where farming systems research has been sustained and successful in other countries and institutions the key individuals have included economists, particularly those specializing in microeconomics and farm management.

There is nevertheless a continuing, serious shortage of economists in the PARC system. This lack of trained personnel needs to be met by increased recruitment and by a coherent plan for the institutional development of the place of all the social sciences in agricultural research in Pakistan.

The World Bank is funding agricultural economics research units at NARC and in four main agricultural research institutes, one in each province. It is planned that the research units may include social scientists of other disciplines as well. CIMMYT will be stationing an agricultural economist in Islamabad under USAID funding, with regional responsibility for Pakistan, Nepal, and northern India. This person is to assist PARC in devising a plan for the development of farming systems research in Pakistan. Coordination of assistance efforts in this area should be discussed among PARC, USAID, CIMMYT and the World Bank.

#### PARC Accomplishments Relating to Farming Systems

PARC has so far conducted little research explicitly on farming systems. This is neither surprising nor negative. We have seen that the major project emphases have been on physical development of NARC and on organizational development of PARC, and that availability of trained staff, particularly economists, has been a constraint.

A certain amount of research has already been carried out which indicates that despite difficulties the right sorts of direction are being taken. Research funded jointly by the Ford Foundation and by PARC (11) helped to clarify a number of important interrelationships among variety, fertilizer, labor, and plant density. The Department of Farm Management at the University of Agriculture in Faisalabad, along with the Punjab government, sponsored a study of cost of production of major crops including wheat and rice in an area of the Punjab (6). The Rice Research Institute at Kala Shah Kaku near Lahore is working on an improved rotation involving rice, oilseeds, and pulses (7). Association with an IRRI advisor, under USAID assistance, seems to have been an important factor leading to the latter project.

### Workshop on Farming Systems

In 1982 a PARC workshop supported by USAID was held in Islamabad on the subject of farming systems. The workshop included field work with farmers; it was well attended and generated much enthusiasm. A number of PARC's current efforts in relation to farming systems work can be traced to the workshop and to the continuing interest which it seems to have raised.

### Travelling Seminars

PARC's sponsorship of the so-called travelling seminars has also been successful (See reference 27 for the report of the 1983 wheat travelling seminar.) In these seminars a multidisciplinary group of scientists meets and then travels together through several areas in order to study a particular crop or problem by means of visits to farmers' fields, to research and educational institutions, and to demonstrations.

### USAID Study Team Report on Farming Systems

In September and October of 1981 a USAID/ST/RAD-AGR and Michigan State University team visited Pakistan to evaluate the need for and the possible means of introduction of a farming systems research program among PARC's activities. Their report (3) is likely to be a valuable background document, particularly in future discussions among PARC, CIMMYT and USAID.

### Recommendations

1. Selection and appointment of a PARC Farming Systems Coordinator are of very high priority. Because farming systems research must be multidisciplinary to be effective, this individual must be creative, experienced in agricultural development, and committed to furthering the development of a multidisciplinary approach. These qualities, and the ability to recruit and manage effective teams, are more important than specific disciplinary background.
2. PARC is at present without a council member for Social Sciences; selection and appointment for this full-time position are very important.

3. Much work of interest to PARC's farming systems effort is likely to have been carried out already or to be underway in the major social science institutions in Pakistan. PARC would benefit by carrying out or by contracting a summary of such research and its conclusions.
4. It is important that alternative approaches to farming systems, as carried out by international centers and by national research systems, be evaluated by PARC. This is to establish what portions of each approach can contribute the most to Pakistan's work in agricultural development.
5. An effort needs to be made to locate those Pakistani sociologists and anthropologists, whether or not they are now in agricultural institutions, who are most interested in farming systems research and have the most to contribute. A review and state-of-the-art paper sponsored by PARC, as well as participation by such social scientists in travelling seminars and on PARC/CIMMYT diagnostic field teams, are possible means of beginning such associations. Such means would also encourage focusing from the first on practical problems of importance to a range of scientists.
6. Travelling seminars have proven to be effective, and are popular with the scientists involved. With due attention and organization, this is a program which PARC, assisted by CIMMYT, can build on with great potential for accomplishment in a farming systems research context.
7. The Project Paper Amendment envisions that by the end of the Project, in FY85, reports on farming systems will be completed for wheat, maize, and oil crops. Although these reports need not be exhaustive, they would be valuable initial foci for PARC's Farming Systems Coordinator when this individual is appointed. The reports, which could be in general form and make use of initial field studies using CIMMYT methods, could also make good use of existing PARC publications, (20, e.g.).

#### VIII. ON-FARM TRIALS AND EXTENSION ACTIVITIES

##### Questions for the Evaluation

Questions relating to extension, in the terms of reference for the social science portion of this evaluation, are to determine whether:

- 1) field testing is extensive and realistic;
- 2) research results are disseminated to farmers and their reception by farmers is evaluated;
- 3) institutional linkages are adequate to assure that small farmers have access to both new and existing improved technology; and
- 4) empirical data regarding farmers' reception of new technology are gathered, analyzed, and the results fed back into research design and implementation. (Appendix A, section B:4-7).

### Agricultural Production in Pakistan

The Chairman of PARC and the scientists in both central and provincial institutions are deeply concerned by the presently low overall yields in Pakistan's agriculture. High-yielding varieties of both wheat and rice have been introduced and are in widespread use, but their full potential has not been realized. Pakistan's agricultural scientists are working diligently to meet the challenge. (Appendix F outlines the production situation for major crops)

### Lessons of the "Maximization Projects"

PARC's Chairman emphasizes the need to improve physical, localized, availability of inputs for farmers, as well as the availability of convenient, workable arrangements for credit. He also emphasizes seed production and distribution. The Chairman feels these have been major lessons from the so-called "maximization projects". In these projects concentrated publicity and extension campaigns are mounted by provincial departments of agriculture in cooperation with research personnel, aiming to have as many farmers as possible, in a circumscribed target area, adopt a proven new production package. Convenient provision of inputs and credit is given particular emphasis.

These projects are evidently of considerable value in arousing and marshalling farmers' interest and enthusiasm. They have similar effects on extension and research personnel. They increase contacts and cooperation between these latter groups, as well as between them and farmers.

The projects have a demonstrated, marked effect on yields. A successful maximization project to which PARC and the PARC Chairman gave special attention was carried out in Gujranwala District, Punjab during the 1980-81 season (31,1). Average district wide yield increases were three quarters (76%) for finegrain paddy, up to approximately 3,000 kg/ha from an earlier level of approximately 1,700 kg/ha. Yields of the coarsegrained, high-yielding IR-6 increased by two-thirds (67%), reaching approximately 5,000 kg/ha from earlier levels of approximately 3,000 kg/ha.

The successes in Gujranwala were followed up in other nearby areas. In the current (1983-84) season, a similar project (8) is being carried out in a section of Sheik-hupura District under the supervision of the Deputy Director of Agriculture there. Similar projects have been successful in other provinces.

Despite these successes, there are still bottlenecks in many parts of Pakistan for such crucial items as inputs for these proven, higher-yielding packages.

PARC needs to devise a strategy for success in having the lessons of such projects applied nationwide, by means of government policy decisions at the highest levels to greatly increase (whether through public or private channels) the availability of physical inputs and of credit.

#### The Lessons of Adaptive Research

Much effort has gone into research-extension coordinated adaptive research on farmers' fields. There has been some success here although problems remain. The problems seem to be especially with design and interpretation of the experiments (see ref. 9, e.g.). PARC could usefully make a special study of these on-farm, collaborative activities. Such a study should pay particular attention to information flows, to the mechanisms for assuring evaluation of information, and to the actions taken on the basis of such evaluation. Where any of these links is weak, recommendations for management changes to improve the situation should be made.

Special attention should be paid to the feedback of information from farmers.

Recommendations

1. PARC needs to increase its ability to present agriculture's case at the highest level of government. It can influence policy decisions by detailing the short and medium term effects for which improvements in specific input areas (for example) would have on the economy of the nation as a whole. A series of reports should be prepared to be presented for such purposes, relying in part on PARC's own experience in such activities as the "maximization projects."
2. The travelling seminar system, is an effective means to achieve sustained consultation among research scientists and senior staff of the departments of agriculture. The program needs to be continued with the addition of particular attention to such interaction; a number of these seminars should focus specifically on farmers' current production problems as encountered by the extension bodies.
3. Improving the generation and management of routine, reliable flows of information between research and extension is a high priority. PARC should undertake or commission a special study on the subject. The study could focus usefully on the adaptive research program.

IX. DIRECTORATE OF WORKS AND SERVICES (ENGINEERING)

The PARC has considerably improved its engineering capabilities over the past two years. The current Director is an engineering graduate with good construction experience. He is working closely with USAID's engineering consultants and advisors in supervising the construction at NARC.

To assist the Director three executive engineers and three engineering overseers have been assigned to the Directorate. Three additional engineers and two overseers are sanctioned and are in the process of being assigned.

The functions of the Directorate are to provide coordination between architects, contractors and PARC, provide progress oversight, cost control and assure that momentum is maintained in all essential elements of construction.

A "Works Committee" of engineers outside of PARC assists with qualifying contractors, bid awards, monitoring and inspection; advises on expeditious implementation; and reviews work proposals, and actions of the PARC secretary on engineering matters. They have worked cooperatively with ABRIS consultants.

Since new staff assigned in mid 1982 gained experience in monitoring and supervising construction the regular inspection trips by U.S. representatives of ABRIS have done much to point up oversights by various contractors. Similar services should be considered for any future NARC construction. The independent observations of the works committee have been a major factor in correcting deviations from architectural drawings and improving progress of the construction.

X. MANPOWER DEVELOPMENT

The Project provides for long term training leading to MSc and PhD degrees in the United States and third countries as well as at local institutions. It also includes short term non-degree training abroad for administrators and scientists, mainly at CIMMYT and IRRI. The 1974 project agreement provided for 73 long term training positions in the United States. However, due to the sharp rise in the cost of training, this was scaled back to 46 positions, all of which had been used by June 1982. There was a large shortfall in the utilization of training positions at local universities. Of 46 positions, only 14 had been used by June 1982.

