MART

Management of Agricultural Research and Technology Project
18-6th Avenue, Ramna-5, P.O. Box 1028, Islamabad
Telex: 5604 PARC PK Tele: 240908, 82005326 Fax: 051-240909

To: Bureau fo Program and Policy Coordination
Center for Development, Information and Evaluation
(PPC/CDIE/DI), ACQUISITIONS, Room 209, SA-18
Agency for International Development
Washington, DC 20523

From: Qamar Zaman
Prog/Admin Officer

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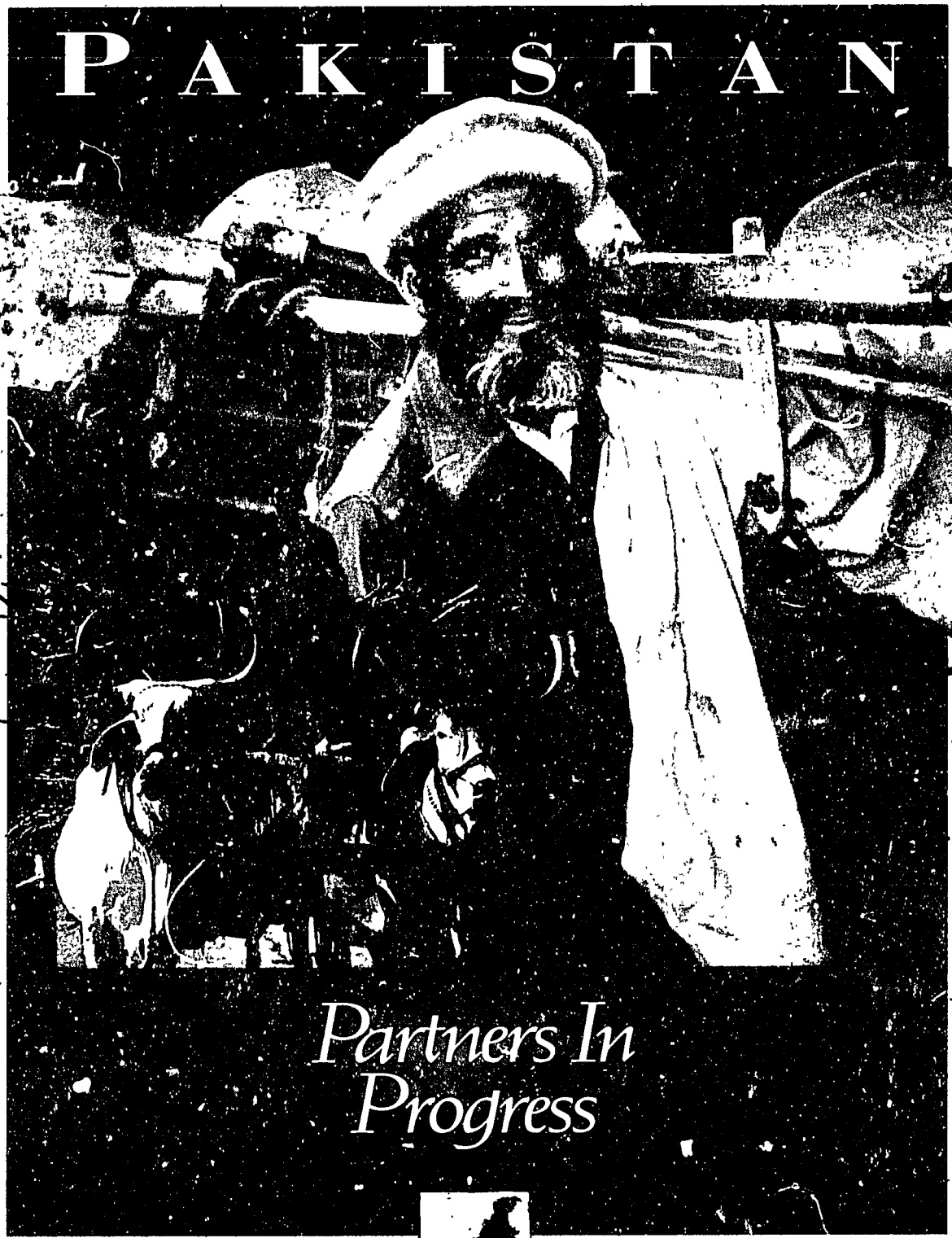
Attached for your use is a copy of Winrock's publication titled "Partners in Progress" by Wayne E. Swegle.

With regards.

PAKISTAN



Partners In Progress

The Management of Agricultural Research and Technology (MART) project, begun in the mid-1980s, is a major endeavor to increase the effectiveness of Pakistan's agricultural research system, and to develop its human resources and strengthen its institutions.

Leading this ambitious project are scientists and administrators in the provincial agricultural research institutes, the Pakistan Agricultural Research Council (PARC) and its National Agricultural Research Center (NARC), agricultural universities and related agricultural research institutions, and agribusiness leaders, including farmers.

The project is funded by the U.S. Agency for International Development (USAID) The Pakistan USAID mission project managers and their colleagues add value to the program through collateral activities.

Collaborating with the Pakistani and USAID leadership is a team of advisors fielded by Winrock International Institute for Agricultural Development, a private nonprofit organization that manages environmentally sensitive, sustainable agricultural and rural development projects around the world.

The project's objective of strengthening the management of the country's agricultural research system is emphasized by the facts that (1) agriculture is Pakistan's most important economic sector, and (2) agricultural research provides the highest payoff from the investment of development dollars. The following statements prove these two points.

Agriculture dominates Pakistan's economy. More than two-thirds of the country's people live in rural areas, most of them in some 45,000 villages. Pakistan's agricultural economy accounts for one-third of the country's investment. About half of the nation's gross domestic product is agribusiness based, from producing farm and forest products to collecting, storing, processing, and distributing those products.

Cotton, rice, wheat, sugar, edible oils, milk, and meat are the principal farm products. Viewed from another perspective, people in Pakistan's agricultural economy consume more than half of the nation's household products, provide two-thirds of its employment, and produce three-fourths of its exports.

Investment in agricultural research has a high payoff. Making the agricultural sector more productive is critically important to Pakistan, and increasing its productivity is largely based on agricultural research, such as developing new technologies, making them available to farmers, and getting them adopted on the land

Three agricultural economists—two from Yale University (USA) and one from Pakistan—conducted a comprehensive study of returns from investments in agricultural research in Pakistan. They found that agricultural research has produced economic growth in agriculture at a low cost, and that growth has been vital to Pakistan, with its rapidly growing population. The economists conclude in their scientific report that for more than 40 years, agricultural research in Pakistan has been one of the country's most productive ventures

What this report comprises. This publication is a progress report about the partnership of the Government of Pakistan, USAID, and Winrock International in implementing the research management and administration, information transfer, and training components of the MART project as embellished to include farming systems research and agribusiness development. As such, the report

- provides a brief history of Pakistan's agricultural research system to put the project in the proper context
- explains the project's components, goals, and objectives
- describes how the Winrock components are being implemented, including some of its successes and areas where it falls short of expectations
- defines constraints to the system's development and suggests changes that allow the system to progress more rapidly

The report is based on discussions with officials of provincial agricultural research institutes and agricultural universities; extensive interviews with leaders and former leaders of PARC, including NARC; talks with private-sector people involved in agribusiness, including farming; discussions with USAID officials and Winrock advisors and consultants; and reviews of project research, training reports, and government documents.

PARTNERS IN PROGRESS

Pakistan's agricultural research system has come a long way in a relatively short time It has well-trained people who conduct agricultural research in the provincial agricultural research institutes, in the agricultural universities and other research organizations, and in the Pakistan Agricultural Research Council (PARC) The system possesses modern research facilities in the provincial institutes and universities, and state-of-the-art research, audio/visual, computer laboratory, and training facilities at the National Agricultural Research Center (NARC)

Many partners have collaborated with the Government of Pakistan and its agricultural research leaders in the provinces and at the national level in attaining the system's progress

GROWING THE SYSTEM THROUGH PARTNERSHIPS

The rapid growth of Pakistan's agricultural research system began in the mid- to late-1960s That is when the new high-yielding, short-strawed, fertilizer-responsive varieties of wheat coming out of the International Maize and Wheat Improvement Center (CIMMYT) in Mexico and of rice developed at the International Rice Research Institute (IRRI) in the Philippines were successfully introduced into Pakistan Much of the adaptive research, variety testing, and plant breeding work was conducted within the provincial agricultural research institutes.

Among Pakistan's partners in achieving the massive increases in yields and production in what has been called the "the green revolution" were the Ford Foundation, USAID, CIMMYT, and IRRI These achievements set the stage for reviewing the Pakistan agricultural research system to determine its needs.

A major USAID project initiated the process. Two Joint Pakistan-American Agricultural Research Teams reviewed agricultural research in Pakistan and found that inadequate applied research was limiting the country's agricultural production They found that the agricultural research capabilities urgently needed strengthening and recommended that the country's Agricultural Research Council establish research centers to better serve farmers' needs Shortly after the second team's review in 1973, a major USAID-funded project entitled, "Strengthening of Agricultural Research Capabilities in Pakistan," was put into effect

