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STRENGTHENING THE AGRICULTURAL RESEARCH CAPACITY OF THE LESS DEVELOPED COUNTRIES: LESSONS FROM AID EXPERIENCE

A.I.D. Program Evaluation Report No. 10

by

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ACKNOWLEDGMENTS

This report summarizes the results of many activities extending over several years. Many people have therefore contributed to it, and it is my pleasure to acknowledge their participation and assistance.

A special mention should be made of Dr. Twig Johnson (AID/PPC/E/S) who coordinated the first part of this series and selected projects for field evaluation. Dr. Richard Blue (AID/PPC/E) and Ms. Charlotte Suggs (AID/PPC/E/S) were involved in the entire series. Dr. Frank Byrnes (IADS) organized a workshop in 1982 on the Impact of Agricultural Research.

The members of our impact evaluation teams took four weeks off from their busy schedules for a field evaluation, which is always exhausting and demanding; they are listed in Appendix B, together with the members of an intra-agency working group who assisted in the preparation of the workshop.

Special thanks are also due to the following individuals who gave detailed and thoughtful comments on an earlier draft of this paper: Joan Atherton (AID/PPC/PDPR), Frank Byrnes and Kenneth McDermott (IADS), Peter Oram (ISNAR), Vernon Ruttan (University of Minnesota), and Ram Yadav (IFPRI).

Josette Murphy

SUMMARY

The U.S. Agency for International Development (AID) and its predecessor agencies have assisted the less developed countries in establishing and strengthening agricultural research systems for over 30 years, and the United States is a major contributor to international agricultural research centers. Current AID policy reaffirms the Agency's long commitment to agricultural research, an activity to which AID devoted over $140 million in 1981, nearly 20 percent of its appropriation for agriculture, rural development, and nutrition.

Because agricultural research continues to be a priority activity, the Bureau for Program and Policy Coordination, through its evaluation program, was asked to examine what lessons were learned from AID's past experience and suggest how they can be incorporated in the Agency's policy, planning, and implementation activities. This assessment is based on an analysis of available project evaluations, field evaluations by interdisciplinary teams of the impact of AID-funded projects in eight countries, and discussions among AID officers, host government officials, and experts from the agricultural research community during a three-day workshop.

The USAID assistance to regional and national research institutions has been found to be highly successful in training researchers and establishing or expanding research facilities, but the effectiveness and sustainability of research activities have often been hampered by managerial insufficiencies and by unfavorable government policies, as well as by an inadequate awareness of conditions in farming households.

The key recommendations that emerge from these studies are as follows:

1. Host Government Commitment and Support to Research Is Essential.

A real, long-term commitment to agricultural research on the part of the host government determines the sustainability of a research project as well as (indirectly) the utilization of research findings. Therefore, a continuous dialogue among politicians, administrators, and researchers will greatly increase the likelihood of adequate support to research. This is more likely to occur if the potential benefits of research programs for the government are clearly demonstrated. Research institutions will be more effective if their mandate and authority are clearly defined and agreed upon with the host government.

2. Technological Solutions Alone Cannot Solve Problems Which Have Political, Economic, and Social Dimensions.

Government policies and infrastructure determine in part whether farmers can and will adopt improved technology and practices, and whether necessary support services will be in place and effective when needed. Therefore, agricultural research programs should be selected within a much broader rural development policy and planning framework.

Technological changes can have negative as well as positive impacts on rural household incomes and well-being, and can sharpen inequity among households if adoption is dependent upon a resource which is unequally distributed.

3. Research Should Be Farmer-Oriented.

If research activities are to increase the productivity of food producers, the program designers and researchers, as they establish the research program, should be aware of and understand the existing farming systems and local agroecological and economic conditions, and the resources available to the farmers. This requires that some of the research activities be interdisciplinary and include on-farm research. It will be essential to establish, maintain, and use a two-way information system among researchers, extension service agents, and the farmers. Official linkages and feedback mechanisms among institutions and government entities with responsibilities in research, extension, and the provision of services to farmers should be established; they should also be established with the educational institutions which train the researchers and extension staff.

4. Inadequate Management of Limited Resources, Especially a High Rate of Attrition Among Skilled Staff, Can Undermine the Effectiveness and Sustainability of an Otherwise Satisfactory Program.

Training skilled researchers has been found to be the most successful component of many research projects, but the training provided should be adapted to the realistic needs and capabilities of the country, in choice of discipline, level of education, and timing of the training. Training provided under a project should be scheduled to complement its technical assistance. Returning trainees should be assured of satisfactory material, professional incentives, and rewards comparable to those offered to other public servants.

National research institutions should not function in isolation, but should maintain an active network of information exchange with other national institutions in comparable ecological zones, as well as with international research institutions.

5. Coordination Among Researchers and Other Development Actors, From Farmers to Politicians, Is the Key to Success.

Most of the issues outlined above share a common solution: coordination and information flow. A research system will be most effective if the many actors who influence its success (defined as the generation of improved technology that is adopted by farmers and increases food production and incomes in the country) are involved in a network in which their needs are identified and through which the interaction between different sectors of development are as synergetic as possible.

In many countries, the main difficulty in activating such a network will be cultural. If the food producers are not recognized as full members of the network, it will remain insufficient. If the administration is highly centralized, if a top-down, authoritarian approach to management is maintained, the exchange of information will be hampered. Donor institutions are part of this network by the very act of deciding which activities they will support.

The importance of coordination is not specific to research, but it may need particular emphasis in research activities because of the frequent assumption that science functions in a world separated from daily reality. The food problem exists in the real world of the small farmers, in the real world of imperfect economies, and that is where the success of any research program is tested. The remarkable contributions of research to food production have been amply demonstrated all over the world. Researchers will meet the challenges ahead if the political and administrative structures and systems in which they function make it possible for them to do so.

I. AGRICULTURAL RESEARCH AND DEVELOPMENT

A. Research, Food Production, and Population Growth

The Green Revolution has demonstrated that high-yielding varieties of food crops and improved technology could lead to increased productivity in the less developed countries (LDC). The overall rate of increase in food production in the LDCs from 1961 to 1976 averaged 2.6 percent per year.[1] While this is a remarkable achievement, in more than half these countries the increase in food production has not kept pace with population growth, so on balance the situation is worsening. This is especially true in Africa, the only region with a net loss in production per capita (see Table 1). Food production must now increase by an average of at least 4 percent per year if consumption needs are to be met by 1990.[2]

Table 1. Agriculture Production Indices Per Capita, 1970, 1975, and 1980 (1969-1971 = 100)

Country	1970	1975	1980
Africa	100	95	89
Latin America	100	103	108
Asia	101	105	107
Near East	98	104	101
World	100	103	104

Source: Food and Agriculture Organization, Production Yearbook 1980.

[1] Bachman and Paulino, 1979, p. 13.

[2] Oram et al., IFPRI No. 10, 1979.

Furthermore, researchers have found that the generation, adoption, and results of improved agricultural technology are complicated by economic, political, social, and institutional constaints both at the farm and the national levels. More funds and more technical assistance do not necessarily solve these problems, even if it were feasible to increase the amounts involved in assistance to LDC research institutions.

The world's annual expenditure on agricultural research now stands at $5,000 million, about double what it was in 1975 in constant 1975 terms,[3] and about $1,600 million of that amount is spent in the less developed countries. Oram and Bindlish computed the amounts and distribution of expenditures on agricultural research in 47 less developed countries, together with the total number of agricultural scientists in each region (see Table 2).[4] They point out that total expenditures seem to have stagnated since 1978-1979. The trend begun in the early 1970s may be changing, especially as most donor countries face internal economic difficulties.

Much effort has been directed toward institution-building and training at the national level, and an effective network of international agricultural research centers has been established. In the context of increased need, a well-established research network, and possibly limited financial resources, it behooves agricultural scientists and rural development specialists to learn from past experience so that future financial and human investments in agricultural research are as productive as possible.

B. AID's Assistance to Agricultural Research

USAID and its predecessor agencies have assisted agricultural research in less developed countries for more than 30 years. During the 1950s, the emphasis was on transfer of Western know-how, characterized by assistance to extension services and training institutions, especially universities. As evidence mounted that Western know-how was not always successful in the agroeconomic context of most LDCs, the emphasis shifted in the 1960s from extension to assisting national and regional research institutions through training and technical assistance, and by providing these institutions with adequate facilities. During that period, the achievements of the Green Revolution demonstrated that agricultural research that was

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[3]World Bank, 1981, p. 16.

[4]Oram and Bindlish, 1981, p. 81.

Table 2. Change in Expenditures on Agricultural Research and Numbers of Agricultural Scientists for 47 Countries, 1971, 1975, and 1980

Region[1]	$ millions (constant 1975 terms)			Percentage Change		Number of Scientists			Percentage Change	
	1971	1975	1980	1971/75	1975/80	1971	1975	1980	1971/75	1975/80
South Asia (5)	41.2	73.3	139.7	78	91	2,529	6,120	12,293	42	101
Southeast/East Asia (5)	28.0	46.7	101.0	67	116	2,285	4,400	5,830	95	31
N. Africa/Middle East (5)	21.9	21.9	35.1	-1	60	1,432	1,163	1,375	-21	18
West Africa (6)	41.8	86.5	112.5	107	30	915	3,239	1,897	154	-42
East/Southern Africa (5)	18.0	18.9	27.9	5	47	513	605	861	18	42
Central America/ Caribbean (11)	18.6	22.7	59.9	22	86	967	1,393	1,680	44	21
South America (10)	110.1	160.4	342.8	46	214	4,100	5,291	5,939	29	12
Total (47)	279.8	430.4	818.9	54	90	12,741	22,251	29,875	74	33

[1]Figures in parentheses denote the number of countries in each region.

Source: Oram and Bindlish, 1981.

focused on commodity improvement (e.g., breeding rice varieties whose yields were highly responsive to nitrogen and water application) could indeed lead to production breakthroughs in the less developed countries.

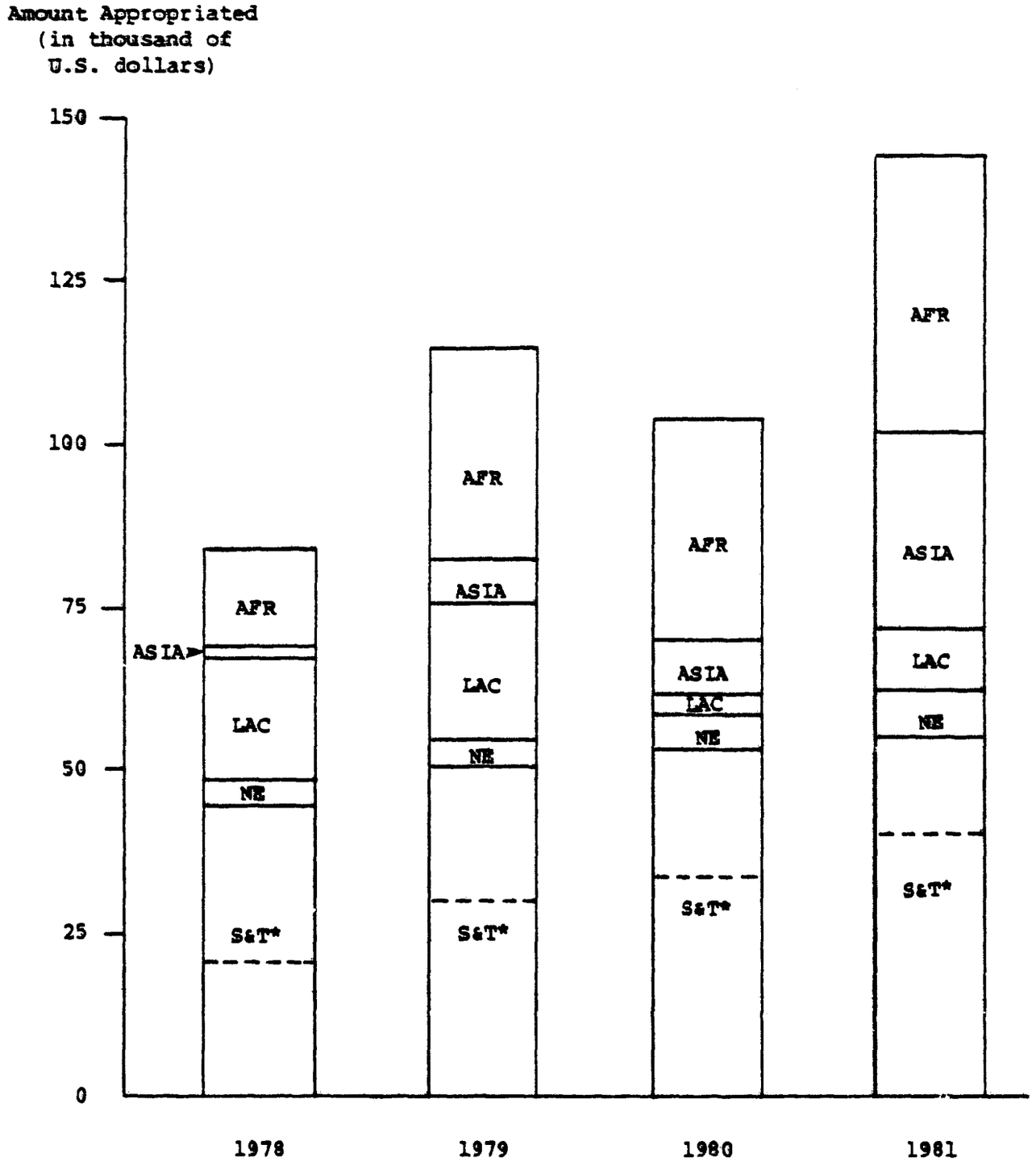
Since the 1970s, U.S. assistance has focused on smallholders and landless farmers. The Foreign Assistance Act (Section 103A) specifically requires that AID-assisted agricultural research programs be adapted to the needs of small food producers and include on-farm testing. The current AID policy on Food and Agricultural Development (AID Policy Paper, May 1982) reaffirms the Agency's long term-commitment to research, citing as one of the major areas of commitment of U.S. assistance the "develop[ment of] human resources and institutional capabilities, especially to generate, adapt, and apply improved science and technology for food and agricultural development" (emphasis in text, p. 2).

The policy paper recognizes the need for long-term assistance and the importance of training, institutional development, and policies that encourage the small farmers and private entrepreneurs to increase agricultural productivity in their country. Specific recommendations for implementation of AID policy are developed in the Agency's Strategy Paper for Food and Agricultural Development.

In 1981, USAID allocated about 20 percent of its appropriation for agriculture, rural development, and nutrition to agricultural research (see Figure 1). The actual expenditures, which fluctuated considerably over the last few years, have ranged between 13 and 19 percent of all appropriations for agriculture. The funds, which include a contribution to the international agricultural research centers, are about equally divided between centrally funded and regional bureau- and mission-funded projects (i.e., projects coordinated directly by the Science and Technology Bureau of AID/Washington and those coordinated by the regional bureaus). Projects funded through the Science and Technology Bureau are usually specific research activities in a commodity sector, while projects funded through the regional bureaus and missions usually focus on institution-building and human resource development.

Funding levels for the regional bureaus are tending to increase. Currently, 24 missions have included agricultural research as an area of particular importance in their Country Development Strategy Statements for 1983, and the Africa and Asia Bureaus have given clear priority to agricultural research for their future programs. The Asia Bureau, which has a long history of agricultural research activities, is conducting a review of its past experience in agricultural research (Asian Agricultural Research Review); results available to date are presented in Section II. The Africa Bureau, conscious of the

Figure 1. U.S. Agency for International Development, Agricultural Research Appropriation, 1978-1981 (in thousand U.S.$)



*Includes U.S. contributions to the international research centers, indicated by - - -

particularly difficult situation in African nations, has refined its strategy for agricultural research to incorporate some of the lessons from experience which are substantiated in this document, in particular, the AID long-term commitment to strengthening national agricultural research institutions; the need for coordination and feedback among scientists at the regional level; the advantages of farming systems approach to research; the importance of linkages between research, extension, the farmers, and education activities; and the necessity of providing support services to the farmers.

II. PAST EXPERIENCE: THE EVIDENCE

AID activities in agricultural research can be documented through the routine evaluations conducted for each project and through special studies and evaluations conducted for projects or programs of particular interest to AID. Examples of these are the series of eight impact evaluations coordinated by the Bureau for Program and Policy Coordination, Office of Evaluation, Studies Division (PPC/E/S), as part of this review of AID experience, and an in-depth evaluation of selected Asian countries coordinated by Professor Vernon Ruttan for the Asia Bureau.

AID officers and contractors have also accumulated much experience and wisdom which is not recorded or published. Discussions among evaluation teams, members of the Intra-Agency Agricultural Research Working Group, and the participants to the Workshop on Impact of Agricultural Research have been incorporated throughout this report.

The evidence from past experience will be summarized in this section as the basis for the discussion of key issues and lessons learned for agricultural research activities which is developed in Section III.

A. The Findings of Eight Impact Evaluations

1. Evaluation Methodology

In addition to a comparative analysis of existing evaluation documents for all completed AID projects, eight projects were selected for field evaluations. The decision was made to limit the evaluations, for the time being, to projects funded through AID's missions and regional bureaus: two in Africa, three in Asia, two in Latin America, and one in the Near East. The projects provided some form of assistance to national

(five) or regional (three) institutions, and all except one (Guatemala) had been completed prior to the impact evaluation. However, AID has continued to assist some of the institutions after the projects evaluated here had ended.

The basic characteristics of each project (compiled from the impact evaluation reports) are listed in Table 3. For ease of presentation, each project will be referred to by its location. Each project was evaluated by an interdisciplinary team (see list in Appendix B) during a visit of about four weeks. Agriculturalists, economists, social scientists, and development generalists were present, with each team including one or more AID officers. Outside consultants joined the teams where the necessary expertise was not available within AID at the time of the evaluation. Every team included members with previous experience in the country and with knowledge of a local language.

To assess the impact of the project, each team interviewed a sample of farmers as well as researchers and administrators, spent a minimal time in the capital city, and traveled in rural areas. The main goals of each evaluation were as follows:

-- To determine whether the institution that had received assistance was functioning and whether the researchers who had received training were active in research

-- To assess the quality of the research program and its applicability in actual farming conditions

-- To determine the extent to which research findings have been adopted by farmers, how food producers have been affected by the new technology, and why

Each team had a common list of topics to cover as a framework for its inquiry, but individual scopes of work were drawn up because of the great diversity of project strategies.

2. Kenya

The Crop Production and Research Project, the starting point of this impact evaluation, was only one among many activities funded by USAID and other donors which led to the breeding and dissemination of hybrid maize lines in East Africa. The first hybrid, bred at the Kitale Research Station in 1964, produced a 40 percent increase in yields. It has been widely adopted by both large and small farmers, in spite of the fact that seeds need to be purchased every year, because no other changes in practices were necessary to obtain a significant increase in production.

Table 3. Characteristics of Eight AID Project Impact Evaluations

Location	Program Title	Project Funding (in millions)	Implementation Dates	Institutions Assisted	Date of Evaluation	Title and No. of Evaluation Report
Kenya	Crop Production and Research (618-0644, 618-0657)	$?.2	1969-1981	East African Community	December 1979	Kitale Maize: The Limits of Success (No. 2)
Central America	Small-Farm Cropping Systems (596-0064)	AID grant, $1.633	1975-1979	Center for Tropical Agriculture Research and Training (CATIE)	February 1980	Central America: Small Farmer Cropping System (No. 14)
Guatemala	Food Productivity and Nutrition Improvement (520-11-130-232)	AID, $1.7 (plus $1.0 in earlier projects)	1975-1979	Institute of Agricultural Science and Technology (ICTA)	October 1979	Guatemala: Development of the Institute of Agricultural Science and Technology and its Impact on Agricultural Research and Farm Productivity (No. 27)
Korea	Agricultural Research Project (DLC/P-2014, 489-11-088)	Loan, $5.0 Korean contribution, $3.124	1974-1980	Office of Rural Development, Ministry of Agriculture and Fisheries	January 1982	Korean Agricultural Research: The Integration of Research and Extension (No. 30)
Nepal	Food Grain Technology: Agricultural Research in Nepal (367-11-110-054, 367-0054)	About $20.0 total	1957-1974	Ministry of Food and Agriculture, with assistance to five research stations	January 1982	Food Grain Technology: Agricultural Research in Nepal (No. 33)
Thailand, Northeast Region	Agricultural Development, Agricultural Research (493-11-190-180.2)	AID, $6.272 Thai Government, $6.8	1966-1975	Thai Phra Agricultural Research Center	February 1981	Agricultural Research in Northeastern Thailand (No. 34)
Tunisia	Accelerated Cereals Production (654-0205.1) and related regional projects (698-0173)	$1.715	1967-1977	Office of Cereals	April 1982	Tunisia: The Wheat Development Program (in preparation)
West Africa	West Africa Rice Development Association: Rice Research and Development (698-11-190-382, 698-0382)	AID, $5.166 WARDA, $0.3 (in kind)	1975-1980 (first phase)	West Africa Rice Development Association (WARDA)	October 1981	West Africa Rice Research and Development (No. 44)

As a result, maize production increased and Kenya has come close to self-sufficiency in this staple food. The report states that production increase could have been higher, however, had the Kenyan Government strengthened its marketing and storage infrastructure to handle crop surpluses, and had necessary inputs, especially credit and fertilizer, been available in sufficient quantities. The private sector did play a crucial role in the rapid dissemination of the hybrid; the Kenya Seed Company assured seed multiplication and distribution, while shopkeepers actively promoted the new hyrbrid.

As hybrid maize became more widely adopted, AID attempted to assist the East African Agriculture and Forest Organization in developing a research institution capable of coordinating varietal trials of hybrid maize and other crops and of disseminating the results among African scientists in the East African Community.[5] This effort resulted in the identification of improved hybrid maize with better potential than the original one, but other technical components of the projects were not successful. They included developing varieties suitable for low rainfall areas and improving maize protein quality, a topic which has been found especially difficult elsewhere.

As institution-building programs, the three projects were failures, not simply because of the break-up of the East African Community, but because from the beginning, each country had avoided sending scientists to the regional institution. The national research programs did not receive sufficient support from their governments either, so the few African scientists were not encouraged to stay with the research institution. Few Africans were trained under the projects, and at the time of the impact evaluation (1979) the breeding program had all but died out after departure of the last American breeder.

Thus, the Kenya report presents the case of research results being widely adopted, in spite of some unfavorable nationwide economic conditions, but little permanent research capacity remaining after some 15 years of technical assistance with limited training.

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[5]This was done under the Annual and Crop Production (618-11-110-644) and Major Cereals and Legume Improvement (618-11-130-652) projects from 1969 to 1972, and under the East African Community Food Crop Research (618-11-110-657) from 1972 to 1977.

3. Central America

The Small Farmer Cropping System project was implemented from 1975 to 1979 through the Center for Tropical Agricultural Research Training (CATIE) so that scientists from CATIE could "develop and demonstrate an innovative multidisciplinary methodology for doing research on the cropping systems of the small farmers of Central America." Both institutional and technical results were expected from this project: development of a regional institution capable of coordinating on-farm research and training programs well adapted to the needs of the small farmers, and some improved cropping systems adapted to various ecological zones in the region, which could then be tested and promoted by the national institutions.

The impact evaluation was conducted in 1980. At that time, it was evident that the program was successful in developing methodologies for on-farm cropping systems research, but only one set of recommendations had yet been verified on a large scale before dissemination. The expected institutional results had been reached, with CATIE providing the necessary training program and coordination with national institutions.

The evaluation report discusses two sets of problems: the division of labor between the regional institution and its national counterparts, and the importance of socioeconomic factors. The project called for the regional organization to survey traditional practices and identify improved cropping systems, which the national institutions would then verify and disseminate. The team found this division arbitrary, as both the regional and national institutions would benefit from cooperation. The team also emphasized the importance of taking into account socioeconomic factors in planning and implementing both research and extension programs. This requires a fully multidisciplinary effort, with social scientists and farm management specialists, as well as agriculturalists.

A recent (April 1983) evaluation of current AID assistance to CATIE confirmed that farm-level research is still on-going in spite of the political instability in the region. It does, however, confirm the impact evaluation concern about the very limited outreach program through the extension services in the national systems.

4. Korea

The Korea Agricultural Research project (1974-1980) aimed at strengthening an existing research capacity within the Ministry of Agriculture and Fisheries with a $5.0 million loan.

It included training, some equipment, and technical assistance, but no new infrastructure. The training component was found to be the most useful, and long-term technical assistance the least. The spread of high-yielding rice varieties has been very rapid in Korea, largely because of the effectiveness of the extension service and the hierarchical social tradition. By 1975, Korea reached self-sufficiency in rice. This success backfired in 1979 and 1980, however, when disease followed by unfavorable temperatures greatly lowered production. The report questions the wisdom of relying heavily on any one variety of a staple crop and points out that this vulnerability stemmed in part from the very strength of the extension service, which assured a rapid diffusion of the Tangil variety before cold-resistant varieties could be developed. The report also raises questions regarding the choice of other crops for research activities, even though some of these crops (wheat, soybeans, and potatoes) are not economically well adapted to the farming community, partly because of the price structure.

5. Guatemala

The Food Productivity and Nutrition Improvement project is one of several projects since 1970 that has provided assistance to the Institute of Agricultural Science and Technology (ICTA) in Guatemala. This project had both institutional and technical objectives.

The project has been successful in strengthening the research capacity of ICTA through training and technical assistance. With the assistance of experts from international agricultural research centers and support from the Inter-American Development Bank and the Rockefeller Foundation, as well as that of USAID, ICTA has developed new varieties of maize, beans, and sorghum and has tested them under farm conditions with the participation of local farmers. Improved farming practices have been identified, and a seed service has been organized which provides a regular supply of good quality, improved seeds.

ICTA is an unusual institution among those evaluated in this series because it has responsibility for research and for "determin[ing] farmer acceptance or nonacceptance by introducing these new technologies to farmers directly and incorporating farmers evaluations into the research effort."[16] The existing extension service within the Ministry of Agriculture retains responsibility for large-scale dissemination. Research

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[16]Report No. 30, p. 4.

personnel work in close cooperation with collaborating farmers to test new varieties and farming practices in real farm conditions, and to draw upon the farmers' knowledge in identifying possible areas for improvement.

The evaluation report notes the success of the ICTA approach, stating that "ICTA has come to represent a new model for agricultural research that planners and researchers in other countries are studying and attempting to replicate. If there is continued and increased support from the Government of Guatemala, it will be able to sustain and expand its present activities."[7] This note of caution stems from some problems caused by the Government organizational structure. Researchers are penalized under the existing salary schedule, resulting in a high attrition rate among ICTA personnel.

As could be expected from its very mandate, conflicts have arisen between ICTA and the extension service, since the division of labor between the two is unclear. At the time of the evaluation, the two institutions were discussing a more coordinated approach to their activities.

6. Nepal

The Food Grain Technology project in Nepal was the longest among those evaluated, lasting from 1957 to 1974 (a follow-on project is still being implemented in 1983). This project also had the largest budget (about $20.0 million total); it included training, commodities, infrastructure, and technical assistance.

While the project goal remained that of increasing production by promoting improved farm technology, the project design was flexible, and project activities shifted over time from general agricultural development, to the development of improved technology for food grains, and finally to a combination of development of new technology and some coordination with the extension service.

The project has had sustainable results. 600 Nepalese have been trained, five research stations have been built and expanded, and a research system has been put in place and is functioning. The research stations are specialized by commodity. The rate of adoption of new technology has been high, leading especially to an increase in cropping intensity (from one to two and sometimes three crops a year in part of the

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[7]Report No. 30, p. viii.

southern plain of Nepal) and a dramatic increase in wheat cultivation. This has not been accompanied by a significant increase in yields, however, and improved rice varieties were used on only about 25 percent of acreage in 1980. The report raises questions regarding the equity impact of improved technology, which depends heavily on the availability of irrigation, and about long-term effects on soil fertility. The technical package calls for chemical fertilizer. Many farmers are reluctant to use the recommended levels, because uncertainties in water supply make the levels economically risky. On the other hand, the higher cropping intensity has had a negative effect on the size of the herds kept by these farmers, and therefore, on the amount of manure available to them.

7. Thailand

The Agricultural Development-Agricultural Research project assisted the already existing Tha Phra Research Center in Northeastern Thailand from 1966 to 1975. The AID project included training in the United States for 11C Ministry employees, constructing and supplying equipment for research laboratories, and establishing research programs and extension activities.

The original mandate of "the Center was to be a multidisciplinary research facility focusing on the Northestern region and responsive to the needs of the farmers. In addition, it was to support and coordinate the work of the Ministry's [of Agriculture and Cooperatives] 112 small research centers and stations in Northeastern Thailand."[8]

The project was successfully implemented, and "by 1975, laboratories were well established, and substantial research work was underway." Since then, the team found that although an innovative extension and training program is now active, on the whole, the research role of the Center has not been as effective as expected, mainly because of bureaucratic constraints.

Part of the difficulties are due to "bureaucratic conflict" between the Center and the Ministry of Agriculture, which disagree on research programming, and to several changes in the mandate of the Center, with more emphasis on planning and coordinating the work of the regional Ministry Agency and implementing development projects. The activities of the Center are further hampered by its insufficient budget and by staffing difficulties.

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[8]Report No. 34, p. iii.

This project is an example of one that successfully strengthens a research institution, providing it with adequate facilities and staffing, but whose long-term impact has been lowered because the institution's role was later modified by its ministerial authorities.

8. Tunisia

The Accelerated Cereals Production program had a dual technical and institution-building purpose. It was a long-term (1967-1977) effort, funded by USAID, the Ford and Rockefeller Foundations, the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, and the Government of Tunisia.

The program was designed shortly after independence, at a time when the Government of Tunisia needed both to establish its own research and extension activities and to reverse the decline in food production due to the departure of the French farmers. The Wheat Development program proposed to adopt the new semi-dwarf, high-yielding wheat varieties recently developed at CIMMYT and to establish a Tunisian research institution in the process. Both objectives have been reached; five years after the end of the project, the evaluation team found a successfully operating Tunisian research institution and widespread use of an improved wheat technology that resulted in increased yield and production. The evaluation report points out that much of the positive impact of the project became evident only after the project itself had ended, showing that a long-term perspective is essential when assessing the impact of a research project.

The report points out that the choice of a semi-autonomous institution for implementation of the project gave project designers and implementors freedom from some of the bureaucratic constraints of the Ministry of Agriculture, and also separated the research function from that of extension. Good cooperation between individuals in the two entities has enabled an ad hoc coordination between research and extension, but it is not institutionalized and therefore remains vulnerable.

9. West Africa

The West Africa Rice Development Association (WARDA), operating in 15 countries, was created in 1970 to adapt the improved technology developed for Asian rice production to West African agroecological conditions. WARDA is assisted by many donors; AID assistance was at first focused on training and on adaptive research for mangrove rice (in Sierra Leone) and for

deepwater rice (in Mali). In a second phase of assistance, AID is now working with WARDA to develop its analytical capacity to identify problems and to make research suggestions for the countries involved.

The mandate of WARDA, which is stated predominantly in technical terms, has been found too restrictive to address a problem which is economical as well as technical. Varieties of rice adapted to local conditions do not guaranty an increase in production if pricing regulations make rice production unfavorable in the first place. This is partly being corrected, because WARDA "on account of its scientific professionalism . . . has discovered a politically acceptable way of targeting project identification and research design on specific situations that are not only ecologically but economically conducive to expanded rice production."[9]

The research projects under the first phase have had mixed results, but the training (rice production course) has been found very useful (the U.S. training component is not yet completed).

The evaluation report discusses the pros and cons of a regional research entity, a topic of crucial importance at this time, as African and donor countries are planning long-term research activities in a coordinated fashion.

B. Other Evaluations and Studies

1. Review of Routine Project Evaluations

All AID projects are normally evaluated during implementation and after the end of the project. A comparative analysis of these evaluations for 48 agricultural and research projects identified a number of recurrent problems at three levels: selection of research topics, implementation and management of the project, and difficulties because of inadequacies in related support and services. The results of this analysis were not as definitive as expected, because it was found that routine evaluations in early years were often uneven in scope and quality and thus difficult to compare in a systematic manner. The review found that while most projects were supposed to focus on research activities that benefit small farmers, not all of the evaluations even considered whether this was actually the case during implementation. Of those evaluations that

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[9]Report No. 44, p. viii.

did, problems were identified in setting clear research priorities, implementing multidisciplinary research activities, and conducting on-farm testing, even though these three factors were found to relate positively to a (subjective) assessment of "better than" or "satisfactory project performance" by the evaluations.

Finally, the routine evaluations of agricultural research projects (as indeed those of most projects) manifested many managerial problems during implementation. Difficulties arose with AID contractors and host government personnel with almost perfect regularity. While many of these difficulties are not specific to agricultural research projects, several characteristics of these projects make them especially vulnerable to management problems: they involve procurement of large amounts of equipment, they involve high-level training (usually in the United States), and they usually involve long-term programs which cannot show concrete results during the life of an AID project.

The first two characteristics, not surprisingly, lead to frequent difficulties with delays and resulting scheduling problems: delays in construction and procurement that hamper research activities; delays in identifying and preparing candidates for overseas training; and discrepancies in scheduling the training of host country nationals to coincide with the presence of expatriate technical assistance, so that all too often, the technical assistant runs the program while his "counterpart" is overseas, with little, if any, overlap upon the trainee's return for on-the-job training.

It is important to note that the only factor which was considered by almost all the project evaluations and found positively related to good project performance was the host government support to agricultural research activities, as reflected in the government allocation of funds and staff, in policies that influence the food producers, and in the flexibility and control over its own activities given to the research institution.

Finally, problems with the performance of the implementing contractor are not unusual, with difficulties in identifying qualified experts and delays in fielding the most often cited.

2. Conference on Impact of Agricultural Research, Leesburg, Virginia

AID/PPC/E organized a conference near Leesburg, Virginia, from June 13 to 17, 1982, on the impact of agricultural research. More than 100 participants from 32 countries discussed the findings of the impact evaluations in the context of their own experience and knowledge. The participants (listed in

Appendix D) included officers from AID/Washington and 24 overseas missions, host government officials, and representatives of donor and research institutions. The key findings and suggestions are presented in Section III.

3. The Asia Agricultural Research Review Project

The Asia Bureau of USAID, seeking to measure the relationship between USAID assistance to national research systems and changes in agricultural productivity, is funding a review of its past activities in selected countries, conducted by the University of Minnesota under the leadership of Professor Vernon W. Ruttan. Through the work of the Minnesota team and its collaboration with Yale and Cornell Universities, and the East-West Center, the study will provide an assessment of the contribution of AID research investigation to agricultural productivity and its impact on equity at the farm and regional levels, in quantitative terms whenever possible. This is under way for the Philippines, Indonesia, Bangladesh, South Korea, and India.

The Minnesota work highlights[10] the importance of the research institution's location in the administrative structure of the country, as well as that of coordination among institutions and entities involved in the generation and diffusion of research findings, two points which are also well illustrated in the Thailand and the Korea impact evaluations.

The report also cites the "lack of information and analysis that goes into establishment of research priorities,"[11] a point that is recurrent among the PPC/E impact evaluations. Ruttan mentions, for example, the Bangladesh Rice Research Institute's goal of developing improved varieties of deepwater rice yielding one ton per hectare, an objective which turned out to be about half of what the farmers were already producing. A similar lack of knowledge about existing farm conditions had been identified in the Korea impact evaluation.

The review of "the income distribution effect of the Green Revolution in India"[12] shows that while improved technology can

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[10]University of Minnesota Economic Development Center, Bulletin No. 81-2, March 1981, p. 12 ff.

[11]Ibid, p. 16.

[12]Economic Development Center Bulletin No. 82-5, April 1982, p. 37.

be adopted by small farmers as well as by the larger ones, the diffusion of high-yielding varieties is "closely interlocked with the nature and level of their [the farmers' region] development in physical and institutional infrastructure." The interaction among agricultural, social, and economic constraints, and the danger of planning research in isolation from its context at the farm and national levels are recurrent throughout the impact evaluations.

Finally, the Minnesota case studies, like the impact evaluations, are constantly citing managerial problems and, especially, the high rate of attrition among skilled research staff because of insufficient material and professional rewards.

III. FROM PAST EXPERIENCE TO LESSONS LEARNED

A. Introduction

In the past, many strategies have been followed for generating research results that will lead to increases in food production. Among the impact evaluations alone, some projects worked through regional institutions (WARDA in West Africa, CATIE in Central America, the East African Community), others through a national ministry (Thailand, Nepal, Korea) or through a parastatal institution (Guatemala, Tunisia). All these projects had the dual objective (albeit not always clearly expressed) of technology transfer and institutional development, with the basic assumption that a host institution can be created or strengthened in a sort of "on-the-job institutional training" as Western research technology is being introduced.