The poor response to local training opportunities is not easily explained. It may reflect a lack of appreciation for the value of an advanced degree from local institutions, or the reluctance of institutions to release staff members for such training. In any case, there has been a very positive response to this training opportunity this year. The 1982 amendment to this project provided for a total of 70 long term training fellowships leading to Msc and PhD degrees at local universities; 62 of these have now been used and it appears likely that all will be taken up before the end of the project. This has been due largely to special efforts by PARC to stimulate expansion of advanced training at Pakistan Agricultural Universities.

The number of persons trained (or in training) under the project are shown in the following table, which gives a breakdown by type of training and by the federal institution or province from which the trainees were nominated.

TABLE 5      Manpower Trained Under Project 0296

egree	Degree	Other Fed. Instn	Punjab	Sind	NWFP	BAL	AJK	TOTAL
. Foreign Trained								
Ph.D.	4	2	7	-	2	-	-	15
MSc	14	5	3	1	6	-	-	29
ubtotal:	18	7	10	1	8	-	-	44
Non-degree								
IRRI	2	-	9	8	1	-	-	20
CIMMYT	7	-	10	1	11	1	1	31
Other	8	-	-	-	2	-	-	10
ubtotal:	17	7	19	9	14	1	1	61
otal Foreign	35	7	29	10	22	1	1	105
. Local Trained								
Ph.D.	1	-	-	-	-	1	-	2
MSc.	17	-	35	-	6	3	-	61
otal Local	18	-	35	-	6	4	-	63

There is general agreement that the quality of training provided at the agricultural universities for advanced degrees does not meet minimum requirements for good scientific research. This is a view shared by many of the university faculty and administrators. The cause of this problem appears to be primarily the lack of facilities and funds to carry out the kinds of research programs at the universities that are needed to provide a good education in agricultural sciences. Despite the deficiencies in the local degree programs they do offer sufficient training to justify continuation of USAID's in-country advanced degree program. Meanwhile it is important that steps be taken to improve the quality of the local degree programs. Some of the agricultural universities, for example the Punjab Agricultural University at Faisalabad, have highly competent foreign trained staff who are capable of good teaching and research if provided with adequate research facilities and funds. The team recommends

that PARC give high priority to assisting the agricultural universities to acquire the research facilities and funds for a strong teaching program. PARC's role as advisor to the University Grants Commission should be institutionalized to assist the Commission in raising minimum standards for degree programs in agriculture. In the meantime it will be necessary to maintain a fairly strong program of participant training abroad for advanced degrees to build up the research capacity of Pakistani institutions.

The advanced degree participant program has succeeded in many respects. Of the 105 participants sent abroad 76 have already returned, and with few exceptions, are employed in the institutions from which they were selected. Four participants returned before completion of their training objectives because of health problems. Performance of five participants was sub-standard for the training objectives for which selected. Based on recommendations of their advisors, training objectives were changed to less demanding requirements. In one case the training objective was changed from a Ph.D. to an MSc. degree. One candidate's program was changed from MSc. to a non-degree program. In the other three cases MSc. programs were changed from the original science specialities to related, but less demanding, programs. Sub-standard performance by 5 out of 105 participants cannot be considered an excessive rate of failure. There are other indications, however, that some of the participants who succeeded in achieving their training objectives were not adequately prepared for advanced degree work. Several had to spend a great deal of time in English language training before being able to pursue their regular course studies; one person spent 9 months in English language training. A better system of screening is required to ensure that candidates are selected who have the required academic background and educational potential. If they have language deficiencies these should be corrected within Pakistan. No one should be sent for advanced degree training who does not meet the 500 level TOEFL standard.

Twenty participants have extended their training periods in order to complete their program objectives, some at their own expense. Where performance has been good USAID has financed part or all of the extension. Several participants who have performed well on their MSc. programs are remaining in the United States to complete Ph.D. training with World Bank financing.

Of the 76 participants who returned to Pakistan, 71 have returned to their parent institutions. Of the other five, three are placed in other departments within Pakistan; two have left for employment abroad. On the whole the team considers this an indication that the participation program is successfully meeting its objectives.

## XI. ORGANIZATION AND MANAGEMENT OF NARC

### Role and Organization

The goals and purposes of the National Agricultural Research Centre (NARC) were set forth clearly by the Chairman of PARC in the brochure entitled "Agricultural Research Systems of Pakistan" under date of 1982 as follows:

"The major goal of NARC is to conduct research in areas of national importance where such research is not currently being undertaken, or is seriously inadequate, and it can best be done at a well-equipped, properly staffed and funded central institution, where facilities are available to all scientists in the country.

"Besides laboratory research on selected aspects of plant and animal genetics, pest management, soil and water management, etc., NARC will also have a Training School to impart theoretical as well as practical training in crop production and related techniques to provincial scientists. The training school will conduct special courses on important agricultural commodities and will have the necessary facilities including lecture rooms, laboratories, and experimental fields, besides a cafeteria and hostel for the trainees. Eminent national and international experts on different commodities will teach these courses, which will also include extensive field experiments to be done by the trainees.

"The other facilities at NARC include a reference library and a centralized information service to provide the latest research information to all the research scientists in the country. A centralized facility for repair and maintenance of sophisticated laboratory equipment is also being established at NARC, which will provide service to all the research institutions.

"The repair and maintenance division will have adequate trained staff and technicians to undertake repairs of most of the laboratory equipment in the country. The division will organize training courses to build up the capabilities of the major research institutions to repair their equipment by training a large number of technicians for various institutions. The Agricultural Machinery Division (AMD) will undertake research in developing designs for urgently needed farm machinery in cooperation with the relevant provincial institutions. AMD will develop linkages with the agricultural machinery manufacturers in the country so that the successful designs, after testing in farmers' fields, can be manufactured in sufficient

numbers and made available to the farmers within a short period.

"The Plant Introduction Centre (PIC) and the National Unit of Plant Genetic Resources (PGR) will also be located at NARC. The main objective of these groups is to collect and preserve the genetic resources of various crops and animals to save them from extinction in order to transfer their desirable traits for development of high yielding varieties with other desirable characters like resistance to diseases, insects and other environmental stresses. The group will also systematically (arrange to) test exotic plant and animal species under various ecological conditions prevalent in different parts of the country, to select those which could be directly used by the farmers with minor modifications. The successful strains/cultures selected by PIC will be passed on to the provincial institutions for adaptive research and large scale introduction in their areas.

"Research in Social Sciences related to agriculture will also be concentrated at NARC so that the social scientists could interact with biological scientists and undertake research on various socio-economic problems of different categories of farmers and the agro-ecological regions. In addition to a strong research group at NARC, small research groups on agricultural economics will also be established in each province to interact and support the applied research on different aspects of agriculture in the provincial institutes.

"NARC will provide a focal point for all the agricultural research scientists of the country to jointly discuss and plan their research activities on different commodities, and to undertake research on common problems, which can best be done at a National Centre rather than at each of the provincial institutions. In particular, research on problems requiring sophisticated equipment like electron microscopes, ultracentrifuges, and elaborate analytical and quality-testing facilities, will be undertaken at NARC. The facilities at NARC will also be available to research scientists of the provincial institutes who will work at the Centre as visiting scientists to use the specialized facilities for undertaking research on their projects, especially when such facilities are not available in their own institutions."  
Ref. 18, pp 11-13: (Condensed; original emphasis.)

Keeping these principles in view, NARC is to be developed as a national center of excellence, providing good laboratory facilities and equipment, and competent research staff. This is consistent in principle with agreements of the government loans and grants provided by USAID and the World Bank.

While it may be a participant in some of the NCPs, NARC would not expect to assume the same kinds of responsibilities which would normally be assumed by the provincial research institutions, such as the development of finished varieties for release and the development of location-specific elements of production technology. NARC would handle those aspects of research which are beyond the capability of the individual provincial institutions, or which may be common to two or more provinces and would not need duplication or replication in each. In other words, NARC takes on a back-up role which would complement and support the provincial research programs and institutions.

The NARC component of an NCP can assure a regular interchange of information and genetic materials among the provinces, and prompt and equitable access by all provincial institutions to needed genetic resources from the IARCs and other external sources. It can assist the coordinator, wherever he may be physically located, in placing locally (within Pakistan) developed genetic entities into international testing programs. This is being done in some of the NCPs, and places the NARC unit in its proper role.

NARC will provide specialized facilities such as computers, data storage banks, and highly specialized laboratory equipment, which would be required in the national research program but which need not be duplicated in each province. Scientists from the province could send material for examination and analysis or could spend limited periods in residence at NARC. With such a range of specialized equipment and research, NARC could develop as a center at which provincial scientists, and perhaps scientists from other nations, could conduct research as part of their requirements for advanced degrees, or as post-doctoral research.

The administrative and management structure of NARC should be such as to facilitate, to the maximum extent possible, the fulfillment of its recognized role in the total national picture. While there is no single perfect way of accomplishing this, the following organizational chart is presented for consideration. There are many informal or even formal relationships which will develop naturally within NARC, between NARC and PARC, and between NARC and provincial institutions which cannot be depicted adequately in a two-dimensional chart such as this. (Chart on page 39a) The organizational

chart and lines of responsibility will generally dictate the kinds of competence needed in the respective major posts in the organization.

The Director General of NARC obviously should be exceptionally competent. He should have an understanding of basic and applied science and have management strength and leadership of people and resources. He should also be a person who is proficient in public relations. He would need to have and to earn the respect and confidence of the wide range of staff competence and of the public.

### Planning Procedures

Until 1980 research planning in the PARC was ad hoc. The scientists used to submit projects in areas of their liking/specialities which were examined by the technical committees of the PARC (7 in number). The projects were approved, modified, or rejected by the technical committees. The recommendations of the technical committees were considered by the Executive Committee of the PARC and finally placed before the General Body of the Council for approval. There was no organized planning unit in the PARC and the planning functions were assigned to various officers on ad hoc basis.