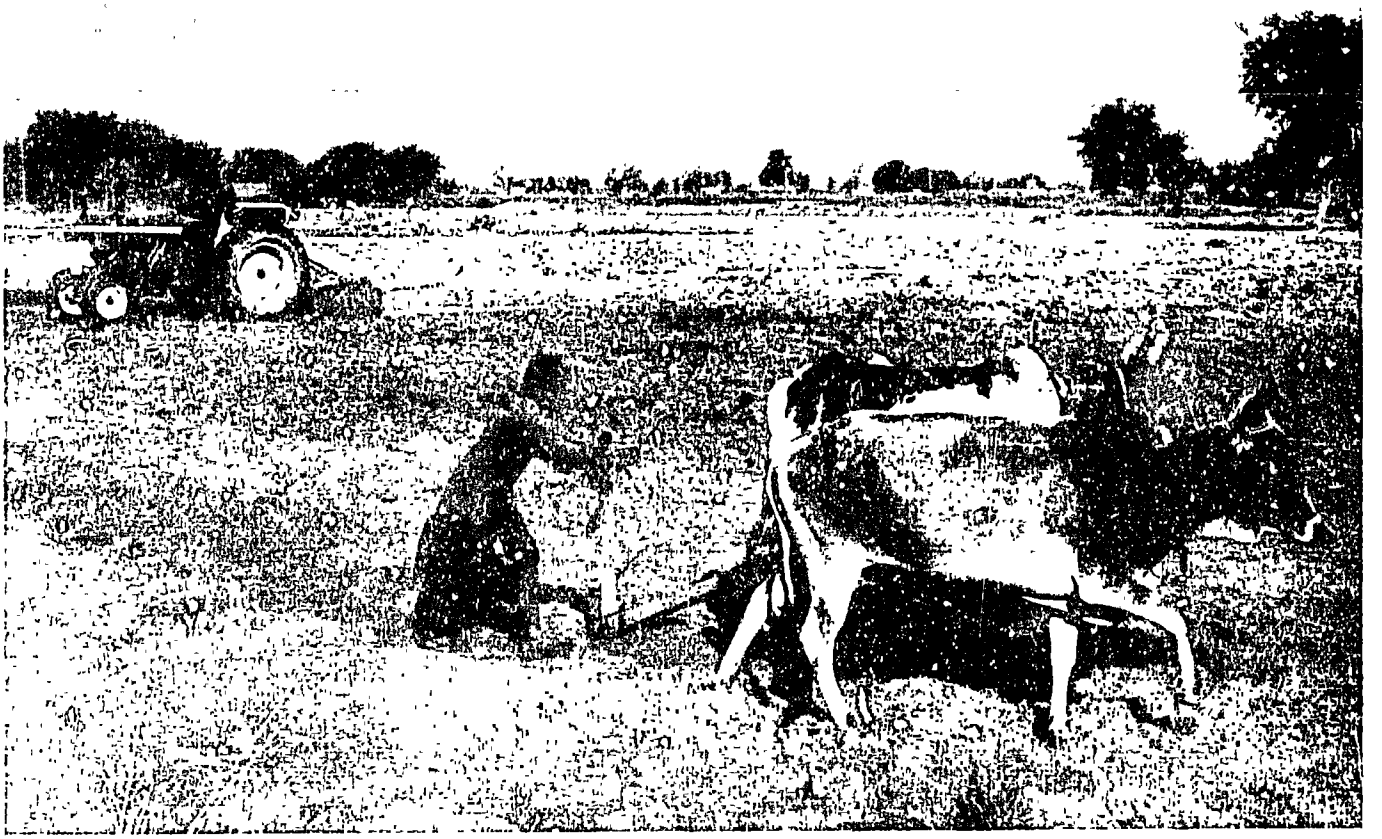
The project strengthened the national coordinated research programs by bringing together scientists from provincial institutions and from the national level to share their expertise on various aspects of a commodity in an integrated fashion Objective was to help increase agricultural production and improve farmers' incomes

Another major activity of the project was constructing NARC, one of the few federal agricultural institutions in Pakistan Construction followed several years of discussion, planning, land acquisition, road construction and architectural design The main facility—which includes administration offices, laboratory blocks, a library, auditorium, training center, and hostels for housing trainees and other visitors—was finished in 1984

The center tackles problems not adequately addressed by the provincial agricultural research institutions or that require investigation in a well-equipped and -staffed central facility

In developing national coordinated research programs, constructing NARC, providing training, lending technical assistance, and supplying commodities, the USAID project strengthened Pakistan's agricultural research and laid a sound base for an effective national agricultural research program

A World Bank project continued the growth. The World Bank was the country's next major partner in its Pakistan Agricultural Research and Development Project (ARP I) The ARP I project provided funds for building a PARC headquarters office building, constructing the Farm Machinery Institute at NARC and expanding certain other NARC facilities, financing PARC's grant support to provincial research institutes, sending research staff abroad to earn master's and doctorate degrees, and obtaining short-term advisors and technical assistance



The MART project is USAID's most recent partnership with Pakistan to strengthen its agricultural research system, particularly in the provinces Pakistan's agriculture ranges from traditional to modern as illustrated by these Sindh farmers leveling land for more efficient irrigation Elements of the MART project support agricultural research that spans the spectrum of farm sizes and types

MART Further Improves the System's Performance

A team reviewing the USAID-funded project, "Strengthening of Agricultural Research Capabilities in Pakistan," in 1982 found that the project strengthened PARC's research capability more than that of the provinces It recommended strengthening the provincial agricultural research institutes and universities for a balanced federal-provincial system.

USAID and the Government of Pakistan then took the next step in their partnership by developing the Management of Agricultural Research and Technology (MART) project The project is designed to improve the system's performance in five key areas, research management and administration, information transfer, training for the agricultural research network, arid-zone research, and wheat and maize coordinated programs.

USAID selected Winrock International Institute for Agricultural Development to advise in implementing the first three components of the project in collaboration with the agricultural research institutes and training institutions in all four provinces, the agricultural universities in the NWFP, Punjab, and Sindh provinces, PARC, and NARC. This partnership began in 1986

The other two elements were executed by two international agricultural research centers The arid-zone research component, aimed at serving the needs of arid, high-altitude, non-irrigated areas of western Pakistan, was assisted by the International Center for Agricultural Research in the Dry Areas and was based at the Arid Zone Research Institute (AZRI) at Quetta, Balochistan CIMMYT advised on the wheat and maize coordinated programs intended to build on Pakistan's gains in producing these two crops.

The MART project strengthens the agricultural research institutes in each of Pakistan's four provinces, as well as its two major federal institutions.

Important Dates in the System's Development

Pakistan's agricultural research system is comparatively young. Born in 1947, it grew in the 1970s, spread its wings in the 1980s, and is taking flight in the decade of the 1990s.

When the Indo-Pakistan subcontinent was divided into Pakistan and India in 1947, several agricultural institutes were conducting research in crops, animal husbandry, forestry, and fisheries in undivided India. These institutes were not located in the areas that became Pakistan. Some independent commodity committees had separate funds and research stations, but their work came to a standstill soon after partition.

The new nation confronted many problems, and the importance of a central research organization was discussed several times by successive federal cabinets.

In 1947, after partition, participants in a Food and Agriculture Conference in Lahore recommended establishing a Pakistan Food and Agriculture Council to continue agricultural research in the country.

In 1948, the Government of Pakistan set up a small Food and Agriculture Committee to deal with all commodities except cotton and jute The committee promoted scientific, technological, social, and economic research relating to food and agriculture, coordinated agricultural research, and disseminated knowledge about food and agriculture.

In 1951, the Food and Agriculture Committee was replaced by the Food and Agriculture Council, an executive body that was assigned the same functions as the committee

In 1964, the council was replaced by the Agricultural Research Council (ARC), which conducted agricultural research in provincial institutes and disseminated research findings, established liaisons with other national and international scientific organizations, accepted fees and donations; and made grants and awarded fellowships for agricultural research

In 1968, the first Joint Pakistan-American Agricultural Research Team reviewed agricultural research in Pakistan and found that inadequate applied research was limiting the country's agricultural production The team recommended that ARC establish research centers to better serve farmers' needs.

In 1973, the second Joint Pakistan-American Agricultural Research Team reported that ARC and the agricultural research capabilities of the country urgently needed fortifying Shortly after that, a major USAID-funded project entitled, "Strengthening of Agricultural Research Capabilities in Pakistan," was put into effect.

In 1974, USAID's partnership with Pakistan to strengthen its agricultural research capabilities began. The project's chief elements were to develop national coordinated research programs for major agricultural commodities, construct a national agricultural research center (NARC), lend technical assistance, train research scientists, and provide commodities.

In 1981, a national ordinance created a Division of Agricultural Research, increased the authority of the Pakistan Agricultural Research Council (PARC) within the division, and lodged it in the Ministry of Food, Agriculture and Cooperatives The chairman of PARC was appointed Secretary to the Government of Pakistan These changes increased PARC's effectiveness in planning, coordinating, and evaluating agricultural research.

In 1982, a World Bank project review and appraisal was followed by approval of the Pakistan Agricultural Research and Development Project (ARP I), which provided funds to build a PARC office building, construct the Farm Machinery Institute and expand other NARC facilities, finance PARC's support to provincial institutes, send research staff abroad for advanced degrees, and obtain advisors and technical assistance.

In 1982, a team reviewed the USAID-funded project, "Strengthening of Agricultural Research Capabilities in Pakistan." The team found the project strengthened PARC's research capability more than the provincial institutes and recommended strengthening the provincial agricultural research institutions to develop a balanced federal-provincial system.

In 1984, the Government of Pakistan and USAID developed the MART project to strengthen the provincial research institutions and improve the system's performance in five key areas: research management and administration, information transfer, training for the agricultural research network, arid-zone resea.ch, and wheat and maize coordinated programs.

In 1986, Winrock International Institute for Agricultural Development began carrying out the first three parts of the project in collaboration with the agricultural research institutes and training institutions in all four provinces, the agricultural universities in the NWFP, Punjab, and Sindh provinces, and PARC and NARC. Two international agricultural research centers assisted in the other two components.

Improving the System's Performance Through MART

USAID MART project funds are used to procure technical assistance, training, commodities, and construction services, and to support field studies and demonstrations needed to

- increase the capacity of the provincial agricultural research network and PARC to plan, manage, and evaluate Pakistan's agricultural research needs and priorities
- strengthen the network's capability to use, manage, and account for financial resources
- strengthen the operating linkages between federal and provincial research organizations, agricultural universities, and extension personnel
- establish long-term institutional linkages between the Pakistani agricultural research network and selected regional and international research centers
- establish a critical mass of research skills and managerial talent within the national agricultural research network
- strengthen the network's capacity to produce and disseminate new technologies responsive to the needs of client groups
- expand in-service training capability at the federal and provincial levels
- strengthen the ability of selected commodity research programs to generate relevant technological packages
- develop and put into effect mechanisms to increase the Pakistani private agribusiness sector's participation in identifying research needs, conducting research, and using and disseminating research results
- improve the ability of AZRI to plan and carry out effective research on agricultural problems of the arid and high-altitude areas of Balochistan and similar areas of Pakistan
- improve the system's research and outreach capability in wheat and maize

The research management and administration, information transfer, and training components of the MART project cover all but the last two items on the list. It is an ambitious undertaking, and includes most of the activities any national agricultural research system would like to accomplish over time.

The objectives and activities of the three components of the USAID MART project implemented by Winrock and Pakistani leaders are outlined on the following page.

A MART provincial advisor for Punjab, left, discusses elements of a Winrock-implemented part of the project with PARC's chairman

The research management and administration component strives to overcome the deficiencies identified by the team that evaluated the USAID research-strengthening project. The team found that

- the research organizations are diffused
- resources are unevenly distributed
- priorities are lacking
- resources are irrationally allocated and inadequately accounted for
- linkages between agencies are inadequate
- major gaps exist in the research programs
- research system managers lack management training

Activities to overcome the deficiencies include

- using long- and short-term advisors for special studies
- developing a farming systems research program
- improving bookkeeping, accounting, and management information systems
- integrating research and outreach activities

The information transfer component objectives are

- to make research results readily available to potential end-users and the general public
- to disseminate information in ways client groups can understand

The project pursues these objectives through

- technical assistance
- training in producing and disseminating media and technical information packages
- constructing and equipping a multi-media production center on the NARC campus

The training component goals include improving the agricultural research system's capacity to

- identify personnel needs
- define educational and skill-development programs to meet those needs
- develop and institutionalize in-service, in-country career-development courses

Steps to attain these objectives include

- assessing personnel needs
- preparing a long-term training plan
- instructing the training staffs in the provinces and at NARC
- expanding the NARC training facility
- developing and conducting in-country training courses
- improving overseas training programs through selecting qualified participants, preparing them for departure, and supervising their academic programs

The following chapters include reports of how these components of the MART project are being put into effect by Pakistani, USAID, and Winrock partners.