A major lesson learned from these evaluations and from the workshop discussions--one that will permeate this section--is that the key difficulties in increasing food production are not solely agricultural or technical, but lie in political, socioeconomic, and managerial constraints that influence the research system on the one hand, and the adoption of research findings on the other.

Technology transfer alone is not sufficient to assure food security and increase food availability per capita. The LDCs need an effective network of regional, national, and international institutions and must be willing and able to revise their policies to encourage increases in food production.

The purpose of much investment in this area is to develop a research capacity in a country by strengthening existing institutions or by creating new ones, so that the ultimate goal of increased food production can be reached. What matters when identifying and planning a development program is to understand that the research capacity in a country is not a simple sum of well-trained researchers, adequate buildings, and well-equipped laboratories. These are means, not ends. The research capacity in a country depends upon how well these means can be made to function and fulfill the mandate of providing farmers with tools (improved practices and technology) that can lead to increased food production, and whether the political, economic, and social environments (at national and local levels) allow these means to become effective.

While research can provide the required technology improvements, a research program will be more effective if it is not planned in isolation, but as part of the political, social, and economic system that it must serve. Assistance to agricultural research must take into account necessary linkages between a research capacity--the macropolicy and the institutional environment in which research institutions function--and the farming community that research is to assist. A focus on research institution-building is not likely to be sufficient.

B. Research Should Be Oriented Towards Farmers' Needs and Constraints

The impact of agricultural research on food production is ultimately decided not by researchers but by the farmers themselves, who decide on their farming practices for each crop season. As a background to the following discussion, it is prudent to first review the various factors that the farmers integrate when reaching a decision about the package of inputs and practices they will use in a given crop season. Researchers must be aware of these constraints in order to identify improvements that make sense from the farmers' point of view.

The farmers are knowledgeable about the microenvironment (soil, climate) in which they work, more so than the researchers working at the national or even regional level. The farmers also are well aware of the resources available to their household (land, labor, irrigation, equipment, cash or credit). These resources vary among households even within the same environment, and from year to year for the same household. While farmers may not be cognizant of the details of legislation bearing on agricultural production, they are well aware of current prices and regulations pertaining to agricultural inputs and to the marketing of their crops.

Farmers, functioning as managers, integrate the information available to them on the various constraints described above and choose the strategies best adapted for their particular circumstances, goals, and incentives (Figure 2). These differ among the farmers and the researchers. Traditionally, researchers use yield as the standard of success: the higher the yield, the better the research. Yield is not the only standard of success for farmers. They have more complex goals: to achieve maximum well-being for the household and, in the less favorable climates, to avoid a catastrophic series of crop failures. This means achieving the best possible combination of sufficient food and sufficient income while avoiding excessive (economic and human) costs and risks of production.

Incentives also differ between farmers and researchers. To be respected by his peers, a farmer must first be a good provider and, if possible, better the household's economic status. Putting one's entire fields into a new variety which could yield a bumper crop but could also fail would be considered irresponsible. There is no need to call upon some "risk aversion" inherent to farmers in the LDCs, for this is perfectly in line with Western principles of good husbandry.

For a researcher, however, reaching higher yields under experimental conditions is a recognized way to make his name known and obtain the consideration of his peers. A crop failure is an expected but temporary set-back and does not influence his salary or the food available to his family. The researcher's training influences the type and level of sophistication of research activities he or she would like to undertake.

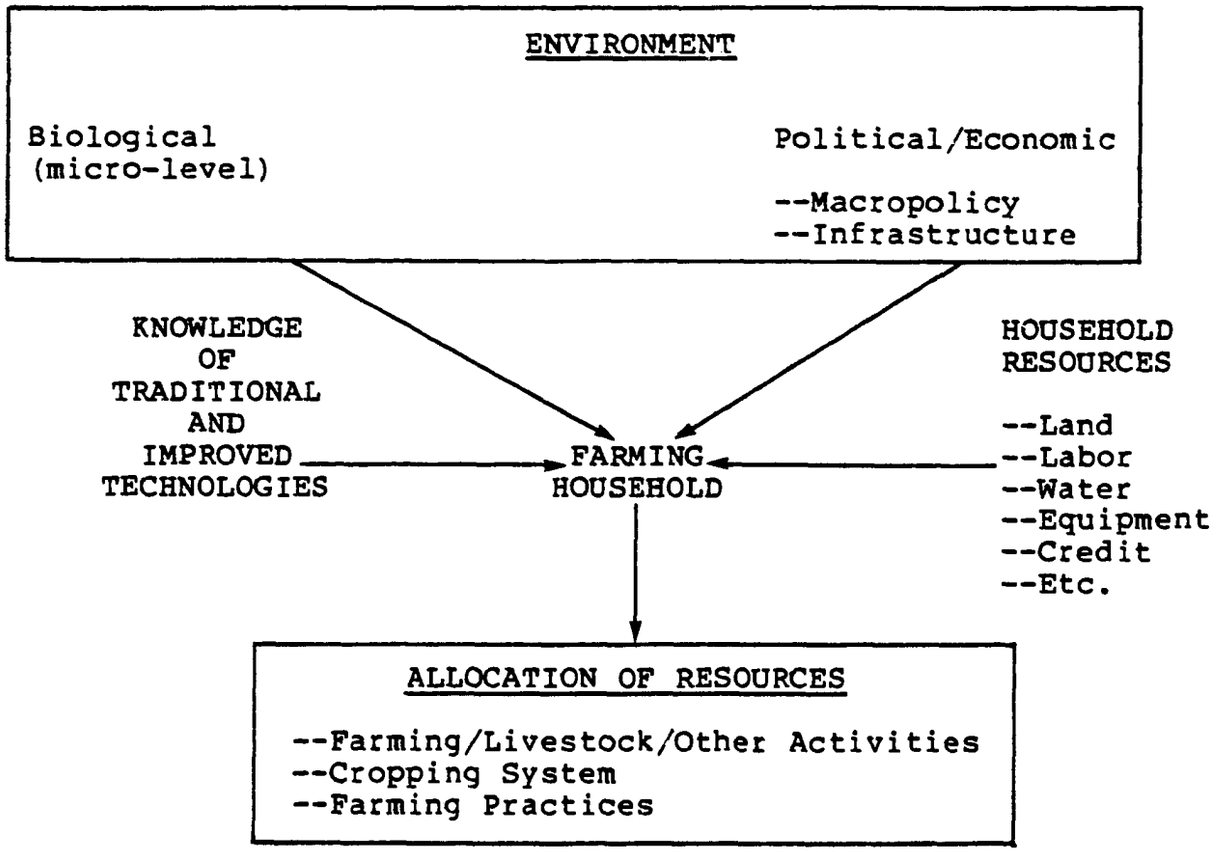
The goals and incentive structure of the researchers determine the research programs in which they would like to participate, although in many research systems the researchers are limited in their choice of activity by administrative and funding constraints. But the goals and incentive structure of the farming community determine which of these findings have a chance of adoption. Were the researchers to become aware of the goals and incentives that apply to the farming community, the research programs would become more effective.

Investments in agricultural research are more likely to achieve their optimal rate of return if the research programs are established as follows:

-- Researchers and decision-makers are made aware of the farmers' priorities and constraints.

-- The research program is integrated into a broader plan for agricultural development, so that all necessary services are available.

Figure 2. Changes in Farming From the Farmer's Point of View



-- There is a systematic information feedback mechanism among researchers, extension agents, and farmers.

-- The research focus is on identification of improved "modules," components that can be used alone, rather than on an improved package that only works well as a unit.

-- Research findings are tested in real farm conditions.

Such a research program cannot be implemented by agronomists isolated in a research station. Farm-oriented research requires an interdisciplinary approach, with agricultural economists and sociologists/anthropologists joining an array of technical scientists. It also requires working outside the experimental stations with the farmers, to ascertain their needs and constraints and to have them test suggested improvements in real farming conditions.

A number of lessons for the design and implementation of research activities and for the desirable structure of the research institutions which derive from this situation are illustrated in the impact evaluation reports.

1. The Impact of Research on Food Production

One has read frequently of the miracles of the Green Revolution over the last 20 years, and indeed AID's experience includes success stories of research results being quickly adopted and leading to increased productivity and to positive economic returns for the country. These stories are often mitigated by some drawbacks in the actual impact of improved technology, which make them all the more worth considering for lessons learned. Among the impact evaluations, Tunisia, Korea, and Kenya are examples of particularly widespread use of research results.

The Tunisia Wheat Development Program, which sought to adapt wheat varieties developed by Mexico's Center for Maize and Wheat Improvement (CIMMYT) to the Tunisian environment and climate, was implemented to counteract the decline in wheat production resulting from the departure of the French estate farmers at Independence. The program was successful in both technical terms (development by Tunisian scientists of new varieties during and after the project) and economic terms. Some of the new varieties, which were quickly accepted, have led to an overall increase in wheat production of more than 5.3 million metric tons for the 11 years 1971 through 1981, compared with the previous 11 years. Despite population growth, annual per capita production of cereals increased from 104

kilograms in 1970 to 160 kilograms in 1980. The evalution team calculated that the increased production saved the Government of Tunisia almost $126 million a year in grain importation costs.

This is not to say that Tunisia has become self-sufficient in cereals, a goal which the evaluation team calls illusory, pointing out that the best utilization of natural resources is more important than a drive for self-sufficiency.

Several factors which facilitated success of the program in Tunisia should be noted. First, the need and opportunity were clear for increasing production of the staple food at a time when the foreign estate owners had left and land was being redistributed. However, early Government attempts to organize cooperative cultivation of the estates failed, and the rate of adoption of improved technology did not increase until individual farms became the norm. The evaluation team identified two key factors in the success of the program--a strong research-extension link and the training component. The training component assured the sustainability of the research effort, and indeed the varieties developed by Tunisian scientists after the project had ended are now the most used.[13] The high rate of adoption, however, is attributed to good coordination and feedback between research and extension.

Lesson 1. A two-way information system between the researchers and extension service and the farmers is essential in programming and implementing research activities.

This lesson goes beyond the recommendation found in every one of the eight impact evaluations that research and extension need to be more closely linked. This may seem obvious since there is no point in developing improved technology for farmers' use if there is no coherent effort to inform them of its existence or of how to use it. Yet, making research results available to farmers is not always easy, especially when there is little cooperation--or even outright rivalry--between the research institutions and the extension service of a country. However, if a new technology is worth using, the first farmers who learn of it will pass on the word and the adoption rate will likely be high and fast, with or without further intervention by the extension service. This was clearly shown in Kenya. Awareness of a new technique, however, is not sufficient to ensure its proper use.

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[13]Lessons for institutional development are discussed in Section III.D below.

It also is important that researchers be informed of how farmers are receiving the new information, what reasons they give for not adopting the extension agents' recommendations or for adopting only part of them, and eventually how they modify these recommendations for their own purpose. The researchers should be involved in obtaining feedback from the farmers.

In addition to Tunisia, this lesson is particularly clear in the case of Korea, Kenya, and Nepal, for different reasons, each of which provides additional lessons learned:

-- In Korea, success was assured by a strong extension service.

-- In Kenya, success was made possible by the technical simplicity of the research findings and by the availability of needed services (through the private sector).

-- In the Nepal Plain, success was hampered by the complexity of the recommendations (technical package) and by the insufficiencies of support services, a clear reverse of the Kenya situation.

The Korea evaluation found that a significant increase in production (due to widespread adoption of a new rice variety) could be attributed partly to the fact that research and extension are closely linked. Improved varieties of rice have been widely adopted; their use has increased from 16 percent of rice acreage in 1972 to 60 percent in 1979. The Tongil variety in particular has become ubiquitous because it yields more than previous varieties under farmers' conditions. This rapid increase is due in great part to the extension service, which is effective and very comprehensive. The team cited "the integration of research and extension" as a key to the project's wide impact. Extension activities included the monitoring of farm trials, training programs, and demonstration plots.

This widespread use of Tongil, which even led to a decrease in cultivation of other crops, was also the result of a higher official farmgate price for rice. While these were positive economic results for the Korean farmers, the use of Tongil rice also made them more dependent on that one source of income and therefore more vulnerable. Since 1977 the profitability of Tongil has decreased as yields declined because of the occurrence of rice blast disease and several years of unfavorable cold weather.

Lesson 2. A simple change in input or practices is more likely to be quickly adopted than a complex technical package.

Kenya is a clear example of the introduction of a technical improvement, a high-yielding hybrid maize, which was quickly accepted by the farmers because it fitted easily into their traditional practices and did not change the schedule of farming activities. Simply switching to the hybrid resulted in higher yields. Many Kenyan farmers promptly adopted the hybrid, even though new seed had to be bought each year. The evaluation team hypothesized that the farmers could assign less land to maize, their staple food crop, and still assure an adequate food supply for the household. That left available land that could then be used for a cash crop. The introduction of hybrid maize enabled Kenya to become self-sufficient in that crop for the first time.

The same rapid rate of adoption is likely when a new package of practices is obviously beneficial to the farmers, as was the recommendation in Guatemala to lower seed density and fertilizer rate.

Lesson 3. Support services must be available to the farmers.

The rapid rate of adoption in Kenya and Guatemala was facilitated by a concomitant improvement in needed support services, so that seeds and other inputs were available to respond to the increased demand. In both cases, the bottleneck in seed multiplication and input distribution was avoided by the involvement of the private sector. In Kenya, seed multiplication was taken up by the Kenya Seed Company. Because hybrid maize seed must be renewed each year, the company is assured of a steady market.

In Guatemala, seed multiplication and distribution has been transferred from the State to private growers. The Institute of Agricultural Science and Technology (ICTA) is involved in quality control only for the first generation, and it rents its processing and storage facilities to the growers. The first generation seed is sold as "ICTA certified," but there are no controls for second generation seed, a potential danger. For the time being, the evaluation found the multiplication and distribution system effective and calculated "that seed developed by ICTA was worth at least $10 million to Guatemalan agriculture in 1979, compared to the ICTA budget of $4 million.... Seed sales considerably decrease the Guatemalan foreign exchange levels previously spent on seed import.... [In] the

coastal area ... 95 percent of the farmers now use ICTA-developed varieties, compared with less than 50 percent in 1975 using improved varieties."[14]

Often though, the situation is more complex. The farmers may want to adopt some new technology but find it difficult because the necessary ancillary services are not yet available (or not sufficient). This can occur for high-yielding variety seed multiplication and distribution; the availability of inputs, especially fertilizer; and the availability of water, machinery, repair services, and storage, processing, and marketing facilities.

The farmers also may be selective in adopting improved technology and practices because of conflicts with other farm or household activities.

Lesson 4. The project designers and researchers should understand the existing farming system and be aware of local agro-ecological conditions and of the resources available to the farmers as they establish the research program. This requires an interdisciplinary effort.

Throughout the impact and routine evaluations, there are numerous examples of research activities producing results which are technically perfectly valid but which are not adopted by the farmers as expected. Insisting, as did a Nepalese researcher during an impact evaluation, that "those farmers simply have to be convinced [to use higher doses of fertilizer]" is not constructive.

The impact evaluations showed that awareness of improved technology is not a problem. In addition to the diffusion of information through the extension services, including eventually radio programs and leaflets, information can be spread quickly by word-of-mouth among the farmers themselves. Awareness however, does not guaranty understanding of correct utilization of a new input or practice, not does it guaranty its adoption.

In the case of Nepal, the evaluation team found that farmers in the Tarai plain were well aware of the advantages of fertilization. They also quickly understood that application of fertilizer on wheat was not profitable if one could not be sure that water also would be available on time. Many farmers, having learned the hard way that they could not control the timely availability of water, cut back on the use of fertilizer. This was true in some areas not because of the lack of

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[14]Report No. 27, p. 7.

irrigation facilities but because of frequent power shortages during which the irrigation pumps could not be used. Furthermore, the high-yielding wheat varieties perform best if planted in early November, a time which conflicts with the rice harvest. Therefore wheat often is planted too late, and fertilizer application would not offset the loss in production potential because of late planting. Finally, the distribution system for seeds and fertilizer, which is controlled by the Government, is not efficient and has not been able to respond to the increased demand in the plain. The situation is much worse in the hills and mountain regions, where transportation is exceedingly difficult.

These constraints have not prevented widespread adoption of improved varieties--acreage in high-yielding rice varieties increased from 0.6 percent in 1965-1966 to 25 percent in 1979-1980, and for wheat from 4 percent to about 85 percent in the same years (wheat is a new crop for most farmers). These constraints did however, prevent the farmers from adopting the entire technical package, and therefore from reaching the expected yields.

Another example of the selectivity of Nepalese farmers was found with maize. The improved varieties of maize yield more than the local strains, and the farmers know it, but the ears do not keep as well. Many producers compromise by planting part of their land to improved maize for immediate sale as a source of cash income, and the rest to local maize for household consumption.

It is not the farmers who need to "be convinced," but the researchers who must look for improvements which are effective in real farm conditions, taking--as the farmers do--the entire set of resources, priorities, and environment of the household into consideration.

Two of the impact evaluations looked at projects using such a farming system approach, and both are optimistic regarding the project impact on food producers. The Guatemala evaluation lists this as its first lesson learned:

> "Farming system research" has been almost romanticized by some students of agricultural research. This evaluation serves as one of the first studies to bring hard data to this new topic. The ICTA approach to technology development demonstrates clearly the positive benefits derived from this unconventional approach for generating acceptable small farmer technologies and practices.[15]

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[15]Report No. 27, p. 12.

The evaluation of the small farmer cropping systems program coordinated by CATIE in Central America also emphasizes that the system approach was conducive to the development of the improved technology adapted to farmers' needs. Having established this factor, both reports make specific recommendations for assuring maximum effectiveness of a farming system strategy. They emphasize the need for feedback from the farmers to the researchers and for more active involvement of the farmers than simply allowing use of their land for on-farm testing. They also specify that such research can be conducted only by an interdisciplinary team with technological, economic, and sociological expertise. The implications of these recommendations for institutional development will be discussed in Section D below.

2. The Impact of Research on Farmers' Well-Being and on Rural Equity

Technical improvements by themselves should not be expected to lead to a more equal income distribution among the population. Macropolicies, especially land tenure rights and access to means of production and support services, will determine which way research results will influence income distribution. These resources vary among households even within the same environment. This is perhaps the most complex of all problems faced by the researchers, as improved technologies often assume the availability of resources, such as water, which not all households can obtain, and may require an intensification of land use, thereby increasing labor and input requirements. These technologies, by their very nature, may be practical only for the better-off households.

The question of equity, i.e., giving all farmers equal access to benefits from the project, is difficult for several reasons. Governments often place a higher priority on assuring the food supply of the urban populations than on bettering the income distribution among farmers. It is also a difficult question from a technical viewpoint because many new or improved farming technologies simply are not efficient on a small scale, or demand a level of investment in tools, inputs, water, or labor beyond the reach of the smaller farmers, especially those who are tenants.

In Nepal, farmers with some irrigated land have had immediate advantage over those with only rainfed land in using the improved varieties of wheat and maize. Farmers who were better off in the first place were more likely to be able to finance the necessary inputs. Tenant farmers were disadvantaged because they did not qualify for credit to buy inputs, and probably had less incentive to invest in the land.

Even in Kenya, where the overall output of maize was greatly increased as a result of research, the impact on equity within the country probably was negative. Disparity increased between the large and small farmers because the smallest farmers were reluctant to adopt the hybrid. Their main concern was to minimize the risk of crop failure (which the hybrid maize did not do) rather than to increase production. In addition, they were not able to finance inputs; even the need to buy new seed each year was a problem.

In contrast, the project in Korea contributed positively to equity among farmers because of the price subsidies provided by the Government and relatively equitable land distribution.

Lesson 5. Technological improvements can sharpen inequity among households with different resource bases.

The Tunisia report describes a mixed equity impact for the Wheat Project. On one hand, farms of all sizes gained access to more productive technology and reached higher yields. The more intensive mode of production has made mechanization more profitable; this does not necessarily lead to a negative impact on smaller farms that are too small to support capital-intensive farming, because some small farmers invest in heavy equipment and work other farmers' land as well as their own. On the other hand, the report mentions a decrease in labor demand in rural areas and a rural exodus, especially among younger people. The evaluation team especially raises the issue of negative impact on women, because of changes in labor demand, and on the nutritional status of the family. The increase in overall cereal production has been accompanied by a shift from hard wheat to bread wheat varieties, with a subsequent nutritional loss.

Lesson 6. Technological improvements can have both positive and negative impacts on a rural household's income and well-being.

As the Tunisia case has shown, one should remember that an increase in production of one crop does not necessarily lead to better overall well-being for the household. When a farmer switches to a high-yielding variety, the cost of production usually increases, and more labor is required from the family and eventually from hired labor. The opportunity cost of land and labor should be taken into account, as often a change in farming practices will force the household to cut down on some other income-producing (or expense-saving) activity. This may be especially true of women's activities.

These changes in turn influence productivity, food supply, income, and pattern of land use. There will be consequences both at the household and the community level.

The impact evaluations did not look specifically at the projects' impacts on consumers. However, the projects may have influenced the food price structure through increased production and also through changes in cropping systems. A shift in land use toward a crop (e.g., rice) or a variety that is especialy in demand in urban areas is likely to benefit the urban consumers, although not necessarily the poorer ones.

3. Conclusions

Lessons 1 to 6 describe the type of research which is likely to be most effective in meeting farmers' needs and in leading to increased production. One further lesson derives from these: the research institution must be given the means to implement a research strategy that focuses on the farming system as a whole as well as addresses the technical problems of commodity production. Institutional development is such a crucial component of AID assistance to agricultural research that it will be discussed in a separate section (Section D below), but this section has already established the need for interdisciplinary expertise and for the material and human resources to establish on-farm testing and to gather baseline data. This section has also established the importance of close coordination between research, extension, and agencies involved in support services, as well as training institutions that take research requirements and findings into account in their curricula.

This does not mean that farming system research is the only effective type of research program and therefore the most worthy of investment. The need for basic research programs and commodity-oriented programs will remain, but such programs are more likely to lead to useful results if they are planned in conjunction with farmer oriented research.

The next section will focus on the impact of national policies and economic environment on the programming of research activities and on the utilization of research results.

C. The Utilization of Research Findings Is Dependent on a Favorable Political and Economic Environment

Nothing in development occurs in a political and economic vacuum, not even scientific research in a laboratory. This basic fact pervades AID's experience with research projects, as the mandate of research institutions changes over time, as budgets and human resources ebb and flow, and as extraneous constraints impede the utilization of research findings.

1. Technological Solutions Alone Cannot Solve Problems Which Are Basically Economic in Nature

The successes--albeit mitigated--discussed in the previous pages should not hide the fact that technological constraints are but a few of the factors that influence food production, and that technological solutions should not be expected to solve economic problems. Examples of such factors are present in all the impact evaluations, but they may be most clearly stated in the West Africa Rice Development Association (WARDA) evaluation. The team has shown that the original mandate of WARDA emphasized solving the technical problems of rice varieties suitable to the ecological conditions of West Africa, when in fact indigenous rice production was discouraged not only by the lack of such varieties, but by pricing and marketing regulations.

Lesson 7. Government policies and infrastructure determine, in part, whether farmers will adopt improved technology and practices.

Section B has shown that the farmers act as managers in selecting production strategies and therefore take into account the macropolicies which determine price, net return, and marketing opportunities for their crops. The farmgate and consumer price of food and other agricultural commodities; price, quality, and availability of inputs; efficiency of marketing systems; foreign trade regulations; and land tenure are all potential constraints on farmers' decisions that are affected by government policy.

This means that the researchers should be aware of existing policies and may eventually try to influence them. It does not mean that research findings are doomed if policies are not favorable or if the required support services are not available; in many countries, both developed and less developed, a new technology can spread and stimulate the necessary changes or additions to existing infrastructure and services. Thus, in Europe, farmer cooperatives were created when the farmers

became convinced of the advantages of using fertilizer but were disappointed with the quality of the existing distribution services. In India, the availability of new wheat strains stimulated the development of a fertilizer industry and the multiplication of irrigation systems.

The breeding of new maize varieties in Kenya led to the development of seed multiplication and distribution by the private sector. In Tunisia, the spread of improved wheat cultivation was hampered at first by the Government policy of cooperative cultivation of the estates previously controlled by foreign colonists. Only when the Government backed off and allowed private cultivation did modern technology spread.

In other projects, for example, in Nepal, the unreliability of input supply has hampered the adoption of improved technology (see Section II.B).

2. Host Government Commitment Is Essential

Lesson 8. Real, long-term commitment to agricultural research on the part of the host government determines the sustainability of a research project and utilization of its findings.

No matter how productive a research station may have been during the implementation of a project, and even within a favorable policy environment, the ability of an institution to sustain research activities on its own is a function of the host government's commitment to research. This is basically what determines whether the research institution will be given the human, financial, and administrative means to pursue its activities. The commitment of the host government also determines how research activities will be programmed and whether related policies might be revised to facilitate the utilization of research findings.

The research institutions in Kenya and Thailand suffered from the lack of such support, expressed through insufficient staff allocation in Kenya and through the uncertain legal status and changes in mandate of the Thailand Center. In both cases, the teams found that research activities could not continue at the same pace after the departure of the project's technical assistants.

The very success of the Korea project is attributable in large degree to the commitment of the Government, which gave agricultural research and extension high priority. Research stations existed and were already effective prior to the AID project. Its program to increase the production of rice and

other crops was conducted with the full support of the Government, which revised its pricing policy for rice to encourage widespread use of improved varieties and to increase the farmers' incomes.

Routine evaluations frequently mention inadequate host government support for the project as resulting in implementation difficulties, while the impact evaluations have focused more on the impact of host government commitment on the long-term effectiveness of the research institution. Among the routine evaluations reviewed for this study, there was a clear correlation between inadequate support and a "less than satisfactory project performance" rating (17 of the 23 projects with inadequate support were found unsatisfactory). The effect of inadequate support is immediately visible through the lack of counterpart personnel, delays in procurement and management, and delays in identification of candidates for training.

A consequence of this after the project has ended is the inability of the research station to maintain an adequate staff and sufficient equipment. (Lessons learned on this issue are presented in Section D since they are pertinent to institutional development.)

Lesson 9. Agricultural research programs should be planned within the broader rural development planning.

This integration of rural development and research planning (but not necessarily implementation) will help ensure that priorities are set up for research activities according to national goals and that there will be coordination among research activities and other development activities that influence the impact of research, such as extension, the provision of inputs and credit, and marketing channels.

It also will facilitate the phasing of various actions, including the effects of changes in policy and regulations on prices of crops and inputs and on marketing. Development, after all, is the systematic elimination of limiting factors.

Perhaps the effectiveness of an integrated approach to research and agricultural policies is best demonstrated in the Korea project. The Korean Government showed its commitment to research by establishing a network of competent research stations, by assuring a productive collaboration between research and extension, by assuring the availability of required support services, and by revising its pricing policy for rice, as needed, to encourage farmers' adoption of a new improved variety. This resulted in a rapid spread of the new technology.

Lesson 10. A dialogue among politicians, administrators, and researchers will greatly increase the likelihood of adequate support to research; the potential benefits of research for the host government should be made clear.

No government should be expected to commit its limited human and material resources to an activity for which it cannot foresee a benefit for the country or for itself. In other words, researchers should not expect a continuous flow of resources if they do not show some results which the government can understand as economically and politically beneficial to itself, and this within a fairly short time. A problem is likely to occur if a station expects many years of support before it has anything to show for it.

The farming system approach or problem-oriented research which has been found most effective in AID experience may require a larger staff than traditional on-station research did, but it also is more likely to show some rapid results, as researchers propose solutions to problems identified by farmers and extension agents. It can speak for itself more quickly than basic research does.

The workshop participants, especially the host government officials and the AID field personnel, were keenly interested in finding ways to demonstrate to the host governments the potential benefits of such research programs, and they emphasized the need for a continuous dialogue among politicians, administrators, and researchers during research programming and resource allocation, as well as during project identification and design.

However, this should not obscure the fact that few countries could possibly assume the recurrent costs for all of the development activities that are currently under way with AID or other donor-institution assistance; this is particularly true in the African countries which are presently in most need of developing their agricultural research capacity.

D. Characteristics of Effective Agricultural Research Systems

The importance of adapting the research program to farmers' needs and constraints and of devising policies and support services that facilitate the adoption of improved technologies have been established. The next questions that need to be answered are what kind of administrative structure is more likely to achieve the desired results, and what kind of staffing pattern is necessary? This section will discuss training and institutional issues, as well as the mechanisms for coordination among research and development institutions.

All the projects selected for an impact evaluation included a component for training and institution development at either the regional or national level. Whether the research institutions are functioning adequately after the project has ended is a crucial element in determining the sustainability of the project achievements. There are also sets of issues recurring in the evaluations: the location of the institution within a country's administrative system and within the research community, and the staff and resources allocated to the institution.

1. The Effectiveness of an Institution Depends on Its Place in the Administrative Structure and the Resources It Receives

A well-trained body of researchers will only be as effective as the institution they work for. Furthermore, the more motivated and competent researchers will not remain in an institution that does not allow for professional growth and satisfaction.

Lesson 11. The mandate and authority of a research institution must be clearly defined and agreed upon with the host government.

Institutional issues were found to be a problem by most of the impact evaluations; although the case of "bureaucratic impotence" described in the Thailand report may be extreme, it does illustrate how the lack of administrative authority can hamper the effectiveness of an otherwise competent and well-equipped institution. Conflict between the Research Center and the central Ministry of Agriculture "created an atmosphere in which much research done at the Center is rejected out of hand by the [Ministry] and often has to be redone in order to be acceptable. Declining budgets, loss of coordinating authority, frequent institutional redefinition, and loss of status and professional autonomy have combined with previously mentioned factors to defeat efforts to build a major research capacity in Northeastern Thailand."[16] One of the sources of the problem became evident early during project implementation when the Government postponed giving the Center the proper legal status. The report points out that AID structures and procedures in project design and implementation did not encourage a revision of the project after the project had started; the negative effects became clear after the project itself had ended.

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[16]Report No. 34, p. iv.

Similarly, the East African research institution faded away when the technical assistants left because the host countries had not provided adequate staff and support to assure its sustainability.

Implementing a project through an institution outside the line ministry could be a temptation in many countries, in an effort to assure more autonomy to the project staff. This was the case in Tunisia, and it did in fact facilitate project implementation. There is a danger of insufficient communication between the research institution and entities involved in agricultural development that could hamper the development of a long-term, self-sustaining research capacity. This is not happening presently in Tunisia because of good personal contacts and exchanges among scientists in the various entities involved in research, partly because those individuals have been trained together and know each other well. This is fine as long as it lasts, but it does make the research institution vulnerable, since these exchanges have never been formalized.

2. Institutional Development and the Concomitant Training of Scientists Is a Long-Term, Complex Process of Critical Importance to the Sustainability of a Research Project

The training component seems to have been achieved successfully in all the projects evaluated except perhaps Kenya, but keeping the trainees on the job after their return has been more of a problem.

Training is considered a major benefit in many development projects, especially for the attainment of scientific degrees which could not be obtained locally in many countries. One should not, however, think automatically of a Ph.D. from a U.S. university when talking about training. In-service training, short-term technical courses, and even observation tours and participation in professional meetings can be of great advantage to the trainees, as well as the formal M.S. and Ph.D. degrees. The workshop participants recommended that AID be particularly flexible in its approach to training. There are great variations among host governments in their training needs, which depend both on the planned research systems and the number and level of training of existing researchers.

There are three key aspects in training: the level and scope of the training program, its timing and scheduling, and its location.

Lesson 12. Training should be adapted to needs.

Training is likely to be needed not only in the traditional areas of expertise related to technical aspects of agricultural research, but also in disciplines of the social sciences which are necessary if the socioeconomic factors that influence development are taken into account in the research program. In addition, training in management is often cited as important, as many researchers are given extensive managerial responsibilities.

M.S. and Ph.D. training is by definition a long-term process. A Ph.D. may require that a candidate spend three to four years out of the country, even if the thesis research is done in-country. Remedial courses and language training can make the process even longer. If one takes into account the time necessary for identifying suitable candidates and getting them accepted in a U.S. university, this becomes a major enterprise, longer than the timeframe of a development project.

There is indeed a major timing difficulty in projects that combine long-term training abroad and technical assistance. More often than not, the technical assistant is not providing in-service training to his counterpart, he is conducting research until the counterpart comes back to "sink or swim."

Providing training assistance outside of a specific development project would help solve this difficulty. AID has done this in the past, and is currently funding such a program in the Africa Bureau, albeit on a small scale.

Where training is provided is also an important factor. AID restrictions against training in developed countries outside of the U.S. are a problem, especially for trainees from non-English speaking countries. Workshop participants encouraged emphasis on arrangements through which trainees who have completed course work can return home and do thesis work in the environment and on the type of problem they will deal with in professional life.

Lesson 13. There should be official linkages and feedback mechanisms among institutions and government entities with responsibilities in education, research, extension, and the provision of services.

In Section B, it was shown that feedback mechanisms from extension to research and among research, extension, and the service providers are important to an effective research program. This also means that feedback should exist to the educational institutions in agriculture and the social sciences, which must adapt the curricula on research, extension, and agricultural development courses to the expected needs of

dealing with these activities. This is essential as the country becomes less dependent on training opportunities offered through donor institutions.

Lesson 14. The scheduling of training and that of technical assistance should be complementary.

Routine evaluations, which focus on implementation problems more than impact evaluations do, frequently mention scheduling conflicts between the training and technical assistance components of a project, where the technical assistant leaves when his "counterpart" returns from training abroad. Preproject training was strongly recommended by the workshop participants and is now encouraged, at least in the Africa Bureau.

Lesson 15. Trainees should be assured of satisfactory material and professional awards.

Staff attrition has been found to be a problem, at least in Kenya, Guatemala, and Nepal, in great part because researchers are given a status and payscale different from that of civil servants. If, in addition, professional rewards are insufficient because the researchers have no say in the selection of research topics, or must work with unsatisfactory equipment, the danger of staff attrition is indeed great. Training abroad is considered a great reward, but the returned trainees who face difficult working conditions and low pay may soon be tempted to move on. Warnings are raised on this subject in most of the eight evaluations.

3. Linkages Among National and International Research Institutions Are Essential

No research institution can be fully self-sufficient, nor should it try to be so. This is especially true of national research institutions which have limited human and material resources at their disposal.

Lesson 16. National research institutions should not work in isolation.

For reasons of research effectiveness and professional satisfaction of the researchers, all the impact evaluations (except Kenya) emphasized the absolute necessity of establishing effective coordination mechanisms among the various government institutions related to agricultural development, including the research institutions, and more specifically between the research institutions and the extension services. In addition, the importance of coordination and exchange of information between research stations within the country as well as with regional and international institutions was emphasized.

The evaluation team in Guatemala found that "ICTA's links to international agricultural research centers and to U.S. centers of technology expertise were highly productive. Technologies and concepts from these centers were applied in Guatemala, and through these same centers the Guatemalan experience is coming to the attention of other countries around the world. Both AID as an Agency and its Missions within each country should be aware of the capabilities of research centers and consider ways to make use of these resources in future research and development efforts."[17]

An effective means of coordination has been the creation of working groups in which representatives from the various agencies and institutions regularly exchange information on achievements and future plans. For example, in Nepal, where research stations are specialized by commodity, yearly workshops enable the researchers to present their findings to their peers, discuss each station's future program, and coordinate some common trials. The Cropping Systems Working Group in Asia has become a much appreciated means of communication among national scientists in the region.

Lesson 17. An international research entity can provide very useful assistance to national research systems.

This is verified in the impact evaluations which assessed the impact of international institutions (CATIE in Central America, WARDA in West Africa), as well as the evaluation of the Tunisian national system, which greatly benefited from CIMMYT assistance, and that of the Guatemala institution.

The CATIE evaluation also found that exchanges of information and coordination among institutions were useful, and it calls for "maximum collaboration and information sharing . . . among related projects and programs." It does point out, however, that such "collaboration and synergism" pose difficult managerial problems.

The WARDA report raises some interesting issues. It points out that a regional institution "should not be used as a fallback resource when national systems prove administratively inadequate for pursuing . . . development of objectives, but rather as a means to improve the scientific inadequacies of these national systems." Donors should not use a regional institution as a substitute manager for their national development programs, thus preventing the regional institution from assuming its own scientific role. The team did find WARDA to be "a particularly effective quality control, advisory backstop

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[17]Report No. 27, p. 13.

to the national research systems of the 15 countries it serves."