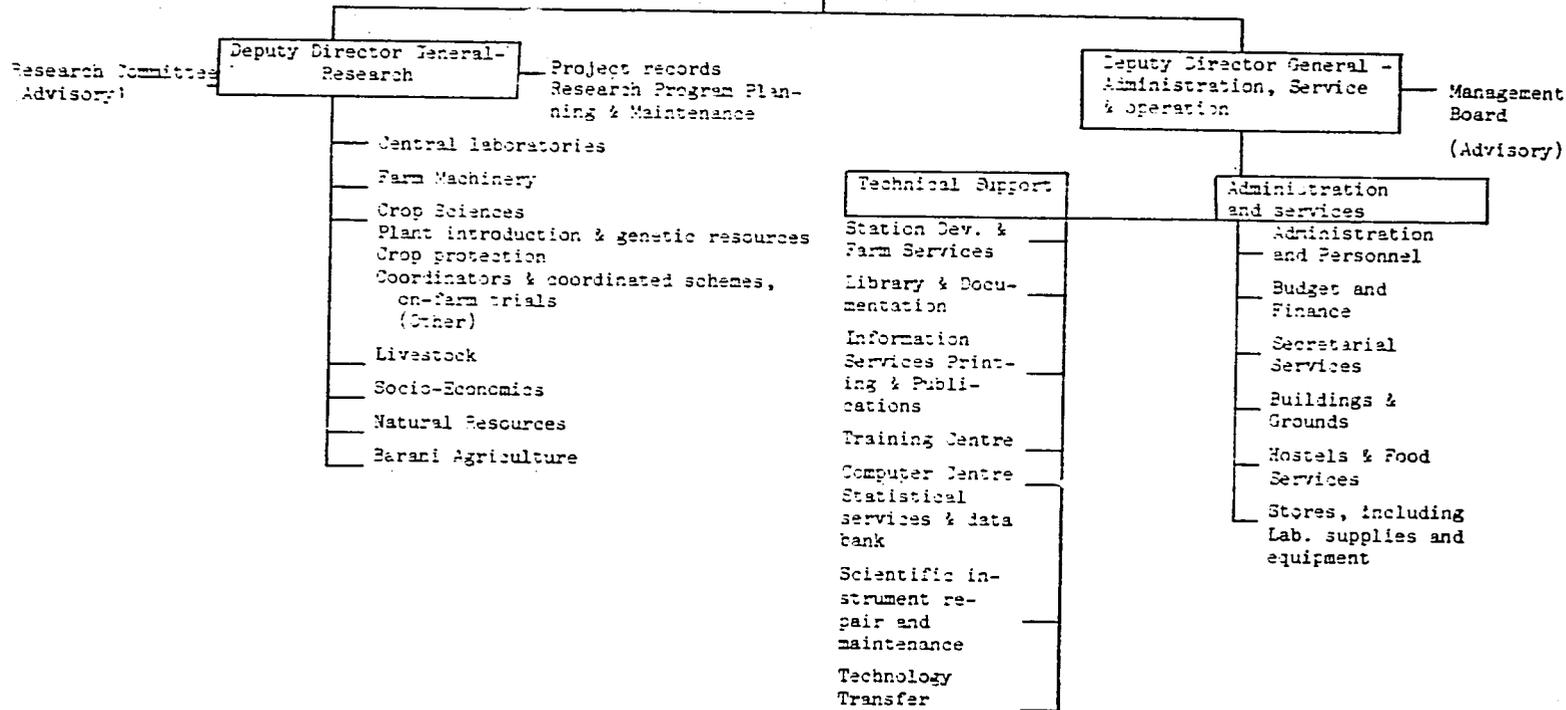
During 1980-81 the PARC introduced Coordinated Agricultural Research Planning Systems of Pakistan (CAREPLANS). This system involves doers of research and users of research-results in the planning process. The various steps involved in this system are:

- i) Identification of problems;
- ii) According of priorities;
- iii) Formulation of projects;
- iv) Evaluation of research projects;
- v) Approval of research projects;
- vi) Assigning of research projects to various institutions;
- vii) Implementation of research projects;
- viii) Accomplishment reporting; and
- ix) Accomplishment evaluation

The CAREPLANS is still at the evolutionary stage. The set of research priorities determined under this system has been used in determining the researchable areas and formulation of projects to solve the problems.

PAKISTAN AGRICULTURE RESEARCH COUNCIL

DIRECTOR GENERAL  
and  
ADVISORS TO DIRECTOR GENERAL



During 1981-82 a Planning Unit in the PARC was created with a Chief Planning (Director Planning) and a small support staff. This unit has been assigned with the duties of planning, coordination, evaluation and monitoring of projects. The unit serves as a support service to the Technical Divisions and maintains liaison between the PARC, Provincial Governments and Federal Government of Pakistan for project planning, monitoring and evaluation. The unit has been able to accomplish the following assignments during the past two years.

1. Priorities of research, (May 1981).
2. Priorities of research for collaborative agricultural research projects between PARC and USDA, (December 1980).
3. Revised priorities of research, (February 1983).
4. Directory of Agricultural research projects (1981).
5. A report on agricultural education in Pakistan (1983).
6. Report on review of Agricultural research institutions in Pakistan, (1983, draft)
7. National Research Plan (draft).
8. Portfolio of projects for the Sixth Five-Year Plan.
9. Development/revision of the PC-I of the following projects:
  - Barani (rainfed) agricultural research and development project (CIDA-CANADA).
  - Strengthening of Agricultural research capabilities in Pakistan (USAID).
  - Italian Technical assistance in the cultivation of fruits, vegetables and olives.
  - National Chickpea Improvement Project (ADB).
  - Crop maximization program for improving productivity of wheat, rice, maize, and groundnut (Italian Government).

The Planning Unit also assists the Finance Division in developing and processing the Annual Development program.

The PARC will be able to carry out planning effectively only if it devotes more of its own resources to this task. Increasing the resources and staff of its planning unit will be a step in the right direction. Strengthening the analytical ability of this unit would allow long term planning and would permit the use of the CAREPLANS procedures. It would also provide the Chairman of the PARC with support that is necessary in his discussions with the Provincial and the Federal Governments in seeking cooperation and mustering resources for research.

XII. FINANCIAL MANAGEMENT

A. Pakistan Agricultural Research Council (PARC)

1. PARC Budget

All funds provided to PARC, regardless of source, are channeled through the Government of Pakistan annual budget and are reflected as (a) Grant-in-aid for current expenditure or (b) Grant-in-aid for development projects. PARC's budgets for 1982/83 and 1983/84 and actual expenditures for 1982/83 are shown in Table 6, below. More detail is provided in TABLE 7. The foreign exchange component (FEC) is reflected in rupees at an exchange rate of Rs. 10 to \$1.

TABLE 6 - PARC BUDGETS (RS. 1000)

	Budget 1982/83	Actual Expenditures 1982/83	Budget 1983/84
Current Budget (Rupees)	47,826	43,194	45,620
Development Budget (Rupees)	84,237	71,137	58,815
Development Budget (FEC)	56,222	30,772	131,598
TOTAL:	188,285	145,103	236,033

Financial restraints on releases of funds appeared as early as December of the fiscal year 1982/83, which ended June 30, 1983. Only one-half of the rupees allocated under the Development Budget was released during the first eleven months, with Rs. 25.376 million being released in June, bringing the total amount for the year to Rs. 71.137 million. The shortfall contributed greatly to the slow-down of NARC construction, according to the 1983/84 PARC budget review

TABLE 7 PARC ANNUAL BUDGETS 82/83 & 83/84  
AND ACTUAL EXPENDITURES 82/83  
(Rs. 000)

	<u>Budget</u> <u>82/83</u>	<u>Actual Expenditures</u> <u>82/83</u>	<u>Budget</u> <u>83/84</u>
<u>Current Budget (Rupees)</u>			
GOP	47,826	43,194	45,620
<u>Development Budget (Rupees)</u>	<u>84,237</u>	<u>71,137</u>	<u>58,815*</u>
World Bank Project:			
GOP & IDA	20,000	7,866	5,000
USAID Project # 0296:			
GOP & USAID	34,000	35,443	30,783
PL 480: USDA	15,000	14,819	8,000*
<u>Other Development Projects</u>			
GOP & Other Donors	15,237	13,009	15,032
<u>Development Budget (FEC)</u>			
USAID	16,000	29,782	15,000
IDA	30,000	266	64,000
CIDA	750	-	28,509
UNDP	7,659	-	8,300
ITALIAN			9,000
OTHER	1,813	724	6,789
<u>TOTAL - Current &amp; Dev.</u> <u>Budgets</u>	<u>188,285</u>	<u>145,103</u>	<u>236,033*</u>

\* The Council Member (FINANCE) stated that the PL 480 budget for 83/84 has been increased to Rs. 20,000 and the Development Budget (Rupees) was increased, overall, by Rs. 10,000 to a total of Rupees 68,815

## 2. AID Project No: 391-0296

The Project Agreement Amendment of June 1, 1982 lists the various cost categories, with amounts, for the life of Project 391-0296. The PC-I, revised in December 1982, lists the planned expenditures by year under the same cost categories. Table 8 gives details of planned expenditures and actual expenditures through June 30, 1983. The only cost category for which expenditures are below those scheduled is NARC construction.

## 3. General

Operating procedures of the Finance and Accounts Division, problem areas in PARC's financing and financial management, and the evaluation team's conclusions, reached during the period of this study, are detailed in Appendix G. Some highlights for which changes are recommended constitute the next section, Financial Management Problems.

### B. Financial Management Problems

#### 1. Uncertainties of Funding

Levels of rupee funding provided in the current and development budgets often vary substantially from year to year. Also, PARC must prepare a monthly request to the MOF for releases of funds which, after going through a lengthy approval process, results in releases of funds approximately two months later. The amount in the approved annual allocation is generally not realized, due to the two-month delay, since funds not received by June 30 are lost for that budget year.

Delays and reduced fundings to PARC are reflected in releases to projects at NARC and in the provinces. Budgetary delays and reductions directly affect project payments of salaries and procurement of seeds, fertilizer, etc. Budget fluctuations from year to year, requiring a reduction of employment, sometimes followed by reemployment, affect efficient project operations, especially the stability of ongoing projects and has a dampening effect on morale at all levels.