Strengthening Management and Administration

Strengthening the management and administration of any organization is a complex task. For the Pakistan agricultural research system, it is complicated by the fact that geographically, it is spread out; organizationally it involves national, provincial, and intergovernmental entities; structurally it includes people and agencies outside the neat chains of command, and; culturally it does not lend itself readily to some western management principles.

The goal of strengthening management and administration is imbedded in most project initiatives and is pursued by Pakistani research leaders, trainers, and educators at the provincial and federal levels. Although no magic solution can upgrade these skills, several approaches to making incremental improvement in the research system's management are being taken.

The following illustrates how the MART project approaches the challenge of strengthening the system's management and administration at the provincial level.

The Project Strengthened Management in the Provinces

The MART provincial research operations specialist (PROS) in the Sindh and Balochistan, collaborated with his Pakistani colleagues to determine those systems' problems. Together they developed ways to solve their problems as one aspect of training provincial staff. Working together, they developed a research master plan in Balochistan

Research system constraints were found. The directors and leaders of the different sections of the Tandojam (Sindh) and Sariab (Balochistan) agricultural research institutes and the project PROS reviewed the management and administration of the systems. The reviews showed that the first constraint to the systems was the usual one—inadequate operating funds. This meant they needed to develop a more efficient research program

Aside from funding problems, the major constraints to effective research at both institutes were found to be

- **Unclearly-defined research objectives.** At the institute level, research initiatives were determined primarily by the funding available from national and international sources and the individual interests of researchers. At the section level, researchers wanted to create results that could be cited in their institute's annual report. Objectives can be clarified by developing a master research plan. The project advisors worked with managers of the Sariab Agricultural Research Institute in developing such a plan, described later in this report
- **Recommendations were not tested on farms.** The extension service normally assists with on-farm testing, but there is little extension activity in either the Sindh or Balochistan provinces

Farming systems research (FSR) was found to be the most efficient way to facilitate the flow of information from researchers to farmers and vice versa

The provincial research operations specialist and provincial agricultural research leaders became actively involved with MART farming systems research programs in both provinces

- **Researchers recognized the need to review statistics** and to update their knowledge of field-plot techniques

The project PROS introduced a user-friendly program that runs on MS-DOS and has screen prompts to guide users through each step. The institute researchers now learn about statistics by performing their own analyses

Further, with the help of two professors from the Sindh Agricultural University (SAU) and a statistician from the Tandojam Agricultural Research Institute, the PROS developed a two-week course in planning, analyzing, and interpreting agricultural experiments. The course has been presented at SAU and at the Sariab institute

Agricultural researchers must keep in mind the ultimate users of their findings—farmers like this one in the Sindh

Researchers Developed a Master Research Plan

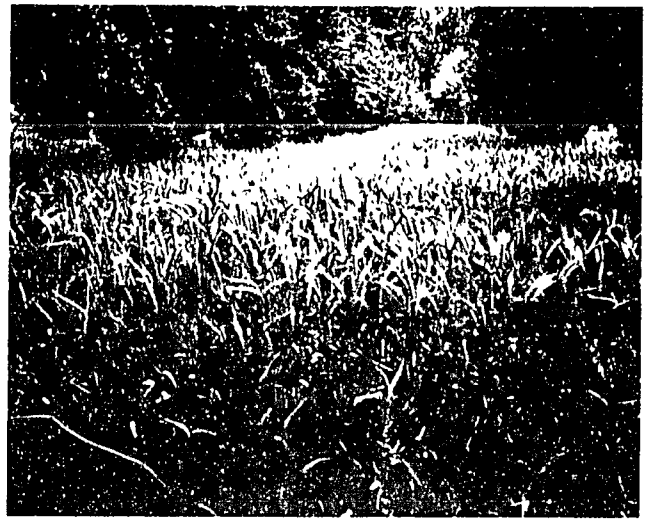
An important step in improving the management and administration of an agricultural research institute is examining its needs and developing a master plan, a route to follow The Balochistan-Sindh PROS began executing such a plan with managers of the Sariab Agricultural Research Institute while still in the province The following steps and recommendations emerged from their work toward a master research plan

Allocate resources based on a priority system. Balochistan has five ecological zones, each with different agroclimatic and soil-formation factors to consider, some of the factors vary within zones The first level of allocating resources is between zones, then between crops within the zones, and then to problem-oriented research subjects.

Establish research substations. Breeding materials and production techniques need to be tested in the different zones The MART project PROS and the station managers agreed that substations need to be established in each of the zones, and they developed guidelines for them. They also listed equipment needed to carry out the research and developed a training plan to prepare scientists to continue their responsibilities at the station and substation levels.

Reorganize research sections. Master plan developers recommended that, in order to improve coordination, managers should consider organizing the research institute's sections by major crop groups. Resources could be allocated according to the economic importance of each crop and the area planted to it in the province. Research scientists in each section could see research results flowing through a sequence of stages until recommendations are tested in farmers' fields.

These highlights indicate the kinds of decisions that must be made in developing an institute research master plan, which is an important step in strengthening research organization and management.



The MART project advisers collaborated with provincial institutes in planning research to test crops in widely varying conditions.

Management Training is Another Approach

The USAID-Pakistani-Winrock partners implementing the MART project provided management training for research system managers. The partners hired consultants to develop training modules on different elements of agricultural research system management such as financial management, personnel management, and experiment station management.

For example, a trio of consultants prepared and conducted a course on the planning and evaluation of agricultural research Another team of consultants presented a course on managing an experiment station. Yet another presented shortcourses on how to prepare project proposals

A modern double-entry accounting system was installed in PARC and at NARC. A Pakistani-chartered accounting firm reviewed NARC's financial procedures and suggested ways to improve them. The firm recommended computerizing the accounting system and revamping accounting and procurement practices. A series of seminars were held for NARC and PARC staffs to train them in the proper procedures.

Now, within seven days of the end of the month, decision-makers have financial-status reports of the institutions.

Gaining necessary financial support. Writing successful proposals to obtain money for conducting research is an important management task Three groups of Pakistanis—two classes of advanced-degree students in USA universities and a group of senior provincial and PARC agricultural research managers—received intensive instruction in writing project proposals at Winrock International headquarters in Arkansas (USA) in 1990 and 1991

Proving the value of agricultural research to those who determine the system's budget is a prerequisite for gaining financial support To provide solidly based reasons for increased funding, the MART project commissioned a noted Yale University (USA) economist, one of his graduate students, and a Pakistani agricultural economist to make an economic analysis of financial costs and returns to agricultural research in Pakistan A popular publication that highlighted the results of this analysis was widely distributed to decision-makers

Project consultants reviewed management. Management reviews of organizations are hard to plan and conduct. They are complex, and staff members often resist them. When a management and operational review of the University of Agriculture Faisalabad was found to be too formidable, university officials and MART project advisors began reviewing individual departments, starting with soil sciences.

As another example, PARC's leadership and the MART project obtained consultants to (1) review NARC's management, (2) help develop the center's research master plan from 1988 to the year 2000, and (3) develop a physical master plan for NARC.

The NARC management review team included three prominent Pakistanis—the vice chancellor of the Pakistan Forestry Institute, the vice president of the International Islamic University, and a high-ranking government administrative officer—as well as the head of the institute that reviews agricultural research institutions in the United Kingdom.

The team spent three weeks interviewing NARC staff groups looking at financial organization, management of production, personnel policies, and so on. It also gave informal training on how to review, monitor, and evaluate research projects. Its best recommendations were incorporated into the research master plan for 1988 to 2000. The master plan process began with the chairman of PARC calling a meeting to tell the NARC staff of the importance of the review and to urge them to devote time and effort to making it a worthwhile endeavor.

An important part of getting funds to conduct research is writing proposals that appeal to donors, be they private or public Three groups of Pakistani researchers got intensive instruction in how to write successful proposals at Winrock International, Arkansas (USA) as part of the MART project This is one of the groups, shown with their instructors and support staff.

Early on in the planning process the MART advisor and his Pakistani colleagues prepared a comprehensive survey document so senior staff could list important research topics, give estimates of the projects' costs, describe the necessary equipment needed, and present similar information

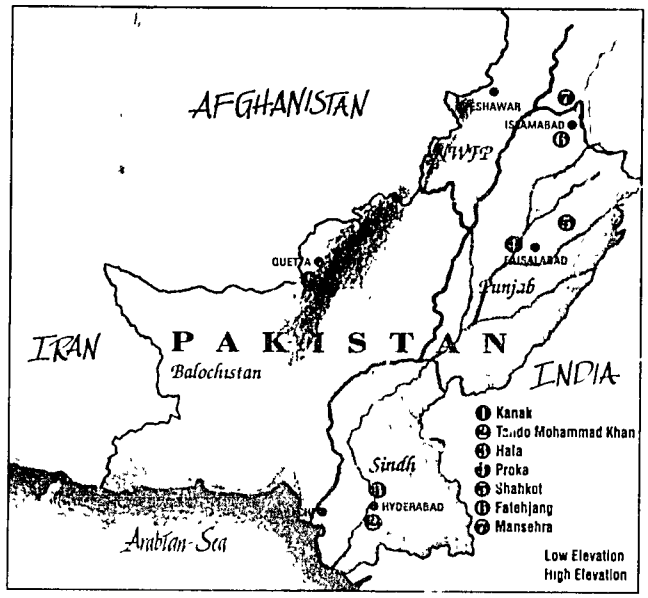
Committees were formed to evaluate the various components, such as livestock research, crops research, equipment needs, and so on, and to assign priorities These committees narrowed the research topics to eight to twelve main research thrusts and estimated how much the new plan would cost.

To implement the plan, the committees requested that the National Commission on Agriculture increase research funding by 10% per year until the level of support was doubled National fiscal realities intervened, however, and the budget was cut, so the process shifted to recommending what thrusts were to be cut and which should be continued The process continues and will need occasional updates

Developing the physical master plan—the third part of the review and needs assessment of NARC—involved designing buildings, offices, laboratories, and other facilities so that staff members could conduct needed research and support activities The NARC leadership, MART advisors and consultants, and the architect worked through these challenges

Developing the research master plan and the physical master plan included developing, writing, and publishing two well-documented volumes that summarize the findings

Advisors designed the AVC-TI building. Working with Pakistani research leaders and the designated architect, MART project advisors managed the design process for the audio/visual center-training institute (AVC-TI) building at NARC, which was constructed with USAID funds Upon its completion, Pakistani research leaders, USAID project managers, and the advisors wrote specifications for and procured computers and audio/visual equipment to enable the center to serve its intended purposes.