E. Logistical Difficulties Should Not Be Underestimated

While logistical difficulties are to be expected in any development activity, they appear with a vengeance in research projects, which often include large training and commodity components. The very thought of ordering one million dollars worth of scientific equipment, bringing it into the country and getting it out of customs, and respecting the regulations of AID, the host government, and the contractor's institution ought to give nightmares to even experienced project officers. That task, however, is given not to an experienced procurement officer but to the chief of party of the research project, who is selected for the job on the basis of research experience and accomplishments.

Many routine evaluations point out that the chief of party is obliged to neglect his/her research role simply to keep up with--or try not to get too far behind--the managerial tasks of the project team. This can lead to much frustration and bad feelings between the technical assistants and the host government, as both sides are shortchanged in the process.

This situation is compounded in a loan, when logistical support of the technical assistants is to be provided by the host government. Some routine evaluations have recommended that in such a case, AID should assure that adequate logistical support will be available on time, either by budgeting for it or through precedent conditions. This does not apply to normal recurrent costs of the host institution, only to special expenses for the direct benefit of the technical assistants (e.g., housing, transportation, and secretarial services).

IV. UTILIZATION OF LESSONS LEARNED FOR FUTURE AID ACTIVITIES[18]

Lessons from past experience are worthless unless they are incorporated into the planning and implementation of new activities. About half of the Workshop on Impact of Agricultural Research was devoted to small group discussions of how the

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[18]This section draws heavily from the Workshop Proceedings presented in Appendix D. It is not an official statement of AID policy or strategy, but the sum of the experience of the workshop participants.

lessons learned could be incorporated into the design and implementation of future AID activities. The result of these discussions is summarized in Section B below. The discussions were not limited to the design of "good projects." A good project, however one defines it, does not fulfill its development goal if it does not establish a sustainable and effective indigenous research capacity.

A. The Changing Relations Between Host Governments and Donor Institutions

Several formal presentations during the workshop discussed the changing relations between host governments and donor institutions. Mr. Curt Farrar, then Deputy Assistant Administrator for Research with the Science and Technology Bureau, USAID, emphasized that many dimensions of current assistance to research are changing, among which are a decelerating growth of investments in international research centers, increased donor collaboration, a stronger focus on understanding the farmers, an awareness of needed changes in training programs and timeframes for research assistance, and finally a greater interest in assisting national research systems and institutions. More attention is also being given to involving the private sector in technology innovation and support services.

At a time when development concerns are becoming more complex, the mechanisms that provided assistance in the past are becoming less effective. The private foundations whose leadership was at the origin of the international centers network have much reduced their activities in research. The international research centers have accomplished dramatic breakthroughs but must now handle more diversified local needs under less favorable agroecological conditions. The technical expertise of USAID has greatly decreased because of a shift toward managerial staff and an increased reliance on contractors for technical assistance. The international development banks are emphasizing resource transfer rather than development programs.

Professor Vernon Ruttan (University of Minnesota) pointed out that while successful research projects can be found, successful research programs and national systems are rare, and in many cases the development of physical facilities is outstripping the growth of a country's capacity to use the facilities. A disturbing phenomenon is the cycle of rising national research capacity resulting from donor activity, followed by relative deterioration, as may have been the case in Thailand and Kenya.

Donors need to ask if this problem is related to the way they do business or if the donor project system provides perverse incentives to the leaders of national systems. The political systems of most countries cannot be relied on to turn out "good" people. They can be relied on to turn out ambitious individuals, and ambitious individuals respond to organized pressure. Research managers have to learn to marshall political support, and a few national managers have done so. For many, however, donors are easier to deal with than national financial sources, and this discourages research leaders from building the political support essential for a sustained program.

Ruttan pointed out that decisions related to project assistance should be made by criteria of the national system, not by those of the donor system. This is true also of project evaluations. Professor Ruttan proposes a formula by which donor support would be based on increments of national support and so would give the correct incentives. The formula would vary from country to country as a function of both fiscal strength and political will. Under this system, decisions would be left to the host country, the learning process would be rapid, and self-interest would bring increasing productivity.

A second-best alternative would be planning between donors and the host country following the Joint Commission on Rural Reconstruction (JCRR) model in Taiwan. The process of learning and internalizing the management process would be slower under this alternative.

There would be opposition to this strategy, flowing chiefly from the loss of identity of donor contributions. However, many countries would support Ruttan's ideas. Participants from the Philippines pointed out that researchers are grateful when donors negotiate with their Government to increase commitment. Once there is an international contract, it tends to maintain the stability of the research program even through changes in government.

The CGIAR experience has provided some lessons regarding the value of continuity and maintenance of funding, the value of periodic replanning, and the utility of external, formalized reviews. The donors who make up the CGIAR treat their national efforts differently, however. They expect too much, too soon. They need to apply to national efforts what they have learned through the CGIAR.

Professor Ruttan suggested that a Consultative Group for National Agricultural Research (CGNAR) could have an impact on national systems comparable to that of the CGIAR on the international centers. With a five-year planning horizon and a two-

year plan of work that is continually rolled forward, all actors would have a basis for commitment. Donors could set some minimum requirements regarding linkages among research institutions. The CGNAR would consist of two national leaders (one from research and one from planning) and one representative per donor.

The CGNAR may need a group, probably internal to the research system, to provide information and analysis. Donors would need to indicate their intended level of support far enough into the future to allow the national government time to adjust to changes and to provide for security of expectations.

Some regional research has produced good results, but it is often beset with political problems and may have no institutionalizing mechanism. An institution like WARDA, which is independent of national mechanisms, has been found to be especially helpful for training and, surprisingly, for identifying and coordinating micro-level research. Networks of researchers from developing countries could be useful when the country programs really are interdependent. The success of the Cropping Systems Working Group in Asia is encouraging.

While not all workshop participants agreed with Professor Ruttan's proposal, it was generally felt that the role of international centers and regional institutions will change as the capacity of national systems improves. Indeed, the mandate of the International Service for National Agricultural Research (ISNAR), the youngest of the international research centers in the CGIAR, is to provide assistance to host governments in strengthening their own research system, rather than to organize research programs directly. Donor countries are also increasing coordination of their activities, for example, through the Cooperation for Development in Africa (CDA). The United States has taken primary responsibility for coordination of assistance to agricultural research under the CDA.

B. Suggestions for AID Assistance

1. Planning Assistance to Agricultural Research Activities

Throughout the impact evaluations and the workshop, the importance of adequate macropolicies and of government support to the research system was emphasized. Thus, the current emphasis in AID on facilitating policy changes that will encourage food production is supported by past experience. A project must be designed to fit national objectives. This means that there may be country-specific answers to specific issues and situations and that the strategy selected for assistance must

fit the host government's political set-up. The total environment, farm-level constraints, economic policies, and institutional capabilities should be taken into account. A project, or even the AID program of assistance, does not necessarily address all of the constraints identified, but it better be aware of them.

Coordination between the government, AID, and other donor institutions is essential, at this early stage, to determine government commitment and priorities as well as to assess the constraints and resources at hand. The host government should be actively involved in the preparation of assistance programs, project identification, and project design. The issues of availability of counterparts and potential trainees, the capacity of the host government to assure its contribution to projects and recurrent costs, the potential conflicts between a project's timeframe and a realistic schedule and phasing of activities should be discussed with the donor institution very early in the process.

In some countries, this may mean that assistance at the policy and program level will be required first, and that a "critical mass" of personnel, facilities, and management capability (both at senior and junior levels) must be assured before a full research program can be established.

Workshop participants recommended that donor institutions resist the temptation of pushing a research program through by temporarily duplicating insufficient local institutions. Short-term projects run entirely by expatriates make a limited contribution to the national research capacity.

Institution-building and the concomitant training of scientists is an especially long-term, complex process of critical importance to the sustainability of a research project. If an existing institution is to be strengthened, it must be carefully selected and treated as part of the overall administrative system of the country and not as an isolated entity. Training of counterparts for both scientific and managerial tasks is an integral part of institution-building.

Bilateral agreements with developed countries and international organizations are not the only sources of assistance; technical cooperation and exchange of trainees among developing countries should also be encouraged.

However, both the institutions and the host governments need visible results on a rather frequent basis as a justification for continuing assistance and as an enticement to policymakers to reinforce their commitment to the research program and to continue funding. This can be achieved if it is included in the program planning and if the project scientists and managers are committed to it.

A well-run research system can give the government a powerful tool for development if it is used both for technology generation and for problem solving at the level of micro-agroecological regions. Used in this way, research investments can give short-term as well as long-term payoffs.

However, a major difficulty for many donors, and certainly for USAID, is the fragmentation of assistance into relatively short projects. This does not allow adequate planning for most research programs and unduly taxes the host government with requirements for counterpart, support staff, and recurring costs. It is likely that long-term commitments, if only in principle, to agricultural research programs will be more acceptable to host countries at the political and technical level. Mr. Joseph Wheeler, then Assistant Administrator of USAID, was sympathetic during the workshop to the suggestion that AID make a commitment to long-term projects or programs. With long-term approval, funding could still be handled on a project basis. This, however, requires from both AID and the host government a long-term research program with assigned priorities and definite goals clearly tied to national development goals. Such an exercise, by itself, would be extremely beneficial to the research system and to the government, as was shown in Section III.

Since, for the foreseeable future, AID will provide assistance in the form of projects, further recommendations in this report are made within that framework.

2. Project Design

The preparation of project documents is a complex and lengthy process. Negotiations will have to take place between agricultural research institutions and various sections of government, between donor country mission and home office, and between country and donor. The host country may spend six months to a year before a proposal is ready for AID review. It is essential that the project design be as collaborative an effort as possible to attain the support of all parties within both the government and the mission.

Since agricultural research is a long-term endeavor requiring a steady support of funds, donors should consider whether to include funds for operating expenses in the project, and how incentives can be built in for national governments to find sources of long-term support for these increments to the agricultural research system. A realistic assessment of the resources the host country can provide, especially human resources and operating funds, should be made during the project design.

Project design should be influenced more by the implementation of the host country than by the theoretical considerations of the AID administration. As projects go through the various clearance processes in AID/Washington, and each office looks at them from its particular viewpoint, they tend to acquire appendages that may inhibit their implementation. Bangladesh has developed a project implementation document that responds to the project document, but that is related to host government procedures and uses government vocabulary. It may be a useful model for other missions.

Project targets need to be realistic, attainable, and related to the real world and specific country conditions. Perhaps this needs to be reiterated more often in Washington than at the missions. The project designers need to have available an appraisal of the farming technology used in the area and an assessment of the policy and institutional framework of the country. Documents such as the Country Development Strategy Statement and the Social and Institutional Profile, when available, should be complemented with special assessments as necessary.

Indicators of progress at various phases during project implementation should correspond to the target projects. The preparation of good baseline data and a regular monitoring of project progress make it possible to assess progress toward institutional and research goals and to revise these activities during project implementation when inadequacies in planning or unforeseen difficulties are encountered. This requires that the project paper maintain some flexibility in the implementation schedule and program.

Scheduling of project activities as listed in the project paper is often a cause for difficulty, especially those involving training and technical assistance. Training may need to be started well before other project activities if trainees are important to project implementation. Having available a preselected pool of persons who have been cleared by their government to receive training may speed the training process.

3. AID Management of Research Projects

AID's resources (particularly in-house talent and operating expenses) must be marshalled to support project managers in the field. Often managers for country-level research projects have insufficient technical experience and require backstopping to do an effective job. They should have access to training, technical assistance (including consultants), and research networks that permit them to draw on top expertise, both within the country and externally. In regard to technical assistance,

closer relations should be developed between the international agricultural research centers and the missions--perhaps on a more formal basis.

The workshop participants, however, believed that reliance by the project manager on technical backstopping should be only a temporary stopgap. Better research-oriented training of management professionals should be the rule: generalists may not know how to handle difficulties and crises in research implementation. Assignment of AID agricultural professionals should be based on the appropriateness of their language skills, training, technical specialty, and geographic experience.

Ideally, the AID manager should be assigned through the life of a project. The mission participants to the workshop also recommended that the AID manager spend more time on the project site(s) rather than at the mission, and even live in the project area, as should the host country manager.

Flexibility is essential in managing a research project; however, this does not mean disorganization: an appropriate management plan should be agreed upon with the host country and enforced. The workshop participants emphasized that the project manager must clearly and cogently communicate AID regulations to the host country and to the AID contractor. Difficulties too often arise because of lack of information and communication among the host government, contractor, and AID staff, yet it is essential, for the rules and regulations of each institution involved must be respected and eventually reconciled.

Host country managers and/or project leaders and donor counterparts should meet periodically to take stock of implementation. The AID administrators and the AID agricultural professional (project manager) should participate in these periodic monitoring reviews along with their host country counterparts. Efforts should be made to arrange these reviews so as not to duplicate those already scheduled by host country governments. Host country scientists and administrators should make sure that reports of monitoring reviews reach the levels of the research institution and government where plans are made and funds are allocated.

4. AID Evaluation of its Assistance to Research

Research projects usually have a dual goal: they seek to produce specific technological outputs as well as to develop the institutions involved. Both are long-term goals and their accomplishments cannot always be measured adequately within the scope of the project.

Project design is the most critical factor in achieving an effective evaluation program. The design of the project itself is more important to evaluation than the design of the evaluation per se. Project targets should be realistic. Overoptimistic targets make useful evaluation more difficult and exacerbate the antagonisms inherent in evaluation. Without flexibility in the project design, evaluation is much less effective: there is little point in recommending changes in a research program if the project design does not have sufficient flexibility to permit such mid-course corrections without a major redesign effort. The project's institutional placement affects the willingness of host country officials to participate actively in evaluations and in the project itself.

The evaluation design should consider not only the type and scheduling of evaluations, but also the methodology to be used, the composition of the team, and the necessary pre-evaluation preparation. Project information systems must be established from the beginning of the project in order to provide the raw materials needed for evaluation and project management. Data cannot be gathered by the team unless adequate preparation is made.

Finally, evaluation is not an unmitigated good. Evaluations can be disruptive and divisive as well as constructive. This is particularly true when evaluation staff members do not have a technical background sufficient to judge project achievements. The workshop participants made four recommendations to increase the effectiveness of evaluation:

1. Participation by host country representatives, AID mission personnel, AID/Washington managers, and outside experts is critical to evaluation success, if they have the necessary language skills and country experience. Host country participation is essential for meaningful evaluation, despite the political and technical difficulties that this may pose. Effective AID/Washington participation is hampered by the conflict between its personnel's technical skills and administrative duties.

2. Project design should establish a mechanism for sustained evaluation attention. This may take the form of a peer review committee drawn from host country, AID, and other sources. It may also take the form of a contracted, informal arrangement permitting a core group of individuals to be involved in several evaluations over time (regardless of their institutional location). This continued overview would increase both the value of the recommendations made and their acceptability to project staff.

3. Research projects should be flexible enough to allow for changes during project implementation. Project control

must therefore be decentralized to allow the AID mission and host country managers to respond constructively to evaluation recommendations. The research process does not permit complete planning, but requires a flexible response to opportunities as they are identified.

4. Research evaluation requires an explicit methodology and a carefully developed plan to guide team performance. The overall guidelines for such evaluations should be revised and made more available, but this does not obviate the necessity for tailoring this design to specific needs and fully briefing teams on the job they are expected to perform before they go out.

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APPENDIX B

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The Agricultural Research working group was created in December to ensure participation of all AID bureaus in the preparation of the workshop. The participation of the following individuals in all or some of the monthly meetings is gratefully acknowledged.

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PPC/E, Mr. David Steinberg
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APPENDIX C

Executive Summaries of Impact Evaluation Reports

KITALE MAIZE: THE LIMITS OF SUCCESS

AID first became involved with hybrid maize research in Kenya in 1963, through the Organization of African Unity and the East African Community. By 1970, the yield of the original hybrids had been successfully improved by 25 percent under research station conditions. The breeding program was continuously followed with similarly positive results until the EAC broke up in 1977. Other aspects of the A.I.D. program were less rewarding. Research to improve maize protein quality and to develop varieties for low rainfall areas did not succeed. Nor did the attempt to train Kenyans and integrate them into the research operation succeed. When the last American scientist left almost 15 years after the first A.I.D. project began, the effort was not sustained by Kenya.

In 1964, the first hybrid maize seeds were released for commercial production. Hybrids produced a remarkable 40 percent increase in yield over local seed and proved appropriate to the environment of the high potential areas of Kenya, with their fertile soils, abundant rainfall, and moderate temperatures. At the time, it was assumed that African farmers would continue to use the local improved variety rather than the new hybrid--it was less prone to crop failure and it could be re-used year after year whereas hybrid seed had to be re-purchased each year. But the hybrid was clearly superior in yield, enjoyed the status of a crop used by large farmers, and small farmers soon demanded it. By 1977, the majority of smallholders in high potential Central, Rift Valley and Western Provinces grew hybrid maize and their production far surpassed large farmer output.

An aggressive private firm, the Kenya Seed Company, reproduced the seed, distributed it, and promoted it throughout the country via a network of private shopkeepers. Extension agents demonstrated the use of improved cultivation techniques. The government-supported official prices and marketing system provided incentives, particularly for large farmers, to adopt and profit by the hybrid technology.

Innovations are usually unfair in the sense they reward those who have the means to benefit from them. Consequently, it is not surprising that hybrid maize was of greater value to those farmers with sufficient land, labor and capital to fully utilize the innovation. More surprising is the large number of smallholders who did gain access to the hybrid maize technology and who have improved their food security as a result. The overall impact of the increased maize production attributable to the use of hybrid seed is that Kenya has continued to be more or less self-sufficient in maize, the country's staple food. As a result, Kenya, despite a very high rate of population growth, has not had to face some food policy problems which have confronted other developing countries. Without hybrid maize, population pressure would likely have led

to a demand for more land for food crops and a reduction in less essential export crops. Hybrid maize helped to keep the price of food down in the cities, thus muting the pay demands of urban workers and keeping Kenya attractive for foreign investments.

There is a question, however, whether the government saw the increased production of maize as more of a problem than an opportunity. The government continued a pricing and marketing system more suited to dealing with the problems of scarcity than those of abundance. The Maize and Produce Marketing Board responded to an obvious need for increased storage capacity, for example, with too little, too late. Nor did the government take adequate measures to ensure the continued success of hybrids by: guarding the flow of critical inputs, including sufficient credit and chemical fertilizers; and being supportive of the research facilities which made the hybrids possible. The loss of the incremental benefits which the A.I.D. project demonstrated were possible by improving hybrid seed year to year, cannot be calculated--but based upon the benefits derived from the program in early years, the loss is substantial.

Smallholders have not yet exerted policy influence on the government (as did the European-dominated large farm sector prior to Independence) by forming effective organizations of their own. If government policy toward maize is to become more effective, it will require not only better long range planning but wider popular participation, especially among smallholders, in its formulation.

From the experience of hybrid maize in Kenya and from the observations of Kenyan maize growers and consumers, an A.I.D. evaluation team drew seven key lessons:

1. Simplicity and viability were the decisive factors in the success of hybrid maize.

2. The private sector was crucial in the rapid diffusion of hybrid maize.

3. Perfect equity cannot be expected even from the most successful technology.

4. The long-term continuity of foreign experts was basic to the success of the breeding program.

5. Foreign advisors and finance do not automatically create institutional capacity to perform agricultural research.

6. Pragmatism and skepticism should surround A.I.D. support for regionalism.

7. Too many lessons should not be drawn from a unique experience in one African country.

Central America: Small-Farmer Cropping Systems

The small-farmer cropping systems research project in Central America was selected for evaluation as part of A.I.D.'s effort to assess the impact of its activities in several development sectors. Field work for the evaluation was done in Costa Rica, Guatemala, Honduras and Nicaragua by a six-person team in February 1980. The findings and interpretations are those of the team and pertain only to this project. However, they will contribute to a forthcoming analytical report for the agricultural research sector as a whole.

In 1975, AID's Regional Office for Central American Programs (ROCAP) began support to the Center for Tropical Agricultural Research and Training (CATIE), located in Turrialba, Costa Rica, to develop and test "a coordinated regional research approach for improving the cropping systems of small farmers in Central America." CATIE agreed to negotiate working arrangements with the principal agricultural research institutions of the five Central American republics. These arrangements were to provide for CATIE and national scientists to collect survey data on the cropping practices and crop yields of the peasant farmers as well as data on their socio-economic environments. Then the scientists were to work with representative farmers by setting up experimental plots designed to test and evaluate alternative crop combinations for their potential in increasing production and income.

ROCAP undertook this project with the expectation that CATIE would develop and demonstrate an innovative multidisciplinary methodology for doing research on the cropping systems of the small farmers of Central America. It hoped to mobilize a permanent regional institutional capacity and commitment for on-farm research and training addressed to the needs of this vital sector of rural society. It also expected to see CATIE produce, through the project, improved cropping systems alternatives for different ecological zones of the region that might be suitable to rapid verification and dissemination by the national institutions. Its longer-term goal was that as farmers adopted these proven, improved systems the total yields from small farms would significantly increase and family incomes would rise.

By the end of the project in 1979, CATIE had made working arrangements and had carried them out in varied ecological zones of all five of the Central American republics. Twelve agricultural scientists from CATIE had been engaged full-time in on-the-farm research. They had developed and demonstrated a cropping systems research methodology working on the farms of seventy-five smallholders. Impressive production gains and potential economic benefits had been documented for the ten

major cropping systems alternatives elaborated by the project staff. But these alternatives were yet to be verified through extensive field trials in the region. However, one highly promising alternative crop mix of sorghum and beans, which did undergo limited verification, had been adopted by Nicaraguan agricultural officials for widespread dissemination among peasant farmers.

During this five year period, CATIE increased its graduate training on small-farm systems and generated a five-fold increase in its budget, largely from international donors and almost exclusively for smallfarmer oriented agricultural research activities using the "systems" approach. CATIE's institutional commitment to improving small farmer production had become well established as had its ability to work with national institutions in the region.

Although the project had achieved most of its stated objectives, the beneficial impact of the emergent research methodology and of the expanded institutional capacity at CATIE on large numbers of small farmers was yet to be demonstrated. There was no wide-scale adoption of the newly tested cropping systems alternatives developed from the on-farm experiments. In spite of this and partly because of it, some lessons were learned from the project evaluation.

Doing agricultural research on the farms of smallholders, as opposed to research done on far-removed experimental stations, holds much promise for the development of truly appropriate production technologies and their more rapid adoption and dissemination. But for that potential to be realized, the projects should be designed to include the full cycle of research through both verification and dissemination. Donors sponsoring such research should provide the time and resources necessary, perhaps eight- to ten-year authorizations, to allow for validated technologies to reach numbers of small producers. International or regional research institutions, like CATIE, must be prepared to maintain their collaboration with the national agencies, not only to support the verification and dissemination phases as they come on line, but to capture important findings during these phases for improving subsequent research work.

Agricultural institutions undertaking on-farm systems research must give adequate attention to non-agronomic issues--such as input constraints, market analysis, and household and area labor availabilities by season--in the planning of the research, the analysis of constraints to production, and the implementation of research, verification, and dissemination programs. To do so requires that the institution have adequate staff skills in the social sciences and in farm management within the multidisciplinary teams undertaking each phase of the research effort.

Scientists need to be aware of the difference between doing research on small farms and doing research with the active interest and participation of small farmers. The former may well inform the agricultural scientist about agronomic issues, but only the latter is likely to educate both the scientist about how the small-farmer household economy works and the farmer about new agricultural options that will fit with the economy. Several of CATIE's field staff demonstrated that being a scientist and an involved participant, or even change agent, are not mutually exclusive roles.

Korean Agricultural Research: The Integration of Research and Extension

A profound change occurred in the early 1970s that transformed the Korean Government's rural development strategy. From one emphasizing industrial exports, the costs of which were largely borne by the Korean farmers, the strategy evolved into one devoted to improving rural Korean life. The genesis of this approach was both political and economic: a hardening of PL 480 terms and the results of the 1971 election that amply demonstrated that government support had eroded in the countryside. The Korean Government responded with a rice pricing policy advantageous to the farmers, the strengthening of the extension service, the formulation of the Sae-maul ("New Village") Movement, and a rapid increase in rural infrastructure.

The origins of AID's support to agricultural research are found in the Korean Agricultural Sector Survey (1972) and succeeding documents that advocated a strengthening of research as a primary need. The project, proposed in 1973 and implemented in 1974, provided $5 million for a tripartite program to strengthen the capacity of the Office of Rural Development of the Ministry of Agriculture and Fisheries. It included training of Korean researchers overseas, equipment (including a computer and library materials), and both resident and short-term expatraite advisory services. At the close of the project in 1980, 21 Ph.D. students and 17 M.S. students were trained overseas, while an additional 94 received short-term training and 106 participated in observation tours.

Although there were problems with the English language competence of prospective students, the training aspects of the project were universally regarded as the most successful part of the program. Of notable, but secondary, importance was the provision of equipment and supplies, especially the computer and the library materials. Lagging far behind was the value of resident expatriate assistance, which was of marginal use to the project but was more significant in terms of relieving the AID Mission from continuous monitoring of the project than in providing help to the Koreans. Of greater importance was shorter-term foreign technical advice.

The inchoate goal, from a Korean perspective, was probably rice self-sufficiency--a strategic, political, and economic objective. The project purposes, however, were specified in considerable detail outlining exact yield increases on agricultural experimental stations over a ten-year period in the areas of rice, barley, wheat, and soybeans as well as generalized improvement in potato production and in the cropping systems. Specific increases were also proposed for

farm fields for the same time. Since the decade of crop improvement is to end in 1984, this evaluation must be somewhatcircumscribed.

The project paper suffered from spurious specificity regarding experimental station crop increases. Before the project began, experimental yields were higher than those indicated in the paper, often by considerable amounts. The research breakthroughs that the project anticipated were generally made prior to the project. Farmer yields may well reach their objectives by 1984, but the AID project was only a beneficial increment to Korean agricultural research. It supplemented an existing, competent system, but offered little that was innovative.

The concentration on rice led to a lack of emphasis on other crops, an inattention caused by national concerns as well as social and economic factors the project ignored. Although there have been increases in crop yields, hectarage of the other crops has consistently been falling, even before the project began. Thus, national targets will not be met even if a relatively few farmers benefit. The choice of some of the crops covered by the project such as wheat, soybeans and potatoes seems questionable, as does the emphasis on increased fertilizer responsiveness.

Critical to a developmentally effective agricultural research program is the transference of experimental results to the farmers. Through a widespread extension service, a farmer training program that includes almost all families annually, demonstration plots, and the Sae-maul Movement, Korea has developed an authoritarian but effective means of disseminating research results.

Thus, beginning in 1972 the spread of the high-yielding varieties of rice was pushed with alacrity by the Korean bureaucracy in response to a national command structure. The effort was effective, making Korea self-sufficient in rice by 1975. Yet there were two inherent problems in this comprehensive effort: these varieties were sensitive to cold, and new races of the fungal disease called blast normally develop after a few years if large areas are planted to a single variety.

The crisis developed first in 1979 with a drop in production caused by blast followed by a disastrous 1980 crop due to cold temperatures. The rice crop fell by one-third, creating a crisis of confidence in the government and in the guidance service.

Ironically, the failures of 1979 and 1980 can be attributed to the strengths of the Korean guidance service. Thus its

weakness is based on the omnipresent bureaucratic hierarchy that, in contrast to most developing societies, can transform research into production. In singleminded pursuit of its political goals, it neglected elemental precautions that might have avoided the problems of the last two years.

Agricultural research was an appropriate intervention for AID at the time. It assisted a well-established, agricultural research network, but did not materially transform it. It created no new institutions.

Agricultural researech will continue in Korea but replication abroad will be difficult. Any successful adaptive agricultural research project will be dependent upon a positive pricing policy, an effective extension service, rural infrastructure, and continuous contact with international research centers, among other factors. Political will is required for its success, but too strong an emphasis on political objectives can undercut its effectiveness.

Guatemala: Development of the Institute of Agricultural Science and Technology (ICTA) and its Impact on Agricultural Research and Farm Productivity

During the decade of the sixties, food production in Guatemala barely kept pace with the demands of a growing population. In 1970, the Government of Guatemala initiated a restructuring of public agencies to provide coordinated service to small food-producing farms. An innovative organization, the Institute of Agricultural Science and Technology (ICTA), emerged from this restructuring with responsibilities for generating and promoting the use of improved technologies in basic food crops. AID supported this restructuring with a series of loan and grant projects beginning in 1970.

In 1975, AID approved the Food Productivity and Nutrition Project. Its purpose was to increase the production and nutritive quality of basic food crops in Guatemala and to strengthen and develop ICTA as an institution. Of $1.73 million allocated for the project, $1.2 million was for expatriate technical assistance, including plant breeding experts and other technicians who staffed ICTA while project-sponsored Guatemalans were being trained to assume positions within the new Institute.

Three crops, maize, beans, and sorghum, were targeted for increased production. Working with experts from international agricultural research centers, ICTA personnel developed new varieties and tested them under small farm conditions by collaborating with farmers. With the assistance of the Inter-American Development Bank, a seed service was organized to process seed and help maintain genetic quality.

New varieties of both maize and beans were introduced and increased yields have been recorded. Using improved seed and other technologies recommended by ICTA, collaborators have obtained increased yields. Gains in maize have been primarily in lowland varieties, but one new highland variety is promising. The impact of new seed on maize production is expected to increase as the amount of seed produced increases.

New varieties of beans may reduce or eliminate the need for costly programs to control Golden Mosaic. New varieties of sorghum were not released until 1980 and thus could not be evaluated. However, they appear markedly superior to previously available varieties.

In addition to developing and recommending improved seed, ICTA developed and recommended other farming practices related to increased yields, such as planting distances, seed densities, fertilizer applications, and weed and insect

control. Indices of acceptance developed by ICTA indicate that increasing numbers of farmers who have collaborated in the fieldtesting of such new technologies are adopting ICTA recommendations. Interviews with ICTA personnel and with individual farmers support this impression.

The AID project facilitated and hastened the strengthening of ICTA as an institution. The number of ICTA staff increased and staff qualifications improved. Expatriates facilitated the research work of ICTA and its growth as an organization. With project support, 10 Guatemalans received advanced training and by 1979 and 1980, they were returing to ICTA to replace expatriates.

However, high attrition rates among personnel with advanced degrees are a serious problem for ICTA. Rigid salary schedules are apparently responsible, but ICTA managers have been unsuccessful in efforts to obtain the authority to revise these schedules. With the departure of expatriate advisors, these high attrition rates may make sustaining and expanding the present ICTA system more difficult.

Some confusion remains regarding the respective role of ICTA and DIGESA, the extension service of the Ministry of Agriculture, particularly as ICTA's approach to research draws on some techniques of traditional extension methodology. ICTA and DIGESA are working on this problem, and it seems likely that new patterns of relationships will develop.

ICTA has come to represent a new model for agricultural research that planners and researchers in other countries are studying and attempting to replicate. If there is continued and increased support from the Government of Guatemala, it will be able to sustain and expand its present activities.

Food Grain Technology: Agricultural Research in Nepal

In 1957, the U.S. Operations Mission initiated support for a broad-ranging agricultural development effort in Nepal. This project continued without pause for 17 years, largely in pursuit of the objective of increasing Nepal's food grain production capacity by enabling and encouraging Nepali farmers to apply the techniques of scientific agriculture. While the U.S. financial and technical assistance was continuous, the emphasis, the pace, and the amount of Nepali involvement were altered considerably during the course of project implementation. The project began as a "general agriculture" initiative and gradually evolved to its concluding emphasis on the development and dissemination of "food grain technology."

The project successfully contributed to the establishment of agricultural research and extension systems by training almost 600 Nepalis to the B.S., M.S., and Ph.D. levels and by constructing facilities for research at five stations in the Tarai--at Nepalganj, Bhairawa, Parwanipur, Janakpur, and Rampur. With the assistance of the extension service, improved wheat, rice, and maize varieties that were tested on the research stations were spread to farmers across the Tarai. Some of the selected improved varieties proved widely adapted to Nepal's enormous range of agroecological conditions and spread into the Hill and Mountain farms as well. Other parts of the "technology packages"--which included recommendations for fertilizer, time of planting, spacing, and irrigation--were not so widely adopted.

In trying to assess more precisely the differences that could be attributed to the implementation of the Food Grain Technology project, we first examined statistical fact sheets and research reports. We then talked with agricultural leaders (many of whom had apparently taken advantage of training opportunities offered under the project) and with agricultural producers. We took a long view in these dialogues, trying to comprehend the pattern of changes which had occurred in the agricultural sector over the past two decades. While looking at reports of experimental trials and at growing fields of wheat and mustard, we discussed not only what had happened, but what might not have occurred had the project never been implemented.

Our examination provides both a sense of solid accomplishment and a basis for some disquieting fears. On the positive side, we found the following:

-- A functioning research system has been developed.

-- Farmers are immensely aware of the need for and the problems related to Krishi bikash (agricultural development).

-- Extension and research services can, at times, work together in complementary, mutually reinforcing activities which result in new plant varieties and increased knowledge in the countryside.

On the negative side were the following factors:

-- Researchers and farmers are not in complete agreement on which agricultural problems need to be addressed, nor are the channels for communication as open as they could be.

-- The "green revolution" as it has occurred in Nepal has not yet resulted in long-term security and economic independence as expected but has contributed to economic and environmental destabilization.

-- The productivity of farmers, extension workers, researchers, and those agencies charged with input supply distribution is far from optimal.

Thus, researchers articulate the need to continue the search for new varieties which are higher yielding, more disease resistant, and produce grain with acceptable qualities of taste. Farmers agree that variety development is important, although they emphasize other criteria for variety selection as well. Farmers also recommend that increasing reliability of water and fertilizer supplies is more important for handling their problems of deteriorating soil fertility, declining farm sizes, with low yields, and high risks. The role of agricultural research and extension is not in question; at stake are the issues of research priorities and their relevance to farmers' resources and constraints.

The fact that farmers have adopted components of technology packages at all may reflect less the persuasive rhetoric of research and extension than the farmers' response to the increasing pressure of population and to their families' requirements for food and cash. Nevertheless, without the technology packages, it is unlikely that Nepal's farmers would be as productive as they are today.

Agricultural Research in Northeastern Thailand

In 1962, the Ministry of Agriculture and Cooperatives in Thailand officially established an agricultural research center at Tha Phra near Khon Kaen, located 400 kilometers from Bangkok. The center was to be a multidisciplinary research facility focusing on the Northeastern region and responsive to the needs of the farmers. In addition, it was to support and coordinate the work of the Ministry's 112 small research centers and stations in Northeastern Thailand.

USAID/Bangkok first assisted this project in the mid-1960s by providing graduate training to 24 Ministry employees who were to staff the center. In 1966, a multifaceted project was launched for institution-building at the center. A contract was signed with the University of Kentucky, Lexington Kentucky, and from 1966 to 1975 Kentucky Project officials were responsible for (1) advising center administrators; (2) arranging for training employees in the United States; (3) assisting in the establishment of research laboratories, research programs, and extension activities; and (4) coordinating functions at the center.

An excellent physical facility was constructed which has been carefully maintained. Since 1966, a total of 118 Ministry employees have received U.S. training in agricultural disciplines mostly at the University of Kentucky. By 1975, laboratories were well established and substantial research work was underway. However, since 1975, research programs have been reduced and the professional staff of the center is far below projected numbers. The research carried out is essentially conventional and laboratory- or station-focused; there is little evidence that it is responsive to the needs of small farmers in Northeastern Thailand.

Kentucky Project extension and training activities started slowly, but since 1975 several initiatives have been launched. These include a series of television and radio programs, a mobile extension unit, and an agricultural information network. These initiatives were not planned at the beginning of the project. However, at the time of review, these activities and their support units were the most dynamic at the center. Modest USAID support to these programs could do much to enhance the quality and quantity of agricultural information available to Northeastern farmers.

Scientists at the center need to familiarize themselves with the complexities of agricultural production and decision-making in the Northeast. This could contribute to future research activities and outreach programs which are more relevant to the needs of a greater variety of farmers. Furthermore, bureaucratic conflict has created an atmosphere in which much research done at the center is rejected out of hand by the central Ministry of Agriculture and often has to be redone in order to be acceptable. Declining budgets, loss of coordinating authority, frequent institutional redefinition, and loss of status and professional autonomy have combined with previously mentioned factors to defeat efforts to build a major research capacity in Northeastern Thailand.