An agreement with the MOF to release GOP funds to PARC on a quarterly basis, in advance, should eliminate the bureaucratic delay associated with monthly requests and provide a measure of stability to project operations that is now missing.

TABLE 8

AGRICULTURAL RESEARCH PROJECT NO: 0296  
 PLANNED AND ACTUAL EXPENDITURES  
 (RS. 000)

	Planned 1974 thru <u>6/30/85</u>	Planned thru <u>6/30/83</u>	Actual thru <u>6/30/83</u>
Technical Assistance	71,645	33,675	42,531
Training	37,247	18,794	21,203
Commodities	48,908	27,908	34,539
Primary Research Projects	94,800	55,526	56,919
Operation of NARC	31,300	15,558	15,900
Construction - NARC	70,192	62,681	53,236
Off-Campus Housing	11,943	11,943	11,942
Contingencies	7,585	1,194	
Evaluation	200		
<b>TOTAL:</b>	<b>373,820</b>	<b>227,279</b>	<b>236,270</b>
<b>FUNDING SOURCES:</b>			
USAID-LOAN \$	6,200		5,609 (9/30/83)
USAID-GRANT \$	3,962		1,741 "
<b>TOTAL FOREIGN EXCHANGE (FEC)</b>	<b>10,162</b>		<b>7,350</b> "
<b>Rupee Equivalent of FEC</b>			
(10 to 1 - Basis of Planned)	101,620		73,500
Mondale Rupees	143,200		103,224
GOP Rupees	129,000		59,546
<b>TOTAL:</b>	<b>373,820</b>		<b>236,270</b>

(PC-I Rev.)  
 ( 12/82 )

(FC-I Revised)  
 (12/82 and )  
 (PRO AG. 6/1/)  
 (82 )

## 2. Use of Institution Staff Members on PARC-Funded Projects

To alleviate the effect of project budgetary reductions, specifically that resulting in the release of project-funded employees, we believe that increased use of staff members of research institutes and universities should be explored. At present, some staff members are seconded to PARC projects on a full-time basis. An increase in this practice, as well as possible use of staff employees on a less than full-time basis with PARC reimbursing the institution for its portion of the related cost, would appear to offer advantages to the institutions as well as to PARC. If PARC would give increased emphasis to locating projects at institutions with available facilities and staff members, lessening the need of additional employees for the specific projects, the result should be more efficient use of resources and added stability to the project and to the institute. An increase in valuable research experience for faculty and institute staff members would also result.

## 3. Communications Between PARC and Project Locations

It is unclear how effective the lines of communication from PARC through the project coordinators and directors to the project at institutes and universities are, especially as regards budget changes. When PARC is informed of its approved budget allocations at the end of June, it conducts meetings with project directors and coordinators to determine the specific changes that might be required in each project's budget. At some locations visited, team members were told by project officials that they first received information as to their approved budget in August or September.

One question that arises is what voice should project officials have in determining the budget changes that affect them directly. It would appear that responsible project management, exercised during the annual budget exercise, would provide for changes to be made if the approved budget allocation should vary from the annual request by, say, 10% 20% and 30%. These would apply to each project and to overall programs of coordinators and directors. Then when approved allocations are made known to PARC there should be no need for long delays in passing along the necessary changes to the project level.

#### 4. Financial Management System

Any emphasis on improving PARC's management system, in line with the concepts of modern management, should incorporate changes in Financial Management.

The present system accounts for costs incurred under various projects such as the AID project and the World Bank project and provides information under various formats required by the various donors. The system is adequate to provide this information. When looking at PARC as a growing entity, the premier agricultural research institution in the country, its overall financial system has to be considered.

The accounting system is essentially one of accounting for cash receipts and disbursements. Other records are kept independently. But there is no integrated accounting system able to provide information as to the assets under its control and the liabilities of the institution, in addition to the cash receipts and disbursements. The system of internal control is also weak.

Improvements in the overall financial management system have been under consideration by PARC and various donors for some time. The PARC Council Member (Finance) explained PARC's reasons for not initiating some of the recommended changes. These are included in Appendix G.

PARC expects to install a micro-computer soon for use in the Finance and Accounts Division as well as other PARC offices. It is considered advisable to initiate improvements in the Financial Management System fairly soon, in coordination with the installation of a computerized accounting system and in line with other projected improvements in its overall management system.

#### 5. Operating Costs of PARC and NARC

A portion of the PARC Headquarters and NARC salaries and operating costs, in addition to construction, commodities and training, are funded under the USAID and World Bank projects. Due consideration should be given to gradually shifting a greater portion of the Headquarters (including NARC Headquarters) burden to the Government of Pakistan in case of any follow-on activities by USAID. The Government of Pakistan should at some target date be able to demonstrate the capability of maintaining the operation of this research institution, while outside donors contribute more to activities such as training and research projects in the provinces.

SCOPE OF WORK

A. General

Following is a scope of work for the evaluation of project 391-0296:

1. Provide a synopsis of the Project Evaluation, Objectives and Inputs.
2. Analyze achievements in terms of Project Objectives, Inputs, progress towards these and articulate the lessons learned.
3. Identify Agricultural Research System Performance in terms of organization, function, resource allocation and project supervision/management.
4. Examine research Program, Planning, Implementation Monitoring, Quality and Multi-disciplinary/Inter-Institutional participation and suggest strategies for future improvement.
5. Determine efforts and successes in transfer of technology and in developing (for different agro-sub-zones) readily farmer adoptable technology through strengthened provincial linkages.
6. Provide a consolidated list of Recommendations aimed to strengthen the Agricultural Research System including identified areas, particularly those with potential for quick pay-off for future USAID and World Bank support.

B. Social Science

1. To what extent are AID activities in agricultural research relevant to farmer/small farmer needs?
2. In what way, and how well, is research planning based on an understanding of the systems of production, distribution and consumption that already exist? Are research priorities established on the basis of an understanding of these systems?
3. Is research being conducted on farmer/small farmer agricultural systems using an interdisciplinary approach to take into account the interrelationships between technological, institutional, economic, social, environmental and cultural factors?

4. Is extensive and realistic field testing being used to adapt research findings to local environment, techno-economic and socio-cultural conditions?
5. How effectively are research results disseminated to farmers/small farmers? To what extent have research results been adopted by farmers? Are there groups of farmers who have not adopted research results? Why?
6. How adequate are the institutional linkages that are necessary to assure that small farmers have effective access to both new and existing improved technology?
7. To what extent is empirical data gathered and analyzed on the positive and negative effects of the research results at the farm level? How is this information being fed back into the research design and implementation process? What could be done to improve this aspect of implementation?
8. To what extent has this project contributed to a discernible effect on farmer/small farmer production, cropping patterns, household income and women? To the extent possible, use empirical data to support the analysis.

APPENDIX B

EVALUATION METHODOLOGY

A six member, multidisciplinary team, including a social scientist member of the USAID Mission, was engaged to carry out the scope of work outlined in Appendix A. Members of the team arrived in Islamabad on October 6th. Three days were spent in the city to review documentation and for meetings with USAID staff, officials of PARC and scientists and administrators at NARC. Four members of the team spent two days in Northwest Frontier Province visiting with administrators and scientists at Tarnab Institute and the Peshawar Agricultural University in Peshawar and the Agricultural Research Institute at Pirsabak. Five members of the team made site visits at the College of Veterinary Medicine, Lahore, the Rice Research Institute at Kala Shah Kaku and the Ayub Agricultural Research Institute and the Punjab University of Agriculture at Faisalabad.

Upon return to Islamabad on October 13th team members resumed discussions with NARC and PARC staff. Prior to the team's arrival in Pakistan the staff of the PARC had conducted a comprehensive internal review which provided information that was very useful in the evaluation.

Rough drafts of the main sections of the report were completed by October 19th when two of the team members departed Pakistan. The team met with the Director and staff of USAID on October 19th to present an overview of major findings. A complete draft was submitted to the Mission for review on October 24th. A revised draft was submitted to the Mission on October 26th.

The time available for the task was less than would be desirable. Lack of time made it impossible to make site visits to Sind and Baluchistan. Our visits to NWFP and to the Punjab would have been more useful if there had been more lead time and the institutions visited had been informed in advance the precise purpose of our visits. Despite these constraints, and largely because of the excellent information developed in the internal review, the team believes it was able to obtain the information needed for a balanced evaluation.

Institutions and Individual Visited  
(partial list)

PARC

Dr. Amir Muhammed, Chairman  
Dr. Yousaf Chaudhri, Member, Crops  
Mr. Syed Sohail Ahmad, Member, Finance  
Mr. Ikram-ul-Haq, Director, Planning and Technical Services  
Mr. M.H. Rizvi, Director, Training  
Mr. Mafooz Ali Shah, Director, Research

NARC, Islamabad

Dr. G.R. Sandhu, CSO/Director  
Abdul Hafeez, Administrator  
Dr. Akhtar Beg, Coordinator (Oilseeds)  
Dr. Mohammad Aslam, Coordinator (Plant Pathology)  
Dr. Zahoor Ahmad, P.I. Plant Introduction  
Mr. Ghulam Habib, SSO, Sugar Crops, NARC  
Dr. Zahur Aslam, Coordinator (Vegetables)  
Dr. M. Qasim Chatha, Coordinator (Maize, Sarghum and Millet)  
Mr. Bashir Ahmad Malik, Coordinator (Food Legumes)  
Dr. S. Karam Shah, Director, Animal Sciences Inst.  
Dr. Banaras Bhatti, SSO (Fodder) NARC  
Dr. Azra Qureshi, SSO (Tissue Culture)

TARNAB Agriculture Research Institute, Peshawar

Mr. Mohammad Sadiq Khan, Director General  
Mr. Ghulam Sarwar, Plant Pathologist  
Mr. Bashir M. Khan, Entomologist  
Mr. Fazal, Subran, Statistician