Provincial MART farming systems research is conducted at six sites, NARC's FSR approach is tested at Fatehjang

Helping Small Farmers Earn Higher Incomes

In terms of numbers, agriculture in Pakistan is primarily a small-farmer activity, 70% of the farmers operate less than five hectares They manage complex crop-and-livestock systems, and do not simply raise wheat or rice, buffaloes or goats

Their farming systems are diversified so they can adjust to seasonal changes in temperature, rainfall, marketing conditions, and the availability of labor If the weather isn't good for one crop they can fall back on another or on raising livestock Small farmers can't risk their livelihood on one crop, for failure of that crop could be disastrous for their families

These smaller farmers need research to help them with their diversified farming operations While conventional commodity research contributes greatly toward increasing Pakistan's agricultural productivity, it primarily benefits large farmers who specialize in one or a few agricultural commodities

The small farmers may not adopt production technology developed at the research institutes for any of several reasons, they may lack credit, production inputs may not be available, they may be unwilling to assume the risk of trying new practices, or they may not hear of the new technology

Recognizing these facts, the MART project introduced farming systems research (FSP) methodology and practice to Pakistan in 1987 as part of the component focusing on strengthening management and administration

How Farming Systems Research Works

Farming systems research, designed to help small farmers, recognizes the complexity of their production decisions, and considers the factors that affect their adoption of new technologies or their adaptation of existing ways of doing things

FSR scientists work with farmers to

- identify priority problems
- look at constraints to solving those problems
- consider such factors as household needs, risk-tolerance, labor supply, and financial situation
- test improved technology based on the whole farm's soil-water-crop-livestock system

The objective of farming systems research is to increase farmers' productivity and net farm income FSR verifies experiment station technology and adapts it to specific agro-ecological conditions. It complements but does not replace experiment station research.

FSR teams begin by conducting diagnostic surveys. The FSR teams begin their work in a demonstration area by conducting diagnostic surveys to understand the indigenous crop-and-livestock farming systems, find gaps in the systems, and look for ways to fill the gaps.

The gaps are filled through two basic approaches:

- grafting, which is improving on what the farmer is already doing
- introducing and testing new technologies

Both approaches include testing improved technologies under local conditions and determining whether the new practices are economically and socially acceptable. For example, in Pakistan's Islamic society, some activities are considered socially unacceptable for women to undertake.

MART FSR teams learn of local farmers' problems, develop possible solutions, and test ideas in the context of the farming systems used in the community

FSR Takes a Multidisciplinary Approach

The MART FSR advisor and the national FSR coordinator established a national FSR coordinating cell at NARC They developed program guidelines, planned the program, and brought scientists from the provincial agricultural research institutes and agricultural universities, extensionists, and representatives of private firms together to establish the FSR programs. Economists, agronomists, animal scientists, and researchers representing other disciplines were on the teams MART added women scientists to work with women farmers

The Pakistani national FSR coordinator said that assembling the teams was a new kind of undertaking—getting researchers to shift from commodity-oriented work to cooperating with scientists from different institutions and disciplines to research farmers' needs and help them The FSR leaders sought out eager, bright, and practical scientists.

FSR sites were established in all four provinces. Farming systems research sites were selected where the new approach could be demonstrated and where there was promise of achieving

benefits for participating farmers. Two sites were established in the Sindh, two in the Punjab, one in the NWFP, and one in Balochistan.

The national program coordinating cell established a site at Fatehjang in the barani (rainfed) region of the Punjab about 40 kilometers from the NARC, the cell serves both to implement a research program and coordinate the national program.

Training and Outreach are Important

Training in FSR methods was important in introducing this new and different research approach. The MART FSR advisor brought in expert consultants to conduct in-service training within Pakistan. The project provided funds to send promising scientists abroad for training Team members were trained through technical shortcourses, workshops, seminars, conferences, internships, postgraduate theses, and traveling seminars

Women scientists working in the MART project trained rural women to vaccinate chickens to protect the birds from a prevalent disease

An average of 25 to 30 interdisciplinary scientists and extension officials from different institutes attended the workshops, seminars, and technical shortcourses Field days attracted many farmers, government administrators, extensionists, and private-sector people. Twenty postgraduate students used their FSR internship experience in writing their theses

Through the traveling seminars, key FSR researchers from all the provinces visited two or three farming systems research sites during an appropriate stage of the growing season to evaluate the trials, talk with farmers, and learn from each other's successes and mistakes The traveling seminars were held once or twice a year, with no site being visited more than once a year

Extension's role varied by province. The involvement of extensionists, considered important from the beginning, varied from province to province and sometimes from site to site In some cases, extensionists took an active part in planning, in identifying farmers and sites for research, in working at the technical level at the sites, and in conducting demonstrations, others chose not to be involved in the program

Women were integrated into the FSR program. The FSR team leaders studied ways to integrate women into the FSR program. A national workshop on the role of rural women in farming systems research was held at NARC, and a woman scientist became part of the national FSR coordination cell at NARC.

Two FSR projects for women were implemented at Fatehjang, the national FSR cell site A multidisciplinary team of women scientists working in the MART project trained rural women on the proper use of chemicals in controlling rodents and insects in stored grain. They also introduced an improved vaccine to protect chickens from a prevalent disease and taught women how to administer the vaccine. As a result, stored grain losses were reduced and poultry disease losses fell.

How the FSR Team Worked in the Sindh

An example of how an FSR team works will illustrate this approach The 12-person multidisciplinary farming systems research team in the Sindh chose two target sites for the initial stages of their program The team comprised subject-matter specialists from the Sindh Agricultural University, the Tandojam Agricultural Research Institute, and the Atomic Energy Agricultural Research Center. The MART FSR advisor and the provincial research operations support specialist provided technical assistance

Farmers at each site used typical indigenous practices to grow crops economically important in the area At the Hala site, farmers grow cotton and wheat At the Tando Mohammad Khan site, farmers grow sugarcane, rice, and wheat

This farmer increased his net income by growing radishes between rows of sugar cane, an example of farming systems research payoff.

Diagnostic surveys showed that the major constraints to crop and livestock production were the same at both locations Crop production was constrained by the low-yield potential of the local varieties, improper fertilization, poor pest-management, and poor land preparation Livestock production was held back by poor health care and inadequate feeding due to a shortage of fodder during some months of the year The FSR team grafted some innovations onto what the farmers had been doing

The payoff: increased profits for farmers. The following examples illustrate the value to farmers from farming systems research

At the Hala site, when an improved variety of mungbean, 20-21, was inoculated and properly fertilized, it increased net returns by Rs 3,454 per hectare The area planted to mungbean 20-21 increased three-fold within two years

Deep plowing, land leveling, improved pest management, and planting the cotton cultivar NIAB-78 brought a 1 4 cost-benefit ratio to cooperating farmers, as compared to those following normal cultural practices and growing the local cotton varieties At the Tando Mohammad Khan site, cooperating farmers who intercropped sugarcane with radishes increased net income by Rs 14,108 per hectare as compared with traditional practices; intercropping with onions increased income by Rs 6,703

Livestock tests showed that sugarcane tops could be used for silage and that adding urea increased the digestibility and nutritive value of rice straw.

How the FSR Team Worked in the Punjab

In 1987 and 1988, farming systems researchers surveyed two farming communities near Faisalabad. They looked at small households—those with less than one hectare to twelve hectares. The households had an average of five to six people per family and from six to seven animal units per farm.

Farmers at both sites had problems with their livestock. Their buffaloes, for instance, were late in maturing sexually, slow to rebreed, and had a high rate of worm infestation. Most of the farmers operated at a subsistence level and were not aware of agricultural research or modern farming practices.

The FSR team helped the farmers increase their production without upsetting their traditional farming practices. For example, they suggested three steps to increase the fodder supply for their animals.

1. The team helped the farmers enrich available crop residues, such as wheat and rice straw, by adding urea solution and stacking the straw for about 3 weeks to let the nutritive-enhancement process take place.

2. They introduced better varieties of existing fodder crops and suggested more-productive crops and mixes of crops. One of these was Mott, a variety of napier grass developed at the Coastal Plains Experiment Station in Georgia, (USA). The University of Agriculture Faisalabad provides free planting materials and simple information about agronomic practices in Urdu to farmers. In most villages, someone can read the information.

3. The team taught the farmers how to preserve excess fodder for use in lean times by making hay and silage. Silage can be made in a simple pit; even sugarcane can be used if some molasses is available to get the cane-molasses mix into the fermentable range.

The chairman of the University of Agriculture Faisalabad's livestock management department, a champion of farming systems research, said an important part of the farming systems approach is discovering what the farmers' needs are and helping them meet their needs without radically changing their practices or subjecting them to unwelcome risks. "MART taught us the methodology for such work with farmers. The key," he said, "is working with the flow of how farmers farm."

Scientists working with the Punjab FSR team examine silage as a way to preserve excess fodder for use in lean times.

Other Examples Show FSR Payoff

The following examples illustrate the payoff from farming systems research at other sites in Pakistan.

In the Mansehra district of the NWFP, the FSR team grafted onto the traditional wheat-maize fodder system an improved fertilizer and herbicide technology, seed of a superior Azam maize variety, and a new variety of fodder oats. These interventions doubled the production and net income of participating farmers. Scientists trained extension field officers to accelerate farmer adoption of the wheat-maize system technology.

In the Fatehjang FSR target area, some farmers tried planting sunflower instead of letting the land lie fallow in the wheat-fallow-wheat rotation. During years of low rainfall, yields of wheat following sunflower were drastically reduced Income from the sunflower, however, more than made up for the decrease in wheat income The wheat-sunflower-wheat system increased farm income by Rs 3,492 per hectare as compared to the traditional system.

When mungbeans replaced fallow, participating farmers raised their net income by Rs 3,327 per hectare, although wheat yield also was decreased by moisture stress following mung The mungbean residue was a nutritious small-ruminant feed

Some farmers dewormed their sheep as part of an improved sheep-husbandry test The untreated sheep had 16.8% mortality compared with a 4.6% death rate in the treated flocks The treated animals also produced 50% more wool and almost 30% more lambs. The farmers who practiced good husbandry realized Rs. 18,345 more net profit

At the Shahkot site in the Punjab, 10 participating farmers planted an improved rice variety, Basmati 385. FSR researchers compared their results with those of farmers planting Colonel Basmati, the variety most farmers planted The Basmati 385 had two advantages it returned Rs. 1,324 more profit per hectare and it matured 16 days earlier, so the following wheat crop could be planted sooner, which resulted in a higher yield

On six farms at the Shahkot site, farmers grew a sorghum-sudan hybrid, Sadabahar, and compared results with the traditional farmer practice of growing sorghum and maize for fodder. The hybrid produced high-quality fodder and silage and cost 75% less per kilogram of green feed than the sorghum-maize system.