Ministry, USAID, and University of Kentucky Project officials chose not to reexamine and reformulate the project, inspite of ample, early evidence that the center lacked sufficient bureaucratic potency to accomplish its long-range goals. It seems unlikely that more detailed planning could have pinpointed and overcome this problem. However, AID officials should have recognized the problem by the late 1960s and done something about it. They could have (1) pulled out, (2) decided to support only the most promising portions of the project (e.g., the training component), or (3) worked with the Ministry to strengthen the bureaucratic position of the center. That none of these things happened reflects negatively on responsible USAID officials, but perhaps more so on AID structures and procedures. These may have discouraged Mission officials from reexamining projects and making mid-course corrections 10 years ago. Whether or not there have been sufficient changes in incentive structures to encourage them to do so today remains to be seen.

West Africa Rice Research and Development

The West Africa Rice Development Association (WARDA) was created in 1970 to increase rice production in the 15 member countries through research and training. Importation of the rice necessary to satisfy an increasing demand for what is becoming the food staple in urban areas is a drain on foreign exchange, yet the climate and ecology of West Africa are suited to rice production.

A decade after its creation, one cannot hold WARDA responsible for the fact that West Africa is importing more rice than ever. WARDA was encouraged to look for technological solutions to this deficit, not for economic policy solutions. But a technical solution cannot be divorced from its economic environment. One of the greatest weaknesses of WARDA's research design is its tendency to separate these two. Some of WARDA's research results demonstrate the disadvantages of this tactical separation, laid on the association by its founding charter and by the orientation of the donor and member state support it has received. Nevertheless, because of its scientific professionalism, WARDA, through its development department, has discovered a politically acceptable way of targeting project identification research design on specific situations that are not only ecologically but also economically conducive to expanded rice production.

Much of the more recent, second phase of AID support to WARDA (project 698-0429) is built upon WARDA's evolving skill in contextualizing rice research and development inputs such that, for specific contexts, their outputs are not hindered by the widespread economic constraints on rice production in West Africa. Therefore, with the advantages of hindsight, therefore, we are evaluating the first-phase AID/WARDA project (698-0382), not only in terms of its own stated goals, but also to identify the part it played, if any, in helping WARDA define this more successful, interdisciplinary role for itself.

Under the first-phase project, AID supported (1) two special research projects--one for mangrove rice at Rokupr, Sierra Leone, and one for deepwater/floating rice at Mopti, Mali; (2) a training center adjacent to Liberia's Agricultural University at Fendell just outside of Monrovia; (3) participant training in the United States for key WARDA researchers; and (4) a rice economics study undertaken in conjunction with the Food Research Institute at Stanford University.

Tunisian Wheat Development Program

The Tunisian Wheat Development Program (Project Ble) was designed and implemented from 1965 to 1977 by AID, the Ford and Rockefeller Foundations, the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, and the Government of Tunisia. It was conceived in 1965 at a time when the economic chaos following independence from the French prompted the Government of Tunisia to explore every avenue to reverse the decline in agricultural production, particularly of food. Development of Tunisian institutions and training of Tunisian staff were priority goals to fill the gap created by the exodus of the French civil servants and other European farmers and entrepreneurs in 1964. The ultimate goal of the Government was and remains "self-sufficiency in food production."

The purpose of the program was to introduce and adapt to the Tunisian environment and climate the new semi-dwarf high-yielding wheat varieties that had been developed at CIMMYT in Mexico. The other important purpose of the program was to train Tunisians in agricultural research and extension methods as a means of developing institutional capabilities for Tunisia to carry out research and extension activities alone.

The impact of the program has been slow but positive. Much of the impact is being felt now, some five years after the program was phased out and 17 years after its conception. If one single factor had to be identified as the program's most important contribution, it would be the development of the program for advanced degree training, particularly to the Ph.D. level. The research capability developed by this advanced training has become most effective in the past three years. The impact is being demonstrated in research results; in an effective extension program; in improvements in institutional capabilities in research, extension, and education; and in farmers' increased acceptance of new varieties and improved technology, resulting in increased yields and production.

Training has enabled Tunisians to successfully continue research and extension activities without assistance after the program was phased out. Nineteen Tunisians were trained in the United States to the level of M.S. and Ph.D. degrees in agricultural sciences. This was supplemented by practical training of 55 other Tunisians at CIMMYT in Mexico, in Australia, and in Tunisia. Of the 19 who received advanced training, 13 are working directly or indirectly in the cereals

program in Tunisia; 11 of these are directly involved. Of the 19 Tunisians, one is continuing advanced studies in the United States and five are working abroad with international or other organizations. Four of the Tunisians who received Ph.D. degrees are involved in research at the National Agricultural Research Institute of Tunisia (INRAT) while teaching at the National Agricultural Institute of Tunisia (INAT, the national agricultural university). Two Tunisians trained to the M.S. level are participating in the research program at INRAT.

During the life of the program, five new bread wheat and five new durum wheat varieties were developed and introduced to farmers with varying degrees of success. After the program was terminated in 1977, Tunisians had been trained under the program continued to develop varieties with caracteristics that improved on those developed earlier. In 1980 and 1981, two improved varieties of bread wheat and two improved varieties of durum wheat were developed and put into use. Some of these later varieties were more resistant to diseases and drought than earlier varieties, and consequently were more acceptable to farmers.

An extension and farm demonstration system and program were developed in the beginning of the Wheat Development Program to work closely with the research activities to extend results to farmers and to feed back problems to research scientists. The Technical Division, established in the Office of Cereals, successfully carried out its functions during the life of the program. It is now staffed with trained Tunisians and is still operating a successful program.

As a result of the program, Tunisia's cereal production (wheat and barley) was greater during the 11-year period 1971 through 1981 by 5.302 million metric tons than during the previous 11-year period. Despite population growth, annual per capita production of cereals increased from 104 kilograms in 1970 to 160 kilograms in 1980, using average annual production figures for the two periods and the population levels of 1970 and 1980, respectively. Furthermore, the increased production was achieved on an area of land less (by over 200,000 hectares in each year, 1980 and 1981) than in the previous four years. The increased production of cereals saved the Government of Tunisia the foreign exchange costs of annually importing 299,000 metric tons of durum wheat, 77,000 metric tons of bread wheat, and 106,000 metric tons of barley that would have been required otherwise during each year 1971 through 1981. The value of this amount of annual imports at 1981 prices would have been $125,944,000 (cost, insurance, and freight in Rotterdam, imported from the United States). This was made possible at a total cost to the U.S. Government, Rockefeller

and Ford Foundations, and less than $3.5 million in technical assistance.

The program has resulted in other benefits to Tunisia. It contributed to increased per capita consumption of cereals, mostly in the form of increased use of commercial bread and noodles. While no national data were available to confirm the fact, there was evidence that farmers had been integrated into the money economy. Cereal farming had become mechanized and farm families were purchasing prepared foods such as commercial noodles and bread.

The positive impact was not without some negative effects. Rural migration of men had led to a change in the role of rural women, with an increase in their participation in farming and rural industries, and a decrease in their role in home preparation of food. While this may be viewed as a positive gain for women, it has had one negative result. Increased use of purchased, prepared foods (principally noodles and bread) instead of home-prepared food has decreased the nutritional levels of farm family daily diets.

Not all the institutional goals have been achieved. Integration of research and extension has not been acted on. The planners had sought flexibility in management, financing, decision-making, and action by establishing the program under the parastatal, semi-autonomous Office of Cereals, a commercial organization concerned with the purchase and sale of cereals. This office, which is outside the Agricultural Services of the Ministry of Agriculture, was not impeded by the bureaucratic constraints of other agencies. At the same time, it did not play a role in providing technology to farmers. During the life of the program, activities were integrated through personal cooperation of scientists who cut across institutional lines. This system continues today.

Despite these weaknesses, the institutions in research, education, and extension have developed basic capabilities, resulting directly and indirectly from the program, which permit them to continue successful activities. However, the goal of self-sufficiency in food production has not been achieved. This goal is illusory and has tended to overshadow the progress that has been made, as continued growth of population and increased per capita consumption of cereals have widened the food gap, requiring increases in imports. Tunisia's overall goals of using its resources to comparative advantage, and of producing higher valued crops on the better land (under irrigation where feasible) for export and to supply the thriving hotel-tourist industry are both aimed at achieving a balance in international trade of agricultural products, which makes good economic sense. Achievements in cereal

production are due not only to the scientific progress achieved under this program, but also to improvements in institutions, economic conditions, and policies in the agricultural sector.

AID EXPERIENCE IN AGRICULTURAL RESEARCH
A Review of Project Evaluations

This study reviews the experience of the U.S. Agency for International Development (AID) in the area of agricultural research. It was completed by Development Alternatives, Inc. (DAI) at the request of AID's Office of Evaluation, Bureau for Program and Policy Coordination (PPC/E). The study's objectives were:

-- To review historical trends in agricultural research, especially of AID's expenditure in that sector;

-- To identify the set of projects comprising AID's agricultural research portfolio; and

-- To identify major issues affecting the design and implementation of agricultural research projects by reviewing evaluations of a sample of those projects.

A review of the literature and interviews with various professionals identified several recent trends in agricultural research. These included an increasing attempt by researchers to develop technology applicable to the needs of farmers under adverse envrionmental conditions and in resource poor regions of the world. Moreover, in an attempt to better align research with farmer needs, a broader array of production constraints (both agronomic and socioeconomic) is now being examined in the technology generation process than in the past. This has entailed more emphasis on on-farm research, the use of multidisciplinary teams and a more holistic approach to research, as well as greater participation by the farmers themselves in the technology generation process. Additional issues receiving increased attention are the importance of strong national research systems and the amount of time necessary for agricultural research projects to produce useful results.

AID support to agricultural research has been increasing in recent years. Historically, however, the sector has received relatively little attention from the Agency. According to the interviews and literature review conducted during this study, one reason for this lack of attention was the belief, prevalent in the early 1950s, that the technology necessary to improve agricultural productivity in the developing countries already existed. Limitations during the 1960s included Congressionally imposed restrictions on the amount and type of research that AID could undertake together with decreases in the Agency's in-house technical expertise in agriculture. Finally, the New Directions legislation passed in the early 1970s, while contributing to important changes in the nature and focus of AID's agricultural research, emphasized other development strategies such as rural development and food production

projects, or the delivery of services to meet basic human needs.

AID's increasing interest in agricultural research in recent years has partly resulted from a realization that a lack of appropriate agricultural technology is a serious constraint to food production increases. Moreover, the success of the green revolution technology developed by the international agricultural research centers (IARCs) in increasing production levels of selected crops in certain regions of the world has furthered this realization.

Between 1978 and 1981 AID funds going to agricultural research increased by almost 70 percent, from $84.7 million to $143.7 million. In relative terms, AID's investment in this sector rose from 12.8 to 19.5 percent of the agriculture, rural development and nutrition appropriation (excluding economic support funded appropriations). Most of this increase came from projects funded by AID field missions. On the other hand, the proportion of AID support going to the IARCs and centrally funded bilateral research has increased only slightly. However, the passage of Title XII and the creation of the Board for International Food and Agriculture Development (BIFAD) may provide a basis for greater activity in this area.

Aside from reviewing historical trends in agricultural research, the study examined issues affecting projects in the sector based on a review of 131 evaluations of 48 agricultural research projects (39 regionally and mission-funded and 9 centrally funded). It found that the evaluation documentation provides only an imperfect picture of any project's overall performance. The evaluations were most often focused on the provision inputs and the achievement of outputs. Attempts to measure project impact (to determine the effect of project activities on the beneficiaries welfare) were limited to the four Impact Evaluations included in the sample (part of a series of indepth, ex post evaluations currently being undertaken by AID). The standard evaluations did not provide the basic information (such as project characteristics and standardized performance indicators) necessary to permit a comparative analysis of the projects in this sample.

Using the evaluation documents, it was possible to identify several recurrent issues common to projects in the agricultural research sector. For regionally and mission-funded projects these included:

-- Operational problems entailed in doing on-farm, farming systems-type research, and involving farmers in the research process;

-- The quality of the research conducted and the setting of research priorities;

-- The phasing of activities, especially construction delays which impeded planned research, as well as the amount of time allowed to achieve the research objectives;

-- The adequacy of AID's research project supervision, given a lack of technical expertise and high staff turnover in the missions;

-- Weaknesses in the links between reseach and extension, as well as inadequacies in complementary services (inputs, credit, marketing, and so forth);

-- Host government support for the projects;

-- The lack of qualified counterpart personnel to work with expatriate technicians, together with low salaries for host country researchers which makes it difficult to maintain competent staff;

-- Inadequate participant training programs;

-- Delays in procurement; and

-- The delays or inability of AID and its contractors to provide qualified technical assistance.

For the nine centrally funded projects in the sample (each of which involved overseas research), the issues discussed in the evaluations included: the creation of linkages with host country institutions; the performance of long-term staff; the project's scope and funding; and the quality of the research conducted. Issues not fully treated by the evaluations of these projects included: the problems entailed in simply conducting research within developing countries and in conjunction with local institutions and researchers; the feasibility or necessity of conducting more research away from the research station; and the dissemination of the research findings.

In conclusion, this review of past AID evaluations identified and documented a set of issues or problems that were more or less familiar to development professionals knowledgeable about the sector. The study also identified significant gaps in the evaluation data base that was analyzed. In terms of producing information that might influence overall policy within the sector and feed into the design of future projects, this study highlighted the need for investigations outside the Agency's system of regularly scheduled evaluations in assessing its project implementation experience.

PROCEEDINGS OF A

WORKSHOP ON

IMPACT OF AGRICULTURAL RESEARCH

Leesburg, Virginia
June 13-17, 1982

prepared by the

International Agricultural Development Service

for the

Office of Evaluation

Bureau for Program and Policy Coordination

U.S. Agency for International Development

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PREFACE

The U.S. Agency for International Development sponsored a Workshop on the Impact of Agricultural Research projects worldwide. The workshop was coordinated by the Office of Evaluation, Bureau for Policy and Program Coordination, as part of a study of AID's activities in agricultural research. The study included a review of AID's portfolio in agricultural research and the conduct of impact evaluations of agricultural research projects in Central America, Guatemala, Kenya, Korea, Nepal, Thailand, Tunisia and West Africa.

The purpose of the workshop was to analyze the issues and lessons identified in each impact evaluation, discuss how these findings can be used in planning, designing and implementing technical assistance to research institutions, and make recommendations for future policy in agricultural research.

The workshop, held at the Xerox International Center for Training and Management in Leesburg, Virginia, June 13-17, 1982, was managed by the International Agricultural Development Service, Arlington, Virginia. It was attended by nearly 100 participants, of which one-quarter were from developing countries, one-half were from AID/Washington or missions abroad, and the rest were from international organizations, universities, and consulting firms.

The activities of the workshop were conducted in plenary sessions and in work groups. The plenary sessions consisted of informal presentations, panel discussions, and work group reports. Each plenary included comments by the moderator followed by comments or questions from the floor.

This report consists of three parts: the background document that was distributed prior to the workshop, rapporteurs' notes on the plenary and work group sessions, and annexes.

A final document summarizing the agricultural research study is being prepared. It synthesizes the conclusions reached at the workshop and presents policy recommendations, as well as suggestions for planning, designing and implementing effective research systems.

Part A

BACKGROUND PAPER

AGRICULTURAL RESEARCH AND DEVELOPMENT

THE FINDINGS OF EIGHT IMPACT EVALUATIONS

A Background Paper
Prepared for the
Workshop on Impact of Agricultural Research

Leesburg, Virginia

June 14-17, 1982

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The participants in the eight impact evaluations summarized in this paper are listed in Annex A. Comments and suggestions on earlier drafts of this background paper are gratefully acknowledged, from USAID: Joan Atherton, Bonnie Baker, Joseph Beausoleil, Richard Blue, Dana Dalrymple, Allen Hankins, Joseph Hartman, Twig Johnson, John Lewis, Henry Miles, Mercedese Miller, Emmy Simmons, David Steinberg, Charlotte Suggs, Philip Warren, and, Michael Wilson, and from the International Agricultural Development Service: Francis Byrnes, Steven Breth, and Guy Baird. Linda Densmore of IADS has been a most efficient typist.

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CONTENTS

I. INTRODUCTION

A. Why Evaluate AID-Sponsored Agricultural Research?

Projects to assist the less developed countries in developing their agricultural research capabilities have often been designed according to the following reasoning:

(1) A country that increases its production of food crops achieves a more rapid economic development, its food producers enjoy a higher standard of living, and more and cheaper food is available to its consumers.

(2) Research scientists can find ways to increase food production if they are well trained and receive sufficient funds and adequate facilities.

(3) Therefore, if donor countries provide training and funding for agricultural research, the less developed countries will achieve faster economic growth and their farmers will be better off.

These assumptions may seem oversimplified, and they are rarely stated so bluntly. Yet these assumptions, and the premise that increasing food production is a technical problem that can be solved by agricultural science, have underlaid much of the considerable efforts to promote agricultural development in the less developed countries.

Are these assumptions valid? What are the mechanisms and constraints within each premise and between the premises and the conclusion? Are there constraints other than technical to increasing food production? If so, how can we best address them?

The U.S. Agency for International Development has assisted the development of agricultural research capabilities in the less developed countries for over 30 years, both through financial and technical assistance to national and international institutions, and through training programs. While much has been accomplished in training of Third World agriculturalists and creating or expanding research facilities, the agronomic, economic, and social impacts of these efforts have often been disappointing. Because AID has given priority to increasing food production in the less developed countries for the late 1980's and has reemphasized its interest in supporting agricultural research (AID Food and Agricultural Development Assistance, March 1982), it is important to assess the achievements and difficulties of past development efforts so as to plan and implement future activities most efficiently and to the best advantage of the food producers.

B. Purpose of this Paper

Since November 1979, the office of Evaluation, Studies Division, has been evaluating the impact of the AID's assistance in major development sectors, so that the lessons learned can be incorporated into the AID's policy, planning, and implementation activities.

Agricultural research was among the first sectors designated by senior AID officers for in-depth study. The purpose is to examine critically the impact of completed projects in agricultural research on the research institutions that received assistance and on the food producers of the host country. To achieve this purpose, the Studies Division has completed, or is in the process of completing, the following:

o The entire portfolio of AID's activities in agricultural research has been reviewed, and evaluation documents on a sample of 148 projects have been analyzed. This work is presented in Discussion Paper No. 13.

o Eight projects, in Kenya, Central America, Guatemala, Korea, Nepal, Thailand, West Africa, and Tunisia, were selected for an impact evaluation--an in-country assessment by a multidisciplinary team of the impact of a completed project on the people who were expected to benefit from it. The evaluations have been published as separate reports (see Annexes B and C). Each includes conclusions on the results of the project and specifies "lessons learned" for design and implementation of future projects with similar objectives.

o A workshop will be held near Washington, D.C. in June 1982 to discuss the impact evaluations and the review of AID's portfolio in agricultural research. Participants in the workshop will include AID officers, host country officials and agricultural specialists from other donor and research institutions and from the universities. The workshop participants are expected to research conclusions and make suggestions for incorporating the lessons learned into Agency programming, design and implementation activities, and for future policy in agricultural research.

o A final publication will synthesize the findings and conclusions of all the activities outlined above.

This paper is intended as a background document for use during the workshop. It summarizes the findings of the review of AID's portfolio in agricultural research and of the impact evaluations. It does not prejudge the conclusions and policy suggestions which will be reached by the workshop participants, but does call attention to issues which have been identified in the impact evaluations and in the review of AID's portfolio and which need analysis and discussion.

II. AGRICULTURAL RESEARCH AND DEVELOPMENT

A. The Problem

Fully one quarter of world population suffers from chronic undernutrition. Because the population is growing at a fast rate, it has been estimated that food production must now increase by at least 4 percent per year if consumption needs are to be met by 1990 (IFPRI, 1977 and 1979).

The twentieth century has seen tremendous breakthroughs in agriculture; indeed, the spectacular results of high-yielding wheat and rice have been hailed as miracles. The very real increases in food production and productivity in many less developed countries have been encouraging, yet Bachman and Paulino (1979:13) calculated that the overall rate of increase in food production in the less developed countries from 1961 to 1976 averaged only 2.6 percent per year. In more than half the countries, according to Bachman and Paulino, the increase in food production has not kept pace with population growth, so the situation is in fact worsening. This is especially true in Africa (Table 1).

Such disappointing results are not because of a lack of effort. This century has seen the organization of a systematic attempt to increase food production, first in the developed countries and then in the less developed countries. Despite the many achievements in agricultural research, especially in developed countries, the task of increasing food production in the less developed countries has been found to be much more complex than expected. Demographic, agro-ecological, economic, and political factors combine to make it so. More funds and more technical assistance do not necessarily solve the problem, even if it were feasible to increase the amounts involved.

The world's annual expenditure on agricultural research now stands at $5,000 million, about double what it was in 1975, in constant 1975 terms (World Bank 1981:16), and about $1,600 million of that amount is spent in the less developed countries. Oram and Bindlish (1981:18) computed the amounts and distribution of expenditures on agricultural research in 47 less-developed countries, together with the total number of agricultural scientists in each region (Table 2). They point out that total expenditures seem to have stagnated since 1978-79. The trend begun in the early 1970's may be changing, especially as most donor countries face internal economic difficulties.

Much effort has been directed toward institution building and training, and an effective network of international agricultural research centers has been established. In the context of increased need, a well-established research network and possibly limited financial resources, it behooves agricultural scientists and rural development specialists to learn from past experience so that future financial and human investments in agricultural research are as productive as possible.

B. AID's Experience in Agricultural Research

AID and its predecessor agencies have assisted agricultural research in less-developed countries for more than 30 years. During the 1950's the emphasis was on transfer of Western know-how, characterized by assistance to extension services and training institutions, especially universities. As evidence mounted that Western know-how was not always successful in the agro-economic context of most LDC's, the emphasis shifted, in the 1960's, from extension to assisting national and regional research

Table 1: Agriculture Production Indices per Capita (1969-71 = 100).

	1970	1975	1980
Africa	100	95	89
Latin America	100	103	108
Asia	101	105	107
Near East	98	104	101
World	100	103	104

Source: FAO Production Yearbook 1980.

Table 2: Change in Expenditures on Agricultural Research and Numbers of Agricultural Scientists, 1970-80: 47 Countries

Region[a/]	Expenditures ($ millions (constant 1975 terms))			Change (%)		Scientist Numbers			Change (%)	
	1971	1975	1980	1971/75	1975/80	1971	1975	1980	1971/75	1975/80
South Asia (5)	41.2	73.3	139.7	78	91	2,529	6,120	12,293	42	101
Southeast/East Asia (5)	28.0	46.7	101.0	67	116	2,285	4,400	5,830	95	31
N. Africa/Middle East (5)	21.9	21.9	35.1	-1	60	1,432	1,163	1,375	-21	18
West Africa (6)	41.8	86.5	112.5	107	30	915	3,239	1,897	154	-42
East/Southern Africa (5)	18.0	18.9	27.9	5	47	513	605	861	18	42
Central America/ Caribbean (11)	18.6	22.7	59.9	22	86	967	1,393	1,680	44	21
South America (10)	110.1	160.4	342.8	46	214	4,100	5,291	5,939	29	12
Total (47)	279.8	430.4	818.9	54	90	12,741	22,251	29,875	75	33

a/ Figures in parentheses denote the number of countries in each region.

Source: Oram and Bindlish, 1981.

institutions through training, technical assistance, and by providing these institutions with adequate facilities. During that period, the achievements of the Green Revolution demonstrated that agricultural research focused on commodity improvement (e.g. breeding rice varieties whose yields were highly responsive to nitrogen and water application) could indeed lead to production breakthroughs in the less developed countries.

Since the 1970's, U.S. assistance has focused on the small and near landless farmers. The "New Directions" have been reaffirmed in the 1978 AID Agricultural Development Policy Paper and a March 1982 statement on AID Food and Agricultural Development Assistance. The latter states that increasing the productivity and income of small farmers is a main objective of AID's assistance (p. 3) and includes the generation and adaptation of improved technology among the means to reach that objective. The Foreign Assistance Act specifically requires that AID-assisted agricultural research programs be adapted to the needs of small farmers (Section 103A).

As the objectives of AID assistance have shifted, so have the ways to meet them. The real world is far more complex than any laboratory or experiment station. An improved technology is more likely to be adopted by small farmers if it is adapted to the agronomic, economic, and social dimensions of the farm. To develop such technology, many of the activities of the households need to be taken into account, in addition to the resources (land, water, inputs and labor) available to the farmers. A plant breeder or a soil scientist alone is not able to do this, so multidisciplinary work is a necessity.

The importance of testing and verifying the research output under actual farm conditions also has become evident. A high potential yield under optimal conditions is not an advantage if other requirements, such as early planting, a reliable supply of water, or high levels of fertilization, prevent utilization of the new variety by most farmers.

Given the complexity of the task, no one research institution is likely able to meet the total needs of a country, nor can quick results be expected. Coordination and complementarity between national and international research centers have become a major avenue for increasing the efficiency of national research programs. It also is now recognized that results cannot be expected from a research effort within the usual 4- or 5-year duration of a project, but are more likely to be achieved within 15 or 20 years.

In 1981, USAID allocated about 20 percent of its appropriation for agriculture, rural development, and nutrition to agricultural research (Table 3). The actual expenditure has fluctuated considerably over the last few years, but has ranged between 13 and 19 percent of all appropriations for agriculture. The funds, which include a contribution to the international agricultural research centers, are about equally divided between centrally funded and regional bureau- and mission-funded projects (i.e. projects coordinated directly by the Science and Technology Bureau of AID/Washington, and those coordinated by the regional bureaus).

Table 3: U.S. Agency for International Development, Agricultural Research Appropriations, 1978-1981, By Subcategory[1] ($000)

	FY78 Actual	FY79 Actual	FY80 Actual	FY81 Estimated
Agr. Technology-Research by U.S. Institution[2]				
Africa	-	2,756	-	2,350
Asia	117	1,060	-	-
Latin America and Caribbean	1,100	1,511	700	1,051
Near East	150	1,200	4,032	6,451
Science and Technology	20,244	21,315	19,104	15,058
Totals	21,611	27,822	23,836	24,910
International Centers[3]				
Africa	-	-	-	-
Asia	-	-	-	-
Latin America and Caribbean	10,000	-	-	-
Near East	-	-	-	-
Science and Technology	21,652	29,758	33,800	40,100
Totals	31,652	29,758	33,800	40,100
Agr. Technology-LDC Research[4]				
Africa	15,971	29,827	28,586	39,406
Asia	920	6,042	9,000	30,600
Latin America and Caribbean	8,645	20,569	2,165	8,636
Near East	2,896	1,456	1,115	-
Science and Technology	-	-	-	-
Totals	28,432	57,894	40,866	78,642
Total Agricultural Research				
Africa	15,571	32,583	22,944	35,356
Asia	1,037	7,082	9,000	30,600
Latin America and Caribbean	19,745	22,080	2,865	9,687
Near East	3,014	2,656	5,147	6,451
Science and Technology	45,335	51,073	52,904	55,158
Totals	84,702	115,474	103,502	143,652
Total Aid Appropriation for Agriculture Rural Development and Nutrition				
Africa	147,075	172,449	173,187	200,777
Asia	228,492	286,338	278,989	287,465
Latin America and Caribbean	196,101	129,741	147,365	127,934
Near East	19,814	19,960	14,812	27,855
Science and Technology	63,778	73,664	75,763	77,835
Totals[5]	660,177	689,309	707,938	737,409

1 Source: Agency for International Development, Office of Planning and Budgeting (PPC/PB). Figures as of 7/27/81. Amounts do not include Economic Support Funds ($22,366,000 for agricultural research in FY81).

2 Functional Subcategory "FNDR"--Activities financing direct research in agricultural technology by U.S. institutions.

3 Functional Subcategory "FNIC"--Activities financing international agricultural research centers. Includes appropriations for the International Center for Living Aquatic Resources Management located in the Philippines ($300,000 in 1979, $200,000 in 1980, and $300,000 in 1981).

4 Functional Subcategory "FNDS"--Activities financing direct agricultural research by LDC institutions.

5 Totals may not add because miscellaneous items are omitted.

Projects funded through the Science and Technology Bureau are usually specific research activities in a commodity sector, while projects funded through the regional bureaus and missions usually focus on institution building and human resource development.

Funding levels for the regional bureaus are tending to increase. Currently 24 missions have included agricultural research as an area of particular importance in their Country Development Strategy Statements for 1983, and the Africa and Asia Bureaus have given clear priority to agricultural research for their future programs. The Asia Bureau, which has a long history of agricultural research activities, is currently conducting a review of its past experience in agricultural research (Asian Agricultural Research Review).

III. IMPACT EVALUATIONS OF PROJECTS IN AGRICULTURAL RESEARCH

A. Scope of the Impact Evaluation Series

In order to learn from AID's experience in agricultural research, eight projects were selected for impact evaluations. The decision was made to limit the evaluations, for the time being, to projects funded through AID's missions and regional bureaus: two in Africa, three in Asia, two in Latin America and one in the Near East. The projects provided some form of assistance to a national (five) or regional (three) institution, and all except one (Guatemala) had been completed prior to the impact evaluation. However, AID has continued to assist some of the institutions after the projects evaluated here ended.

Each project was evaluated by an interdisciplinary team (see list in Annex A) during a visit of about 4 weeks. Agriculturalists, economists, social scientists, and development generalists were present, with each team including one or more AID officers. Outside consultants joined the teams where the necessary expertise was not available within AID at the time of the evaluation.

The main goals of each evaluation were as follows:

- To determine whether the institution that had received assistance was functioning and whether the researchers who had received training were active, and to assess the quality of the research program and its applicability in actual farming conditions.

- To determine the extent to which research findings have been adopted by farmers, and how food producers have been affected by the new technology.

While each team was given a list of topics to cover as a framework for its inquiry, team members were free to draw their own priorities for review and conclusions. Each team prepared its own scope of work prior to departure.

In order to assess the impact of the project, each team interviewed a sample of farmers as well as researchers and administrators, spent a minimal time in the capital city, and travelled in rural areas. Every team included members with previous experience in the country and with knowledge of a local language.

B. Characteristics of the Projects Evaluated

The findings of each evaluation are described in Section IV. The basic characteristics of each project (compiled from the impact evaluation reports) are listed in Table 4. For ease of presentation, each project will be referred to by its location.

IV. FINDINGS OF THE IMPACT EVALUATIONS

The institutions assisted by the projects all produced agronomic or other findings of potential value to farmers, but actual adoption of these findings were very unequal. The training component of each project was successful, but the effectiveness and sustainability of the research network have been undermined in several countries by institutional and managerial difficulties. Technical, institutional and policy constraints were found to interact to determine the impact that a research institution has on the farmers and on national development.

The findings of seven impact evaluations (the findings of the Tunisian evaluation are not yet available) can be grouped into four categories: (1) macro-economic and policy environment; (2) institution building and management; (3) technology generation and transfer; and (4) impact on farming households. Findings in each category will be discussed separately. The order in which they are presented has been chosen as a matter of convenience and does not prejudge their relative importance. While each evaluation report touches on all sets of issues, the emphasis varies, so each issue will not be covered in full detail for each evaluation.

A. Policy and Macro-economic Environment

The policy and macro-economic environment in a country determines the long-term effectiveness of a research institution in at least two ways. First, no matter how productive a research station may have been during the implementation of the project, its ability to sustain research activities on its own is a function of the host government commitment to research and its ability to cover recurrent costs. Second, whether farmers use the research results also depends upon government policy. The farm-gate and consumer price of food and other agricultural commodities, prices and distribution of inputs, and efficiency of marketing systems are potential constraints on farmers' actions that are affected by government policy.

Table 4. Characteristics of eight AID projects.

Location	Program Title	Project Funding (in millions)	Implementation Dates	Institutions Assisted	Date of Evaluation	Evaluation Report
Kenya	Crop Production and Research (618-0644, 618-0657)	$2.2	1969-81	East African Community	December 1979	Kitale Maize: The Limits of Success
Central America	Small Farm Cropping Systems (596-0064)	AID grant, $1.633	1975-79	Center for Tropical Agriculture Research and Training (CATIE)	February 1980	Central America: Small Farmer Cropping Systems
Guatemala	Food Productivity and Nutrition Improvement (520-11-130-232)	AID, $1.7 (plus $1.0 in earlier projects)	1975-79	Institute of Agricultural Science and Technology (ICTA)	October 1979	Guatemala: Development of the Institute of Agricultural Science and Technology and its Impact on Agricultural Research and Farm Productivity
Korea	Agricultural Research Project (DLC/P-2014, 489-11-088)	Loan, $5.0 Korean contribution, $3.124	1974-80	Office of Rural Development, Ministry of Agriculture and Fisheries	January 1982	Korean Agricultural Research: The Integration of Research and Extension
Nepal	Food Grain Technology: Agricultural Research in Nepal (367-11-110-054, 367-0054)	about $20.0 total	1957-74	Ministry of Food and Agriculture, with assistance to five research stations	January 1982	Food Grain Technology: Agricultural Research in Nepal
Thailand, Northeast Region	Agricultural Development, Agricultural Research (493-11-190-180.2)	AID, $6.272 Thai Government, $6.8	1966-75	Thai Phra Agricultural Research Center	February 1981	Agricultural Research in Northeastern Thailand
Tunisia	Accelerated Cereals Production (664-0205.1) and related regional projects (698-0173)	$1.715	1967-77	Office of Cereals	April 1982	in preparation
West Africa	West Africa Rice Development Association: Rice Research and Production (698-11-190-382, 698-0382)	AID, $5.166 WARDA, $0.3 (in kind)	1975-80 (first phase)	West Africa Rice Development Association (WARDA)	October 1981	West Africa Rice Research and Production

1. Host Government Commitment to Research. The success of the Korea project is attributable in large degree to the commitment of the government, which gave agricultural research and extension high priority. Research stations existed and were already effective prior to the AID project evaluated here. This program to increase the production of rice and other crops was conducted with the full support of the government, which revised its pricing policy for rice to encourage widespread use of the Tongil variety and to increase the farmers' incomes.

The government in Nepal has also given support to the research centers, and has recently taken measures to ensure greater coordination of research and extension.

In contrast, the lack of government commitment to research and extension greatly undermined the effectiveness of the research center in Northeastern Thailand. The center was created, with AID assistance, but was never given legal recognition. After departure of the AID technical assistants, the center received only a limited budgetary support, and eventually its purpose was switched from research to planning and coordinating development activities.

Government support also seemed weak and somewhat unreliable in Kenya and for some of the countries cooperating in Central America. The team in Guatemala found government interest in ICTA but was uncertain whether support would continue in the future.

At issue here may be the long duration of a program of agricultural research research and the low visibility of research activities, which make research unattractive for a government that depends upon rapid achievement for survival. Yet without assurance of adequate, continuous and timely funding for staff and research facilities, a research program can quickly become ineffective. Recurrent costs can be a burden on public funds, especially when incurred for activities that are not receiving any further external assistance.

2. Macro Level Constraints to the Use of Improved Technology. In deciding whether to adopt a new crop, variety, or farming practice, a farmer does not look solely at its potential productivity. The farmer calculates whether the change is worthwhile in economic terms, taking into account the costs of production, farmgate price, the opportunity cost to the household in time, labor and land, and the risk of failure. High-yielding varieties can reach their production potential only if adequate water and inputs are available. Access to inputs on a timely basis and at a reasonable cost then becomes a key constraint in their adoption, a constraint that is outside the control of either the researcher or farmer.

For example, in Nepal most of the farmers interviewed complained about the unavailability of fertilizer at the right time, and even sometimes about shortages or poor quality of improved seeds, which have limited their use of improved seeds. They also noted that increases in the official producer price of wheat did not keep up with the increased cost of fertilizer.

In Thailand and Kenya, the necessary inputs were often deemed too expensive by the smaller farmers. The Korean project also failed to take into account important issues such as the price of crops other than rice, the cost of labor and of fertilizers.

The research programs evaluated were oriented to the eventual production of a food or cash crop, which depend upon the farmers' access to marketing outlets and transportation. The governments' failure to alter their policies towards pricing and marketing to compensate for the shift from shortage to surplus has also resulted in disincentives and waste, for example in Kenya.

B. Institution Building and Training

All the projects included a component for institution building at either regional or national levels and for training. Whether the research institutions are functioning adequately after the project has ended is a crucial element in determining the sustainability of the project achievements. There are two sets of issues: the location of the institution within a country's administrative system and within the research community, and the staff and resources allocated to the institution.