Mr. Ali Haider, Asst. Botanist  
Mr. Habibullah, Horticulturist  
Mr. S.W. Khattak, Food Technologist  
Mr. Abdul Hamid, Agri-Chemist/Biochemist  
Department of Agriculture, Punjab  
Mr. Mohammad Pervaiz Masud, Secretary  
Rice Research Institute, Kala Shah Kaku  
Mr. Habib-ur-Rehman, Asst. Agr. Engineer  
Dr. Mohammad Afzal, Associate Rice Botanist  
Ch. Sajjad Ahmad, Entomologist  
Mr. Ismail Ali Javed, Asst. Rice Officer  
Ayub Agricultural Research Institute, Faisalabad  
Dr. M.A. Bajwa, Director General  
Mr. Shahabud-Din Fasihi, Director (Sugar Cane)  
Mr. Waheed Sultan Khan, Cotton Botanist  
Mr. Inayat Malik, Food Technologist  
Punjab Agricultural University, Faisalabad  
Mr. Mian Mumtaz Ali, Vice Chancellor  
Dr. Ali Mohammad Chaudhry, Dean, Agr. Economics and Rural Sociology  
Dr. Ashfaq Mirza, Rural Sociology  
Dr. Bashir Ahmad, Farm Management  
Dr. Mian M. Aslam, Agriculturist Economist  
Mr. Abdul Rauf, Agricultural Marketing  
N.W.F.P. Agricultural University, Peshawar  
Dr. Mohammad Hussain Khan, Dean and Acting V.C.  
Dr. Mohammad Attaullah, Prof. Plant Breeding and Genetics  
Dr. Farooq Lodhi, Professor of Horticulture

Dr. Iqbal Shah, Assoc. Prof. Animal Nutrition

Mr. Mir Hatam, Assoc. Prof. Dept. of Agronomy

Cereal Crop Research Institute, Pirsabak, NWFP

Dr. Mohammad Salim, Maizw Botanist/Acting Director

Mr. Nazir Hussain Shah, Wheat Botanist

Mr. Qazi Aqiqullah, Production Agronomist

College of Veterinary Science, Punjab Agr. Univ., Lahore

Dr. M. Ajmal, Principal

REFERENCES

1. Anonymous  
1980 Progress report of the 44-88 rice maximization project, March-August 1980. Islamabad: ARD/USAID.
2. n.d. Proposal for supplementing CIMMYT Economics Program Activities for Pakistan.
3. Beausoleil, J., Appleby, G., Vincent, W., and Freed, F.  
1981 Report of the Farming Systems Research Team. Islamabad, Pakistan: Agriculture and Rural Development, USAID.
4. Bolo, I.C., and Ross, V.E.  
n.d. New method for chemical control of weeds in rice. Islamabad: ARD/USAID.
5. Byerlee, D., Harrington, L., and Winkelmann, D.L.  
1982 Farming systems research: issues in research strategy and technology design. American Journal of Agricultural Economics 64, 5: 897-904.
6. Chaudhry, Ali Mohammed, and Ahmad, Bashir  
1982 Cost of Producing major crops in the canal irrigated area of Gujranwala District. Faisalabad, Punjab, Pakistan: Punjab Agricultural Research Coordination Board and Department of Farm Management, Punjab Agricultural University.
7. Chaudhry, A. Majid, and Iqbal, M. Sarfraz  
1983 Cropping pattern testing - Punjab, Pakistan. Paper presented at a conference at the International Rice Research Institute, 18-22 April 1983, Los Banos, Laguna, Philippines. Kala Shah Kaku, Punjab, Pakistan: Rice Research Institute.
8. Deputy Director of Agriculture, Sheikhpura, Punjab, Pakistan.  
1983 Punjab extension and agricultural development project: rice maximization project 1983 (Khanpur Kallah, Tehsil Ferozewala, District Sheikhpura). Sheikhpura, Punjab, Pakistan: Deputy Director of Agriculture. (mimeo.)
9. Freeman, W.H., and Bolo, I.C.  
1983 Consultancy report on adaptive research: Sind agriculture & adaptive research project (CR 922 - PAK.) 12 May - 11 June, 1983. Hyderabad, Sind/Islamabad: ARD/USAID.

10. Gilbert, E.H., Norman, D.W., and Winch, F.E.
  - 1980 Farming Systems research: a critical appraisal. Michigan State University Rural Development Paper No. 6. East Lansing, Michigan, Department of Agricultural Economics, Michigan State University.
11. Goldman, Richard H., and Shah, Rashid A.
  - 1979 Technical and economic factors influencing rice plant densities in Punjab. Paper presented at the National Seminar on Rice Research and Production, Pakistan Agricultural Research Council, Feb. 1979, Islamabad, Pakistan and at the Workshop on Constraints to Agricultural Production, IRRI May 1979 Laguna, Philippines. (mimeo; revised March 1979.)
12. Government of Pakistan
  - 1983a Agricultural statistics of Pakistan 1982. Islamabad: Planning Unit, Food & Agriculture Division, Ministry of Food, Agriculture & Cooperatives.
13. 1983b Pakistan economic survey 1982-83. Islamabad: Planning Unit, Food & Agriculture Division, Ministry of Food, Agriculture & Cooperatives.
14. 1983c The sixth five year plan, 1983-88; Agriculture: from self-sufficiency to export. 2nd draft, April 1983. Islamabad: Planning Commission, Government of Pakistan. (mimeo.)
15. International Service for National Agricultural Research (ISNAR)
  - 1983 On selected aspects of the Pakistan agricultural research system. Publication No: ISNAR R-12. The Hague, Netherlands: ISNAR.
16. Minehart, D.
  - 1983 Farm services. Paper prepared for Agricultural Research System Workshop, Islamabad, Sept. 3, 1982. Islamabad: (National Agricultural Research Center) (mimeo.)
17. Moseman, A. H., Haq, I., Huque, H., Memon, A.R.M., Baird, G.B., Murray, C.C.
  - 1973 Report of the second joint Pakistan-American team on agricultural research in Pakistan. Islamabad.
18. Muhammed, Amir
  - 1982 Agricultural research system in Pakistan. Islamabad: PARC.

19. National Agricultural Research Center (NARC)
  - 1983 Farm services/operations, functions, policy, and management. Islamabad: NARC.
20. Pakistan Agricultural Research Council (PARC).
  - 1980 Agro-ecological regions of Pakistan. Islamabad: Social Sciences Division and Plant Sciences Division, PARC.
21. 1981a Annual report 1979-80. Islamabad: PARC.
22. 1981b Collaborative agricultural research projects. Islamabad: Directorate of Planning and Technical Services, PARC.
23. 1981c Priorities of research in agriculture. Islamabad: Directorate of Planning and Technical Services, PARC.
24. 1982 Strengthening of agricultural research in Pakistan. PC-I revised. Islamabad: PARC.
25. 1983a National agricultural research plan. Islamabad: PARC.
26. 1983b Pakistan Agricultural Research Council budget 1983-84. (Draft.) Islamabad: Finance Department, PARC.
27. 1983c Report of the 1983 wheat travelling seminar. Islamabad: Pakistan Agricultural Research Council. (mimeo.)
28. 1983d Report on internal review of project for strengthening agricultural research capability in Pakistan. Islamabad: PARC. (mimeo.)
29. Pray, C.,
  - 1978 The Economics of agricultural research in British and Pakistani Punjab, 1905-75. Ph.D. thesis, University of Pennsylvania.
30. Pray, C., Cardwell, V., Crabo, B.G., Teng, P.S.
  - 1982 The agricultural research system of Pakistan: report of the Minnesota reconnaissance team. Bulletin No: 82-1. Minneapolis/St. Paul: Economic Development Center, University of Minnesota.
31. Ross, Vernon E.
  - 1980 Final report of the collaborative rice research project between PARC and IRRI, Philippines, funded under AID loan 391-T-156, November 1980. Islamabad, Pakistan. ARD/USAID. (mimeo.)

32. Shah, Ismat Ali, Chaudhry, Abdul Majid and Ashraf, Malik  
1981 A preliminary analysis of production factors limiting rice yields in Gujranwala - Sheikhpura Districts, Pakistan. Paper presented at the International Workshop on Constraints Research; Pakistan Agricultural Research Council, 1-2 July 1981, Islamabad, Pakistan. (mimeo.)
33. United States Agency for International Development (USAID.)  
1982 Project paper amendment: Pakistan agricultural research, 391-0296. Washington, D.C.: USAID (April 1982).
34. Wahid, Abdul.  
1982 Review of agricultural research in Pakistan. Islamabad: PARC.
35. Zaidi, Basharat H.  
1980 Expansion of the Bolo method of rice production. Report of USAID Provincial Liaison Officer, Sind. Pakistan. (mimeo.)

## FARMING SYSTEMS RESEARCH

### Introduction

This section recapitulates the major points made in Section VII above, about the aims of farming systems research and the types of development intervention that can be based on the results of such research. It also suggests further references, and reviews some of the different approaches to farming systems research which have been tested by various national and international institutions.

### The Strategy of Farming Systems Research

Farming systems research aims to identify physical, biological, social, and economic factors, and their interrelationships, which help to explain why farmers make decisions and form their enterprises in particular ways.

Particularly because of their experience with statistical tools which are useful in such a study, economists - particularly those with experience in microeconomics - have often been key individuals in those cases where farming systems have been sustained and successful. The success of economists in these cases also seem due to the suitability of the micro-unit - the individual farm enterprise - as the focus of farming systems research (9). An overall understanding of why farming is carried out in a certain way in a certain area seems to come most quickly if the first focus is on the individual farm enterprise. Many fundamental relationships among factors which are locally important in farming show up most clearly when one can consider individual units and deal one farmer at a time with the effects of each one's access to and experience with these factors. Of course, the local or regional importance of particular crop sub-systems or of particular types of adaptation has to be verified by sampling and by surveys.

Although economists have taken the lead in many cases in developing farming systems as a particular type of inquiry, natural scientists or those from other social sciences have taken the lead in other cases. One of the most important points that can be made about farming systems research is that it is necessarily a cooperative endeavor among persons trained in a range of disciplines. It is not a discipline by itself, nor is it to be identified with any one discipline's training.