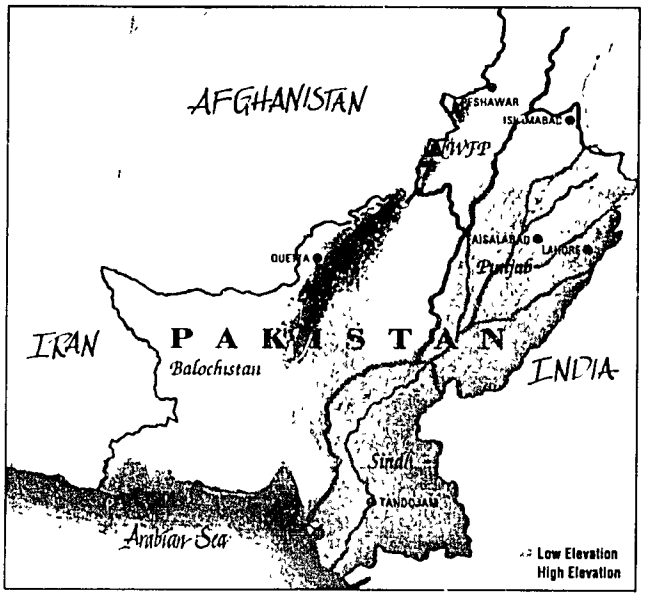
Farmer Feedback to Research Institutes Was Important

Many FSR field demonstrations simply compared one or more interventions with the farmers' normal practices These were easy to conduct and were excellent for showing the differences to farmers But, as the MART PROS in Balochistan and Sindh pointed out, they did not let researchers estimate the contribution of individual components or interactions when two or more practices are combined

For instance, at the Hala site, four cooperating farmers planted pure seed of the high-yielding wheat variety Sarsabz and applied the recommended dose of fertilizer (120-75-0) Compared to the local varieties and practices, the Sarsabz test fields yielded 572% more grain and 76 3% more straw and returned Rs 4,534 38 more net income per hectare. The cooperating farmers got a return of four rupees for each rupee spent on improved seed and practices

Since no other improved varieties or fertilizer rates were tried, the PROS pointed out that researchers cannot say that Sarsabz was the best variety for the area, or that the recommended dose of fertilizer was the best, or how much of the increased yield was due to the variety and how much was due to the fertilizer. These are all questions for further research.

Farming systems researchers also tested proposed recommendations under farm conditions and learned reasons why, in some cases, farmers rationally prefer their traditional methods. As a result of the feedback from farmers to scientists, research at the experiment stations becomes more practical and valuable to client farmers.



MART's information-transfer component, headquartered at NARC, established communication cells in each province

FSR Needs to Be Institutionalized

Farming systems research has not yet been fully institutionalized in Pakistan's agricultural research system. The MART advisor points out that institutionalizing FSR nationally requires each cooperating institute, university, and agency to commit scientific manpower, technical assistance, support staff, adequate budget, and space for conducting an expanded FSR program.

Getting Research Results to Users

As its name implies, the mission of the MART information transfer component is to get agricultural-research-based knowledge to those who can use it. Information transfer staffs link agricultural scientists who have information with farmers and other clients who would like to use it.

The need is reinforced by a former minister of agriculture who said that only 10% or so of the information generated by Pakistan's research system is documented and transferred to other scientists, to extensionists, and to farmers and other private-sector users.

Farmers Receive Information Through Media

How do farmers get information? The answer affects the training, equipment, and approaches that the MART information transfer advisor takes in working with his Pakistani colleagues to improve the system's communication with users. Surveys provide the following answers.

Radio is a popular medium. It is widely used by Pakistani farmers—40% to 50% of farm households have radios and another 15% to 20% of farmers listen to the radio in groups at local union councils. The surveys indicate that about 69% of farmers have access to radio programs and they prize radio as a source of agricultural information. Interestingly, they rank radio commercials high as information sources and consider them credible.

There are 17 broadcast centers in the country; most of them air programs on both the AM and FM bands. Radio is available in all major languages spoken in Pakistan. In the Quetta area, for example, programs are broadcast alternately in Sindhi, Baluchi, and Pushto.

Radio is a convenient medium for information-transfer agents to use. The MART project provided high-quality equipment so provincial and federal information staff members can tape programs in a studio or in the field and send the tapes directly to radio stations.

The project advisor and Pakistani colleagues also started a national radio program, aired weekly, that highlights research activities.

Video and television are becoming more important. The information transfer advisor expects video and television to rise in importance in transferring information. USAID, through the

MART project, has provided the 25,000-square-foot audio/visual center and training institute at NARC with excellent video production equipment. The audio/visual center contains a modern studio with ample lighting, sound baffling, control booths, video recording and editing equipment, offices, and corollary equipment and facilities

The provincial agricultural research institutes and PARC are working with the Pakistan television network, which offers them free air time, a new people's television network was being implemented in 1992, Pakistanis are buying television sets as fast as they can afford them, and televisions are available in the union councils in some villages

Radio is popular with Pakistani farmers. The MART project helped launch local-language radio tape and script services.

Video cameras are being used to document research results that can be broadcast to mass audiences on television, and shown in classrooms, at meetings, and in other settings, as well as being used for training The project buys video cassette recordings from overseas that provide relevant information for use in the country and that offer ideas for producing videos in Pakistan. Because of the increasing importance of video and television, USAID, through the MART information-transfer component, has made a substantial investment in video equipment and training.

Publications still have a place. For those who are literate, publications remain an important communication medium Publications and journal articles are widely used to transfer information between scientists, from researchers to extensionists, and from researchers to farmers and others in the private sector

MART Works with Pakistan's Communicators

Getting the technologies they develop and the information they produce to farmers and other potential users is a challenge for agricultural research systems around the world The MART information transfer advisor has collaborated with his Pakistani colleagues in four major activities, including

- recruiting and training information-transfer staffs at the provincial and federal levels and forming a national network of communication specialists
- specifying and procuring appropriate USAID-financed equipment for the provincial and NARC staffs
- providing operational support and funding
- designing and constructing audio/visual and training facilities

Overall policy guidance is provided by a technical information-transfer committee, which is a national planning and policy group headed by the chairman of PARC, with operational support from the MART project.

Communication cells have been established in the provinces. In late 1987, the project information transfer advisor began organizing information-transfer cells in the provinces and giving training to the staffs. He recruited the best people he could find for the new positions. In one case, it was a person who owned a camcorder and specialized in photographing weddings, in Lahore; he drew on the University of Punjab's Institute of Mass Communications, in Faisalabad, a retired agricultural scientist with a flair for writing and a sense of visual presentation became a consultant. The MART information transfer advisor trained and arranged for training the new staff.

The communication-support cells were established at research centers and other locations where they can best serve the needs of the most farmers—at Faisalabad, Lahore, Peshawar, Quetta, and Tandojam. They are housed in the most appropriate locations, provided by the provinces, that are available.

All of the institutions at which cells are located agreed to provide sufficient space and adequate working conditions for the information-transfer staffs.

The cells consist of publication editors, layout artists, photographers, calligraphers to prepare copy in Urdu, and audio/visual and broadcast specialists. Provincial information-transfer committees—made up of members such as vice chancellors of the agricultural universities, communication directors, and leaders of other agricultural institutions—lend policy guidance to the information activities.

Appropriate equipment was bought for provincial staffs. The project information transfer advisor visited each province to learn of its equipment needs, then ordered, received, and assigned USAID-financed equipment to the staffs in the information-transfer cells. Equipment included camcorders, editing equipment, television monitors, slide and overhead projectors, public address systems, tape recorders, microphones, videocassette recorders, and electric generators for making presentations in remote areas.

After the equipment was delivered, the advisor trained the staffs in its use and encouraged ideas for using the tools to promote agricultural progress. The communicators demonstrated the equipment in each province to prove its value and usefulness. For example, they started the generators and helped speakers use the public-address systems at meetings under the trees in remote locations so audiences could clearly hear the research scientists' presentations. At a Quetta site, 300 people gathered for a meeting at which the PARC chairman spoke after dinner; the new speaker system allowed all the people to hear his speech clearly and comfortably.

Desktop publishing capacity was installed by the MART project at NARC and an operator was trained to use it. The computer graphics workstation included a computer, printers, software, and similar equipment. The desktop publishing capacity included tools for text editing and processing, making page layouts, and performing other tasks in preparing texts for publication.

Similar equipment for producing computer graphics and using desktop publishing was ordered for the provincial agricultural communicator staffs in 1992, again purchased with USAID project funds.

Support is increased as skills grow. A part of working with colleagues and institutions is matching the level of support to their skill levels. In one such case, the first video-production equipment provided to the provincial cells included camcorders. As the skills of the video crews grew, higher-quality equipment became feasible and desirable. In 1992, the MART project bought video cameras comparable to those used by Pakistani television stations, so footage shot with the new cameras can be used directly by the stations.

The audio/visual center needs adequate staffing. Lack of trained staff is keeping the country from getting full value from its large investments in audio/visual equipment and facilities. The USAID-Government of Pakistan project document, guiding implementation of the MART project, calls for an information-transfer staff of 30 at NARC. As of early 1992, only 20 of the people called for had joined the staff. The department is so short of writers and graphic artists that the equipment and facilities are not being fully and productively used.

More trained information-transfer staff are needed. Similarly, the project document calls for the information-transfer staff to have nine long-term overseas training positions. Only one of the positions was alloted to an information-transfer staff person. Eight slots were taken by others before the MART advisors arrived in Pakistan.

Training for a More Effective System

Training is critical to the success of agricultural research; it adds to the fund of knowledge that scientists and administrators bring to their work. They can lend that greater expertise to their jobs, becoming more effective and making valuable contributions to the research system. Training also expands one's mental horizons.

The MART project's training component did not begin as anticipated. Project advisors were supposed to help provincial agricultural research institutes and PARC select their overseas advanced-degree students in keeping with a national manpower development program. Trainees were to fit the research system's needs. But the trainees had been selected by the provincial institutes by the time the MART advisor team arrived in Pakistan.

A further hitch developed when a USA organization with experience in managing overseas training—but with little expertise in agriculture—began managing the students' programs. When the fellowship-management contract came up for renewal, USAID added a stipulation that an organization with experience in scientific agricultural training had to be involved in managing the trainees. The MART project team then helped strengthen the degree-training program.

The Project Begins Developing a Manpower Plan

In late 1987, the MART training advisor designed survey forms to collect data about the system in order to move toward a manpower development plan. The advisor finished collecting data during the first half of 1988. The inventory was designed to provide

- information about personnel, their training, experience, and so on
- institutional profiles of agricultural research institutes and agricultural universities and their capabilities
- an assessment of the system's manpower needs and the ability of Pakistan's higher-education system to meet those needs

Photographs are important in documenting and transferring information. Provincial photographers were trained in the MART project.