1. Affiliation of the Research Institution. Three of the projects evaluated were to develop a research institution serving several neighboring countries (WARDA in West Africa, CATIE in Central America, and an East African Community Institution in Kenya). The other projects assisted national institutions, usually affiliated to the ministry of agriculture rather than linked to a university. The institution in East Africa (Kenya) has collapsed, the institutions in Thailand and West Africa are functioning but with difficulties, and those in Guatemala, Korea, Nepal, and Central America have been found effective. Aside from the political changes in East Africa, one key to sustained activity seems to be the ability to establish linkages (vertical and horizontal) among the research institutions, related government agencies, and, eventually, institutions in neighboring nations and international research centers. Indeed, five of the reports state this as a lesson learned.

Effectively linking different parts of a country's administrative system is often difficult. This is especially true when the research institution is attached to the "wrong" line of government, for instance, to the planning ministry if all other agricultural activities are handled through the ministry of rural development. Coordination among research, extension, training, and input supply is difficult at best. It can be close to impossible if three or four ministries are involved. The choice of host-country channels for implementation of an agricultural research program is an important step that should be carefully planned and discussed with the host country at the project design phase.

Overcentralization and rigidity are counterproductive in any development project and they have been cited as problems in several evaluations. In West Africa, none but the simplest decisions can be made by the field stations. Among the projects assisting national institutions, Nepal seems to have reached a practical compromise, with each station preserving its autonomy (budget, programming), but with regular workshops being held for all the stations' research staff, during which the researchers present their work to their peers, discuss each other's programs, and arrange for some common research activities. Both the Thailand and Korea evaluations emphasized the danger of over-centralization and the need for flexibility in the design and implementation of the research program.

2. Training Agricultural Researchers. All the projects included a training component in agricultural disciplines. The basic problems did not lie with training per se--this seems to have been achieved successfully everywhere--but with keeping the returned trainees working in research. Low salaries, poor working conditions, insufficient career incentives are cited in four projects as detrimental to the institutions' effectiveness and sustainability.

While young professionals in less-developed countries are eager for a period of training abroad, steps have to be taken to ensure there will be adequate incentives to keep the trainees at the research institutions upon their return. The evaluations in Kenya, Guatemala, Korea and Thailand cited the lack of salary or career incentives as a problem in retaining researchers at the station.

C. Technology Generation and Transfer

The projects were all expected to generate varieties adapted to local conditions, and all did achieve that result, but with varying success in adoption rates. Many of the difficulties can be traced to poor planning and lack of understanding of farmers' needs.

1. Planning a Research Program. What kind of research does a country need? Is adaptive research sufficient in some countries? Should a country use the resources available for research to concentrate on a few main crops? The type of research capabilities that should be developed is not always clearly defined when plans are made to create or expand a research institution. Yet it is a crucial decision that determines the potential impact of the research.

The projects evaluated varied from a single-commodity focus (rice in West Africa, maize in Kenya), to those focusing on several commodities (Nepal, Korea), to programs focusing on the cropping system of small farmers (Guatemala, Central America).

A commodity focus can use research abilities efficiently if the commodity is indeed one worth encouraging and if the improved varieties and/or practices are suitable for small farmers. Rice in West Africa is

an example. The commodity is essential to the economic development of the countries involved because the demand for rice in the cities is higher than current national production and is likely to continue to increase. Maize in Kenya is also a case of a food staple with a strong demand.

Korea, Nepal and Thailand focused on several commodities. In Nepal, several research stations were created, each specializing in one of the main crops. Over the years, the stations have come to coordinate their work more closely, while still maintaining their basic specialization, and improved varieties of wheat, rice, and maize have been made available.

The two Latin American institutions differ from the others in that they focus not on one crop, but on the cropping systems used by the small farmers, and this seems to have had positive results.

Whether research is to be conducted on one crop or on cropping systems, the problem remains that the potential of any given crop depends greatly upon local agro-climatic conditions. Indeed, this is a major stumbling block in agricultural development as a variety bred under controlled conditions cannot be recommended for adoption without a lengthy period of testing, and perhaps further adaptive research in other locations. A basic decision must be made when attempting to develop a national research institution: can the research center focus exclusively on selecting strains obtained from regional or international centers in similar climates, or is breeding within the country necessary?

It so happens that all the projects evaluated did propose to disseminate improved varieties, obtained either through in-country breeding or selection within imported materials. However, agricultural research need not necessarily be limited to varietal research. In many cases, great benefits can be derived from improvements to existing farming practices such as identifying optimum planting dates and weeding practices, which do not require many changes on the part of the farmers. Indeed, the West Africa team concluded that research on farming practices with rice might be a more useful program at this stage than varietal trials.

2. Adaptation of Research to Farmers' Conditions. Regardless of the of research planned (breeding or selection among imported materials, varietal improvement or research on cultural practices), two steps were found lacking in most projects: (1) obtaining information on current practices before planning the research program, and (2) testing the research outputs under actual farming conditions.

Most evaluation reports indicate that the research program was designed without sufficient information about existing farming systems and an assessment of the needs and constraints of the small farmers. For example, in Korea, the researchers are trying to develop better varieties of wheat and barley, which are grown in winter. While research is under way, the farmers are beginning to grow vegetables during the late winter and are finding this activity to give higher returns than the cultivation

of cereals, as the demand for vegetables is great. Improved varieties of wheat and barley are not likely to be competitive with vegetable production. The two Latin American programs are different. There, an effort was made to identify the existing farming practices and to study how and why they fit together. This was found efficient in both cases.

Even if the program is well adapted to the existing situation, any research is likely to involve some trial and error, so a testing and verification phase is an essential part of the research process. Yet few of the projects included an attempt at systematic feedback from the farmers to the researchers.

When trials were held outside of the research station, they were sometimes supervised so closely by the researchers, who controlled the timing of all farming activities and supplied all necessary inputs, that the farmers only contributed free land and unpaid labor. This is not quite like conditions prevalent on a real farm, where inputs may not be available on time, or where the farmer may not be able to perform some necessary tasks.

The only project which described a systematic feedback from the farmers to the researchers was in Guatemala. In accord with the concept of farming-systems research, the recommended practices were tested by the farmers rather than in research stations or under controlled conditions in farmers' fields. Researchers then evaluated the results and requested the opinions of the farmers before determining whether to disseminate the new practices.

When researchers seek improvements that enhance the productivity of the farm as a whole and not just those improvements that maximize production of any one crop, disciplines other than agronomy become potentially useful. Five of the eight projects did call for multidisciplinary work, at least on paper. The disciplines ranged from soil and agricultural sciences to economics and rural sociology.

Both the Thailand and the Korea projects called for multidisciplinary research but neither was very successful in this area. In Korea, the problem lay in the hierarchical social structure in which the importance given to rank made teamwork difficult. In Thailand, multidisciplinary research was never established because of institutional constraints along with adverse government policies.

However, even when agricultural scientists are convinced of the advantages of multidisciplinary work, they may not be able to obtain the necessary funds and positions. Some of the station directors in Nepal complained that they had requested an agricultural economist for their staffs for years, to no avail.

In Guatemala though, multidisciplinary work proved to be beneficial. Social scientists, economists, entomologists and agronomists worked together

to develop a comprehensive program that takes into account social, agronomic, and economic factors.

3. Dissemination of Research Results to the Farmers. Research results are quite useless if the farmers are not aware of them. Six of the reports indicated that research and extension need to be linked. This may seem obvious, since there is no point in developing improved technology for farmers' use if there is no coherent effort to inform them of its existence and how to use it. Yet, making research results available to farmers is not always easy, especially when there is little cooperation--or outright rivalry--between the research institutions and the extension service of a country. However, if a new technology is worth using, the first farmers who learn of it will pass on the word and the adoption rate will likely be high and fast, with or without further intervention by extension. This was clearly shown in Kenya.

The eight projects vary greatly in their approach to dissemination. In Korea, the extension service was effective and comprehensive and played a major role in the successful, rapid spread of the Tongil rice variety. The team cited "the integration of research and extension" as a key to the project's wide impact. Extension activities included the monitoring of farm trials, training programs, and demonstration plots.

In Thailand, formal extension channels were found ineffective, but radio programs and a mobile information unit were useful in providing information to the farmers.

In Nepal, the focus of development activities in the project being evaluated shifted from extension to research in the 1960's, but now there is a concerted effort on the part of the extension and research people to coordinate their efforts, with a renewed emphasis on extension.

In Central America, extension had not been included in the first phase of the project, and this has been found to hamper dissemination of research results. The situation in Guatemala was different; there, research findings were disseminated to the farmers by a specialized extension unit attached to the researchers, circumventing the existing extension agency. This has been cause for conflicts between the research and extension agencies.

The private sector has contributed to the rapid dissemination of research results in at least two projects, Kenya and Guatemala, through its involvement in seed multiplication and distribution activities.

D. Impact on Farming Households

The adoption of new agricultural technologies and practices affect farming and rural households in many ways, both economic and social, and these changes in turn affect the economic development of the country. For ease of presentation, the agronomic and socio-economic impacts of the seven projects evaluated will be discussed separately.

1. Agronomic impact. A change in farming activities for one crop is likely to affect the production of other crops, and indeed may require changes in the household's other activities. These changes in turn influence productivity, food supply, income and pattern of land use. There will be consequences both at the household and at the community level.

Kenya is a clear example of a technical improvement, a high-yielding hybrid maize, which was quickly accepted by the farmers because it fitted easily within the traditional practices and did not change the schedule of farming activities. Simply switching to the hybrid resulted in higher yields. Many Kenyan farmers promptly adopted the hybrid seeds, even though new seeds had to be bought each year. The evaluation team hypothesized that the farmers could assign less land to maize, their staple food crop, and still assure an adequate food supply for the household. That left land that could then be used for a cash crop. The introduction of hybrid maize enabled Kenya to become self-sufficient in that crop for the first time.

But the situation differs in Nepal for both wheat and maize. The high-yielding wheat varieties, which perform best if planted in early November, can conflict with a last harvest of rice, and their production potential can be realized only with adequate irrigation and high levels of fertilizer. The improved varieties of maize yield more than the local strains, and the farmers know it, but the ears do not keep as well. Many producers are compromising by planting part of their land to improved maize for immediate sale, as a source of cash income, and the rest to local maize for household consumption.

In Korea, the Tongil variety of rice produced more than previous varieties under farmers' conditions and its widespread use led to a decrease in cultivation of other crops. This was also because of a higher official farmgate price for rice. While these were positive economic results for the Korean farmers, the use of Tongil rice also made them more dependent upon that one source of income and therefore more vulnerable. Since 1977 the profitability of Tongil has decreased as yields declined because of the occurence of rice blast disease and several years of unfavorable cold weather.

The agronomic impact of the project in Guatemala is different, because the project sought to improve the entire cropping systems rather than focus on one or a few crops. The impact of the project is reported as very favorable, with increased yields despite a decrease in fertilizer use.

2. Socio-economic Impacts. The socio-economic impact of a project was to be evaluated both at the level of individual farms and at the community level. Within the time frame of an impact evaluation, it has been difficult to obtain quantitative information on the incomes of the

families interviewed, but it was often possible to ask the families whether they considered themselves better off than before, and why or why not. It was also possible to understand how the project may have a different impact on families with varying access to farming resources such as land, irrigation, or credit.

The question of equity, i.e. giving all farmers equal access to benefits from the project, is a very difficult one for several reasons. Governments often place a higher priority on assuring the food supply of the urban populations than on bettering the income distribution among farmers. It is also a difficult question from a technical viewpoint because many new or improved farming technologies simply are not efficient on a very small scale, or demand a level of investment in tools, inputs, water, or labor beyond the reach of the smaller farmers, especially those who are tenants.

In Nepal, farmers with some irrigated land have had immediate advantage over those with only rainfed land in using the improved varieties of wheat and maize. Farmers who were better off in the first place were more likely to be able to finance the necessary inputs. Tenant farmers were disadvantaged because they did not qualify for credit to buy inputs, and probably had less incentive to invest in the land.

Even in Kenya, where the overall output of maize was greatly increased as a result of research, the impact on equity within the country was probably negative. Disparity increased between the large and small farmers because the smallest farmers were reluctant to adopt the hybrid. Their main concern was to minimize the risk of crop failure (which the hybrid maize did not do) rather than to increase production. In addition, they were not able to finance inputs; even the need to buy new seeds each year was a problem.

In contrast, the project in Korea contributed positively to equity among farmers because of the price subsidies provided by the government and relatively equitable land distribution.

These evaluations did not look specifically at the projects' impact on consumers. However, the projects may have influenced the food price structure through increased production and also through changes in cropping systems. A shift in land use towards a crop (e.g. rice) or a variety that is especially in demand in urban areas, is likely to benefit the urban consumers, although not necessarily the poorer ones.

V. FOR FURTHER DISCUSSION

Firm conclusions and suggestions for future policy will be advanced only at the end of the 4-day workshop on the impact of agricultural research. The findings of the seven impact evaluations of agricultural research projects described in this paper already point out some key factors that seem to affect the impact of agricultural research on food producers and should be further discussed.

The projects have been successful in training host-country agriculturalists and in implementing productive research activities. However, these achievements have sometimes fallen short of having the expected impacts on the long-term research capacity of the host countries and on the farmers' productions and income. Three sets of problems have hampered the effectiveness of training and research activities: (a) lack of government commitment and unfavorable economic environment; (b) organizational and administrative difficulties, and (c) lack of adaptation of the research program to actual farming conditions and the needs of rural households. Only the third set of problems is technically within the realm of expertise of agriculturalists; the first two are problems of management and policy not specific to agricultural research. A project that addresses only the third set or problems is likely to fail in countries where the policy, administrative, and economic environments are not favorable.

A. Policy and Macro-economic Constraints

Research institutions in several projects have been found ineffective because of a combination of the following problems:

- Lack of commitment on the part of the host government, as evidenced by a lack of continuity in programming and funding. This may be a question of timing: research is a long-term process while government decisions are often made on a short-term basis. It may also reflect a lack of understanding on the part of policy makers of the potential contribution of research to economic development.

- Lack of coordination between the research institution and policy makers and planners in the host government, other host-government institutions that control activities linked to agricultural development, such as extension, marketing, pricing and subsidies, and agricultural inputs.

- Research projects of insufficient duration.

In the 1960's, it became understood that a simple transfer of agricultural know-how from developed to developing countries would not be sufficient to systematically increase food production. An apparent solution was to transfer the knowledge of how to conduct research (in technical terms) rather than a direct transfer of research results. The impact evaluations have found this to be helpful but not sufficient. Planning research programs adapted to the administrative, policy, and economic environments is as important as designing technically effective research programs. To do this, the interactions between changes in agricultural production and the rest of the economy must be understood.

In the Western world, these interactions were often taken into account as a matter of course when research programs were planned at the request of farmers, or by private enterprises for commercial purposes. A host

government establishing a research infrastructure is likely to need assistance in planning and management, as well as technical assistance in agricultural science. The deputy minister of agriculture in one of the countries evaluated, himself an agriculturalist trained under the AID agricultural research project, stated that AID technical and financial assistance to the agricultural research centers would have been more effective on the long term if assistance had also been available for planning and policy decisions regarding the place and role of the research networks within the host government.

B. Strengthening the Scientific Research Capacity of a Host Country

The training of agricultural researchers has been achieved according to plans in most projects, but the actual benefits from training have sometimes been disappointing. This is because the financial or career incentives offered to researchers in less-developed countries are often insufficient to keep them on the job for which they were trained.

In the U.S., research activities are closely linked with the universities. This is not always the case in less-developed countries where a research institution may be part of the government ministry, and where universities are likely to be controlled by the government. Whether agricultural research positions are given civil service status will influence the salary level and career opportunities available to the trainees. It will also determine how much flexibility the researchers have in planning their research programs and controlling research funds.

Other factors contributing to low productivity and eventual loss of trained professionals are inadequate support of research programs and inefficient administration of support services.

Scientific exchanges between the host country researcher and those in other national and international research institutions have been found effective as personal and professional rewards.

C. Adaptation of a Research Program to Actual Farming Conditions

The impact evaluations have found that a research program is more likely to result in improved technology that the farmers find useful if it takes the following into consideration. First, the existing farming practices and the agro-ecological environment in which they are used should be known. Assessing the existing cropping and farming systems rather than isolated commodities has been found effective. Second, the socio-economic constraints that bear on the farm household should be understood. These range from the availability of production resources (land, water, labor, inputs, credit) to felt needs and priorities of the food producers and their families.

Probably as a result of the complexity of the problems addressed by research institutions, programs which maximize linkages between the research activities and related activities have been found most successful. This included establishing maximum contacts among researchers, farmers, and extension services, conducting on-farm trials of varieties and practices, and establishing a systematic feedback from farmers to researchers.

Such programs could not be implemented by agricultural scientists alone, but call for multidisciplinary activities.

D. A WORD OF CAUTION

The U.S. Agency for International Development has reaffirmed its objectives to "enable countries to become self-reliant in food," with "an emphasis on effectively increasing the productivity, incomes and market participation of small producers." (AID Food and Agricultural Development Policy, March 1982, pp. 3 and 6, emphasis in text).

The emphasis on food production and the well-being of small producers will be kept as a central focus throughout the Workshop on Impact of Agricultural Research. The following questions are in order, even though they are not specificially discussed in all the impact evaluations.

Is it enough to increase food production? There is evidence that an increase in food production does not necessarily lead to an increase in net income of the farm household. The additional costs of inputs and opportunity costs of added labor or non-farming activities can counterbalance the increased production. Few of the reports discussed this problem, but the Nepal impact evaluation showed that some farms could have a negative rate of return for high-yield varieties. The assumption "increased production equals increased income" may be incorrect, and this could explain why farmers cannot always be convinced to adopt innovations that are technically valid.

Who benefits from a higher income? The impact of improved technology in agriculture among rural households is also complex. The diffusion of improved technology can have both negative and positive impacts over time or on different sections of the population. Improved technology can open better opportunities for those food producers with a larger resource base (land, water labor, access to credit), therefore widening the gap between the poorer and better-off farmers.

In addition, a high household income does not necessarily benefit all household members. While most development projects take the household as the smallest target unit, it is not so in reality. In most cultures, there is a clear division of labor obligations and of rights to production and income among household members, and especially between the male head of household and his wife or wives. Improved technology can increase the

overall farm production or income while leaving some household members--typically the women--worse off than before. There is little opportunity within the time frame of an impact evaluation to go down to such a level of detail. Nevertheless, it is well to keep in mind that an increase in farm income does not always mean that everyone in the household is better off than before.

Finally, the potential impact of agricultural research on consumers (both rural and urban) should be considered in terms of type, quantity, reliability of the food supply, and market prices.

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Annex A

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Kitale Maize: The Limits of Success	Charles W. Johnson, Team Leader (Bureau for Asia) Keith M. Byergo, Agronomist (Bureau for Development Support) Patrick Fleuret, Anthropologist (Bureau for Program and Policy Coordination) Emmy Simmons, Agricultural Economist (Bureau for Program and Policy Coordination) Gary Wasserman, Political Scientist (Administrator's Office)
Central America: Small-Farmer Cropping Systems	Harlan H. Hobgood, Team Leader (Bureau for Development Support) Rufo Bazan, Agricultural Scientist (Interamerican Institute of Agricultural Sciences) Rollo Ehrich, Agricultural Economist (Bureau for Development Support) Francisco Escobar, Rural Sociologist (University of Costa Rica) Twig Johnson, Development Anthropologist (Bureau for Program and Policy Coordination) Marc Lindenberg, Political/Institutional Analyst (Development Studies Program)
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Annex B

AGRICULTURAL RESEARCH DOCUMENTS

Published under the

A.I.D. IMPACT EVALUATION SERIES

Project Impact Evaluations

No. 2: Kitale Maize: The Limits of Success
(May 1980) PN-AAH-768

No. 14: Central America: Small Farmer Cropping Systems
(December 1980) PN-AAH-977

No. 27: Korean Agricultural Research: The Integration of
Research and Extension

No. 30: Guatemala: Development of the Institute of Agricultural
Science and Technology (ICTA) and its Impact on Agricultural
Research and Farm Productivity

in progress: Thailand: Agricultural Research in Northeastern
Thailand

in progress: Nepal: Food Grain Technology: Agricultural
Research in Nepal

in progress: WARDA: West Africa Rice Research and Production

in progress: Tunisia: Regional Wheat Development and Accelerated
Cereals Projects Impact Evaluation

Discussion Paper

13: A.I.D. Experience in Agricultural Research: A Review of
Project Evaluations

Annex C

EXECUTIVE SUMMARIES OF IMPACT EVALUATION REPORTS

KITALE MAIZE: THE LIMITS OF SUCCESS

AID first became involved with hybrid maize research in Kenya in 1963, through the Organization of African Unity and the East African Community. By 1970, the yield of the original hybrids had been successfully improved by 25 percent under research station conditions. The breeding program was continuously followed with similarly positive results until the EAC broke up in 1977. Other aspects of the A.I.D. program were less rewarding. Research to improve maize protein quality and to develop varieties for low rainfall areas did not succeed. Nor did the attempt to train Kenyans and integrate them into the research operation succeed. When the last American scientist left almost 15 years after the first A.I.D. project began, the effort was not sustained by Kenya.

In 1964, the first hybrid maize seeds were released for commercial production. Hybrids produced a remarkable 40 percent increase in yield over local seed and proved appropriate to the environment of the high potential areas of Kenya, with their fertile soils, abundant rainfall, and moderate temperatures. At the time, it was assumed that African farmers would continue to use the local improved variety rather than the new hybrid--it was less prone to crop failure and it could be re-used year after year whereas hybrid seed had to be re-purchased each year. But the hybrid was clearly superior in yield, enjoyed the status of a crop used by large farmers, and small farmers soon demanded it. By 1977, the majority of smallholders in high potential Central, Rift Valley and Western Provinces grew hybrid maize and their production far surpassed large farmer output.

An aggressive private firm, the Kenya Seed Company, reproduced the seed, distributed it, and promoted it throughout the country via a network of private shopkeepers. Extension agents demonstrated the use of improved cultivation techniques. The government-supported official prices and marketing system provided incentives, particularly for large farmers, to adopt and profit by the hybrid technology.

Innovations are usually unfair in the sense they reward those who have the means to benefit from them. Consequently, it is not surprising that hybrid maize was of greater value to those farmers with sufficient land, labor and capital to fully utilize the innovation. More surprising is the large number of smallholders who did gain access to the hybrid maize technology and who have improved their food security as a result. The overall impact of the increased maize production attributable to the use of hybrid seed is that Kenya has continued to be more or less self-sufficient in maize, the country's staple food. As a result, Kenya, despite a very high rate of population growth, has not had to face some food policy problems which have confronted other developing countries. Without hybrid maize, population pressure would likely have led

to a demand for more land for food crops and a reduction in less essential export crops. Hybrid maize helped to keep the price of food down in the cities, thus muting the pay demands of urban workers and keeping Kenya attractive for foreign investments.

There is a question, however, whether the government saw the increased production of maize as more of a problem than an opportunity. The government continued a pricing and marketing system more suited to dealing with the problems of scarcity than those of abundance. The Maize and Produce Marketing Board responded to an obvious need for increased storage capacity, for example, with too little, too late. Nor did the government take adequate measures to ensure the continued success of hybrids by: guarding the flow of critical inputs, including sufficient credit and chemical fertilizers; and being supportive of the research facilities which made the hybrids possible. The loss of the incremental benefits which the A.I.D. project demonstrated were possible by improving hybrid seed year to year, cannot be calculated--but based upon the benefits derived from the program in early years, the loss is substantial.

Smallholders have not yet exerted policy influence on the government (as did the European-dominated large farm sector prior to Independence) by forming effective organizations of their own. If government policy toward maize is to become more effective, it will require not only better long range planning but wider popular participation, especially among smallholders, in its formulation.

From the experience of hybrid maize in Kenya and from the observations of Kenyan maize growers and consumers, an A.I.D. evaluation team drew seven key lessons:

1. Simplicity and viability were the decisive factors in the success of hybrid maize.

2. The private sector was crucial in the rapid diffusion of hybrid maize.

3. Perfect equity cannot be expected even from the most successful technology.

4. The long-term continuity of foreign experts was basic to the success of the breeding program.

5. Foreign advisors and finance do not automatically create institutional capacity to perform agricultural research.

6. Pragmatism and skepticism should surround A.I.D. support for regionalism.

7. Too many lessons should not be drawn from a unique experience in one African country.

Central America: Small-Farmer Cropping Systems

The small-farmer cropping systems research project in Central America was selected for evaluation as part of A.I.D.'s effort to assess the impact of its activities in several development sectors. Field work for the evaluation was done in Costa Rica, Guatemala, Honduras and Nicaragua by a six-person team in February 1980. The findings and interpretations are those of the team and pertain only to this project. However, they will contribute to a forthcoming analytical report for the agricultural research sector as a whole.

In 1975, AID's Regional Office for Central American Programs (ROCAP) began support to the Center for Tropical Agricultural Research and Training (CATIE), located in Turrialba, Costa Rica, to develop and test "a coordinated regional research approach for improving the cropping systems of small farmers in Central America." CATIE agreed to negotiate working arrangements with the principal agricultural research institutions of the five Central American republics. These arrangements were to provide for CATIE and national scientists to collect survey data on the cropping practices and crop yields of the peasant farmers as well as data on their socio-economic environments. Then the scientists were to work with representative farmers by setting up experimental plots designed to test and evaluate alternative crop combinations for their potential in increasing production and income.

ROCAP undertook this project with the expectation that CATIE would develop and demonstrate an innovative multidisciplinary methodology for doing research on the cropping systems of the small farmers of Central America. It hoped to mobilize a permanent regional institutional capacity and commitment for on-farm research and training addressed to the needs of this vital sector of rural society. It also expected to see CATIE produce, through the project, improved cropping systems alternatives for different ecological zones of the region that might be suitable to rapid verification and dissemination by the national institutions. Its longer-term goal was that as farmers adopted these proven, improved systems the total yields from small farms would significantly increase and family incomes would rise.

By the end of the project in 1979, CATIE had made working arrangements and had carried them out in varied ecological zones of all five of the Central American republics. Twelve agricultural scientists from CATIE had been engaged full-time in on-the-farm research. They had developed and demonstrated a cropping systems research methodology working on the farms of seventy-five smallholders. Impressive production gains and potential economic benefits had been documented for the ten

major cropping systems alternatives elaborated by the project staff. But these alternatives were yet to be verified through extensive field trials in the region. However, one highly promising alternative crop mix of sorghum and beans, which did undergo limited verification, had been adopted by Nicaraguan agricultural officials for widespread dissemination among peasant farmers.

During this five year period, CATIE increased its graduate training on small-farm systems and generated a five-fold increase in its budget, largely from international donors and almost exclusively for smallfarmer oriented agricultural research activities using the "systems" approach. CATIE's institutional commitment to improving small farmer production had become well established as had its ability to work with national institutions in the region.

Although the project had achieved most of its stated objectives, the beneficial impact of the emergent research methodology and of the expanded institutional capacity at CATIE on large numbers of small farmers was yet to be demonstrated. There was no wide-scale adoption of the newly tested cropping systems alternatives developed from the on-farm experiments. In spite of this and partly because of it, some lessons were learned from the project evaluation.

Doing agricultural research on the farms of smallholders, as opposed to research done on far-removed experimental stations, holds much promise for the development of truly appropriate production technologies and their more rapid adoption and dissemination. But for that potential to be realized, the projects should be designed to include the full cycle of research through both verification and dissemination. Donors sponsoring such research should provide the time and resources necessary, perhaps eight- to ten-year authorizations, to allow for validated technologies to reach numbers of small producers. International or regional research institutions, like CATIE, must be prepared to maintain their collaboration with the national agencies, not only to support the verification and dissemination phases as they come on line, but to capture important findings during these phases for improving subsequent research work.

Agricultural institutions undertaking on-farm systems research must give adequate attention to non-agronomic issues--such as input constraints, market analysis, and household and area labor availabilities by season--in the planning of the research, the analysis of constraints to production, and the implementation of research, verification, and dissemination programs. To do so requires that the institution have adequate staff skills in the social sciences and in farm management within the multidisciplinary teams undertaking each phase of the research effort.

Scientists need to be aware of the difference between doing research on small farms and doing research with the active interest and participation of small farmers. The former may well inform the agricultural scientist about agronomic issues, but only the latter is likely to educate both the scientist about how the small-farmer household economy works and the farmer about new agricultural options that will fit with the economy. Several of CATIE's field staff demonstrated that being a scientist and an involved participant, or even change agent, are not mutually exclusive roles.

Korean Agricultural Research: The Integration of Research and Extension

A profound change occurred in the early 1970s that transformed the Korean Government's rural development strategy. From one emphasizing industrial exports, the costs of which were largely borne by the Korean farmers, the strategy evolved into one devoted to improving rural Korean life. The genesis of this approach was both political and economic: a hardening of PL 480 terms and the results of the 1971 election that amply demonstrated that government support had eroded in the countryside. The Korean Government responded with a rice pricing policy advantageous to the farmers, the strengthening of the extension service, the formulation of the Sae-maul ("New Village") Movement, and a rapid increase in rural infrastructure.

The origins of AID's support to agricultural research are found in the Korean Agricultural Sector Survey (1972) and succeeding documents that advocated a strengthening of research as a primary need. The project, proposed in 1973 and implemented in 1974, provided $5 million for a tripartite program to strengthen the capacity of the Office of Rural Development of the Ministry of Agriculture and Fisheries. It included training of Korean researchers overseas, equipment (including a computer and library materials), and both resident and short-term expatraite advisory services. At the close of the project in 1980, 21 Ph.D. students and 17 M.S. students were trained overseas, while an additional 94 received short-term training and 106 participated in observation tours.

Although there were problems with the English language competence of prospective students, the training aspects of the project were universally regarded as the most successful part of the program. Of notable, but secondary, importance was the provision of equipment and supplies, especially the computer and the library materials. Lagging far behind was the value of resident expatriate assistance, which was of marginal use to the project but was more significant in terms of relieving the AID Mission from continuous monitoring of the project than in providing help to the Koreans. Of greater importance was shorter-term foreign technical advice.

The inchoate goal, from a Korean perspective, was probably rice self-sufficiency--a strategic, political, and economic objective. The project purposes, however, were specified in considerable detail outlining exact yield increases on agricultural experimental stations over a ten-year period in the areas of rice, barley, wheat, and soybeans as well as generalized improvement in potato production and in the cropping systems. Specific increases were also proposed for

farm fields for the same time. Since the decade of crop improvement is to end in 1984, this evaluation must be somewhatcircumscribed.

The project paper suffered from spurious specificity regarding experimental station crop increases. Before the project began, experimental yields were higher than those indicated in the paper, often by considerable amounts. The research breakthroughs that the project anticipated were generally made prior to the project. Farmer yields may well reach their objectives by 1984, but the AID project was only a beneficial increment to Korean agricultural research. It supplemented an existing, competent system, but offered little that was innovative.

The concentration on rice led to a lack of emphasis on other crops, an inattention caused by national concerns as well as social and economic factors the project ignored. Although there have been increases in crop yields, hectarage of the other crops has consistently been falling, even before the project began. Thus, national targets will not be met even if a relatively few farmers benefit. The choice of some of the crops covered by the project such as wheat, soybeans and potatoes seems questionable, as does the emphasis on increased fertilizer responsiveness.

Critical to a developmentally effective agricultural research program is the transference of experimental results to the farmers. Through a widespread extension service, a farmer training program that includes almost all families annually, demonstration plots, and the Sae-maul Movement, Korea has developed an authoritarian but effective means of disseminating research results.

Thus, beginning in 1972 the spread of the high-yielding varieties of rice was pushed with alacrity by the Korean bureaucracy in response to a national command structure. The effort was effective, making Korea self-sufficient in rice by 1975. Yet there were two inherent problems in this comprehensive effort: these varieties were sensitive to cold, and new races of the fungal disease called blast normally develop after a few years if large areas are planted to a single variety.

The crisis developed first in 1979 with a drop in production caused by blast followed by a disastrous 1980 crop due to cold temperatures. The rice crop fell by one-third, creating a crisis of confidence in the government and in the guidance service.

Ironically, the failures of 1979 and 1980 can be attributed to the strengths of the Korean guidance service. Thus its

weakness is based on the omnipresent bureaucratic hierarchy that, in contrast to most developing societies, can transform research into production. In singleminded pursuit of its political goals, it neglected elemental precautions that might have avoided the problems of the last two years.

Agricultural research was an appropriate intervention for AID at the time. It assisted a well-established, agricultural research network, but did not materially transform it. It created no new institutions.

Agricultural researech will continue in Korea but replication abroad will be difficult. Any successful adaptive agricultural research project will be dependent upon a positive pricing policy, an effective extension service, rural infrastructure, and continuous contact with international research centers, among other factors. Political will is required for its success, but too strong an emphasis on political objectives can undercut its effectiveness.

Guatemala: Development of the Institute of Agricultural Science and Technology (ICTA) and its Impact on Agricultural Research and Farm Productivity

During the decade of the sixties, food production in Guatemala barely kept pace with the demands of a growing population. In 1970, the Government of Guatemala initiated a restructuring of public agencies to provide coordinated service to small food-producing farms. An innovative organization, the Institute of Agricultural Science and Technology (ICTA), emerged from this restructuring with responsibilities for generating and promoting the use of improved technologies in basic food crops. AID supported this restructuring with a series of loan and grant projects beginning in 1970.

In 1975, AID approved the Food Productivity and Nutrition Project. Its purpose was to increase the production and nutritive quality of basic food crops in Guatemala and to strengthen and develop ICTA as an institution. Of $1.73 million allocated for the project, $1.2 million was for expatriate technical assistance, including plant breeding experts and other technicians who staffed ICTA while project-sponsored Guatemalans were being trained to assume positions within the new Institute.

Three crops, maize, beans, and sorghum, were targeted for increased production. Working with experts from international agricultural research centers, ICTA personnel developed new varieties and tested them under small farm conditions by collaborating with farmers. With the assistance of the Inter-American Development Bank, a seed service was organized to process seed and help maintain genetic quality.

New varieties of both maize and beans were introduced and increased yields have been recorded. Using improved seed and other technologies recommended by ICTA, collaborators have obtained increased yields. Gains in maize have been primarily in lowland varieties, but one new highland variety is promising. The impact of new seed on maize production is expected to increase as the amount of seed produced increases.

New varieties of beans may reduce or eliminate the need for costly programs to control Golden Mosaic. New varieties of sorghum were not released until 1980 and thus could not be evaluated. However, they appear markedly superior to previously available varieties.

In addition to developing and recommending improved seed, ICTA developed and recommended other farming practices related to increased yields, such as planting distances, seed densities, fertilizer applications, and weed and insect

control. Indices of acceptance developed by ICTA indicate that increasing numbers of farmers who have collaborated in the fieldtesting of such new technologies are adopting ICTA recommendations. Interviews with ICTA personnel and with individual farmers support this impression.

The AID project facilitated and hastened the strengthening of ICTA as an institution. The number of ICTA staff increased and staff qualifications improved. Expatriates facilitated the research work of ICTA and its growth as an organization. With project support, 10 Guatemalans received advanced training and by 1979 and 1980, they were returing to ICTA to replace expatriates.

However, high attrition rates among personnel with advanced degrees are a serious problem for ICTA. Rigid salary schedules are apparently responsible, but ICTA managers have been unsuccessful in efforts to obtain the authority to revise these schedules. With the departure of expatriate advisors, these high attrition rates may make sustaining and expanding the present ICTA system more difficult.

Some confusion remains regarding the respective role of ICTA and DIGESA, the extension service of the Ministry of Agriculture, particularly as ICTA's approach to research draws on some techniques of traditional extension methodology. ICTA and DIGESA are working on this problem, and it seems likely that new patterns of relationships will develop.

ICTA has come to represent a new model for agricultural research that planners and researchers in other countries are studying and attempting to replicate. If there is continued and increased support from the Government of Guatemala, it will be able to sustain and expand its present activities.

Food Grain Technology: Agricultural Research in Nepal

In 1957, the U.S. Operations Mission initiated support for a broad-ranging agricultural development effort in Nepal. This project continued without pause for 17 years, largely in pursuit of the objective of increasing Nepal's food grain production capacity by enabling and encouraging Nepali farmers to apply the techniques of scientific agriculture. While the U.S. financial and technical assistance was continuous, the emphasis, the pace, and the amount of Nepali involvement were altered considerably during the course of project implementation. The project began as a "general agriculture" initiative and gradually evolved to its concluding emphasis on the development and dissemination of "food grain technology."