### The Purpose of Farming Systems Research for Agricultural Development

The purpose of farming systems research for agricultural development is to support successful interventions to improve the ways of farming in an area. These interventions may already exist, or they may have to be developed after the identification of a particular problem. To repeat from pp. 25-26 above: by understanding the interactions in the smallest unit of production, scientists will be able to choose crucial points from which to bring pressure from outside - by plant breeding or by institutional means, for example - that will enable the farm unit to move to a higher level of productivity and return.

Such interventions can focus on a sub-system: for example, through the breeding of a shorter-duration variety of a key crop which will make possible an intensified and more profitable rotation. Focus can be on the physical environment, in the case of soil preparation techniques and the machinery for these. Interventions can be social and these in turn can be specific or diffuse: organizational innovations to support a local irrigation facility; or expanded, multipurpose credit available to farmers to use as they see fit.

As noted in Section VII of the main text, above, well-conducted farming systems research can be particularly important for small farmers, who have relatively less flexibility than large farmers and who can afford change only if well based in reality and focused on their major constraints.

### PARC and the Development of Farming Systems Research in Pakistan: Choice Among Models

Whatever the particular disciplinary background of PARC's farming systems research coordinator, this individual will be recruiting and working with multi-disciplinary teams focused on particular research topics of importance for Pakistan. These topics will not all be suited to approach by means of the same particular farming systems research techniques. A number of national and international institutions have experience in farming systems research, and a number of tested approaches is therefore available from which to choose in the light of particular research goals. (9).

For example, CIMMYT's approach (9, 5) is primarily focused on the use of quick, diagnostic surveys by multi-disciplinary teams, in order to identify problems or to monitor particular situations. These surveys can include

both "exploratory" visits as a first step, when no attempt is made to collect standardized quantitative data; and "verification" visits to samples of farmers, to collect limited amounts of data after the exploratory visits have tentatively identified an important research focus. Further follow-up work can include on-farm testing of innovations; again, the data collected are limited in number, and focused in terms of a particular problem or intervention.

ICTA (Instituto de Ciencia y Tecnologia Agricolas) in Guatemala uses an initial survey system based on discussions with farmers, to identify problems. Follow-up is by devising a package to meet problems, testing it on-station and on-farm, and finally evaluating it by means of trials carried out in their own fields by farmers themselves, after instruction. A key part of this last portion of the ICTA approach is to observe which parts of a package convince the farmers who carried out the work, as demonstrated by their decision to continue on their own with these portions after the end of the trials.

IRRI's cropping systems program concentrates on a single crop within a rotational context, and emphasizes the inter-regional comparison of on-farm trials as well as the collection of data on existing rotations and their determinants. Quantitative data are important. Innovations are tested along with this careful monitoring of context. The focus is on isolation of particular factors affecting yields, and on determining the relative importance of these factors.

ISRA (Institut Senegalais de la Recherche Agricole) in Senegal emphasizes the analysis of what happens when existing systems are confronted with introduced change. Scientists work first in an on-farm context with those farmers who are most receptive to a proposed innovation; later they work with a broader group. At the same time they study the overall situation and in order to determine what made the first group receptive.

ICRISAT's Economics Program stresses the contributions which long-term monitoring, of stratified random samples of farm households in different regions, can make to helping research station scientists interested in developing new technology in the laboratory and on the experimental farm. The data acquired in this way have proved useful in identifying research needs and in analyzing responses to on-farm tests. ICRISAT's Farming Systems Research Program is made up primarily of physical and biological scientists; it carries

out station-based work, and on-farm testing of technological systems developed on-station.

PARC should be aware of these and other approaches (9) and should evaluate them. At some point in the not too distant future some of these techniques are likely to prove valuable to Pakistan.

PRODUCTION OF MAJOR FOOD CROPS IN PAKISTAN

The following tables and discussions are meant to provide a brief overview of some aspects of agricultural production in Pakistan. The information presented is much too broad to provide good pictures of variations and their causes among or within regions. For particulars and for more detailed analyses one must consult handbooks (11, 13) and various current studies.

Tables 1 - 3 suggest that wheat is the major food crop in which steady increases have been achieved since 1965 in both production and yield. Table 1 shows that since 1970-71 the yield of unirrigated wheat has grown more quickly than the yield of irrigated wheat. While this suggests that small farmers with few modern inputs are able to make use of at least portions of the high yielding wheat technology, unirrigated wheat begins its rise in the table from a very low base. Similarly, absolute yields of irrigated wheat are also low, relative to potential.

Table 1 indicates that important advances have been made in wheat production, especially in recent years. As noted above (p. 23) rust resistant varieties were spread rapidly following a serious rust epidemic during the 1977-78 season. Estimated production in 1982-83 was 12.27 million metric tons, an increase of 47% over the 1977-78 figure of approximately 8.37 million tons. This figure is also 30% above the 1975-80 five-year average.

If growth in production continues to be healthy the outlook for wheat should be relatively bright. Pakistan's production of this commodity was at a level of self-sufficiency in 1982-83 and a small amount was exported. Annual increases in production over the last five years have averaged 9.3%.

In the case of rice (Table 2) there have also been important increases in yield, but greater production overall also owes much to increased area. This relationship is particularly strong in the case of finegrain, export-oriented varieties. Introduction of high yielding (HYV), coarse grain types in the 1960's raised overall rice production/ha quite markedly (Table 2, 1965-80 five-year averages). Improvements in the performance of the HYVs during the latter part of the 1970's was slow. Recent improvements have been better; 1982-83 estimated yield figures are 10% above the 1975-80 five-year average. Yield relative to potential is still quite low, however.

Other major crops (Table 3) have been relatively static in their performance through 1979-80. This is particularly the case with pulses and oilseeds, which are nutritionally vital parts of the home consumption base for the poor, for laborers, and for small farmers. (The average size of holding in Pakistan is growing smaller: see Table 5.)

Table 4 suggests one major reason for low yields relative to potential, particularly for wheat and rice. Much of Pakistan's cropped area is irrigated, and thus, in principle, could benefit from relatively high levels of fertilizer use. Nevertheless, fertilizer use through 1981-82 was quite low overall. Part of the problem undoubtedly lies with poor control of irrigation, a situation which makes farmers reluctant to invest scarce capital in an input from which they would not be able to realize the full return. USAID projects, among others, are underway to assist the Government of Pakistan in dealing with problems for irrigation organization and management.

Aside from irrigation organization and administration, however, some of the problems with low levels of fertilizer use may lie in lack of its easy availability in the right place at the right time, and in relatively complicated means necessary to obtain government credit in order to purchase such inputs. Tables 6 and 7 indicate that the government is making an attempt to deal with the credit question, at least in terms of total amounts of official credit available. (The sources in Tables 6 and 7 accounted for an estimated 72% of agricultural credit from official sources in 1982-83: see reference 13, p. 109.) Convenient and timely distribution of fertilizer and other physical inputs will be another important facet of the answer here, however.

The maximization programs (Table 8, e.g.) show what excellent results can be achieved over large areas, when coordinated programs are carried out to meet input problems and to disseminate information widely and efficiently.

TABLE 1PRODUCTION, AREA, AND YIELD OF WHEAT IN PAKISTANALL WHEAT

<u>Year</u>	<u>Production ('000 tons)</u>	<u>Area ('000 ha)</u>	<u>Yield (kg/ha)</u>
65-70	5716.3 (100)*	5774.0 (100)	987.0 (100)
70-75	7222.6 (126)	5934.0 (103)	1217.0 (123)
75-80	9401.6 (164)	6494.3 (112)	1448.0 (147)

ALL WHEAT ESTIMATED FIGURES

82-83	12267.0	7236.0	1695.0
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IRRIGATED WHEAT\*\*

70-75	6479.6 (100)	4438.5 (100)	1459.4 (100)
75-80	8288.7 (128)	4988.0 (112)	1660.4 (114)

UNIRRIGATED WHEAT\*\*

70-75	742.7 (100)	1495.5 (100)	497.2 (100)
75-80	1112.9 (150)	1506.3 (101)	732.2 (147)

\* Figures in parentheses are percentages.

\*\* Note: figures for irrigated/unirrigated wheat available only for 1970-82.

SOURCE: adapted from ref. 11 pp. 5-10; 13 p. 101.

TABLE 2

PRODUCTION, AREA, AND YIELD OF RICE IN PAKISTAN

<u>ALL RICE</u>			
<u>Year</u>	<u>Production ('000 tons)</u>	<u>Area ('000 ha)</u>	<u>Yield (kg/ha)</u>
65-70	1722.2 (100)*	1479.9 (100)	1162.0 (100)
70-75	2312.0 (134)	1511.1 (102)	1531.0 (132)
75-80	2958.5 (172)	1883.6 (127)	1571.0 (135)
<u>ALL RICE ESTIMATED FIGURES</u>			
82-83	3369.0	1954.0	1724.0
<u>FINEGRAIN RICE**</u>			
72-73	399.8 (100)	337.9 (100)	1181.0 (100)
72-77	557.9 (140)	454.5 (135)	1228.2 (104)
77-82	871.9 (218)	727.9 (215)	1192.0 (101)
<u>HYV RICE (IRRI VARIETIES)**</u>			
72-73	1255.0 (100)	646.8 (100)	1937.0 (100)
72-77	1253.3 (100)	657.9 (102)	1902.8 ( 98)
77-82	1879.1 (150)	909.1 (141)	2072.4 (107)

\* Figures in parentheses are percentages.

\*\* Note: figures for rice by variety available only for 1972-82.

SOURCE: adapted from ref. 11 pp. 14-18; 13 p. 103.