The first publication based on that survey was the 326-page "Directory of Agricultural Research Institutions in Pakistan," published in October 1990 by the MART project

In other training-related activities, the MART training advisor helped PARC process 67 graduate students for the 1988 fall term, prepared individual graduate-degree study programs for more than 75 nominees, and designed a predeparture training program

In the short-term overseas training category, the advisor collaborated with PARC in placing 126 individuals in nine 16-week shortcourses in five USA universities and designed an evaluation form used in assessing the training

Consultants Advised on Critical Issues

The training advisor left the project in August 1988 The PARC, USAID, and MART project advisors opted to use short-term consultants to advise on critical training issues and to use the training position funds to post a provincial research operations support specialist in Hyderabad to collaborate with researchers in the Balochistan and Sindh provinces Two consultants worked with Pakistani colleagues on major studies of training activities.

New directions for training. A former communication and training officer at the International Rice Research Institute and at the International Center for Tropical Agriculture, came to Pakistan in September 1988 to review the training component of the MART project The officer recommended training activities reflecting the views of PARC, USAID, and MART advisors and cited steps the national training institute at NARC could take in

- developing a master training plan
- offering in-service training to help staff members keep current in agricultural research concepts and methods
- maximizing the use of training facilities at NARC, the provincial institutes, and the universities providing training for the provincial trainers

The consultant suggested bringing exceptional consultants to Pakistan to develop and conduct shortcourses at the national and provincial levels instead of sending staff overseas for short-term training. Also proposed were. making courses longer, reducing the amount of time devoted to ceremonies, making the course objectives sharp and clear, engaging consultants who are experts in both subject matter and teaching methods, and continuing to evaluate and improve the training courses.

The consultant recommended ways to make more effective use of expatriate consultants in training activities, including.

- Avoid short-term consultants Require assignments of a month or longer if possible. Schedule consultants for a crop season or, at least, for the critical time in the growth period
- Choose consultants who can make recurring visits over a 2- or 3-year period
- Have consultants work in a research program for several months, interacting daily with a number of scientists, instead of teaching a shortcourse
- Ask consultants to identify promising candidates for advanced study and recommend appropriate institutions for them.

Recommended ways to smooth students' reentry. A training and management consultant from the University of Illinois (USA) with extensive international experience, tackled the problems faced by trainees returning from long-term overseas study The consultant also suggested ways to strengthen the NARC training institute

Students returning from long-term overseas training were experiencing problems of waiting several weeks or months to get back on the system's payroll, and in finding adequate housing, office space, and office supplies. And they sometimes had difficulty finding challenging work to do when they came home to Pakistan

Expert consultants conduct training for provincial trainers and research managers through the USAID-funded MART project.

Some of the consultant's recommendations, such as the one to end the PARC rule that scholars accrued no official service time while studying abroad, were implemented promptly Other suggestions helped ease the stress of students' being away from home for an extended time, such as improving two-way communication between students and their home institutions.

The consultant also recommended ways to strengthen the NARC training institute and suggested that its roles are

- to improve the performance of research personnel by providing training in scientific, technical, and administrative areas
- to de 'elop the capacity of the provincial agricultural research institutes, universities, and other institutions to train their agricultural research staffs
- to expand job-oriented training and improve its quality throughout the national agricultural research system

Expert consultants conducted training and lent advice Other short-term MART training consultancies included.

- A USA consultant on agricultural and natural resource planning, management, and evaluation refined the manpower survey database and produced reports of the studies
- A former director of Cornell University's Geneva, New York (USA), experiment station and a former NARC director general conducted two management workshops for research station managers
- A plant pathologist and an agricultural education specialist of Oklahoma State University (USA) identified training coordinators' training needs and conducted two workshops in Pakistan They also conducted a workshop in the United States for 17 NARC and provincial trainers to help create a research-system training network
- An Oregon State University (USA) biometrician, with assistance from a NARC statistician, prepared a training manual and reference book on statistics for training courses The biometrician also conducted workshops on using computers to analyze crop and livestock data from on-farm trials and on biometrical issues
- The MART project's Balochistan and Sindh PROS reviewed the training needs of those provinces and recommended ways the NARC training institute could support those programs

- An expert from the University of California, Davis (USA) international training and education center, produced a preacademic handbook for overseas trainees that contained 162 pages of detailed information and suggestions to make trainees' academic careers more productive and meaningful.

The Training Institute was Expanded

The NARC training facility was expanded in 1991 when its staff moved into the new 25,000-square-foot audio/visual center and training institute building, built with USAID funds The training institute has four lecture halls, four seminar rooms, two dry-wet laboratories, and two computer-training laboratories It also contains a hostel and cafeteria to provide room and board for trainees from the provinces.

Pakistani researchers are becoming computer skilled, thanks to the MART project and collateral USAID activities The MART computer laboratory was established in the NARC training institute in 1989

Training has been the key in making the staff of the agricultural research system skilled in computer usage From its establishment until September 1991, 695 researchers were given computer training. A total of 42 computer courses were conducted that covered seven soft ware packages.

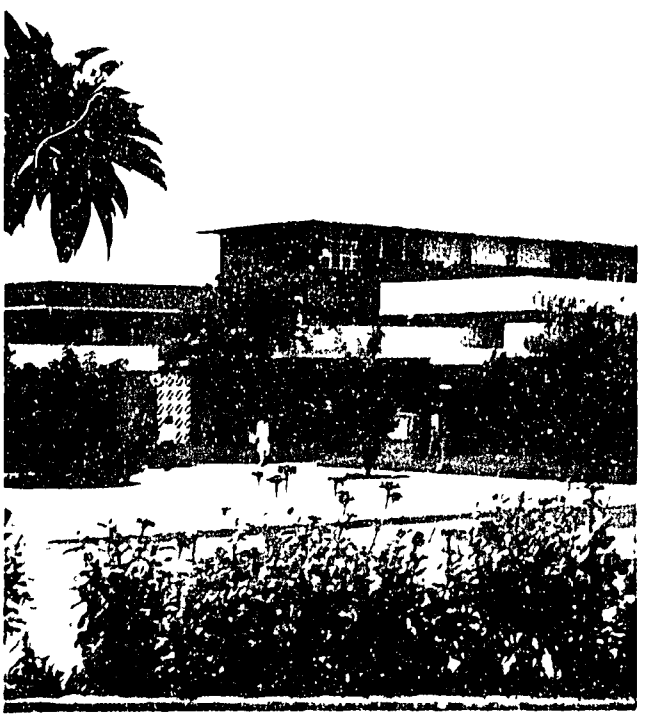
One NARC computer-training laboratory contains 10 fully equipped work stations for use by two instructors The lab has a special projection system so one instructor's keyboard commands can be projected on a large screen in front of the room while the other instructor assists students with problems Two students can use each computer, so 18 users can be trained at once (the instructor uses one machine) Instructors teach both basic and advanced classes

The laboratory is open late at night so students can practice and use the equipment when classes are not being held. The MART project provides travel money, room and board, and pocket money for research service trainees.

In 1992, USAID bought 20 new personal computers for advanced training in a new computer lab in the training institute building. Each advanced training class will be limited to 20 to 25 participants.

Provincial training capacities are improved. Beyond computers, the NARC training institute's mandate is to develop the training capacities of the provincial research systems and to provide in-service training to upgrade the skills of the NARC staff

Since 1985, with USAID's MART funding, the training program has vastly increased its scope and effectiveness Through 1991, 183 courses, including training in disciplinary, management, and computer skills have been presented, benefitting 4,326 participants. The largest number of class participants have been research scientists, followed by extensionists, educators, administrators, farmers, students, and women



This is the 25,000-square-foot audio/visual center and training institute, built with USAID funds at NARC It is used intensively

ADVISORS SUPPORT THE NARC TRAINING INSTITUTE

The information transfer advisor and farming systems research advisor have offices at NARC and support the development of the training institute They helped improve training programs, strengthened the organizational and administrative structure, established the computer-training program, and provided technical and moral support

The information transfer advisor said he feels good about his collaboration in training as well as in information transfer, which also involves training. A former professor at Pennsylvania State University (USA), he mentioned that as he visits research sites and talks with researchers, he can sense the enthusiasm and vigor of people who have been trained in-country or overseas, explaining that they exude the confidence that comes from knowing their jobs and what they can accomplish through them.

EXPANDING PARTNERSHIP ARRANGEMENTS

Pakistan USAID mission officials and MART advisors cooperate in collateral activities that add to the project's effectiveness in strengthening the country's agricultural research system. MART advisors see opportunities to enhance the value of USAID's work, and mission officials provide the funding to capitalize on those opportunities. Some examples follow.

USAID FUNDED A US$ 1 MILLION LIBRARY-STRENGTHENING PROGRAM

Agricultural scientists in developing and developed countries, at the international agricultural research centers, and in the private sector are learning new technologies and developing new methods at an unprecedented pace. This knowledge used to be shared solely through books, technical reports, bulletins, scientific journals, reports of scientific meetings, and similar products found in conventional libraries.

The sources of information have changed. Today, compact disk read-only-memory (CD-ROM) and other high-technology databases and auxiliary equipment have revolutionized the way knowledge is stored, shared, retrieved, and used No longer must agricultural researchers go to conventional libraries in research and academic institutions and endure the time-consuming and laborious searches for the information they need, with the risk of getting an incomplete set of literature

MART advisors anticipated the information revolution In 1988, they brought a library consultant to Pakistan to review the country's library system and suggest ways it could benefit from new developments in information dissemination The consultant agreed that using microfiche technology, as was contemplated, was all right, but emphasized the desirability of computerized state-of-the-art technology

With USAID encouragement and funding, MART project advisors developed the specifications that enabled Pakistani colleagues to acquire the new information technology. In 1989, PARC installed a CD-ROM drive and an Agricultural Online Access (AGRICOLA) database at NARC's Directorate of Scientific Information The AGRICOLA database contains as many as 3 million scientific references, and opened a new frontier in modern information-handling technologies The success of CD-ROM technology encouraged PARC to add more databases to its inventory It also encouraged MART advisors, with PARC's active collaboration, to propose to USAID a program to revolutionize Pakistan's library system

USAID committed funds to implement the program. The program called for strengthening 17 scientific libraries at universities, research centers, and institutes throughout the country at a cost of US$ 1 million. The equipment reached Pakistan in 1992. It included computers, printers, CD-ROM drives, the most frequently used CD-ROM computerized databases, video players, microfiche and microfilm readers and printers, microfilm processors, plain-paper copiers, and library software.

PARC selected compatible equipment. The library consultant emphasized the need for compatible hardware and software since the indiscriminate use of different equipment could limit the usefulness of the computer network. After a thorough market survey, MART project advisors and their Pakistani colleagues chose powerful, flexible, and user-friendly INMAGIC software as the national standard.