The project successfully contributed to the establishment of agricultural research and extension systems by training almost 600 Nepalis to the B.S., M.S., and Ph.D. levels and by constructing facilities for research at five stations in the Tarai--at Nepalganj, Bhairawa, Parwanipur, Janakpur, and Rampur. With the assistance of the extension service, improved wheat, rice, and maize varieties that were tested on the research stations were spread to farmers across the Tarai. Some of the selected improved varieties proved widely adapted to Nepal's enormous range of agroecological conditions and spread into the Hill and Mountain farms as well. Other parts of the "technology packages"--which included recommendations for fertilizer, time of planting, spacing, and irrigation--were not so widely adopted.

In trying to assess more precisely the differences that could be attributed to the implementation of the Food Grain Technology project, we first examined statistical fact sheets and research reports. We then talked with agricultural leaders (many of whom had apparently taken advantage of training opportunities offered under the project) and with agricultural producers. We took a long view in these dialogues, trying to comprehend the pattern of changes which had occurred in the agricultural sector over the past two decades. While looking at reports of experimental trials and at growing fields of wheat and mustard, we discussed not only what had happened, but what might not have occurred had the project never been implemented.

Our examination provides both a sense of solid accomplishment and a basis for some disquieting fears. On the positive side, we found the following:

-- A functioning research system has been developed.

-- Farmers are immensely aware of the need for and the problems related to Krishi bikash (agricultural development).

-- Extension and research services can, at times, work together in complementary, mutually reinforcing activities which result in new plant varieties and increased knowledge in the countryside.

On the negative side were the following factors:

-- Researchers and farmers are not in complete agreement on which agricultural problems need to be addressed, nor are the channels for communication as open as they could be.

-- The "green revolution" as it has occurred in Nepal has not yet resulted in long-term security and economic independence as expected but has contributed to economic and environmental destabilization.

-- The productivity of farmers, extension workers, researchers, and those agencies charged with input supply distribution is far from optimal.

Thus, researchers articulate the need to continue the search for new varieties which are higher yielding, more disease resistant, and produce grain with acceptable qualities of taste. Farmers agree that variety development is important, although they emphasize other criteria for variety selection as well. Farmers also recommend that increasing reliability of water and fertilizer supplies is more important for handling their problems of deteriorating soil fertility, declining farm sizes, with low yields, and high risks. The role of agricultural research and extension is not in question; at stake are the issues of research priorities and their relevance to farmers' resources and constraints.

The fact that farmers have adopted components of technology packages at all may reflect less the persuasive rhetoric of research and extension than the farmers' response to the increasing pressure of population and to their families' requirements for food and cash. Nevertheless, without the technology packages, it is unlikely that Nepal's farmers would be as productive as they are today.

Agricultural Research in Northeastern Thailand

In 1962, the Ministry of Agriculture and Cooperatives in Thailand officially established an agricultural research center at Tha Phra near Khon Kaen, located 400 kilometers from Bangkok. The center was to be a multidisciplinary research facility focusing on the Northeastern region and responsive to the needs of the farmers. In addition, it was to support and coordinate the work of the Ministry's 112 small research centers and stations in Northeastern Thailand.

USAID/Bangkok first assisted this project in the mid-1960s by providing graduate training to 24 Ministry employees who were to staff the center. In 1966, a multifaceted project was launched for institution-building at the center. A contract was signed with the University of Kentucky, Lexington Kentucky, and from 1966 to 1975 Kentucky Project officials were responsible for (1) advising center administrators; (2) arranging for training employees in the United States; (3) assisting in the establishment of research laboratories, research programs, and extension activities; and (4) coordinating functions at the center.

An excellent physical facility was constructed which has been carefully maintained. Since 1966, a total of 118 Ministry employees have received U.S. training in agricultural disciplines mostly at the University of Kentucky. By 1975, laboratories were well established and substantial research work was underway. However, since 1975, research programs have been reduced and the professional staff of the center is far below projected numbers. The research carried out is essentially conventional and laboratory- or station-focused; there is little evidence that it is responsive to the needs of small farmers in Northeastern Thailand.

Kentucky Project extension and training activities started slowly, but since 1975 several initiatives have been launched. These include a series of television and radio programs, a mobile extension unit, and an agricultural information network. These initiatives were not planned at the beginning of the project. However, at the time of review, these activities and their support units were the most dynamic at the center. Modest USAID support to these programs could do much to enhance the quality and quantity of agricultural information available to Northeastern farmers.

Scientists at the center need to familiarize themselves with the complexities of agricultural production and decision-making in the Northeast. This could contribute to future research activities and outreach programs which are more relevant to the needs of a greater variety of farmers. Furthermore, bureaucratic conflict has created an atmosphere in which much research done at the center is rejected out of hand by the central Ministry of Agriculture and often has to be redone in order to be acceptable. Declining budgets, loss of coordinating authority, frequent institutional redefinition, and loss of status and professional autonomy have combined with previously mentioned factors to defeat efforts to build a major research capacity in Northeastern Thailand.

Ministry, USAID, and University of Kentucky Project officials chose not to reexamine and reformulate the project, inspite of ample, early evidence that the center lacked sufficient bureaucratic potency to accomplish its long-range goals. It seems unlikely that more detailed planning could have pinpointed and overcome this problem. However, AID officials should have recognized the problem by the late 1960s and done something about it. They could have (1) pulled out, (2) decided to support only the most promising portions of the project (e.g., the training component), or (3) worked with the Ministry to strengthen the bureaucratic position of the center. That none of these things happened reflects negatively on responsible USAID officials, but perhaps more so on AID structures and procedures. These may have discouraged Mission officials from reexamining projects and making mid-course corrections 10 years ago. Whether or not there have been sufficient changes in incentive structures to encourage them to do so today remains to be seen.

West Africa Rice Research and Development

The West Africa Rice Development Association (WARDA) was created in 1970 to increase rice production in the 15 member countries through research and training. Importation of the rice necessary to satisfy an increasing demand for what is becoming the food staple in urban areas is a drain on foreign exchange, yet the climate and ecology of West Africa are suited to rice production.

A decade after its creation, one cannot hold WARDA responsible for the fact that West Africa is importing more rice than ever. WARDA was encouraged to look for technological solutions to this deficit, not for economic policy solutions. But a technical solution cannot be divorced from its economic environment. One of the greatest weaknesses of WARDA's research design is its tendency to separate these two. Some of WARDA's research results demonstrate the disadvantages of this tactical separation, laid on the association by its founding charter and by the orientation of the donor and member state support it has received. Nevertheless, because of its scientific professionalism, WARDA, through its development department, has discovered a politically acceptable way of targeting project identification research design on specific situations that are not only ecologically but also economically conducive to expanded rice production.

Much of the more recent, second phase of AID support to WARDA (project 698-0429) is built upon WARDA's evolving skill in contextualizing rice research and development inputs such that, for specific contexts, their outputs are not hindered by the widespread economic constraints on rice production in West Africa. Therefore, with the advantages of hindsight, therefore, we are evaluating the first-phase AID/WARDA project (698-0382), not only in terms of its own stated goals, but also to identify the part it played, if any, in helping WARDA define this more successful, interdisciplinary role for itself.

Under the first-phase project, AID supported (1) two special research projects--one for mangrove rice at Rokupr, Sierra Leone, and one for deepwater/floating rice at Mopti, Mali; (2) a training center adjacent to Liberia's Agricultural University at Fendell just outside of Monrovia; (3) participant training in the United States for key WARDA researchers; and (4) a rice economics study undertaken in conjunction with the Food Research Institute at Stanford University.

Tunisian Wheat Development Program

The Tunisian Wheat Development Program (Project Ble) was designed and implemented from 1965 to 1977 by AID, the Ford and Rockefeller Foundations, the International Maize and Wheat Improvement Center (CIMMYT) in Mexico, and the Government of Tunisia. It was conceived in 1965 at a time when the economic chaos following independence from the French prompted the Government of Tunisia to explore every avenue to reverse the decline in agricultural production, particularly of food. Development of Tunisian institutions and training of Tunisian staff were priority goals to fill the gap created by the exodus of the French civil servants and other European farmers and entrepreneurs in 1964. The ultimate goal of the Government was and remains "self-sufficiency in food production."

The purpose of the program was to introduce and adapt to the Tunisian environment and climate the new semi-dwarf high-yielding wheat varieties that had been developed at CIMMYT in Mexico. The other important purpose of the program was to train Tunisians in agricultural research and extension methods as a means of developing institutional capabilities for Tunisia to carry out research and extension activities alone.

The impact of the program has been slow but positive. Much of the impact is being felt now, some five years after the program was phased out and 17 years after its conception. If one single factor had to be identified as the program's most important contribution, it would be the development of the program for advanced degree training, particularly to the Ph.D. level. The research capability developed by this advanced training has become most effective in the past three years. The impact is being demonstrated in research results; in an effective extension program; in improvements in institutional capabilities in research, extension, and education; and in farmers' increased acceptance of new varieties and improved technology, resulting in increased yields and production.

Training has enabled Tunisians to successfully continue research and extension activities without assistance after the program was phased out. Nineteen Tunisians were trained in the United States to the level of M.S. and Ph.D. degrees in agricultural sciences. This was supplemented by practical training of 55 other Tunisians at CIMMYT in Mexico, in Australia, and in Tunisia. Of the 19 who received advanced training, 13 are working directly or indirectly in the cereals

program in Tunisia; 11 of these are directly involved. Of the 19 Tunisians, one is continuing advanced studies in the United States and five are working abroad with international or other organizations. Four of the Tunisians who received Ph.D. degrees are involved in research at the National Agricultural Research Institute of Tunisia (INRAT) while teaching at the National Agricultural Institute of Tunisia (INAT, the national agricultural university). Two Tunisians trained to the M.S. level are participating in the research program at INRAT.

During the life of the program, five new bread wheat and five new durum wheat varieties were developed and introduced to farmers with varying degrees of success. After the program was terminated in 1977, Tunisians had been trained under the program continued to develop varieties with caracteristics that improved on those developed earlier. In 1980 and 1981, two improved varieties of bread wheat and two improved varieties of durum wheat were developed and put into use. Some of these later varieties were more resistant to diseases and drought than earlier varieties, and consequently were more acceptable to farmers.

An extension and farm demonstration system and program were developed in the beginning of the Wheat Development Program to work closely with the research activities to extend results to farmers and to feed back problems to research scientists. The Technical Division, established in the Office of Cereals, successfully carried out its functions during the life of the program. It is now staffed with trained Tunisians and is still operating a successful program.

As a result of the program, Tunisia's cereal production (wheat and barley) was greater during the 11-year period 1971 through 1981 by 5.302 million metric tons than during the previous 11-year period. Despite population growth, annual per capita production of cereals increased from 104 kilograms in 1970 to 160 kilograms in 1980, using average annual production figures for the two periods and the population levels of 1970 and 1980, respectively. Furthermore, the increased production was achieved on an area of land less (by over 200,000 hectares in each year, 1980 and 1981) than in the previous four years. The increased production of cereals saved the Government of Tunisia the foreign exchange costs of annually importing 299,000 metric tons of durum wheat, 77,000 metric tons of bread wheat, and 106,000 metric tons of barley that would have been required otherwise during each year 1971 through 1981. The value of this amount of annual imports at 1981 prices would have been $125,944,000 (cost, insurance, and freight in Rotterdam, imported from the United States). This was made possible at a total cost to the U.S. Government, Rockefeller

and Ford Foundations, and less than $3.5 million in technical assistance.

The program has resulted in other benefits to Tunisia. It contributed to increased per capita consumption of cereals, mostly in the form of increased use of commercial bread and noodles. While no national data were available to confirm the fact, there was evidence that farmers had been integrated into the money economy. Cereal farming had become mechanized and farm families were purchasing prepared foods such as commercial noodles and bread.

The positive impact was not without some negative effects. Rural migration of men had led to a change in the role of rural women, with an increase in their participation in farming and rural industries, and a decrease in their role in home preparation of food. While this may be viewed as a positive gain for women, it has had one negative result. Increased use of purchased, prepared foods (principally noodles and bread) instead of home-prepared food has decreased the nutritional levels of farm family daily diets.

Not all the institutional goals have been achieved. Integration of research and extension has not been acted on. The planners had sought flexibility in management, financing, decision-making, and action by establishing the program under the parastatal, semi-autonomous Office of Cereals, a commercial organization concerned with the purchase and sale of cereals. This office, which is outside the Agricultural Services of the Ministry of Agriculture, was not impeded by the bureaucratic constraints of other agencies. At the same time, it did not play a role in providing technology to farmers. During the life of the program, activities were integrated through personal cooperation of scientists who cut across institutional lines. This system continues today.

Despite these weaknesses, the institutions in research, education, and extension have developed basic capabilities, resulting directly and indirectly from the program, which permit them to continue successful activities. However, the goal of self-sufficiency in food production has not been achieved. This goal is illusory and has tended to overshadow the progress that has been made, as continued growth of population and increased per capita consumption of cereals have widened the food gap, requiring increases in imports. Tunisia's overall goals of using its resources to comparative advantage, and of producing higher valued crops on the better land (under irrigation where feasible) for export and to supply the thriving hotel-tourist industry are both aimed at achieving a balance in international trade of agricultural products, which makes good economic sense. Achievements in cereal

production are due not only to the scientific progress achieved under this program, but also to improvements in institutions, economic conditions, and policies in the agricultural sector.

AID EXPERIENCE IN AGRICULTURAL RESEARCH
A Review of Project Evaluations

This study reviews the experience of the U.S. Agency for International Development (AID) in the area of agricultural research. It was completed by Development Alternatives, Inc. (DAI) at the request of AID's Office of Evaluation, Bureau for Program and Policy Coordination (PPC/E). The study's objectives were:

-- To review historical trends in agricultural research, especially of AID's expenditure in that sector;

-- To identify the set of projects comprising AID's agricultural research portfolio; and

-- To identify major issues affecting the design and implementation of agricultural research projects by reviewing evaluations of a sample of those projects.

A review of the literature and interviews with various professionals identified several recent trends in agricultural research. These included an increasing attempt by researchers to develop technology applicable to the needs of farmers under adverse envrionmental conditions and in resource poor regions of the world. Moreover, in an attempt to better align research with farmer needs, a broader array of production constraints (both agronomic and socioeconomic) is now being examined in the technology generation process than in the past. This has entailed more emphasis on on-farm research, the use of multidisciplinary teams and a more holistic approach to research, as well as greater participation by the farmers themselves in the technology generation process. Additional issues receiving increased attention are the importance of strong national research systems and the amount of time necessary for agricultural research projects to produce useful results.

AID support to agricultural research has been increasing in recent years. Historically, however, the sector has received relatively little attention from the Agency. According to the interviews and literature review conducted during this study, one reason for this lack of attention was the belief, prevalent in the early 1950s, that the technology necessary to improve agricultural productivity in the developing countries already existed. Limitations during the 1960s included Congressionally imposed restrictions on the amount and type of research that AID could undertake together with decreases in the Agency's in-house technical expertise in agriculture. Finally, the New Directions legislation passed in the early 1970s, while contributing to important changes in the nature and focus of AID's agricultural research, emphasized other development strategies such as rural development and food production

projects, or the delivery of services to meet basic human needs.

AID's increasing interest in agricultural research in recent years has partly resulted from a realization that a lack of appropriate agricultural technology is a serious constraint to food production increases. Moreover, the success of the green revolution technology developed by the international agricultural research centers (IARCs) in increasing production levels of selected crops in certain regions of the world has furthered this realization.

Between 1978 and 1981 AID funds going to agricultural research increased by almost 70 percent, from $84.7 million to $143.7 million. In relative terms, AID's investment in this sector rose from 12.8 to 19.5 percent of the agriculture, rural development and nutrition appropriation (excluding economic support funded appropriations). Most of this increase came from projects funded by AID field missions. On the other hand, the proportion of AID support going to the IARCs and centrally funded bilateral research has increased only slightly. However, the passage of Title XII and the creation of the Board for International Food and Agriculture Development (BIFAD) may provide a basis for greater activity in this area.

Aside from reviewing historical trends in agricultural research, the study examined issues affecting projects in the sector based on a review of 131 evaluations of 48 agricultural research projects (39 regionally and mission-funded and 9 centrally funded). It found that the evaluation documentation provides only an imperfect picture of any project's overall performance. The evaluations were most often focused on the provision inputs and the achievement of outputs. Attempts to measure project impact (to determine the effect of project activities on the beneficiaries welfare) were limited to the four Impact Evaluations included in the sample (part of a series of indepth, ex post evaluations currently being undertaken by AID). The standard evaluations did not provide the basic information (such as project characteristics and standardized performance indicators) necessary to permit a comparative analysis of the projects in this sample.

Using the evaluation documents, it was possible to identify several recurrent issues common to projects in the agricultural research sector. For regionally and mission-funded projects these included:

-- Operational problems entailed in doing on-farm, farming systems-type research, and involving farmers in the research process;

-- The quality of the research conducted and the setting of research priorities;

-- The phasing of activities, especially construction delays which impeded planned research, as well as the amount of time allowed to achieve the research objectives;

-- The adequacy of AID's research project supervision, given a lack of technical expertise and high staff turnover in the missions;

-- Weaknesses in the links between reseach and extension, as well as inadequacies in complementary services (inputs, credit, marketing, and so forth);

-- Host government support for the projects;

-- The lack of qualified counterpart personnel to work with expatriate technicians, together with low salaries for host country researchers which makes it difficult to maintain competent staff;

-- Inadequate participant training programs;

-- Delays in procurement; and

-- The delays or inability of AID and its contractors to provide qualified technical assistance.

For the nine centrally funded projects in the sample (each of which involved overseas research), the issues discussed in the evaluations included: the creation of linkages with host country institutions; the performance of long-term staff; the project's scope and funding; and the quality of the research conducted. Issues not fully treated by the evaluations of these projects included: the problems entailed in simply conducting research within developing countries and in conjunction with local institutions and researchers; the feasibility or necessity of conducting more research away from the research station; and the dissemination of the research findings.

In conclusion, this review of past AID evaluations identified and documented a set of issues or problems that were more or less familiar to development professionals knowledgeable about the sector. The study also identified significant gaps in the evaluation data base that was analyzed. In terms of producing information that might influence overall policy within the sector and feed into the design of future projects, this study highlighted the need for investigations outside the Agency's system of regularly scheduled evaluations in assessing its project implementation experience.

Part B

RAPPORTEURS' NOTES

Part B. Rapporteurs' notes

I. CRITICAL ISSUES IN THE SUCCESS OF AGRICULTURAL RESEARCH PROJECTS

On arrival at the workshop, each participant was given several sheets of paper, each of which contained an incomplete statement related to agricultural research. The participants were asked to complete each statement; later the work groups tabulated the responses. The aim was to give the workshop a sense of the diversity or uniformity of opinion held by the participants on various aspects of agricultural research, as well as to highlight relevant issues.

The major constraints (technical and other) to achieving effective agricultural research in most developing countries are (in order of priority assigned by participants):

1. Communications (however, communications constraints may, in fact, be a symptom that other factors, e.g., human resources, administration, national policy, are not functioning well, rather than being constraints in and of themselves).

2. Human resources: lack of scientific personnel, administrative and support staff; low level of training; and lack of human resource management.

3. Administrative: lack of appropriate incentives to organizations and researchers; and poor organization, coordination, and management of research institutions and programs.

4. National policies: lack of support or coordinated approaches to research at national policy levels; inappropriate national research priorities; inappropriate agricultural policies; and inadequate infrastructure to utilize research results.

5. Technical: lack of technical knowledge of production and consumption systems; and lack of scientific knowledge.

The principal criterion for evaluating the long-term impact of investment in agricultural research in most developing countries should be (figures in parentheses indicate the number of participants favoring):

1. Welfare (22): improved farmer welfare (9); improved nutrition (5); improved consumer welfare (2); increased farmer income (6).

2. Increased production over the long term (19).

3. Rate of adoption of technologies developed (15).

4. Institutionalized sustained research capablity (14).

5. Increased productivity (7).

The principal consideration for a donor or technical assistance agency in deciding whether to invest in national agricultural research in most developing countries should be:

1. Commitment of host government (20). Perceptions of donors may vary, from one of assurance that the policy environment will become highly conducive to increasing agricultural productivity, to one that serious interest in usefulness of improved technology by key persons is sufficient commitment to start.

2. Capability to sustain project (7). Institutional capability to sustain activity beyond life of assistance program, including availability of funding. Implications for program design and for duration of program.

3. The extent to which research can increase productivity, reduce risk, and increase incomes (6). There should be sufficient opportunities for success: to increase yields, decrease risks through use of improved technology or change in economic environment through research.

4. Low crop yield (5).

5. Availability of funds to follow through programs started (5).

6. Political environment (5).

7. Recognition that research is long-term process (5).

A major problem for most developing countries in seeking or receiving funds or technical assistance in support of national agricultural research is:

1. Lack of institutional capability to plan and coordinate programs and requests for assistance for these programs (28).

2. The inadequacy of resources, both budgetary and personnel, needed to receive and use external assistance (17).

3. Lack of commitment by the government to the research program--policy environment (16). There is some relationship with the problem of resource inadequacy. But a developing country could be committed to research without having adequate resources, or if resources are adequate, the commitment to allocate them might be lacking.

4. A lack of congruence of host country and donor country on priorities and on the duration of commitment (14). The issue of "strings"--being difficult for developing countries to accept--also comes in here.

5. The inability of developing countries to promote their own interests to donors (5).

The principal consideration for a developing country in deciding whether (and how much) to invest in agricultural research should be:

1. Importance of agriculture in the economy as an employer and income generating agent (17).

2. Potential returns to investment (9).

3. Benefit to target population (farm households) (7).

4. Impact on general standard of living (5).

5. Availability of adequate funds (4).

All discussion on this statement touched on the returns-to-investment theme, with consideration to relative priority of agricultural research vis-a-vis investments in other sectors. Relative foreign exchange earnings potential and potential for savings derived from import substitution were also considerations encapsulated in this theme.

Emphasized also was the importance of making research available in ways that the results can be, and will be used by farmers. Additionally, the implementation/extension leg of the agriculture cycle bears mentioning, as the findings from research are ineffective unless they reach farmers.

The most important change in national agricultural research efforts in most developing countries in future years will be:

1. The need to approach agricultural research as part of a system supporting technology improvement in agriculture. The most common concern expressed focused on the linkages within the research and extension system, including the linkages between different parts of the research network. Respondents expressed a desire to see research and extension unified in a single system involving the farmer as well as researchers and extension agents. Another common concern was the linkages between the research system and the client, in particular the need to expand the farming systems approach, to increase direct involvement of the farmers, and to address the farmer's problems more directly.

2. Program content, including greater emphasis on applied research, an orientation to food production, self sufficiency and energy production, and closer integration of socio-economic concerns into the programming of the research effort.

The major constraint to more effective utilization of agricultural research professionals in most developing countries is:

1. Lack of adequate incentives, both financial and professional (35).

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2. Lack of national research policy and coordination among agencies (both national and international) (15).

3. Lack of adequate research financing, particularly for operating expenses (15).

4. Lack of strong capable research leadership (too often trained scientists are expected to become administrators) (12).

5. Isolation from the target audience (farmers) (8).

6. Lack of physical infrastructure (8).

II. WHY EVALUATE AID-SPONSORED AGRICULTURAL RESEARCH

Dr. Twig Johnson, AID/W, speaker
Mr. Steven Breth, IADS, rapporteur

Background

The AID impact evaluation studies began about 1979 in response to a question asked by Congress: what difference have you made? The first attempt was the success-story approach, but Congress wasn't receptive. The second attempt was to develop multiple cases, and ask missions to write success stories. But not enough could be found. Hence, AID turned to formal evaluation that would ask specific questions and get answers on what happened.

The studies are designed on an incremental learning model, i.e. look at previous AID studies and build on them.

The early evaluations were too large and voluminous. Now the Office of Evaluation decides what question to ask by discussion with senior administrators. Then it turns to the library by hiring a scholar to do an issues paper or a review of literature to find out what has been written and perhaps find answers to basic questions. If questions still remain, an evaluation team visits the country.

A representative array of AID projects is chosen for evaluation.

Methodology of impact studies--Features

The evaluation team aims to find out what worked, what didn't work, and why? Later it asks what should the development community have learned from the project, and it attempts to provide answers.

The studies are done largely in-house because of career development, i.e. opportunities for AID personnel to ask the questions and get answers, but, more important, because it increases chances that the results will permeate AID thinking and influence AID policies and personnel.

An effort is made to make the reports brief and literate. Each impact study has a 2-page summary, 15-pages emphasizing lessons learned, and liberal appendixes. These are not scholarly studies, but they may encourage more elegant studies. They are inexpensive: $9,000-$30,000 are spent for travel and per diem, excluding direct-hire staff salaries and printing.

Skills of teams

All teams consist of an experienced manager of evaluation studies, a technical expert, and a grass-roots social scientist. The basic team is supplemented by other specialists, e.g., a host-country social scientist. The teams spend 3 to 4 weeks in the field.

Agricultural research was the sixth topic given to Office of Evaluation. Previous topics were rural roads, rural water, health, etc. The assignment was the result of shifting emphasis in the agricultural research projects of AID and a desire to learn from previous AID experiences.

AID has three types of research investment: international agricultural research centers, contract research, and research funded by missions and regional bureaus. The last was chosen because it involves lots of people and money and should have a demonstrable impact.

Issues

Can you evaluate agricultural research? Research takes a long time to show results. But if you wait for decades, it's hard to ascribe results to the research. It turns out that it is possible to find out a lot if evaluation occurs rather soon.

Why should the Office of Evaluation look at agricultural research when everyone else (CGIAR, World Bank, Development Assistance Committee) is looking at it? Answer: The Office of Evaluation thought that it could look at projects themselves. The results might be useful to other agencies as well as AID since the project is the unit of action. Evaluations would look at purpose and goals, not just at buildings built, people trained, papers produced.

III. TECHNOLOGY GENERATION AND TRANSFER

Dr. Donald Pluckett, CGIAR, moderator, and Dr. Robert Jackson, AID/W;
Dr. Albert R. Hagan, Univ. of Missouri, rapporteur

The moderator posed two questions: (1) How to make agricultural research more successful? and (2) What constitutes success in evaluating agricultural research? He also stated a guiding premise that "every country should have a strong agricultural research capability of its own, oriented to the problems and needs of that country and doing research to fit local conditions."

In order to stimulate discussion, the moderator made several observations:

--Future research efforts should give more attention to interdisciplinary, land capability, and farming-systems approaches.

--Extension and research efforts should be more closely linked and integrated.

--More attention should be given to the overall farming system, including livestock, vegetables, tree crops, and all other farm family resources. Even so, a continuing need for disciplinary and component research will still exist and, in some countries, will be the most feasible approach.

Dr. Robert Jackson reviewed some of early developments in AID-sponsored agricultural research in developing countries and some of the adjustments which evolved. Following this, workshop participants were encouraged to raise questions about AID-sponsored research past, present, and future plans.

While many types of questions were raised, most discussion centered around the following topics:

Project design

Questions were raised about the time frame for designing agricultural research. Typically a long-term effort often must be designed for short-term fruition. Could more realistic projects be funded, given political considerations? One suggestion was to develop plans and project design for long-term development (15 to 20 years) and break them down into shorter periods for implementation.

Other considerations:

1. Project designers must consider the political pressures on government leaders to get quick results.

2. Designers must consider competition with other developmental needs in other sectors and with other donor agencies for the economy.

3. While some aspects of research require a long term for results, others can yield results more quickly and a balance between the two should be sought.

4. In dealing with commodity research (which may still be most appropriate for some countries) efforts always are extended to the margin. Hence, adjustments always will be needed.

5. Future project design should give more attention to the farming systems approach, embracing all of farm and family resources and enterprises, not just agronomy alone.

Funding research

1. Shortages of funds must be recognized as political realities and project designs should consider addressing some short-term needs in order to get adequate funding for long-term projects.

2. Some funding limitations may result in more effective use of resources for research efforts.

3. In order to get better financial support, researchers should keep objectives simple and realistic with particular attention to problems of the farmer and in particular, to those where payoff seems promising in the short term.

4. "Most projects get too much money for too short a time: smaller increments over a longer time would be preferable." (comment by Dr. Plucknett).

Personnel training and institution building

These seem to have been major components of many USAID projects in developing countries for many years. The establishment of agricultural universities--with extension, teaching, and research components--in several states in India was cited.

Discussion related to these AID efforts may be summarized as follows:

1. While USAID has financed advanced training for many young people from developing countries, both to the M.S. and Ph.D degree levels, few have returned and developed careers in research and extension. This was a major concern of many participants. Several causes were suggested: low salaries, as compared with those in other agencies and in private employment; the low professional recognition and status of those career workers in agricultural reseach and extension; the location of posts to which assigned; and to the lack of support in the form of facilities, equipment, and opportunities for continuing professional advancement.

2. Counterpart training often is unsuccessful because of delays in implementing projects and getting training started soon enough--some trainers do not return until after project completion.

3. Some institution-building efforts were "umbrella-like" attempts that were not always appropriate for the particular needs and stages of development for the country in question.

General Problems

Several problems were mentioned as contributors to difficulties encountered in successful completion of projects. Some examples:

1. Failure to get "technical packages" and specific inputs (seed, fertilizer, insecticides, etc.) to the cooperating farmers on time and in the quantity and of the quality needed.

2. Failure to use project funds for the intended purpose (one example mentioned was the diversion of funds allocated for farming systems research to the construction of a seed-processing plant).

3. Lack of real efforts to achieve interdisciplinary approaches to solve farmers' problems.

4. Failure to take advantage of the experience, ability, and knowledge of the farmer cooperators.

5. Failure to distinguish between on-farm trials and trials located on farmers' fields.

6. Failure to get personnel assigned (both expatriate and counterpart) in time to initiate project development without substantial delays.

7. Failure to involve extension-type personnel and farmers in the project planning and design stages of development efforts.

8. Failure to provide adequate infrastructure and pricing policies on the part of government authorities, which would motivate farmers to accept the risks that might lead to higher yields and productivity.

Group reports: Technology Generation and Transfer

1. Planning for Agricultural Research

Dr. Budhoyo Sukotjo, Indonesia; Dr. Donald Anderson, AID/Zambia;
and Dr. Robert Werge, USDA, rapporteurs
Dr. Arnold Radi, chairman

A country can best determine its research needs by a convergence between political goals, policies, and the national resource base. A country should encourage a dialogue between its political structure, users (farmers, consumers, exporters, agribusiness), and researchers in order to develop research priorities and to determine program strategies.

The types of criteria that should be employed to determine the country's priorities for its agricultural research program include: technical and socioeconomic constraints limiting production/consumption; resource endowment; political, socioeconomic, and security considerations; overall development goals and strategy; donor interests (in cases where outside funding is sought); and assessment of the agricultural sector's contribution to the overall development of the country.

The minimum conditions necessary to realize a return on investment in agricultural research must be those that allow an ongoing process of adoption of agricultural innovations. For this to occur, there must be an effective research capability on the part of research and other organizations and national agricultural policies that encourage the generation of innovations. The critical components of an effective capability are trained manpower, continuity of policy and resources to maintain human and organizational resources, and dissemination. The technology thus generated needs to minimize risk and optimize socioeconomic benefits/returns.

Optimal conditions include integration of research organizations on both an international and national level, a multidisciplinary approach, a set of rational priorities, good communications, research goals that are related to the overall development of the nation, marketing systems to absorb resulting production changes, and infrastructure to supply the necessary inputs.

Participants in the decisionmaking process for agricultural research necessarily vary depending on whether the plans are for broad programs or for more discrete projects. On a broad level, political and economic leaders, researchers, experts from other parts of the agricultural sector, and users (producers, consumers, exporters, and agribusinesses) should be represented. For smaller projects, individual producers, consumers, and research scientists should be included.

Several factors would be a great help in increasing scientific input at the national level. First, science and technological concerns should be incorporated into development plans by scientists who take advantage of political opportunities as they develop. Second, scientists should improve their ability to communicate to policy makers, politicians, and the general public about their research projects, results, and objectives. Third, an administrative and organizational structure should be developed that would allow scientists to make an effective transition to administrative posts or to remain in scientific posts. Fourth, there should be a sense of realism concerning the results of research and the time and support necessary to mount successful research programs.

Overview

1. The identification of the objectives and elements of the research program and its priorities must involve a process/dialogue as well as input from and among political leaders, agricultural professionals, and the farming community. One basis for such discussions would be an agricultural sector analysis, which should include consideration of national, political, development, and social goals.

2. The focus of the research program should be the farmer's system, production, and productivity. Project-level planning must be based on a convergence of concerns of the researchers and the end users.

3. The research system should be process oriented, dealing with priority agriculture problems, adapting to and anticipating new problems and second-generation problems.

4. The organization of the research system must relate the various elements to each other in a manner that has prospects for impact. The research system must have a basic scientific research capability through manpower development, support at political levels by authorities, continuity of political and resources support, adequate professional and financial incentives for the researchers, a cadre of highly trained agricultural scientists, and a means of coordination with other institutions.

5. The mandate of the research system must relate the policies and programs of research that concentrate on farmers, farm families, consumers, rural areas, and national development. The research program has to have objectives that incorporate both short- and long-term usable impacts at the farm, community, and/or national levels.

6. The structure of the research system will have to vary based on the country's administrative tradition, the technical demands of research, the level of development, and the quality of human resources. The choice of structural approach may be an integrated system or a non-integrated, system-selected focus; be centralized or decentralized; stay with old organizations or develop new ones; be private, parastatal, or governmental; be an integrated system with research, extension, and education, or non-integrated.

2. Developing the Agricultural Research Operation

Dr. Ben Ngundo, Kenya, and Dr. Henry Miles, AID/W, rapporteurs
Dr. Edward J. Rice, USAID/Philippines, chairman

Steps in developing a research program are, first, to develop linkage to policy makers, extension services, and farmers; second, to make diagnostic studies to determine the limiting factors at the farm level, and, third, to determine if the constraint is a researchable one (we may need constraints research first).

When the problem is known, or it is determined that problems are not known, the method of research can be considered. Whether systems or commodity, the approach must place researchers in farmers' fields.

To determine the nature of research to be conducted, countries must consider: (a) constraints farmers face, and rank them; (b) demands on the agriculture budget, and rank them; (c) research activities under way in the local private sector and in regional and international research organizations.

To determine the minimum organizational and physical infrastructure needed for a national agricultural research program, the country must assess the research capability of government, the private sector, and education institutions. It must determine how to improve links between the national research system and the private sector and regional and international research institutes in order to supplement the national research system. It must estimate the difference between the capacity of the national research system, as supplemented by private regional and international research resources, and the capacity needed to carry out the national research program. And it must identify the minimum research capacity needed to address situations that could cause national disasters, e.g., combat an outbreak of wheat rust, the research capability needed to conduct maintenance research, and the capacity to do the analysis needed to reach this point.

At this point, donor funding should be sought. The objective should be to build the minimum institutions needed to reach the goal, keeping in mind the cost of maintenance and constraints of manpower.

The AID impact studies have shown that most agricultural development personnel have known that researchers must appreciate the farmer environment.

To determine where to locate research and experimental facilities, the country must consider the major ecological zones within its borders; transportation to markets, proximity of a university, availability of schooling for dependents of scientists; the use of small outstations associated with major stations; proximity to research dissemination organizations; and the relative cost of establishing and maintaining facilities at various locations.

To meet its needs for agricultural research personnel, the country must consider salary levels and training. In regard to the latter it is important to train people with the crops or animals they will research after training. Countries should rely more on short courses at international research institutes and relying less upon Ph.D. training in U.S. In addition there should be more short in-country courses in management.

Planning and implementing research to have a positive impact on farming, farm families, consumers must take into consideration policy and physical and human resources.

Government policy must be formed in the context of available resources and macro/national economic goals with specific goals for agricultural research related to national goals. It is important not to lose sight of the need for some short-term results.

Planning must include ways of communicating and influencing policy. Donor agencies have a legitimate role in influencing policy (they can "buy time" to make the value of research more evident to policy makers).

In considering the physical and human resources necessary to implement a research program (human resources include managerial, institutional, administrative, and research skills) specific research objectives should be identified. That is, within the context of available resources (land, labor, capital, infrastructure, etc.), consideration should be given to limiting factors and to availability of shelf technologies and the experience of others. Also the minimum critical mass required to achieve goals should be determined. An interdisciplinary approach--either existing or to be established--will lead to decisions on technical assistance (long- or short-term) and training (in-country, long-, short-term, degree) based on the local situation, and the need for incentives to keep people in research system. Other considerations are commodities and physical facilities, identification of reasonable time frame, and establishing systems for monitoring and managing after implementation begins, to ensure that linkages are maintained and strengthened.

The overriding issues that must be considered for planning and implementation to have impact are the strength of links between the research system and other parts of government (politics and realism are a constant called for); between research and the extension dissemination system; between research and farmer (farming system approach); with international organizations. In addition, it must be recognized that there are other conditions that must be present for the research to be used, such as inputs and markets. Finally, the role of the private sector must be considered at all points.