TABLE 3

PRODUCTION, AREA, AND YIELD OF VARIOUS IMPORTANT FOOD CROPS IN PAKISTAN

MAIZE

<u>Year</u>	<u>Production ('000 tons)</u>	<u>Area ('000 ha)</u>	<u>Yield (kg/ha)</u>
65-70	642.1 (100)*	593.3 (100)	1079.0 (100)
70-75	728.5 (113)	632.7 (107)	1153.0 (107)
75-80	812.2 (126)	650.3 (110)	1249.0 (116)

RAPSEED AND MUSTARD

65-70	228.6 (100)	473.1 (100)	480.0 (100)
70-75	279.5 (122)	518.6 (110)	535.0 (111)
5-80	259.0 (113)	448.7 ( 95)	579.0 (121)

ALL EDIBLE OILSEEDS

<u>Year**</u>	<u>Production</u>	<u>Area</u>
70-71	325.6 (100)	574.2 (100)
70-75	343.3 (105)	589.2 (103)
75-80	333.8 (103)	531.4 ( 93)

ALL PULSES

<u>Year</u>	<u>Production</u>	<u>Area</u>
65-70	738.2 (100)	1526.5 (100)
70-75	736.5 (100)	1439.2 ( 94)
75-80	737.4 (100)	1556.4 (102)

\* Figures in parentheses are percentages.

\*\*Figures on all edible oilseeds available only for 1970-82.

SOURCE: adapted from ref. 11 pp. 19-20, 59-60, 72.

TABLE 4CROPPED AREA, IRRIGATED AREA, AND FERTILIZER CONSUMPTION IN PAKISTAN 1981-82

<u>Province</u>	<u>Area*</u> <u>Irrigated**</u>	<u>Net Sown</u> <u>Area*</u>	<u>Gross Cropped</u> <u>Area*</u>	<u>Average Consumption***</u> <u>of fertilizer Nitrogen</u>
Punjab	10.34	10.42	13.10	41
Sind	3.17	3.17	3.90	59
Northwest Frontier Province	0.74	1.48	1.79	32
Baluchistan	0.54	0.48	0.51	9
Countrywide	14.79	15.55	19.30	43

\* '000,000 ha

\*\*The fact that the area irrigated in Baluchistan is reported as higher than the net sown area in that province may be indicative of the relative undependability of irrigation sources there.

\*\*\* kg/ha, gross cropped area

SOURCE: adapted from ref. 11 pp. 112, 115, 130-131.

TABLE 5

CHANGES IN FARM SIZE IN PAKISTAN

Holding Size (ha)*	1 9 7 2		Holding Size (ha)	1 9 8 0	
	% Holdings	% Cult. Area		% Holdings	% Cult. Area
0- 1.0	14	1	0- 1.0	17	2
1.0- 2.0	14	4	1.0- 2.0	17	6
2.0- 3.0	15	8	2.0- 3.0	17	9
3.0- 5.1	<u>25</u>	<u>21</u>	3.0- 5.0	<u>23</u>	<u>21</u>
Subtotal	68	34		74	38
5.1- 10.1	21	29	5.0- 10.0	17	26
10.1- 20.2	8	19	10.0- 20.0	6	17
20.2- 60.7	3	13	20.0- 60.0	3	13
60.7 and above	negligible	<u>5</u>	60.0 & above	negligible	<u>6</u>
TOTAL:	<u>100</u>	<u>100</u>		<u>100</u>	<u>100</u>

\* Data on holding size are not available by irrigated/unirrigated sub-categories. Pakistan government calculations are that a farm of 5.0 irrigated hectares provides income at a subsistence level. This specification of an area which seems quite large in comparison to irrigated areas and their productivity in many other Asian countries is probably due to a combination of factors, including both living costs and the prevailing undependability of irrigation in many parts of Pakistan.

SOURCE: adapted from ref. 11 pp. 116-117.

TABLE 6

## LOANS BY THE AGRICULTURAL DEVELOPMENT BANK OF PAKISTAN TO FARMERS

Year	% Of All Loans, by Size of Holding					Total ('000 Rs)	% Increase/ Decrease
	Landless (Tenant/Pro- ject Loans)	up to 5.06 ha	5.06-20.23ha	20.23-40.47 ha	40.47 ha and above		
73-74	47.7	24.0	11.8	8.7	7.8	415,180	n.a.
74-75	13.6	11.4	46.3	21.4	7.3	395,500	-5
75-76	10.3	8.7	48.0	24.2	8.8	532,190	+35
76-77	17.1	17.8	40.9	20.5	3.7	637,390	+20
77-78	10.7	6.5	56.8	23.3	2.7	429,830	-33
78-79	3.7	9.9	66.0	17.2	3.2	416,390	-3
79-80	15.4	10.2	21.2	36.4	16.8	709,840	+70
80-81	16.2	9.5	57.1	9.6	7.6	1,065,592	+50
81-82	8.5	17.6	53.5	18.3	2.1	1,550,790	+46

SOURCE: adapted from ref. 11 pp. 152-153.

TABLE 7

LOANS BY COMMERCIAL BANKS IN PAKISTAN TO FARMERS  
(by size of holding)

Year	% Of All Loans, by Size of Holding			Total (000 Rs.)
	<u>Up to 5.06 ha</u>	<u>5.06 to 20.23 ha</u>	<u>20.23 ha and above</u>	
79-80	54	33	13	1,432,030
80-81	56	30	14	1,661,300
81-82	68	22	10	2,099,650

SOURCE: adapted from ref. 11 p. 158.

TABLE 8

RESULTS OF THE 44-88\* RICE MAXIMIZATION  
PROGRAM, GUJRANWALA DISTRICT, PUNJAB,  
PAKISTAN 1980-81

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	District Gujranwala (253,000 ha)	
	Yield (kg/ha)	
	<u>Basmati</u>	<u>IR-6</u>
Average yield 1979-80	1680 (100)**	2964 (100)
Average yield 1980-81	2964 (176)	4940 (167)
Highest yield obtained by a farmer using improved cultivation involving dry application of fertilizer	3952	7410

\* Respective target yields in maunds/acre (1 md = 88 lbs.) for basmati (finegrain export variety) and IR-6 (coarsegrain) paddy.

\*\*Figures in parentheses are percentages.

SOURCE: adapted from ref.29 p. 18.

## FINANCIAL MANAGEMENT

### A. Finance & Accounts Division of PARC

#### 1. Organization

The 1983/84 budget of PARC lists 2527 positions funded by PARC. Of these, 1208 are funded from the current budget; 606 by the USAID project 391-0296, strengthening of Agricultural Research Capabilities in Pakistan; 302 positions by the World Bank project, Pakistan Agricultural Research Development; and the remainder by the other projects under the development budget.

The Finance and Accounts Division, which comes under the Council Member, Finance, has approximately 40 accountant or assistant positions in PARC headquarters. Another 18 are located at NARC. The top four positions of the Division are the Director and Deputy Director (Finance) and Director and Deputy Director (Accounts). The Director (Accounts) and Deputy Director (Finance) positions are presently vacant. The Council Member (Finance) said that employees for these positions have been selected and are expected to join NARC on November 1, 1983.

#### 2. Services Provided

Services provided by the Finance and Accounts Division to PARC, NARC and the various research institutes and agricultural universities where PARC-funded projects are located are generally in the areas of annual budget preparation, project approval, receipts of funds, expenditures and funds releases, and accounting and financial reporting.

#### 3. Operating Procedures

##### a) Annual Budget Operation

Budget instructions are received by PARC (from the Ministry of Finance (MOF)). The Budget Department of the Finance and Accounts Division then issues instructions, including the format to be used, to all locations of PARC-funded projects. Instructions for the 1984/85 budget were sent out in October 1983. The deadline for returning completed budget requests to the Finance and Accounts Division is November 10, 1983 and the PARC budget has to be submitted to the MOF by December 21, 1983. This timing appears to be more ambitious than is warranted by past results.

In the process of consolidating the PARC budget proposal the Director, Finance, and the Accounts Officer, Budget, consult with Project Coordinators and Directors. The Council Member, Finance, provides the financial input during PARC's review of the requested budgets and through the approval procedures by the PARC Council and Executive Committee. The review in the MOF is conducted by the Priorities Committee, of which the 5 PARC Council Members are members. At this stage, in April or May, PARC has unofficial notification of their probable allocated budgets. They can then prepare how best to absorb possible cuts in the budget and notify the various project coordinators and directors.

The annual budget allocations are usually received in June or early July. The current allocation is in total for PARC; the Development allocation is by project or program. PARC determines which components of the various projects are affected by changes in the budget.

When the 1983/84 approved allocation was received the amount had been reduced from the amount that PARC had been informed of earlier in the year.

b) Project Approval

The PARC technical committees, consisting of representatives of research institutes, agricultural universities, NARC and PARC meet twice a year to consider new project proposals. The PARC Executive Committee, which includes the Council Member, Finance, determines whether the project should be included in the Current Budget or the Development Budget. Projects to be included in the next fiscal year's budget are approved by the PARC Board of Governors, of which the Member, Finance, is also a member.

c) Receipt of Funds

All funds of PARC are received from the MOF and are credited to PARC bank accounts in the National Bank of Pakistan. In 1982/83, AID reimbursed PARC expenditures by payment to the MOF of Rs. 16.1 million in two payments of slightly more than Rs. 8 million each. PARC makes expenditures from two revolving funds, totalling Rs. 12 million, advanced by AID for project 391-0296. The AID reimbursement to the MOF is deposited in the PARC Treasury Account, replenishing the revolving fund.

USDA makes payment every six months for PL-480 projects and these funds are released to PARC at approximately the same interval. GOP funds are scheduled to be released monthly on the following schedule: (i) one-fifth of the annual budget during the first quarter (July - September);

(ii) one-fourth the second quarter; (iii) three-tenths the third quarter; (iv) one-twelfth in April, and (v) the remainder in May and June.

PARC presents monthly expenditure reports of funds utilized during the previous month. Monthly requests for releases are also required. These are submitted by the seventh of each month. Funds requested July 7th were received in September 1983. The two-month lag is generally not made up during the year; thus, it effectively serves as a budget reduction process. Funds not released by June 30th are lost for that fiscal year.

d) Expenditures and Funds Releases

The Finance and Accounts Division pays the costs incurred by PARC, as well as releasing funds to NARC and the various project locations. Releases are scheduled on much the same basis as PARC's receipts from MOF, i.e. one-fifth during the first quarter, etc. Releases to NARC are made monthly and to research institutes and agricultural universities generally on a quarterly basis. Releases are made directly to the institutions in the form of bank drafts generally payable to the institution heads.