The sophisticated equipment needs to be properly used and cared for to exploit its potential. In 1991 the MART project sponsored a two-week training course on library automation using the INMAGIC software. Eighteen people from the 17 libraries who will operate the equipment participated. Further, the Directorate of Scientific Information has produced publications on library and information science, including directories, user's manuals, and system guidelines for users.

The collaboration of PARC, NARC, USAID, and MART's advisors has opened the window to the world's latest scientific information and data exchange to accelerate the intellectual growth of Pakistan's agricultural researchers, teachers, students, extensionists, farmers, and other private-sector users.

USAID Bought Computers for Provinces and Universities

A MART advisory team reviewing the University of Agriculture Faisalabad resources found a need for computers to help in research work. University officials and MART advisors requested assistance from USAID.

USAID provided computers to the university. The agency looked into the university's needs, determined they were genuine, and provided 120 microcomputers to the university. The computers were placed in 15 laboratories and are used for instruction. They enabled the university to offer a master's degree in computer science, and they allowed the teaching and research faculty to be more effective. The students were also able to increase their computer training and usage.

In 1992, MART arranged for the procurement of 270 computers—80 of which went to the Sindh Agricultural University and 190 sent to all parts of the national agricultural research system—which will further add to the impact of computers on Pakistan's agricultural research system. USAID provided agricultural commodities and equipment funds to pay for the order.

USAID bought more sophisticated equipment—from computers to video—as the skills and needs of Pakistani partners grew.

TIPAN and MART Projects Publish Textbooks

The Transformation and Integration of Provincial Agricultural Network (TIPAN) and MART project advisors found that existing textbooks do not fit the needs of Pakistan's students, farmers, or others seeking farm production information Textbooks do not cover the varied assets and limitations of Pakistan's crops, soils, agroclimatic conditions, and other factors.

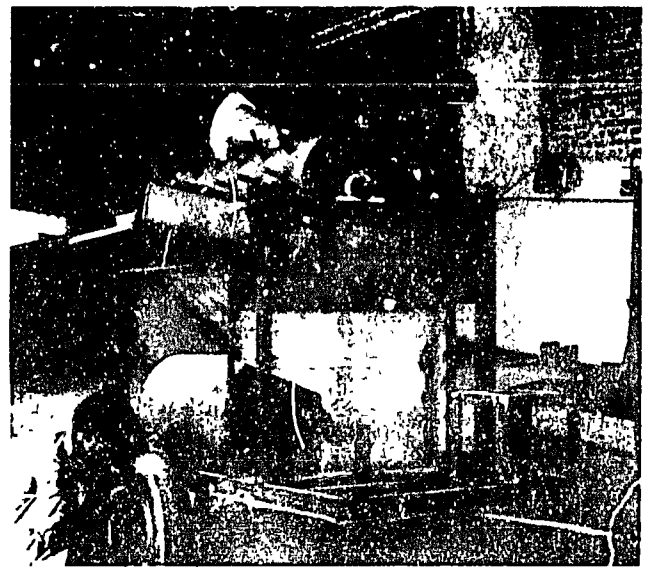
Since the TIPAN project is helping coordinate university, research, and extension activities in the North West Frontier Province, its advisors were natural allies with MART advisors in seeking funds for producing textbooks that take account of Pakistan's unusual conditions. They received funding support from USAID and other donors, organized a textbook-publishing task force, and are collaborating in getting texts published.

The books are being produced by authorities in various fields For example, leading soil scientists wrote a text on Pakistani soils. As of early 1992, books on five different subjects were being written.

These foregoing examples illustrate how USAID officials and MART advisors use added resources to multiply the value of their project activities.

Building Ties to Agribusiness

One of the MART initiatives is strengthening the partnership of Pakistan's agricultural research system with the private sector. An important part of that interaction is helping agribusiness carry the results of research to farmers and other users of new technology. This section explains how the MART project collaborated in this initiative.



Through the Directorate of Agri-Business Relations, strengthened by MART, new manufacturing companies have been helped.

The Project Supports the Agribusiness Directorate

Private companies influence the priorities of Pakistan's agricultural research system and use the output and findings of the provincial research institutes and of PARC. Making this partnership work better is the thrust of PARC's Directorate of Agri-Business Relations. MART's agribusiness support specialist is helping make the directorate more effective.

The directorate's two main thrusts are

- marketing the technologies and processes developed by the provincial research institutes, the agricultural universities, PARC, and other institutions doing agricultural research in the country
- including the agribusiness sector in planning research and setting priorities

In times past, agricultural researchers identified a problem, found a solution, wrote a research paper, and considered their work done. Today, that is not enough. Researchers need to think about non-traditional ways of getting the results of their research used. One consideration is whether agribusiness companies can take research results to farmers through products and services. The agribusiness directorate, with help from the MART agribusiness support specialist, has found new ways to bring researchers and agribusiness together for mutual benefit. The following are some examples.

The directorate does prefeasibility studies. In 1991, the directorate staff prepared eight pre-feasibility reports of promising business ventures that could use technology developed by the system's researchers. Each report described the importance of the technology, told how to get the business up and running, showed how the provincial research institutes and PARC can lend scientific and technological support, suggested a logical area in which to build a production plant, and provided other pertinent information.

The prefeasibility business venture ideas were as varied as producing poison baits for rodent control, raising bees and processing honey, manufacturing a sugarcane planter, and producing a wheat reaper-windrower.

New products are being developed and adapted. The program is proving to be effective. A peanut thresher developed at NARC's Farm Machinery Institute is being manufactured by Al-Younus Agro Industry in Rawalpindi. Bio-Labs, Ltd., of Rawalpindi is producing a hydropericardium vaccine developed by PARC scientists for use by poultry farmers. A Farm Machinery Institute specialist worked with a farm machinery manufacturer for three months developing a rice thresher.

Institute researchers studied an imported no-till grain drill, simplified it, made it smaller, and adapted it to Pakistan conditions. The drill has the potential to enable farmers to plant wheat in rice stubble without taking time for land preparation. A local manufacturer plans to produce the adapted machine with local components.

Researchers work with producers of services. Another illustration of cooperation between the research system and the private sector is an agreement between PARC and K & N's Poultry Farms of Karachi to establish a poultry disease diagnostic and feed-testing laboratory. Through collaboration facilitated by the MART project, PARC provided technical assistance and trained the laboratory's technicians, USAID provided the diagnostic laboratory equipment, the company provided lab space and the technicians to run the tests and do the diagnosis, and the facility's services are provided to poultry farmers for a nominal fee.

A groundnut thresher, developed at NARC and being manufactured in Pakistan (see photo on page 28) is demonstrated.

When agricultural research system scientists help private companies develop new products and services, the system doesn't charge for its technology. It does charge a moderate fee of from Rs. 500 to Rs. 700 per day, plus transport and lodging, for technical assistance.

MART is Helping to Upgrade the Seed Business

In Pakistan, many people know MART's provincial research operations specialist (PROS) stationed in the Punjab. He first lived and worked as a maize breeder in Pakistan as a member of the Ford Foundation's agricultural team, and later with CIMMYT, during the green revolution in the late 1960s and early 1970s, before returning as a member of the MART team.

The PROS's work in upgrading the seed production and distribution system in the country provides another example of MART's promotion of the private sector; in this case, with an emphasis on small-scale seed producers.

"Good seed doesn't cost, it pays." This adage is true enough, but when planting time approaches and a poor, small farmer has little cash in hand and an urgent need to get his crop in the ground, it may become just a saying and not acted upon. The farmer may plant the seed he has saved from last year or buy the cheapest seed available.

Unfortunately, many small farmers do not understand the importance of planting good seed of improved varieties that increase yields and income many times more than they increase costs. But if a farmer could buy dependable seed of a superior variety at reasonable cost from a neighbor or acquaintance in the village, he might choose good seed that pays in the long run.

Farmers buy seed close to home. Most farmers travel no more than five kilometers to buy wheat seed; they either save seed from year-to-year, acquire it from their neighbors, or buy it from merchants in market towns. Studies also reveal that most Pakistani seed sellers have adequate supplies of basic seed for sustained, systematic multiplications, they sell seed that is not certified as to variety, germination, or purity, and they rely on public crop research for their parent material and information.

Efforts to improve the private sector's seed production and marketing activities have not been successful because

- policies favor public sector organizations
- credit and tax exemptions are lacking
- low public-sector seed prices limit profit potential in the private sector
- the public research program does not produce suitable hybrids
- information about seed production technology is limited
- assistance in improving management and marketing capability is limited
- farmers are not aware of the importance of planting good quality seed of improved varieties

Local, private seed enterprises are needed. The MART's Punjab PROS is working with Pakistani researchers, local seed producers and merchants, multinational seed companies, and seed associations in promoting the production and distribution of better seeds to farmers. The PROS believes that developing widely dispersed local private seed companies can provide many farmers with high-quality seeds at reasonable prices. Among other ways in which he helps is by bringing promising inbred lines of maize to Pakistan for reproduction and testing, by importing seeds of other crops, and by helping seed companies build markets for high-quality seed.

Consultant suggests a seed improvement association. In another step in building support for establishing farmer-based seed associations to produce and market better seeds, the MART project brought a widely-known seed consultant to Pakistan to review the seed industry and recommend improvements. The consultant suggested organizing seed improvement associations under Pakistan's Societies Act as nonprofit organizations to help local seed councils

- arrange for dependable parent lines and produce better-quality seed
- develop and share seed-production technology
- help members design and construct seed processing and storage facilities
- aid in developing sound seed-quality assurance programs
- provide technical and other support for obtaining loans
- assist in developing markets for good seed
- get research institutions involved in conducting shortcourses on seed production

As the MART Punjab PROS says, "It's a complex process, it can be accelerated, but steps in the process can't be skipped."

A Juicing Plant Gives Farmers a New Market

The Punjab PROS is a facilitator as well as a scientist and implementer, who develops connections between people and institutions through his wide acquaintanceship with provincial, national, and international agricultural researchers, farmers, and agribusiness people

For instance, he took a lead role in facilitating a seminar held in Sargodha, Punjab in January 1992 During the seminar, farmers, agricultural researchers, and agribusiness people found they had a common interest in increasing the production of Kinnow, which is a type of tangerine.

This farmer, in the barani (rainfed) area of Pakistan, is typical of the ultimate beneficiaries of MART project activities

Many farmers in the area produce Kinnow. When Cargill, an international agribusiness company, built a juicing plant at Sargodha, a new market opened for these farmers Cargill concentrates, freezes, and ships Kinnow juice to Europe, Japan, and the United States, where it is blended with other juices and marketed

At the seminar, speakers from the Ayub Agricultural Research Institute and the University of Agriculture Faisalabad told farmers how they can establish productive orchards, increase production, and fight diseases and other factors that cause losses of trees and fruit.