3. Adaptation of Research to Farmers' Conditions

Dr. H. Hasnain, Pakistan, and Dr. Floyd Williams, ISNAR, rapporteurs
Dr. John Mullenax, chairman

It is always appropriate to adapt research programs to client conditions. In many circumstances, client needs and conditions are major factors to consider in forming the research program. In a few cases, such as more basic research, to understand a process, client needs and conditions are not significant factors.

Research programs cannot be structured with concern for only one client's needs, however. A national research system exists to serve the nation. While farmers' conditions, problems, and opportunities should be primary formers of research programs, other forces (including government policies, price relationships, and input supplies, for example) have a legitimate effect on the formation of research programs and on what constitutes usable technology.

A research system needs to use several mechanisms to ensure its continuing awareness of the needs of the various groups of clients. The focus is often on an awareness of farmer-clients' circumstances. Working relationships that bring researchers and extensionists together in the farmers' fields may be one of the most effective ways to help ensure a responsive research system. Input traders and other informal linkages between research and farmers should be exploited. Reliance on only formal links through extension may not be successful, especially when extensionists have regulatory roles that inhibit their functioning as extenders of technology. A national technology system that does not provide for substantial direct contact between researchers and extensionists in farmers' fields is not likely to be highly productive. In some instances the formation of a technology system that merges the traditional research and extension functions may be considered.

Constraints research to determine why individual farmers do or do not use available technology has brought researchers insight into the farmers' decision environment. In Bangladesh, "training and visitation" persons meet with key researchers every fortnight. This forms an important two-way communication link between researchers and farmers. Extension subject-matter specialists who interact day-to-day with both researchers and extensionists have been effective bridges among researchers, extensionists, and farmers. These techniques may be most effective when a single commodity dominates a region. Under similar conditions, research leaders have helped train field-level extensionists in the latest research results for a given commodity each year. This provides an effective two-way communication link. In Honduras, researchers and extensionists have jointly done on-farm constraints surveys and thereby formed effective links among the three elements.

Successful linkages among farmers, extensionists, and researchers are essential for an effective technology system. These linkages are more likely to function as desired when they are based on day-to-day working relationships, not on more formal written or oral communications.

Overview

Each country's research system must be taken from where it is along a development path and at a pace that is specifically applicable to its conditions. Principles can be developed and applied to each phase of the research-system-development process. For example, researchers need to understand the needs, aspirations, resources, opportunities, and constraints that form the decision environment of their several groups of clients if they are to produce technology that will be used with the desirable effects. The research process to develop technology for a particular group of farmers therefore should usually start with the client farmers and include processes that will bring continuing awareness of those farmers' conditions. Other principles can be developed.

A plan to produce technology should include a stated strategy to spread the technology that is to be produced.

An awareness of clients' needs and constraints will bring a need for establishment of priorities, because resources will seldom match all needs. Development of priorities for research begins with an awareness of clients needs and constraints, but various groups of clients may have different needs. Not only are there various groups of farmers, but also of urban consumers, policy makers, and various national objectives--all of which affect research priorities.

Development of research priorities may be conveniently divided into two units: the major areas for concentration of effort and the specific research strategy to be used in each major area.

Decisions on priorities for major areas--such as what commodities, importance of geographic regions, client groups, and the resources to be made more productive--are usually made by inter-ministerial committees, augmented by funding-agency decisions. The decision process links with other macro policies, including pricing and trade policies. Technical agriculturists need to feed information into this process to ensure optimum decisions.

Decisions on research strategies to be used to address opportunities or problems in a major area are technical decisions to be made within the research system. Strategies and methods chosen include consideration of the resources needed to do the work, and must be linked to the budgeting process.

Evaluation of the program will be necessary, preferably at regular intervals.

4. Implementation of Agricultural Research and Extension Activities

Dr. Guy B. Baird, IADS, and Dr. Roger Carlson, USAID/Somalia, rapporteurs
Ms. Emmy Simmons, AID/W, chairman

The activities most productive in helping scientists gain understanding of farmers' production problems and conditions are surveys, both informal, multidisciplinary surveys, "sondeos," and formal, more highly structured surveys; face-to-face communication between scientists and farmers (during the surveys, in identification of research problems and priorities, and in planning and reviewing research); and on-farm research, which should involve participation of farmers, including evaluation and demonstration activities such as field days on farmers' fields; and representation of input-supply and processing industries (both public and private) in planning and evaluation (e.g., on boards of research institutes, or in annual reviews of national commodity research programs).

There are several major constraints to more widespread adaptation of agricultural research systems to farm needs and conditions. One is the nature of training and orientation of scientists. This is commonly reflected in a narrow approach to a commodity or discipline type problem, in contrast to a systems perspective. It may also involve inadequate involvement of social scientists.

Other important constraints are insufficient incentives/rewards to scientists; over-centralization of research and inadequate delegation of authority and responsibility; the range in specificity of micro agro-ecological conditions and the variability in farming systems; research station weaknesses (unsuitable location, inadequate development, poor management); and limitations in financial and human resources, and infrastructure (e.g., roads, transport).

The principal constraints to adoption and adaptation of research results by farmers are lack of, or cost of, inputs, lack of financial resources/credit, price disincentives/market distortions, accessibility to results of research (from scientists, extension workers, others), quality and effectiveness of extension, risk, farmer skills as related to the new technology, labor requirements, and land tenure.

Among the ways to overcome these constraints is training of scientists, particularly in systems approach (e.g., as in CATIE). Also experiment-station specialists should be integrated with farm-level researchers. Experiment stations can be more effectively used to simulate farmers' problems (e.g., farmers' implements, or source of traction). Off-station research, demonstrations, and field days should be developed and attention given to other ways of increasing farmer participation. Finally, planning, management, budgeting, and evaluation of research should be improved.

A research system can measure research progress and results through farmer adoption rates (includes spot surveys for progress); productivity (with factor defined, e.g., land, labor); interim outputs (such as technology/ recommendations; training, building staff complement, retaining personnel; reports, written-up results; and identification of incipient or new problems such as disease occurrence); distribution of benefits-equity; matching of resources with research priorities as identified by farmers; and process evaluations, with periodic redesign.

Overview

In considering how technology generation and transfer might be planned, implemented and managed to have a maximum positive impact on producers and consumers, we examined some of the national and regional issues involved in planning research programs, and what the response of donor and host government policy makers should be.

Impact on producers and consumers. Small producers should be involved in research planning as well as implementation. At the initial planning stage, farmer participation may be formal or informal. In the Philippines, a well-structured system is in place to integrate farmer inputs into research planning. In other countries a more informal system may be more practical. A multiplicity of feed-back systems should be employed such as diagnostics, on-farm trials/field days, consulting farmer organizations, and consulting group leaders.

In addition, a more structured analysis of the producer environment is necessary to ensure that the research scientist is receiving more complete data on the crop production system(s) with which he is dealing. Such analyses should include structure of local production, costs of production, structure of the labor force, and past experience in research planning, implementation, and management.

Unfortunately in many countries research scientists are not taking into account, sufficiently, the nature of consumer demand and its impact on crop production research. The researcher must be aware that the farmer is producing a product that must be marketed (even on-farm consumption involves taste and acceptability of the end product). Furthermore, economic growth and increased incomes often lead to shifts in consumption patterns away from traditional crops. Such patterns must be detected early and incorporated into research planning. More attention should be given to demand analysis and household consumption surveys to determine the importance of nutritional content and acceptability, how research output impacts on stability of food supply at low cost, product acceptability in terms of food-preparation practices and food crop byproduct utilization, and product substitution possibilities, etc.

National and regional issues. Research programs must be tailored toward realistic objectives in terms of foreign exchange availabilities to finance production inputs, and take into account such key national policy

objectives as income goals and strategy of the government and regional development strategies.

A research program targeted on lowland crops, for example, when the government's agricultural policy is emphasizing development of crops for highland or marginal-land area will not be responsive to national needs. Other key regional issues that affect research planning and implementation include variations in labor productivity, and integrating research into rural development systems. Finally, national research planning must take into account the cost of technology generation and transfer compared with the return on the investment. Often research programs run into trouble with national planners because (1) initial cost/benefit analysis has not been attempted, or (2) the implications of such analyses have not been effectively communicated to planners on a timely basis in order to insulate important long-term research programs from budget cuts, or (3) the technology to be introduced is clearly uneconomic and should not be developed.

Donor and host-government response. In designing research activities, financing agencies must consider:

--Who benefits and who pays in society when new technology is introduced?

--Does a long-term commitment exist to sustain the research process?

--Are various donor inputs clearly delineated and well coordinated?

--Can financing criteria be made flexible, and is project management sufficiently responsive to changing research objectives as the program unfolds?

--Is the research training program broad enough to include field orientation as well as crop specialization?

--Does the size/diversity of the agricultural economy and cropping pattern justify the size, content, and cost of the research program being recommended?

--Is the manpower/resource base sufficient to sustain a long-term research program?

5. Dissemination of Research Results to Farmers

Ms. Charlotte Suggs, AID/W, and Dr. Reuben Wani, Sudan, rapporteurs
Mr. William Nance, USAID/Nepal, chairman

1. The question, to what extent do you agree with the frequent comment that most agricultural research results are not reaching farmers; or, if they are, that farmers do not use the results? was discussed at length without concensus. Those who agreed that research results do not reach

farmers (or, if they do, are not used by them) felt that the reasons were that (1) some farmers avoid extension agents, regarding them as agents of the government and adversaries (e.g., the extension agent may be the tax collector); (2) research and extension entities are not linked, and do not work in concert; and (3) extension services are poorly staffed, poorly trained and immobile (lack transportation to reach areas where extension is needed).

2. Among the causes of breakdowns in dissemination or in non-use of results are that the results being disseminated are not pertinent or relevant to farmers' needs or desires (preferences). Design/implementation teams plan projects that reflect U.S. points of reference. This does not translate into client needs. Also, results under laboratory or research station conditions are often not replicable in on-farm situations. Where they are, success can be impressive. For example in Bangladesh, wheat area went from 60,000 hectares to over 300,000 hectares, yield increased from 0.6 to 2.2 tons/ha. New wheats were introduced that required a shorter growing season, reducing conflict with rice cropping, and allowing a two-crop system. Subsequent varieties introduced had even shorter growing time, encouraging greater use. The varieties were demonstrated on farms and the results were communicated informally from farmer-to-farmer (informal communication network). Government services were limited to providing and distributing seeds, and to sending researchers who demonstrated to farmers on the farm.

Another factor in non-use of results is that farmers' risk aversion is not considered or mitigated. Credit may not be available, so that even given the intervention of research technology, the farmer is unable to afford ancillary inputs (e.g., fertilizers, pesticides, herbicides). Or, distribution of inputs may be unreliable (e.g., Niger farmers need to replace hybrid varieties year after year, but they cannot always obtain new seeds). Or a particular cropping system may not be compatible with farming system with which the farmer must deal. Finally, government pricing policies may discourage farmers from using technology, i.e. increasing yield may give a negligible monetary return.

A third factor is malfunctioning input distribution mechanisms. Frequently private enterprises are discouraged by government policy, and the political, economic context of the country from engaging in inputs distribution. Frequently the expectation of private firms for profit cannot be met because small farmers cannot afford to pay for inputs at rate that would offset the firms' costs. Often private businesses must compete in providing inputs to the farmer that are subsidized by the government.

3. One way a country can make the interpretation, publication, and dissemination of results more effective is through a protocol as in Senegal where, with research and extension in separate ministries, AID has required the definition of procedures for interaction between the two, with research based on feedback from extension activities--get them talking to each other--to ensure research/extension coordination).

Some other mechanisms are:

--Combine research and extension on the farm, where appropriate to countries' research resources.

--Develop technology on farmers' fields, involving the farmer in evolution of new technology. Advantages to be gained are that the farmer learns technology, the farmer participates in its development, and the farmer has more faith in it.

--Change training of extension agents, making it more pertinent and realistic in terms of small farmer needs. Suggested methods of extension include using farmers informal information network and training farmers in extension to return to their own villages.

--Create system in which provision of quality inputs is ensured.

--Encourage change in government pricing policy that would increase farmgate prices, encouraging farmers to use technology, increase their yields, provide incentive for (farmers') change. Another incentive the government can provide is cash bonuses for increased yields.

--Provide incentives for cooperation between research and extension to get people where they are needed in hardship areas. Some examples are provision of promotion potential, educational and health benefits for families, adequate housing, and early retirement with pay. Such a system, however, is difficult to fashion. In some countries promotionals and perquisites, amount to bribes in which AID and other donors end up paying twice as much for a job that is barely done.

--Encourage use of the private sector to distribute inputs, because the private sector will distill information from research and interpret it into practical technologies for farmers, because it is to the best interest of the entrepreneur and that of the farmer to look at what the farmer needs and how to get it to him in the most cost-effective method, and because the private sector can afford, and stands to gain, from spending on continuing research.

--Make sure that U.S. personnel who plan, design, and implement projects do so with the client countries' points of reference. This may well indicate a requirement for change in the training of agriculturalists coming through the universities, for instance, where a greater awareness of developing countries' conditions should be encouraged.

Overview

In attempting to determine how technology generation and transfer might be planned, implemented, and managed so as to maximize positive impacts on farmers, farm families, consumers, rural areas, and national development, the question arose: Can programs be devised that are in the best interests of farmers at the same time that they are in the best interests of consumers, and national development? Often projects designed

to benefit one group can be detrimental to the others. The statement was put forward that planners have to be careful to identify the group(s) who are intended to benefit from a particular technology intervention.

Further, it was observed, that in developing countries, often, there is no strong connection between research planning and the establishment of government priorities; these activities often take place in separate ministries. It was noted that poor communications between lead ministries (responsible for planning) and technicians (more conversant with farmers' needs and practices) is also often a cause of inappropriate project designs. This situation has been exacerbated in the past when donors collaborated directly with lead ministries on project design, overlooking the potential for constructive and appropriate feedback from field technicians.

Observation 1: National policymakers and national agricultural researchers do not always share the same agendas. Moreover, they often do not understand each others' constraints.

Observation 2: National policymakers often lack the technical knowledge to make the most pertinent decisions for agricultural research priority setting, planning, and implementation.

Observation 3: The agricultural researcher and other agricultural technicians do not always know what the planners' objectives are.

Added to these observations was the statement that host-country clients often perceive projects as belonging to AID. Lacking the feeling of ownership and involvement, the commitment of host-country clients--from the farmer to the lead ministries--is less than optimal.

Another observation on the planning of agricultural research projects was that most often research is planned for specific food crops or cropping systems without adequate consideration of the whole farm environment, and the crops/cropping systems' interaction with other components of the "farm system." These components include interactions between crops, livestock, family labor patterns (on- and off-farm), family consumption patterns, and market access mechanisms.

As to what criteria can be used to tailor "effective," "affordable" research systems, the group felt that whether a system is affordable will vary from country to country, a function, interalia of each country's individual farmers and the level of technology available to and used by them; the crop being introduced; existing cropping practices; existing national research capability and infrastructure; the economy; and the research priorities of the administration. That is to say, research systems may not be transferable from one country to another.

Recommendations to donors and host countries for planning effective research systems (1) Planners need to consider the complete farm environment when designing agricultural research projects/programs. To this end, social science/anthropological, as well as political and economic, evaluation of the client is important. (2) While it may not be possible to

develop a "recipe" for a successful research project, the following should be in place: appropriately trained personnel; host-country government policy and budgetary support to research and extension efforts; and a monitoring and evaluation system, sensitive to what is happening at the farm level, which can feed back data through extension/research/planning channels.

Recommendations to donors. (1) AID and other donors, when designing agricultural research projects, should involve host-country field technicians and farmers in the process early on, consulting with them simultaneously with host-country planners when possible. In any case, consultation with host-country clients and with the host-country technicians who will implement the project, at the pre-design, developmental stage is important. This is essential to the definition of the problem, and the identification of the appropriate interventions. (2) AID and other donors can act as "honest brokers" in trying to facilitate more effective communications between technicians and administrators within a given ministry, or with these same actors, between ministries.

Recommendations to host countries. Impress upon donor governments (legislators and funding allocators) the importance of a lengthier developmental (or design) phase prior to implementation.

At the end of the discussion, the point was made that we have focused only on AID's involvement in agricultural research for food crop production. The question followed: should AID shift focus from funding research for mostly food crops for domestic consumption (encouraging "food self-sufficiency"), or should AID focus on food, and other, crops for export (fostering "food self-reliance"). Excess food crops can join other cash crops for export, this would serve two purposes: the generation of foreign exchange earnings for use in the purchase of food (or other necessities); and the alleviation of the world food shortage. AID should clarify its policy in this instance.

6. Interdisciplinary Research

Dr. Jennifer Bremer, DAI, and Dr. John Liwenga, Tanzania, rapporteurs
Dr. Joe Hartman, AID/W, chairman

Circumstances requiring interdisciplinary research

The main motivations in adopting an interdisciplinary approach are the need to avoid costly errors by allowing for feedback among those working on different aspects of the problems and the desire to develop a coherent set of recommendations that address all aspects of the farmer's situation. The interdisciplinary approach enables research to consider many different aspects of the problem, so that important interactions are not overlooked. It therefore promotes program flexibility and encourages program evolution to meet changing farmer needs.

In consequence, interdisciplinary research is particularly appropriate when the problem addressed is multivariate and complex. It is particularly fruitful when the problem cannot be subdivided into component problems and several different aspects must be attacked in parallel. This inseparability is likely to occur as research moves toward development of farmer recommendations: the more applied the research, the more important that the varied perspectives of different disciplines be tapped to develop useful research findings.

The interdisciplinary approach is also especially applicable where farmers are themselves unable to identify their needs without outside assistance. If farmers become more sophisticated in dealing with new technologies, they themselves can take the lead in integrating the various programs.

The interdisciplinary approach was initially developed to deal with the observed reluctance of farmers to accept research recommendations. This reluctance was diagnosed as resulting from researcher inattention to critical components of the farmers' problems and in particular the failure to consider the social and economic aspects. Social scientists were therefore the prime movers in developing the approach and it is not applicable to cases where the social-science perspective is central to research objectives.

Despite its advantages, interdisciplinary research is neither a panacea for research problems nor the only means of achieving coordination. In some cases, informal communication among researchers is sufficient. This is especially the case in small, highly focused research programs.

Problems with interdisciplinary research

The principal problem in interdisciplinary research is getting different disciplines to work together. This problem takes several forms.

First, scientists from different disciplines define problems in different ways and have different vocabularies, concepts, and perspectives that make working together difficult.

Second, there is disagreement as to which disciplines should take the leadership role: specialists tend to view their part of the problem as the central issue, and one that is not adequately recognized by specialists in other disciplines. This view is not conducive to establishing and maintaining project leadership.

Third, the professional incentives in the research system reward specialized, within-discipline work over more practical, applied, interdisciplinary work. The imperatives of promotion, professional development, research funding, and publishing all encourage maintenance of closed disciplinary borders.

These difficulties make interdisciplinary work more complex than single-discipline work. In extreme cases, the difficulty of achieving

team cooperation is so great that it can absorb all of the available organizational resources to the exclusion of the research itself. Cooperation becomes an end rather than a means and the team may even lose sight of the very technology-generation goal that motivated adoption of the interdisciplinary approach.

Factors favoring success with an interdisciplinary approach

The decision to use an interdisciplinary approach should be made on a case-by-case basis; the care and feeding of interdisciplinary teams is not costless and this cost should be held below the level of benefit expected from expanding interdisciplinary cooperation.

The team, therefore, should be limited to the core disciplines actually needed with other disciplines providing back-up support as needed. The team composition should also be flexible, with additional members joining or leaving the team as the project progresses. The core team should be large enough to incorporate the major disciplines, but not too large to work together as a team.

Other factors

1. Even if the team is interdisciplinary, parts of the research will remain discipline-restricted. This is true of both back-up and team work.

2. The approach works best when the problem is well defined and sufficiently narrow so that interactions across disciplines are clear.

3. A well-established and continuing system of farmer-researcher contact encourages researchers to see the broader aspects of the problem.

4. The team should be formed at the beginning of the project, since personal interactions are more valuable than earlier formal training in building mutual understanding.

5. Private-sector involvement is beneficial to the approach because private producers must respond to the disciplines of the market, which forces them to consider all aspects of the farmer's situation affecting acceptability of their product and which at the same time restricts their efforts to the most important of these aspects in order to hold research costs within profitable limits.

6. A firm focus on dissemination during all phases of the research effort helps the researchers keep in mind the practical needs of the farmers, testing each step of the research against the standard of acceptability to the farmer.

7. Professional and financial incentives, particularly funding targeted toward interdisciplinary research per se, can be effective in overcoming the disincentives to such an approach inherent in the structure of research programs.

Overview

In attempting to maximize the positive impacts of technology generation and transfer on farmers, farm families, consumers, rural areas, and national development, it must be remembered that there must necessarily be trade-offs between them. There must be a focus to the maximization process. No set of research goals can serve all areas equally well. Once a focus has been established, a strategy can then be formulated from which research goals and objectives can follow. For example, a country may decide on a strategy to develop export crop production and, based on its foreign exchange earnings, import required foodstuffs. The objectives and areas of research then become defined. The strategy can also be of various levels; for example, a country may have a substrategy of replacing imported fertilizer to the extent possible by biological nitrogen fixation. It then is established that an aspect of the research program must deal with legumes and their associated rhizobia.

It should be possible to develop an evolutionary or partial strategy that can be acceptable to various political, social, and economic realities at any one time. The strategy must be flexible, and can be more completely developed over time. The development of a too detailed or explicit a strategy may sometimes impede consensus.

Research should approach the strategy in two ways. One is concerned with the constraints and problems as they presently exist, and the other is to look into the future and to serve as a guiding force to the farming system, able to supply appropriate technical options along the way. In this way research is not only taking care of current problems, but is also planning for problems that might arise. In order to maximize the long-term impact of agricultural research, it must have clear and appropriate objectives and there must be provision for an integrated follow-through on those other factors that would affect the adoption of technology such as marketing channels, price structure, input supply, etc.

Among factors involved in the long-term impact of agricultural research is to ensure that it is tied to a permanent institution in an area, most notably agricultural extension. In one area an agricultural university attempted to introduce some of its proposed technology, without involving extension. In this situation, when the university left the area, there was no mechanism for assuring a continued flow of information since the extension service had not been involved. The impact of research should be measured by the success of research in developing technologies that farmers can adopt. Research should be done under conditions that take into account existing constraints whether artificial or otherwise, but that are tied to the overall economic situation, i.e., prices, availability of inputs, institutional arrangements, and other factors likely to affect production goals.

The criteria, therefore, for selecting research programs could include (a) the chances of successful results; (b) relevance to the real problem in a given situation; (c) institutional commitment which would ensure easy

transfer of technologies to the farmer; (d) availability of resources necessary for successful adoption of technology; and (e) size of the intended target area.

7. Farming-Systems Research and Extension

Dr. John Cropper, CARDI, and Dr. Peter Youn, Liberia, rapporteurs
Dr. David Delgado, USAID/Guinea, chairman

The "why" of farming systems research has been described as the result of adjustments made to the unsuitability of technical packages, unavailability of inputs, and the inappropriateness of the recommendations for all farmers. In attempting to define, describe, identify problems, and formulate recommendations, most of our time was spent defining the term "farming system."

Definition of farming-systems research/extension

Defining farming-systems research is like defining the small farmer--we know him when we see him--it's just hard to describe him. Farming systems research is an operational concept, a "mind set" toward problem identification and analysis. It examines a farming practice (or practices) against a background which includes social/ cultural patterns, and economic and ecological factors. Farming-systems research should be complementary to component research not competitive with it. It is a logical and comprehensive approach to identifying farm problems. Farming-systems research requires a multidisciplinary approach and it relies heavily upon interaction with the farmer.

Farming-systems research could be further characterized by asking three questions: What's going on (on the farm)? Why? How can it be improved? These questions have corollary and cyclical activities: data collection, research station work (component research based upon problems identified from farmers), and on-farm trials/testing.

The group agreed that: (1) Farming-systems research need not create new institutions--stressing its complementarity and natural fit within existing institutions. (2) Farming-systems research will place greater responsibilities on the extension forces. In addition to his role as a bearer of the technical package, the extension agent will be asked to funnel problems back to researchers. New analytical shells may be required. The emphasis on the research part of the farming-systems approach should not obscure the responsibility of the extension agent in the transfer of newly generated technology, but should enhance it. (3) Farming-systems research is relatively new and not always clearly understood by those asked to manage or administer these activities. (4) Farming systems research might accelerate the impact of research (there may be "shelf" technology available that would be appropriate for testing). (5) Farming systems research is still developing and while its results are not replicable across geographic zones, its approach to problem identification is

largely transferable. (6) Farming systems research is a means to "institutionalize experience," i.e., more effective way of giving that appreciation to the realities of the on-farm situation, which normally only comes to the best research and extension personnel after years of field work. It is especially important where people with a farm or rural background do not have the educational opportunities enabling them to be recruited into the extension services. (7) Farming-systems research increases the technical options available to the farmer.

Problems with farming-systems research mostly arise from the fact that there is a lack of agreement as to its definition, application, and role in on-going research programs. Other problems include greater need for collaboration with host government. Finally, the group suggests that visitors (AID and other consultants) wishing to sell farming-systems research to developing country officials should know how to explain farming systems research.

Recommendations

1. Extension agents must be part of the development of farming-systems research.

2. Full collaboration of the host country in the design/implementation must be assured.

3. The active participation of the private sector in agricultural development is to be encouraged (hybrid seed, fertilizers, agrochemicals, farm machinery, credit, marketing).

Overview

Traditional research in North America and Europe developed technology (varieties, fertilizers, machinery, etc.). For a dynamic, relatively prosperous farming community, it constantly pushed back the frontiers of knowledge. Because farmers were aware of what technology was available, it was sufficient to produce a "basket" of goods to choose from. The private sector had an important role in promoting and selling these goods.

In developing countries, however, the situation is different--farm families are much closer to the absolute poverty (survival) line. Risk aversion is a critical factor. Some items of technology have been sufficiently outstanding to bring about wide acceptance, but the very poor have often not benefitted.

Since the traditional approach to extension (and research) has mainly failed to move the rural poor to a "take-off" point, we need to have a new approach--a new understanding of the farmer's objective situation (his

problems and the opportunities these create)--in order that "technology/ science" can be put to work for his benefit.

Farming systems research is the analytical tool that can lead to the understanding. The components of farming systems research are a survey of the farm situation from both a technical and a socioeconomic viewpoint, analysis of the survey findings, hypotheses, extension, on-farm testing and validation, and backup (component) research.

Comments: Technology Generation and Transfer

Dr. David Steinberg, AID/W, moderator
Dr. James Nielson, BIFAD, rapporteur

The following points were made by the moderator in concluding the discussion on technology generation and transfer.

1. On multidisciplinary research: sometimes one of the difficulties is the hierarchical structure of the team (e.g., the oldest person on the team may expect to be the leader, whereas a younger and more recently trained scientist may have more to offer). So, a real peer relationship among team members may be another criterion for success in multidisciplinary research.

2. For training, which is one of the crucial aspects of research, timing is an important issue, especially in view of the long lead time needed to make research pay off. We lose a lot of time by forcing the training inside the project. We could speed the process if we could make budgetary and other arrangements to get people trained to fill key slots prior to the initiation of the project.

3. Some of the issues that were not reported by the work groups, but which are covered in the research evaluations are:

--The advantages of long-term and short-term technical assistance (e.g., is the technical assistance for the benefit of the donor or the host government?) Is its purpose to monitor progress and problems on the project? Will it help internalize processes and results?

--What are the most effective kinds of relationships between AID (and other donors) and host-county personnel in order to interpret and utilize research results?

--The question of research on nonfood agricultural products. Could countries become food self-reliant rather than food self-sufficient through research that would increase production of nonfood commodities that could be exported to earn exchange for purchasing food abroad?

--The tough issue, if there are limited budgets, where do you put your money? In agricultural research? If so, what type? If so, how does agricultural research compare with investments in other agricultural sectors?

IV. IMPACT OF RESEARCH ON DEVELOPMENT

Dr. Josette Murphy, AID/W, and Dr. E. Walter Coward, Cornell University
Dr. Dana Dalrymple, AID/W, rapporteur

This session was composed of three main portions: an introductory paper by Dr. Josette Murphy, on the "Impact of Research on Development," some more general comments by Dr. E. Walter Coward, and group discussion.

Impact of research on development

The paper focused on the effect of adoption of new agricultural technology on farming households. Three major sets of factors were identified as influencing adoption of technology: (a) the environment, including both biological and political/ economic factors; (b) availability of resources; and (c) knowledge of farming techniques available, both traditional and improved.

The impact of these technologies was then examined in the context of the several AID evaluation studies, and examples were drawn from them. It was found that farmers were generally aware of new scientific and technological developments. If there is a significant yield advantage, the technologies are adopted quickly, often by both small and large farmers. But where a technology package is involved, farmers often are quite selective: they will use some components and not others; and if they use some, they may use them at less than recommended levels. In some cases, their adoption pattern is influenced by government policies and programs. In others it may be influenced by other farming practices or by family characteristics and traditions.

The consequences of adoption can be sorted into several categories. The most common is the direct and positive effect on production, but there may also be more indirect effects such as the influence of new technologies on crop intensification (e.g., multiple cropping). The result of each is often increased farm-family income, but this is not always the case. The new technology may also significantly affect other household activities and the community, often by influencing employment. And more generally, consumers usually benefit through increased food supplies and lower food prices.

The effects are not always beneficial. Some farmers are by-passed in the adoption process because the technology that has been developed is not suitable for their needs. Or they don't have access to resources of various types needed to make best use of the technology. The technology may have an associated risk factor: some new varieties prove more susceptible to certain diseases or climatic stress (Tongil rice in Korea is a

prime example). Or the results may be mixed: new bread wheat varieties were readily adopted in Tunisia because they take less time to prepare than durum varieties; durum varieties, however, may be of greater nutritional value.

Three points were suggested for further discussion: (a) the reasons for selectivity in adoption by farmers, including the differences in criteria between farmers and researchers, (b) the consequences of selective use by farmers, and (c) the consequences and implications for research and the design for research programs. In the latter case, researchers may need to give greater attention to priorities and constraints at the farm level; this may lead to the design of packages in modular form.

Comments

Coward started by indicating that his comments would be somewhat more general. Much of what had been discussed concerned the relationship between farmers and the agricultural research system. In the past this relationship had often been considered in terms of the diffusion and adoption of new technology. Communications was considered a key factor in this process. Characteristics of adopters were also studied closely.

The "green revolution" shifted perceptions. Formal communication did not prove to be as important as social scientists previously thought. Rather, two points not previously given close attention proved to be of significance in adoption: (a) the suitability or appropriateness of the technology; and (b) the availability of the technology and its associated components. As a result, increased pressure has been placed on agricultural research to develop technologies to fit a wider range of environments. Also, the research process needs to be extended considerably beyond the laboratory. This is particularly true in the case of farming-systems research.

Agricultural research should be developed more broadly in the future. Traditional emphasis has been placed on production. More attention may need to be given to delivery systems, management systems, etc.

Discussion

The discussion tended to focus on some of the communication issues.

1. Receptivity of villagers to new technology. It was noted that a large body of literature in the 1950's and 1960's documented the imperviousness of villagers to outside communication and new technologies --features that did not hold up with the advent of the "green revolution." Reasons given for this misreading of villagers included the facts/notions that: (a) many of these studies were done during a period of limited social and economic change, (b) that little significant new agricultural technology was available during this period, and (c) that many changes have taken place in communication in recent years.

2. Need for researchers to mix with farmers. It was pointed out that researchers need to know more about the kinds of trade-off decisions actually faced by farmers in dealing with new technologies (farmers in Bangladesh, for instance, must choose between three alternative uses for plant residues). Researchers need to look beyond relatively simple maximization of yields and consider other factors of import to farmers. While farmers in developing countries are short on scientific knowledge, they have built up a considerable body of knowledge based on experience, which can be of value and significance. Farming-systems work is a useful device for getting researchers into the field.

3. Institutional aspects. Research and extension services tend to be organizationally separate in many developing countries, which limits feedback to researchers. In Korea, however, the two groups have been rather closely linked under the dissemination of new knowledge. A principal drawback is that if a wrong decision is made, its effects are not mitigated by the usual delays found in other technology-diffusion systems.

4. Susceptibility to fadism. One research administrator from a developing country noted that some nations may fall prey to fads or to inappropriate technologies. Either donor nations or national administrators may tend to pick up and press something that is flashy or attractive, but which may be quite inappropriate, at least at that stage, for the country. He cited the examples of triticale and super-seeds in his country.

5. Technological receptivity and selectivity. A social scientist noted that farmers show varying responses to new technology at different points in their life or family or farming cycles. And because of the need to provide for variability and selectivity, he questioned the value of technological packages at the farm level (though their development might have a salutatory effect on the researchers involved.)

V. FARMING-SYSTEMS RESEARCH TRAINING

Dr. Donald Winkelmann, CIMMYT, moderator; Dr. Bebe Okigbo, IITA;
Dr. Luis Navarro, CATIE; Dr. Fernando Bernardo, Philippines;
Dr. Winter Chibasa, Zambia
Ms. Joanne Hale, USAID/Bangladesh, rapporteur

The panel of five speakers focused on the perception of training for farming-systems research, the actual orientation and course content of such training, and the main results from this type of orientation.

Perceptions of farming-systems research training

Dr. Winkelmann maintained that the farming-systems research approach is a "mind set," that orients researchers to a broad consideration of the total set of factors that farmers manipulate to their advantage in allocating resources for food production: technical, physical, social, cultural, economic, political, and ecological. This approach increases the efficiency and appropriateness of research programs by providing a more global view to the scientist's examination of farmers' needs.

Dr. Bernardo stated that farming-systems research in the Philippines was viewed as a regional effort to focus on site-specific issues that address agricultural problems in an integrated fashion. Various disciplines are brought together and farmers are intimately involved as research participants rather than as research recipients.

Dr. Chibasa illustrated the perception of farming-systems research training in Zambia as one that addresses current farmer problems. The incorporation of maize production into the farming-systems research training program reflected the real system needs of those farmers cultivating approximately 500,000 hectares of maize and realizing yields half those attained on research stations. Incorporating this type of component technology into farming-systems research is perceived as complementary to, rather than as a substitute for, a farming-systems research training. High potential research pay-offs in narrowing the maize yield gap prompted the Zambian trainers to integrate this researchable problem into the training program. Trainees do not focus primarily on the maize aspect, but on the position of maize within a farmer's system. The impact of increased maize yields on other parts of the farming system is studied.

Dr. Navarro discussed cropping-systems research programs in Central America. He perceived the role of training in cropping systems research to be one of motivation and orientation of field workers to the interrelationships between environment (physical, social, economic, political) and

specific components of a farming system. The field workers receive an appreciation for the relationship of each part of the system to the whole environment. The trainee becomes sensitive to the impact and modifications that research on an individual component will have on other related components. Basic production constraints are identified within the context of the entire system.

Dr. Okigbo's perception of farming systems research was that of an enterprise in which farmers orchestrated interacting components. He viewed the approach as an attempt to simultaneously review all interrelated factors. Farming-systems research is a method, a process of thinking whereby production options are generated and presented to farmers. The orientation enables one to move with farmers and co-discover benefits of modified systems.

Course orientation and context

Dr. Bernardo described the farming-systems research training program in the Philippines, which includes the promotion of upland rice projects in six major agro-climatic zones. Core staff receive two months of academic training followed by two months of field tours to provide practical aspects of farming-systems research orientation. Agricultural economists, agronomists, livestock specialists, and horticulturists receive this type of training. Site research managers receive four months of farming-systems research training, which includes input delivery, marketing/distribution networks, cost-benefit ratios, nonfood crops, traditional technology, as well as an overall conception of the system, which encompasses all these features. Farmer-trainees receive one week of farming-systems research courses, which present the advantages and disadvantages of current farming systems as well as potential new systems or minor alterations in existing systems. The farmer is oriented to consider all recommended technologies in production practices as effects on total systems rather than as isolated incidences.

Dr. Chibasa described farming-systems research training in Zambia to be primarily on-the-job training in conjunction with workshops. Sociologists are available on "call" to respond to requests from training graduates who have returned to field situations.

Dr. Navarro stated that training in Central America included cropping-systems research methodology, component research problems, and basic research concepts. Training is conducted through graduate schools in non-degree courses, workshops, and seminars. The orientation of such training identifies the role of research to overall national development and the position of component research within the systems research framework.