The release to NARC is made near the beginning of the month. Expenditure reports from NARC and the projects are usually submitted to PARC on a monthly basis, after the fact. During the team's visit some project officials reported that they did not receive the first quarter's release until August or September.

e) Accounting and Financial Reporting

The World Bank Staff Appraisal Report of the Agricultural Research Project, dated April 1, 1981, listed improvements required in PARC's maintenance of financial records and consultants were scheduled to be funded under the project to assist PARC in making the necessary changes. The consultant services have not been used and the accounting system appears to be essentially the same as that existing at the time of the World Bank appraisal.

PARC accounts separately for (1) the Current Budget, (2) the USAID project, (3) the World Bank project and (4) other development projects. The accounting system consists of the recording of cash receipts and cash payments. Asset and liability accounts are not included in the trial balance. Stock cards are prepared for each purchase of durable goods, giving description and cost. The group of cards is totaled and checked against the annual procurement figure for durable goods, as shown on the trial balance. The various bank balances are also kept outside the accounting

system. But durable goods and bank balances, both asset accounts, are not integrated into an overall accounting control system.

A statement showing receipts of funds from July 1, 1982 to June 30, 1983 and a report titled "Financial Statements" for the same period were prepared for the fiscal year. The statement of receipt of funds did not include all receipts, e.g. receipts of PL-480 funds. A statement showing total receipts of PARC for the year is not prepared in the form of one report. The Financial Statements were a variety of useful reports tied in to the budgets. These serve PARC's purpose of reporting receipts and expenditures on a cash basis, by project. They do involve a great deal of manual summarization. If PARC should receive funding from additional sources the accounting and reporting requirements could become most cumbersome, given each donor's requirement of reporting on its own prescribed format.

The team was informed that PARC has decided to acquire a micro-computer for use in the Finance and Accounts Division as well as serving other PARC needs. This would be quite useful in assembling data for various categories of expenditure and in preparing various reports on a variety of formats.

## B. Problems

### 1. Funding and Timing of Releases to PARC

The main constraint to the use of funds appears to be the restriction imposed on the use of local currency. The 1983/84 rupee budgets, including the reported restoration of Rs. 10 million, approximate actual expenditures of 1982/83. PARC has also applied for a further restoration of Rs. 20 million for this year which would bring the rupee budgets to the level of the 1982/83 budgets. However, to judge by the past, PARC will not receive the entire amount budgeted.

The GOP has to consider IMF requirements, inflation control, and other economic problems on a national scale and, thus, has to consider a large number of agencies, in addition to NARC. Accordingly, the recent budget cuts were pretty much across the board. In PARC a sizeable cut was imposed on PL-480 funds supplied by the U.S. Department of Agriculture (USDA). In 1982/83 PARC received Rs. 15 million from this source. PARC's proposal for 1983/84 was for Rs. 35 million, of which Rs. 23 million was for 104 on-going projects. The allocation approved by MOF was Rs. 8 million for 68 projects. This has, reportedly, been increased to Rs. 18 million.

The budget is effectively reduced by the GOP procedure of releasing funds, as discussed, above, under the section on receipt of funds. PARC's monthly request for funds has to be approved by the Ministry of Food & Agriculture and the Accountant General-Pakistan Revenues (AGPR), which is under the Ministry of Finance. We were told that AGPR usually required the greatest time to approve the release of funds.

PARC has a revolving fund, advanced by AID, for project 391-0296 expenditure uses and expressed a need for something similar from other donors, especially the GOP. Especially useful would be advanced releases of funds by the GOP, if not annually, at least on a quarterly basis.

## 2. Funding and Timing of Releases to Projects

Reduced funding and delayed releases of funds to PARC are reflected in releases to projects, especially those in the provinces. A common complaint that the team heard during its visits to research institutes and agricultural universities was that delayed releases often resulted in delayed payments of salaries and delays in purchases of equipment, seeds, fertilizer, etc. past the dates most urgently needed. Budget reductions of ongoing projects result in the more drastic step of employment reduction of project-funded employees. Also cited was that the timing of releases does not match the urgent needs of funds at certain times of the growing season such as the time of planting. The desire was also expressed for advance releases of funds by PARC, at least on a quarterly basis. Some of the institution officials told the team that their first quarter's release of funds this year was received in August, some in September. Instances of project-funded employees not being paid during July and August until the first of this fiscal year's funds were received were also related. A question directed to a PARC Headquarters-based employee as to whether salary payments had been delayed to Headquarters and NARC employees brought the response that such an event would probably result in a march on the Headquarters offices by affected employees.

## 3. Notification of Budget Reductions

This is an area that appears to require added attention at PARC. In April or May PARC has a fairly good idea of their probably budget for the next fiscal year and of amounts for individual programs and projects. Then, and also when the approved budget allocation is known in June, the project coordinators and directors are informed so they can plan accordingly. Yet the team was informed at some of

the institutions visited that they did not know of budget reductions until some time in August or September. It appears that changes in a project's budget require meetings between PARC, including budget personnel of the Finance and Accounts Division, and project coordinators and directors to determine cost categories to be affected. This process probably accounts, substantially, for the delay but doesn't explain the apparent lag in communication with responsible officials at project locations.

#### 4. Accounting and Financial Reporting

PARC adequately accounts for expenditures on the AID project number 391-0296 and presents timely reports and requests for reimbursement. So the weakness in the accounting system does not have any apparent effect on PARC's accounting for various project expenditures.

However, judging PARC as a prominent research institution, the lack of an adequate integrated accounting system and the weak system of internal controls could prove an embarrassment at some future time. It certainly cannot be considered a good example of strong financial management.

Two reasons were given for the decision not to accept management consulting assistance at this time to improve the accounting system, as had been recommended by the World Bank. First, PARC follows the GOP-prescribed accounting system and they feel it best not to depart from it at this time; and, second, consultants coming in would require some time to become familiar with PARC's system and much of the time of employees would be spent in helping them. The Finance and Accounts Division is filling two of its top four positions, hopefully on November 1, 1983. It will take time for the appointees to learn PARC's system. To attempt both at once would not be advisable. Also, a change of accounting system would have to be initiated only after close discussions and approval of the Ministry of Finance and possibly other Ministries.

PARC plans to procure a micro-computer. A System Design and Analysis section, with eleven positions, is included in the 1983/84 current budget. At such time as PARC might decide to update their accounting system, it would probably be practical to computerize the updated system.

### C. Conclusions

1. PARC received only 80% of the rupee budget funds that had been allocated in fiscal year 1982/83 and 30% of those funds were received during the last days of the fiscal year. The shortfall seems to be partly a result of the federal system of review and the resulting bureaucratic delays of monthly requests for release of funds, and is largely beyond PARC's control. Rupee budgets for 1983/84 are below those of 1982/83 although there is evidence of improvement, at least to the level of 1982/83. Operation of the PARC and NARC institutions and funding of ongoing projects is dependent on each year's budgetary allocation. Reduction of funds usually results in releases of project employees and delays in various research operations.

PARC appears to have had some degree of success recently in obtaining urgently needed funds for emergency payments of bills at fiscal year-end and in gaining restoration of budgetary cuts. We feel that even more intensive efforts to gain an agreement with the MOF to receive GOP provided rupees quarterly, in advance, should be made. Without some such form of agreement the present bureaucratic delays seem destined to continue and the uncertainty of funding will continue to adversely affect morale and effective use of funds received from other donors in strengthening and stabilizing the PARC-funded institutions and programs for agricultural research.

2. Reductions in funding and delays in release of funds to PARC are reflected in PARC's releases to projects.

Delays in releases of funds to provinces could be reduced in some cases by more careful and prompt submission of expenditure statements, accounting for funds already received, by the projects to PARC. More attention and closer monitoring of this reporting by project coordinators and directors might also be required.

PARC and project coordinators might also explore possibilities of increased use of staff members of research institutes and universities where PARC-funded projects are located. This would appear to benefit the institutions, and PARC, in more efficiently utilizing staff members when they have time available for PARC activities, reduce the instances of having to release project employees during times of budgetary restrictions and provide additional research experience, especially for university staff members. PARC should then give added priority to approval and increased funding of projects located at institutions with available

facilities and staff. At a number of institutions employees are hired especially for the PARC-funded projects and equipment and supplies are procured separately. With reduction in the project budget some of these employees have to be rified.

In some instances employees are seconded from institutions for full-time employment on PARC projects. In addition to paying their salaries, PARC has to pay the pension contribution to the provincial government. It seems that some arrangements could also be made in certain cases to pay partial salaries and pension costs where part-time use of staff members is feasible. It is more complex than using a staff employee on secondment but, if deemed beneficial, it might be arranged through application of managerial initiative at a level equal to the professional initiative displayed by many of the project scientists the team met.

3. PARC should review the communication lines from PARC through project coordinators and directors to projects at institutes and universities, especially in the communication of budgetary changes. After going through the annual budget process, each level should have plans for areas of change in the event of project budgetary increases or decreases of, say, 10% 20% and 30%. This may require increased attention to management of projects by coordinators and directors and increased use of the budget in managing projects. For PARC one product of budgetary management should be a priority-ranking of projects and contingency plans for various degrees of possible budgetary increases or decreases.

PARC management should also review the role of project officials at the provincial locations in the determination of revised budgets. PARC officials and project directors and coordinators determine the project categories to be affected. It is unclear whether project and institution officials at the provincial level have any voice in these decisions.

4. A section of this team report deals with Management. It is should be determined that PARC is to emphasize improvement of its management system, in line with the concepts of modern management, then it would be imperative that improvement of financial management be a prominent feature of such effort.

An integrated accounting system, including balance sheet accounts and accruals, would have to be installed. A strong system of internal controls would be required. Audits by independent chartered accountants would be required on a more current basis than the present two to three years after the fiscal year-end. Further training of personnel might also be required.

Considering the possible installation of a computerized accounting system, the effort to improve financial management might exceed that envisaged in the World Bank project.

The Team recommends that PARC seriously consider initiating changes in its financial management system, in line with its consideration of other management improvements, while a funding source remains available.

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