The market for Kinnow juice is growing, and farmers in the area have an opportunity to increase their production and sales Farmers can boost their output by increasing yields of trees now in production, by expanding acreage planted to Kinnow, by planting new varieties that mature at different times, and by introducing new kinds of fruit for juicing.

The Cargill plant can extract the juice from 250 tons of fruit a day. It operates for only three months a year, when farmers harvest their Kinnow Since the plant is modular, units can be added as supplies of Kinnow and its demand increase.

Three groups win by cooperating. The cooperation among farmers, researchers, and agribusiness represents a win-win situation Farmers have a market available for more of their output at the plant, prospects for higher yields and profits from adopting the results of research, and the potential of new citrus crops to plant. Researchers have new goals to strive towards in helping both farmers and Cargill reap the benefits of increased production And Cargill has an interest in expanding its plant and increasing the fruit production to run its plant at closer to capacity to lower its per-unit costs

These activities illi strate ways that MART project specialists help build and strengthen mutually beneficial ties between the private sector and agricultural researchers

Accelerating Agricultural Research

A Faisalabad agribusiness executive, in summing up the importance of agricultural research in Pakistan, said "We have to increase production or control population Our population keeps growing, so our per-acre yields must be increased. That means we must have a productive agricultural research system."

The agribusiness executive added that, in addition to increasing yields and production to feed a rapidly growing population, there is an economic reason for supporting productive agricultural research: To help Pakistani farmers produce for expanding global markets.

Farmers—and Pakistan—Need Growing Markets

The executive's company is an affiliate of an international agribusiness firm, which can prepare the same products it processes in Pakistan in its plants in other countries. The technology for producing consumer food products is easily transferred; multinational companies can get food-processing technology from anywhere in the world For these food products, and jobs, to be produced in Pakistan, the raw materials—agricultural products—must be available

His company makes products from maize, and is expanding its production from 200 tons to 600 tons per day The question on this agribusiness manager's mind is whether Pakistani farmers can continue to produce enough maize at competitive prices to meet the plant's needs.

To help assure that an adequate supply of maize will be produced in Pakistan, the company hired a maize-development manager for its staff to collaborate with other agricultural scientists in carrying new produ .ion-research information to farmers MART's provincial research operations specialist in the Punjab was once a maize breeder, and now helps ease that collaboration.

Pakistan Must Feed its Rapidly Growing Population

The most pressing aspect of the need for agricultural research in Pakistan is meeting the needs of its rapidly expanding population. The nation's population of 103 8 million is growing at 3% a year—one of the fastest population-growth rates in the world. The population will reach almost 140 million by the turn of the century So providing even the current amount of food per person will require a production increase of at least 40% over the next 8 to 10 years.

Producing enough agricultural products to serve the expanding needs of food and fiber processors, the growing farm household and consumer demands, and the expanding export potential, will challenge Pakistan's farmers Their success, and the nation's success, in meeting the challenge depends largely on how well the national agricultural research system produces new, usable, production-increasing technologies

Agricultural research holds the key. In a study funded by the MART project, a PARC agricultural economist and two Yale University (USA) economists, reported that the increased agricultural production cannot come from cultivating more land Some land resources are being degraded by soil erosion, salinization and waterlogging, and desertification Further, agricultural land is being diverted to residential development, industrial uses, and recreation parks.

The researchers found that on a per-capita basis, cropped area has decreased by 13% and the area planted to food grains has dropped by 9% in the past decade This means more food and fiber must be produced on each hectare of land that is planted.

Increasing the productivity of agricultural land does not happen spontaneously, it requires investing in agricultural research to produce new technology, educating farmers to help them respond to new opportunities, and building infrastructure to make farm-product markets more efficient And it requires an economic and policy climate that encourages farmers to invest in improving their farming operations.

Investment in agricultural research has a high payoff In "Agricultural Research Productivity in Pakistan", a publication written by economists that reports their research results, it is mentioned that

> Agricultural research has produced economic growth in agriculture at low cost That growth has been vital to Pakistan, with its rapidly growing population There is little doubt that investments in agricultural research have been among the most productive investments in Pakistan over the past 40 years

Agricultural research, such as this test of low-cost silage-making, has been among Pakistan's most productive investments over the past 40 years

> This study has shown that research is a bargain in Pakistan even though the research system is presently severely stressed by support and skill constraints. These constraints should be relaxed, which would make research even more of a bargain — because the real costs of scientific effort in Pakistan are low, relative to the costs of irrigation equipment and capital goods.
>
> Pakistan is underinvesting in research in both qualitative and quantitative terms. If Pakistan is to meet the massive challenge that it faces regarding agricultural production in the future it will have to invest more in its agricultural research system. It will have to provide better support (and) upgrade the skill level of its scientists. It will have to expand its research system as well, and develop extension and related systems to further support its research program. Only then will it be able to expand agricultural production at a rate sufficient to meet the development challenge that lies ahead.

Pakistan Under-Invests, Even in Wheat Research

The findings of the three economists are complemented by other studies. In "Technical Change and Returns to Wheat Breeding Research in Pakistan's Punjab in the Post-Green Revolution Period" (PARC/CIMMYT paper 90-7), for example, a CIMMYT economist reports that "returns to investment to wheat breeding have been above 20% and are over 15%, even if all research costs at the national and international level are included. More rapid diffusion of new varieties in the Punjab could considerably increase returns to wheat research."

The writer concludes, "The evidence would suggest that Pakistan grossly under-invests in agricultural research even for wheat, its basic food staple."

MART's chief-of-party, a noted agricultural scientist, calculates that the cost of Pakistan's 1991 wheat imports would fund the nation's wheat research for 123 years.

Agricultural research—Pakistan's best investment. The conclusions are inescapable, agricultural research has been among Pakistan's best public investments. The nation is underinvesting in agricultural research, and increased investment in productive agricultural research is essential for the nation's future.

Alleviating Constraints to the System

Discussions with provincial agricultural leaders, researchers at PARC and NARC, USAID mission officials, MART project advisors, and others within and outside of the Pakistan agricultural research system yielded many thoughtful suggestions for further improving the system's management and administrative processes. Such improvements are critically important.

As a former high-level PARC official explained, "A national agricultural research system can train scientists in needed disciplines, buy equipment, construct buildings, and develop an appropriate infrastructure. But the critical factor is putting those human resources, materials, and physical facilities together for maximum effectiveness. That is the role of management."

Improving Pakistan's Agricultural Research System

Management and administrative challenges to research systems are not unique to Pakistan; in fact, they are shared by most systems throughout the world. The following suggestions were offered for Pakistan's system.

Improve personnel management and selection. "One of our serious problems is we select people for top-level jobs on a seniority, favoritism, or ad hoc basis, seldom because they have experience or an aptitude in management," one official said. "The wrong person in a job can mess up an institution. Young, bright, dedicated people want to do good work, build a reputation, and contribute to the body of knowledge. They can size up their leader within days, if that leader has no vision, program, or sense of justice, production and the institution will suffer."

Persons interviewed suggested the following ways to improve personnel management and selection:

- Eliminate seniority as a basis for promotion. This will be difficult because it will require action by the Government of Pakistan. Today, if a young, talented, aggressive person is selected for a top job, more-senior people are apt to complain and even stop the appointment.
- Promote by merit, base selection on the candidates' qualifications. If employees know they have a better chance for promotion by being productive, they are more apt to excel.
- Provide a dual promotion ladder throughout the research system so administrative staff can move up as researchers do. The Atomic Energy Agricultural Research Institute and PARC have such promotion incentives.
- Make selection objective. Develop job descriptions that allow applicants to be matched against the requirements of the position. Form search committees to examine the records and qualifications of candidates, and interview top prospects.
- Provide opportunities for people to grow in their jobs. Orient new staff members, train managers in writing and preparing proposals, and provide continuing education so people don't get stale and lose touch with developments in their fields.

Improve research management processes. "We need objective criteria for setting priorities," a former PARC leader said. "We have a long shopping list of research activities with no sense of which are more important or how one relates to the others. We try to do everything at the same time." The needs of farmers and agribusinesses, consumer demand, equity, and export potential need to be considered in setting priorities.

The following sequence was suggested: Develop research plans that are related to the priorities, fit staff development and financial plans to the research plans, armed with these plans, managers should monitor and evaluate progress toward the research targets.

Provincial agricultural research institutes, universities, and the national research institutions need to develop ways to implement project planning, monitoring, and evaluating.

Improve researchers' relations with the finance people. Many researchers and others trying to get things done in the Pakistan agricultural research system mentioned that the finance department can limit the system's productivity. They claim that finance people sometimes hold up payments, even when approvals have been given. Such delays may dilute the value of planned activities. One oft-repeated suggestion is for finance departments to become service agencies and for their procedures to be simplified.

Let the private sector conduct research and extension. Pakistan is privatizing many business activities. It has found that the private sector is more efficient than the public sector in running some businesses and conducting some activities

Those who argue in favor of letting the private sector do more research and extension work contend that, since researchers' salaries are guaranteed, they need incentives to do great work. Money for the system is scarce, a high percentage of it goes towards salaries and maintenance, leaving too little for research.

Experience in distributing and marketing cotton insecticides illustrates the benefits of privatization. The government used to import and subsidize the sale of cotton insecticides But some of the government people in charge of the system failed to handle and distribute the insecticide properly, much of it deteriorated and was wasted. When farmers lose faith in the pesticide's effectiveness and think that their plants are going to be sacrificed to insects, they don't irrigate, try to control pests, or take care of their crops

When the rules were changed and Pakistan removed the insecticide subsidies and put distribution and marketing in the private sector, chemical companies imported their products and sold them to farmers. Conditions improved The companies did adaptive research and extension work

This suggests that the private sector can take on some research activities and help transfer research results to farmers. Private companies can sell seeds, fertilizers, and other inputs, then monitor and evaluate the performance in farmers' fields to retain the confidence of their customers. By being in the marketplace, private companies can translate research findings into products and information for farmers and consumers.

Send the right people for the right training. Selection of persons to be sent abroad for advanced-degree or other training should be based on such factors as merit, ability, potential to use the training productively in the system, English-language skills, and expected career path

In advanced-degree training, selecting the right educational institution and the right major professor is critically important. Depending on the type of training a person needs, a USA university may not be the most cost-effective choice, other countries offer a good education and better value in some disciplines.

Develop a useful, relevant personnel database. Research-system managers need the right kind of up-to-date information about personnel in the database system for analyzing staffing needs For example, they need to know how many entomologists the system has, where they are located, and what they're working on in order to make decisions about whether more entomologists need to be trained, whether some need to be moved, and so on.

ARP II Will Continue the Progress

USAID and The World Bank have alternated as major funding partners of projects that have strengthened Pakistan's agricultural research service and therefore have hastened the country's agricultural and economic development The next major project in this series is the World Bank's Agricultural Research II project. This project will continue the progress currently being made by an agricultural research system that is contributing mightily to Pakistan's farmers, its people, and its future development.

Wayne E. Swegle

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