Dr. Okigbo stated that farming-systems research in Nigeria includes long-term training as well as workshops and study tours. The course emphasizes land productivity and the generation of appropriate technology that genuinely answers farmers' questions.

Dr. Winkelmann described farming-systems research training as one which assists researchers to assess farmers' opportunities. It provides a framework for on-farm research which is area-specific, collaborative among disciplines, and results in the formulation of recommendations. It focuses on a set of farmers sharing common denominators. Winkelmann stated that CIMMYT training is supportive of this type of training. Effective in-country training rests on a series of "calls." Participants convene for six weeks for training in exploratory surveys. At a later date, they re-convene for training in formal surveys. This is followed by training courses in pre-screening and courses in on-farm research techniques. The advantage of this type of training is based on the quick "turnaround;" trainees equipped with new skills and knowledge are able to apply these techniques in the field before the next "call." This precludes "overloading" the trainee's system and provides immediate opportunities to use the farming systems research approach. Graduates of CIMMYT training return home to initiate similar courses and approaches to research.

Results of training

Dr. Bernardo stressed that the results of farming-systems research training were seen in the three levels of trainees involved: core staff, site research managers, and farmers. Those trained with this approach tended to produce more useful results than those without this orientation.

Dr. Winkelmann felt the results were reflected in the series of in-country courses conducted by CIMMYT graduates. The pool of researchers trained to think in terms of the client's environment and the decision-maker's environment was increasing as a result of CIMMYT's farming-systems research training.

General discussion

The general discussion largely departed from the theme of training. Attention was mainly apprehensive. Some felt that farming-systems research overstated its promises. Others felt its claims to originality in method or perspective was baseless.

There was also a guarded sense of territorialism with respect to farming systems research usurping traditional leaders. Individuals in some disciplines were concerned that their license to orient research and establish priorities within their dominions were being challenged by farming-systems research. There was concern that farming-systems research might absorb financial support, greatly diluting component research programs.

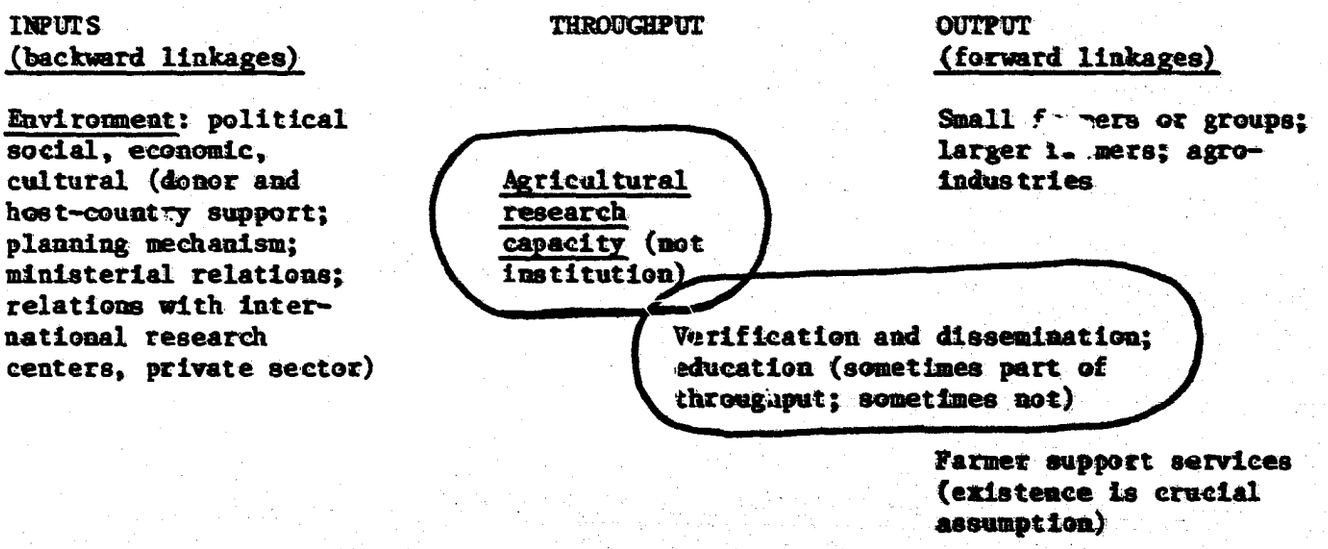
There is the problem of identifying who will determine which farming-systems interactions are to be funded. Is the skill for identifying these researchable and affordable studies of specific interactions a skill that is teachable? Or does this skill develop only over time and with exposure to a wide variety of agricultural experiences? Others felt that there is an abundance of farm interactions that can be captured and researched only when one becomes sensitive to such interactions.

A more positive note was expressed when someone described the merits of farming-system research as having legitimized the relationship among the agronomist, the economist, and sociologist. Farming systems research has developed both a methodology and a mechanism for "fine tuning" research results in the field.

VI. INSTITUTIONAL AND MANAGEMENT ISSUES

Dr. Joseph Madamba, SEARCA, moderator, and Dr. Farland Hobgood, AID/Haiti, speaker
Dr. Eric B. Shearer, RTI, rapporteur

Dr. Hobgood presented a schema of the institutional aspects of agricultural research, as follows:



Internal management issues were introduced, expressly without an attempt to suggest answers but rather to stimulate discussion:

1. Who manages? Director or board. Tensions often develop.

2. Who manages best? Professional manager or scientist?

3. What is being managed? How is research agenda set, and by whom? This is important with respect to clientele and may have far-reaching consequences (e.g., case of square tomatoes in California). Also, who manages the research process and what discipline should lead multidisciplinary efforts?

4. How do they manage? Generalists vs. specialists.

5. Centralization vs. decentralization of decision making where sub-units are involved; pros and cons.

6. Institutional roles and priorities, e.g., research versus teaching and dissemination.

Dr. Madamba summed up with the remark that agricultural researchers must think in terms of the broad environment within which the activity takes place, and not just in terms of the narrow institutional framework. His comments included the following:

--Donor support has positive and negative aspects--negative in the sense that it may divert resources away from national priorities.

--Agricultural research should follow national goals set by a national planning mechanism "if it is in the right direction"; if it is not, the research system should try to influence the planning process.

--Verification in the Philippines is a relatively new activity; dissemination has been found risky if it emanates from the experiment station directly to the farmer.

--Managers must understand the research process.

--Funds are often easier to obtain than to spend wisely.

--Decentralization of decision making should be implemented gradually, if it has not been customary.

--The scope of research programs must be realistically adapted to available means.

Principal points arising out of the discussion from the floor were:

1. A distinction must be made between the researchers' opportunities for controlling externalities (e.g., national policies and plans) and their potential and responsibility for influencing them and taking an active interest in them. They must be aware of key external relationships, regardless of whether they are scientists or managers. Furthermore, they must be realistic in dealing with politicians and political problems.

2. A distinction should be made between directors (leaders) of research institutions and administrative managers. The former must be prestigious, "credible" scientists who can command the respect of the politicians and obtain required funding, but they should be freed from administrative (housekeeping) responsibilities.

3. Two sides of an equation need to be brought together: what needs to be accomplished and who are the scientists available able to do it. The solution involves the very difficult art of (realistically but not over-modestly) predicting research outputs. Problem: Can a system be designed in such a way as to bring both sides of the equation together? In some places the answers may well be the creation of an independent governing board for the institution.

4. There should be a clear relation between official support for agricultural research and the "track record" of the activity.

5. Are there any examples of formal links between national planning goals and establishment of an agricultural research agenda? Reply: in Philippines, yes.

6. Perhaps planning and agricultural research should not be related because too many plans are merely pieces of paper and they tend to be modified too often to be able to govern agricultural research programs.

VII. MACRO-POLICY ISSUES

Dr. Per Pinstrup-Anderson, IFPRI, moderator, and
Ms. Emmy Simmons, AID/W, speaker
Dr. James Thomas, CID, rapporteur

Introduction

Ms. Simmons said the policy issues have to be explicitly taken into account if research institutions are to be effective. Research institutions require the wholehearted support of policy makers. Consequently bureaucratic fit is important in designing research institutions.

Some examples of policy decisions from the impact evaluations:

1. In Korea, rice production and pricing was a national decision and commitment.

2. In Thailand, research centers were decentralized.

3. In Kenya, there was a regional approach, a hands-off policy on seed production, intervention in marketing (action), and national policy on exports to other states.

4. In Guatemala (ICTA), export-import decisions were made to balance national food needs.

Those policies affected research, but not always negatively. Many times they had positive effect.

Roles played by policy makers at the national level

1. International intermediation is performed by policy makers in relations with international agricultural research centers and in relations with neighboring countries and donors. Policy makers establish the openness or closedness of foreign relations as expressed through trade policies, attitudes toward foreign private investment in the country, and education abroad. They shape fiscal and monetary conditions, particularly exchange rates. And they establish the degree independence from international markets, such as a goal of being self sufficient in a staple food.

2. National directions. Examples of ways policy makers set national objectives and rewards, are nation-building, e.g., decentralizing to strengthened backward regions, fostering industry, keeping food prices low for urban consumers, and land reform.

3. Sectoral emphases: Through budgetary allocations, policy makers affect such things as choices between investing in improvement of different crops, e.g. rice vs. millet, or the availability of money to cover recurrent costs.

4. Running a bureaucracy. Policy makers are mostly civil servants--they run a bureaucracy. They determine who will get ahead. They also determine the reward structure in a bureaucracy, i.e., who will be rewarded by training. Finally they facilitate personal contact among members of the bureaucracy.

Some Policy questions

1. Can or should research people have an input into policy, whether asked for or not? If so, how?

2. Should policymakers influence research other than by providing money? If so, how?

Moderator's comments

Dr. Pinstrup-Andersen commented that there are four sets of policies that affect research differently depending on the line of research pursued: those that affect output (prices, markets), those that affect inputs (credit, inputs, fertilizer), those on land tenure (owner, tenant), and those related to foreign trade and foreign policy.

Governments have the tendency to manipulate food prices and since small farmers are very price sensitive, they will move toward better paying enterprises, especially toward a commodity whose price is not controlled. Price policy is important for research to be used. Lower prices usually only benefit the consumer. Governments can manipulate price by export-import balance. Prices also affect who pays for research. Private industry will fund research if the benefits are capturable.

On the input side, policy for imports and investment can affect research, for example, whether or not fertilizer supply is dependent on imports. New technology will not get far if inputs are not available.

A balance is needed between policy dictating research and research avoiding policy. Research policies should be based on longer range policies and national interests. But most policies are short-run or can be changed quickly (except land tenure), especially pricing policy. Hence, it is risky to plan research on the assumption that policies will never change. Consequently, research leaders must make judgments about which policies are likely to change in the foreseeable future.

Research should provide feedback to policy makers on successes and failures.

Comments from the floor

--Rates of return to agriculture research should be known. Can we capture some of the returns from agriculture research for agriculture research?

--The tendency (which we must avoid) is to think of policy as a negative in research.

--Research must be accountable to nation.

--Research must be responsive, but not too concerned about short runs and whims.

--We should focus on policies, whether right or wrong--then try to bring research to bear on wrong policies and try to change them.

--Agricultural research leaders often don't have the kind of staff support that they need to talk to policy makers effectively.

--What alternatives do researchers offer policy makers?

--Donor policies have a great effect on agricultural research. But the national government must find ways to make donor policies compatible with national policies.

VIII. SPECIFIC ASPECTS OF INSTITUTIONAL AND MANAGEMENT/MACRO POLICY ISSUES: GROUP REPORTS

1. Linking the Research System with the National Planning and Budgeting Process

Dr. Robert Werge, USDA, and Dr. Budhoyo Sukotjo, Indonesia, rapporteurs
Dr. Arnold Radi, USAID/Egypt, chairman

The group proposed some sort of a national council for most developing countries. Two possibilities are a national council reporting directly to the executive branch of the government or a national council empowered through the ministry of agriculture and/or allied ministries. In most cases a council purely for agricultural research council is recommended.

An agricultural research council would be a multidisciplinary organization. Some countries might have to consider an overall council for science and technology research. The mandate for the national council should include (1) access to highest authority, (2) responsibility for budget presentation, (3) responsibility for participation in national agricultural planning and policy decisions, (4) responsibility for coordination of the research program and budget allocation, (5) visibility--agricultural research being a function of national planning.

The actual administrative location of programs would be a function of type of crops, livestock, resource, etc.; size of country; agroecological zones; general infrastructure; degree of development; and political structure of government.

It is important that a national council for research (agriculture or expanded) function at the highest levels of government. This organization will have to have the best-trained and best-qualified research agriculturalists--technical and socio-economic. The national council plans, allocates research funds and programs, reviews programs, and evaluates the system.

2. Developing and Managing Professional Staff

Dr Henry Miles, AID/W, and Dr. Ben Ngundo, Kenya, rapporteurs
Dr. Edward J. Rice, USAID/Philippines, chairman

The requirements for developing and managing professional staff can be categorized as follows:

	Civil Service			Resources
	Yes	Sometimes	No	
1. Rewards for performance				
Selection and promotion on merit			x	
Judgement by peers			x	
Upward mobility		x		
Security	x			
Competitive salaries		x	x	x
2. Environment for research				
Facilities and equipment				x
Libraries and communications				x
Continuous, adequate funding				x
Delegation of financial authority and control			x	
3. Professional recognition				
Authorship				
Publications				
Conferences				x
4. Professional growth: training		x		x
5. Amenities and facilities for families	x	x		x

The priorities given by the members of the work group to different factors varied between regions and countries and between research station administrators and nonadministrators.

Management appears more important than the organizational structure.

Attempts to free research scientists from civil-service bureaucracy have led to establishment of new systems especially for these scientists. Some of the new systems have improved the conditions of employment for scientists, while others have continued to suffer from the same deficiencies that hinder the civil service.

The forward and backward linkages prove important to achieving the goals of national research systems. The system must gain political support to achieve special amenities for its employers.

The level of financial support does not affect all the requirements for maintaining a research staff.

An attempt to rank the priority of work factors was done by one group member from Africa and one from Latin America:

Rank		
Africa	Latin America	Factor
1	1	upward mobility
2	1	security
3	3	rewards based on performance
4	2	good research environment
7	2	professional recognitions
5	4	opportunities for advanced training
6	5	adequate facilities and staff
	6	good conditions for family
8		continuity of support

3. Overcoming Inadequate Internal and External Communications

Dr. Floyd Williams, ISNAR, and Dr. H. Hasnain, Pakistan, rapporteurs
Dr. John Mullenax, USAID/Niger, chairman

The group recognized that communication (in the form of working relationships) among disciplines, departments, and organizations requires continuous attention. However, the group took a broad approach to the issue. The linkages of the research system with policy makers, users, donors, and others was discussed along with their levels of performance. The system was considered too complex to prescribe a recipe. It is dynamic and changing. As such, effective communication requires a level of sophistication on all sides. This leads to the question of training and its connection with communication. Latin America, Africa. and Asia were compared in matters of investments in training. Initially, the majority of trained professionals seem to get drawn out of national research systems. However, some have ended up as policy makers or become senior administrators in a position to influence agricultural research and related policy issues.

Training was cited as the best investment, particularly if it was broad based (as in the Netherlands at Wageningen) and on-the-job. It should not be restricted to the middle level (M.S.), as stated by some,

but it should be high-level and more appropriate to the situation pertaining to the developing country. A dialogue could be opened with BIFAD for this purpose.

A multidisciplinary approach found overall support. Donors could make the case with their policy makers.

4. How the Research Organization can Improve its Capacity for Training its Professional Personnel

Dr. Guy B. Baird, IADS, and Dr. Roger Carlson, USAID/Somalia, rapporteurs
Ms. Emmy Simmons, AID/W, chairman

It is first necessary to place "training" in a context. Assuming that the organization has a clear research agenda, it can derive training objectives such as: develop disciplinary skills; develop managerial skills; interdisciplinary awareness and skills, (e.g., field methods theory/ concept); peer-professional contact/linkage development. Then a training plan can be developed. Training plan development involves setting priorities, and is based on needs analysis.

Ultimately implementation follows. Three choices for implementation of a training plan, all of which are generally possible are in-house, in-country, or "outside." The appropriate mix can be determined by five criteria: availability of resources; economies of scale (e.g., whether one person needs training, or a dozen; whether the subject of training is important/large enough to develop capacity if it does not already exist); ecological fit; location of skills needed; and linkages desired to be developed (with peers, mentors, etc.).

Where a choice is made to develop in-house or in-country training, several factors to be considered:

--assigning managers for the training program (full-time, part-time, special task, committee)

--having a training staff development plan drawn up

--having resources in place, funds in budget

--having linkages with universities and other institutions

--how to make training part of overall staff development

Effective utilization of returned trainees involves improved support facilities; proper placement, either technical or managerial (the trade-offs

involved in placing a technically-trained person in a managerial job should be recognized); incentives to perform; institutional environment and peer networking, both within and outside of country.

To increase the impact of research, training can introduce multi-disciplinary approaches/knowledge, and increased awareness of progress elsewhere.

5. The Need for the Agricultural Research System to Give Attention to "Outside" Factors Influencing the Use of Generated Technology

Ms. Charlotte Suggs, AID/W, and Dr. Rueben Wani, Sudan, rapporteurs
Mr. William Nance, USAID/Nepal, chairman

All the factors in question--availability and cost of inputs, market facilities, and policies relating to prices, imports, and exports--must be taken into account by the scientist designing research. In a perfect world, these complementary factors must be in place. The research scientist, however, operates in a world that is neither perfect nor static: a generated technology often appears ahead of complementary inputs and policy. The introduction of a technology ahead of complementary input availability can often stimulate changes in infrastructure and induce the presence of inputs (as in India where the advent of new wheats encouraged the growth of the fertilizer industry and construction of irrigation systems). At the same time, there are cases where technology was delivered before complementary inputs and/or policy were at hand, and effectiveness of the intervention was impeded.

What can agricultural scientists do when confronted with the absence of complementary factors? What leverage do they have in such matters and how can it be exercised? Although putting complementary factors in place is most often outside the scope of influence of scientists, there are some possible lines of action:

1. The scientist can serve as a catalyst, trying to influence those who make the research agenda to develop varieties that require fewer inputs (e.g., varieties that are high-yielding but require less fertilizer; breeding varieties closer to the farmer, thus reducing the need for storage and transportation; breeding varieties that are resistant to disease and require fewer insecticides; and breeding varieties whose color and taste match consumer preferences.

In such a situation, the scientist can identify the problem as he sees it, his intervention, and the constraints to the success of his intervention. He can feed this information to the administrative levels of the agricultural research system (institution). It would be the responsibility of these actors to influence government policy makers and planners.

A scientist can recommend to agenda makers a course of action that is either basic or adaptive research, based on his consideration of the factor constraints he faces in a given area.

2. The scientist can build into his hypothetical assumptions, when designing research, the absence of complementary factors. Run trials with test and control cases (for each factor), getting results that can show policy makers, funds allocators, and farmers what is possible, and selling a strategy for technology generation in the context of required inputs. This would be particularly effective if done on the farm rather than the research station or in the laboratory.

If the scientist can show the benefits of a certain course of action, new technology in some cases can convince policymakers (and farmers) of its utility.

To the extent that he has a receptive and supportive administrator, who enjoys a good relationship with government policy makers, a scientist can be more or less effective in selling a particular course of action.

3. If researchers developed well organized, well focused, cost-effective technology (that provided results) for the client, it would sell itself. Financial assistance from donors would not be needed.

It was also pointed out that scientists face certain risks in pursuing the catalyst role. There are things he can do. For example, he can assess the land, water, labor, and other factors required to increase production and explain them to policy makers in terms of time requirements, showing limitations. The government, on the other hand, may emphasize and require quick production results without wanting to pay, or being unable to pay, the costs of inputs required to increase production.

6. The Role and Organization of Research as Part of a Rural Development Program

Dr. Jennifer Bremer, DAI, and Dr. Joe Hartman, AID/W, rapporteurs
Dr. John Liwenga, Tanzania, chairman

To focus the discussion, the group concentrated on Project North Shaba (PNS) in Zaire as an example of a rural development project. The Shaba Project is directed toward increasing maize production and regional surpluses through a program of research and extension, farmer groups, road-building, and input supply. While the research component has not been implemented due to the difficulties inherent in fielding research personnel in the extremely remote location, the project has more than doubled maize production in the area and increased maize "exports" five-fold.

The overall success of the project, despite the absence of the research component, was attributed by the AID/Zaire representation to two factors: project utilization of a well-adapted maize variety developed by the National Maize Program and the improved marketing system resulting from the road-building program.

This experience, and others brought up by the group, suggest the following:

1. A full-scale research program is neither necessary nor even necessarily beneficial to an area development program. Particularly when national programs have developed technologies appropriate to project needs, on-farm verification trials conducted by extension with support from the national program may be more effective. In some cases, technology is not the constraint, and thus roads, credit, etc., may represent a better use of project resources. As these constraints are relieved, however, production may reach a plateau requiring research before further growth can be achieved.

2. The timing of integrated rural development projects makes research as part of the project an unlikely source of project technologies. Research should be begun in an earlier phase of activities or, if this is impossible, projects should not rely on the research component to produce the technologies to be used by the project.

3. The location of integrated rural development projects may make a significant research component inappropriate. Scarce national research resources should not be allocated to project regions selected for non-research reasons at the expense of building national capacity. Over time, decentralized research networks are necessary, but the placement of the stations should not be determined by temporary project needs.

4. Despite those overall concerns, research may be desirable in an area project for a variety of reasons:

--A research component may be politically necessary.

--Research may be necessary to refine or verify existing recommendations.

--Research may be required to address specific area needs, such as particular crops that are not addressed in the national program.

--A project research component reduces project risk, even if it duplicates national capacity somewhat, if there are political or technical reasons for believing the national program may not actually deliver needed technologies to the project.

--Project research can help to identify constraints needing national research attention, clarifying national research priorities.

The group also addressed two related topics: determinants of the role of research and the role of research organizations in project management.

The relative importance of research in an area development program depends in part on whether the constraints to such development are well-understood and well-identified. In general, the less information there is about development constraints, the more important is the role of research in the total development program.

When there is little information, research is critical to identify constraints and opportunities, even if those constraints are later found not to be subject to research. For example, in FNS careful analysis of the constraints recorded that the road-construction was central to area progress. Even though this implies that research per se had a lesser role in implementation, earlier social research was critical to identifying roads as a principal constraint in Shaba.

On the subject of research organizations in project management, there was widespread agreement that research organizations (whether U.S. or host-country) should not have a large role in management of non-research activities. First, research organizations do not have a comparative advantage in managing nonresearch activities. In general, they do it badly. Second, use of scarce research resources for project management draws off management expertise for the management of the research programs themselves. Research can nonetheless make a valuable contribution to project and program management by identifying constraints to development and providing other guidance to project management.

The foregoing implies that project designs seeking to incorporate both large research components and significant nonresearch activities are ill-advised, since management of research by nonresearch organizations is nearly as disastrous as management of other activities by research organizations. Such programs might better be undertaken as two separate projects rather than forcing research and nonresearch programs into an unwelcome alliance.

7. Technical Assistance Priorities in Relation to the Level of Development of the Agricultural Research System

Dr. John Cropper, CARDI, and Dr. Peter Youn, Liberia, rapporteurs
Dr. David Delgado, USAID/Guinea, chairman

We agonized over the fact that developing countries are not more able to take the decisions that they ought without assistance. Not surprisingly, therefore, discussions came back time and again to training--not just formal

M.S. and Ph.D. training, but also observation tours, in-service training, and short, specific subject, attachments.

The impact studies show that training was a major benefit and was appreciated. The group recognized that developing country training institutions have improved what they have to offer. Therefore, AID should not automatically think of the U.S. for training.

There was support for the proposed fund for training unrelated to specific projects (staff ready for projects). Apparently, there is a small fund for training in Africa--but it is said to be woefully inadequate. Again, it need not necessarily be formalized training and not necessarily in the U.S.

The group recognized that AID must be flexible in its approach to supporting developing countries. In countries with the least developed agricultural research systems, any project/program must have a "critical mass" to meet its goals. This includes personnel, facilities, and management capability (senior and junior).

The institution to be supported must be carefully selected. It must be part of the overall system and not off on its own. There must also be counterparts, with some chance that they can carry on the work started under the project. The more developed systems are, by definition, more able to identify their own needs and who and what they want by way of projects consultants and technical assistance. This is to be encouraged.

Technical cooperation among developing countries (tc/dc) should be encouraged and possibly to be built into projects.

There is a need to help countries come to terms with their own organizational needs. AID should not always be looking for "quick fixes" by duplicating institutions, or by having short-term projects run by consultants. In this regard, AID should include local personnel on project design teams, and should look for short, manageable projects.

Because there is often difficulty in getting host-country commitment to ensure continued funding, the project should be designed with the possibility for a few quick results, however small, as an inducement to the policy makers. Project scientists and managers should be selected with this in mind. People should be conscious of the need to "sell" the project.

Projects need an ongoing review of their objectives in terms of perceived need and what is sensible in the context.

Comments: Institutional Management/Macro Policy Issues

Carl Pray, Univ. of Minnesota, rapporteur

The moderator, Dr. Twig Johnson, AID/W, noted that one pervasive theme is the value of training. USAID does not encourage degree training at present, but it should. One problem for USAID is that it cannot train people in developed countries other than the U.S. But training in the U.S. causes difficulties for people from non-English-speaking countries. Wageningen (Netherlands), for example, has better facilities for trainees from developing countries than most places in the U.S. It was noted that AID is currently reviewing its policy on training.

Developing countries should be used as much as possible for training. Another technique that makes Ph.D. training more relevant is to have the candidate do his thesis at home. Title XII strengthening grants should make it possible for U.S. universities to provide more relevant training for students from developing countries.

Comments from the floor

--A survey of 100 World Bank projects in Africa that had research components uncovered few successes. The time factor was the main problem. Technology is there or not, and this should determine whether it is a research or development project. The mix was successful only when the research was done and the project only had to do adaptive research, and when firefighting type research was included.

--In Tanzania, the regional development projects have taken people out of the National Commodity Program.

--AID's tendency to move away from sector programs to projects leads to host-country problems. The host countries have to put up much money and people, etc. There is time wasted meeting all donors. There are needs for counterparts and current expenses.

--Research has been successful in selling itself. It has grown exceedingly fast. The money/scientist ratio in Africa is far above Asia. It is not always an unmitigated good. Agricultural scientists have a responsibility to say when things do not work. There are not going to be a lot of additional resources in the future.

--The money/scientist ratio is high in Africa because the ratio of expatriates to local scientists is high. Money for research has expanded rapidly, but you cannot do research without scientists and there still are not enough scientists. Mexico has 250 persons with M.S. and Ph.D. degrees. That is enough for Guatemala's agriculture but not for Mexico's. Eighty percent of the scientists in less-developed countries are in 8 countries. There just is not much money going into it at the moment. Research is a cheap for the country; if it can afford an airline, it can afford research.

--How do research institutes choose social scientists for agricultural research? Rural sociology has little to offer and the anthropologists and sociologists who are chosen usually are of low quality.

IX. NEW DIMENSIONS IN AGRICULTURAL RESEARCH

Dr. Curtis Farrar, AID/W, moderator; Dr. Vernon Ruttan, Univ. of Minnesota;
Dr. Floyd Williams, ISNAR; Dr. John Monyo, FAO
Dr. James K. McDermott, AID/W, rapporteur

Dr. Farrar observed that several elements could be listed as new dimensions, including some "old" new dimensions, such as institution building, the decelerating growth of investment in international centers, increased in interest in (and in some cases support of) national research system development, increased donor collaboration in national system support, increased interest in understanding the farmer, the need for a new look at training programs, and the need for and commitment to a long-term approach. We may see other new dimensions, such as interest in cash crops for the small farmer, nutrition, and role of the private sector in technology innovation.

Dr. Ruttan commented that while successful research projects can be found, successful research programs and national systems are rare. This is a critical period; unless some badly needed reforms are made in the structure of international assistance, further resource transfers for agricultural research may be counter productive. The private foundations, which provided early leadership, have all but abandoned the field. AID itself has seen its technical-professional capacity erode to the point that it can only provide the burcaucratic function, and its resources have been shifted to support political rather than developmental objectives. International development banks are emphasizing resource transfer rather than programs, and in many cases the development of facilities is outstripping the growth of capacity to use the facilities. The international agricultural research centers have already accomplished the dramatic advances and will be faced with more mundane achievements from now on.

A disturbing phenomenon is the cycle of rising national research capacity, resulting from donor activity, followed by serious deterioration. Donors need to ask if this problem is related to the way they do business. It may be that the donor project system provides perverse incentives to the leaders of national systems. Donors are often easier to deal with than national financial sources, and this discourages research leaders from building the political support essential for a sustained program. The political systems of most countries cannot be relied on to turn out "good" people. It can be relied on to turn out ambitious individuals, and ambitious individuals respond to organized pressure. Research managers have to learn to marshall political support. A few national managers have done so.

When we evaluate our own projects, instead of the effectiveness of the system, we must ask if we are providing the incentives for correct action. Project decisions need to be made by the criteria of the national system, not by those of the donor system.

A formula by which donor support would be based on increments of national support would give the correct incentives. The formula would vary from country to country as a function of both fiscal strength and political will. Under this system, decisions would be left to the host country. The learning process would be rapid under this system and self-interest would bring an increasing productivity.

A second best alternative would be joint planning between donors and the host country following the JCRR (Joint Commission on Rural Reconstruction) model in Taiwan. The process of learning and internalizing the management process would be slower under this alternative.

There would be opposition to this strategy, flowing chiefly from the loss of identity of donor contributions. However, the feeling of frustration and the chance it would work are forces in favor of a restructuring.

Dr. Williams said that if governments are to support research, there must be a political base of people who benefit from it. Research organizations can help by providing information and by making the research productive. All research takes time--even quickie efforts to borrow technology--and most donors do not like to give very much time.

Research systems also need to have an internal facility to develop their own personnel.

The CGIAR experience has provided some lessons regarding the value of continuity and maintenance of funding, the value of periodic re-planning, and the utility of external, formalized reviews. The donors who make up the CGIAR treat their national efforts differently, however. They expect too much too soon. They need to apply to national efforts what they have learned from the CGIAR.

A Consultative Group for National Agricultural Research (CGNAR) could have an impact on national systems comparable to that of the CGIAR on the international centers. With a five-year planning horizon and a two-year plan of work that was continually rolled forward, all actors would have a basis for commitment. Donors could set some minimum requirements, such as linkages, facilities, and the like. The CGNAR would consist of two national leaders (one from research and one from planning) plus one representative per donor.

The CGNAR may need a group, probably internal to the research system, to provide information and analysis. Donors would need to indicate their intended level of support far enough into the future to allow the national government time to adjust to changes and to provide a security of expectations.

Dr. Monyo remarked that new dimensions in research for the less-developed countries are often history for the moderately developed countries. FAO/UNDP is planning its own impact evaluations of research, chiefly to teach themselves

what works and what doesn't. Results will be made available to other donors, especially where research is a component of development projects.

Third World governments are giving increasing recognition to research as a tool of development, and the investment is increasing. It is mostly for salaries, however, and the lack of operational funds means that some salaried people are not productive. Donors are going to be involved in African countries for a long time and need to consider seriously the providing of operational expenses. As it is, donor counterpart requirements are exacerbating the problem. Many governments simply cannot invest more than are currently investing.

Donors need to seek coordination but without collusion.

FAO has experimented with the use of nationals as team leaders of expatriate teams, with some successes and some failures. The leader of expatriate teams often is an impediment to integration of expatriate teams because personnel orient their work and loyalties to him rather than identifying with the national system.

Some regional research has produced good results, but it is often beset with political problems. Regional research has no institutionalizing mechanism. Networks of researchers from developing countries could be useful if the country programs really are interdependent.

One of the major difficulties in linkage formation is that often the different entities are guided by different philosophies. Research needs a special section to provide liaison with extension, and extension is needed.

One of the reasons for the heavy emphasis on bilateral assistance is the desire of some donors to maintain ties with the former colonies and the desire of individuals to keep working in countries in which they had pre-independence experience.

Comments from the floor

Dr. Madamba said the role of international centers and regional organizations such as SEARCA are changing rapidly, largely as a result of increasing capacity in national systems. There is a role for the international agricultural research centers, but it will continually change.

Massive training has been important in national system development. Donors need to help countries retain their personnel. There is both expertise and confidence in developing countries, and they could do much more with a little donor help in retaining personnel. Operating budgets do offer good opportunity for effective resource input.

Dr. Bernardo said manpower supply and development should not be external to the national system. Even with very tight agricultural budgets in the Philippines, the Secretary of Agriculture still invested heavily in manpower, even though education was in a separate department.

Many countries would support Dr. Ruttan's ideas. In the Philippines, researchers are grateful when donors negotiate with the government to increase commitment. And once there is an international contract, it tends to maintain stability even through changes in government.

Dr. Coulter said the weakness of developing countries' research organizations reflect general weakness of their institutions. Can we--or even should we--convince developing countries to lift research appreciably above the general public sector?

The CGNAR is an idea whose time is ripe--if we don't press too hard on the governments of developing countries. World Bank structural adjustment loans could be used to support institutional reform.

Retention of personnel (especially the key program leaders without whom programs will not move) is important. Donors have a responsibility and should be able to help.

Increasing efficiency of utilization of inputs, which are getting to be very costly, is going to be a critical problem in this decade.

Dr. Chibasa said lack of commitment to research in developing countries is sometimes due to resource shortage. In other cases, in spite of the food situation, countries do not want to invest in research, feeling that extension is more important. Dr. Ruttan's idea of basing donor support on country commitment may work. Donors should also consider linking food aid to a commitment to research and using food-aid resources to support research.

Dr. Pinstrup-Andersen said technological change has been extremely effective in stimulating rural growth, both in farm production and in off-farm activity, according to IFPRI research.

Creating autonomous research entities may build barriers between the entities that ought to be linked.

Dr. Liwenga said some donors have sponsored research projects that are too narrowly focused on commodity technology. They need to look at the institutional strength, especially the management. Most managers are called on to manage without any training. As they get drawn away from their profession, they end up being neither very good scientists nor very good managers. If they lose their manager's job they are at a disadvantage in returning to science.

The autonomy or semi-autonomy of a research entity does not allow it to shed responsibility. It still has to seek financial support.

Responses

Dr. Williams said the so-called autonomous research entities are never more than semi-autonomous. They often drift back into the nature of a line agency, and support is always a problem.

Great gains in the productivity of national research systems could be made with small improvements in management. What is needed are short-term training opportunities, either in-country or in nearby countries with similar situations.

Conclusion

Dr. Farrar said the structural adjustment loans and the use of PL 480 resources to stimulate research would require negotiation and planning. But the ideas are certainly relevant.

Emphasis in this session on the integration of research and teaching has come as something of a surprise. An AID evaluation study dismisses the need to relate research and training. Perhaps inclusion of other experiences, such as that of India would have led to different conclusions.

There is a growing attention to research. It is being discussed in conferences now that are free of political considerations and of turf or jurisdictional battles. That is a good omen.

X. RECOMMENDATIONS TO AID

Dr. Richard Blue, AID/W, moderator; Dr. Nyle Brady AID/W;
and Dr. Joseph Wheeler, AID/W
Mr. Steven Breth, IADS, and Dr. Guy Baird, IADS, rapporteurs

Workshop overview

Dr. Blue summarized the purpose of the workshop.

1. The 1970's were a period of vigorous expansion in investment in international agricultural research, though many national research institutions still have serious problems. The breakthroughs of the Green Revolution raised the prestige of, and support for, agricultural research. In addition, the value of interdisciplinary research was increasingly recognized.

2. The 1980's, however, appear to be a period of consolidation. Gains in agricultural productivity seem likely to be only incremental; money is short; policy makers are increasing pressure for achieving practical results quickly.

Despite the difficulty of the times, a good research base has been established. Researchers are giving more attention to the farm family and the whole social and economic environment. But donor and host government desires to aid faltering economies may turn attention to improvement of export crop production, which might in some areas conflict with a focus on food production by small farmers.

3. The changing outlook for international agricultural research is the context for the workshop. The impact evaluation studies, which formed the background for the workshop, went beyond agricultural institutions to address the whole agricultural research system of each country. The agricultural institutions themselves cannot carry the whole burden of improving agricultural productivity--they are only part of the recipe.

The projects addressed by the impact evaluations ranged from ones with considerable success to ones with serious difficulties. A major conclusion from the impact evaluations are that AID has been an effective force in fostering innovations in research, in particular in getting researchers into closer partnership with farmers. The studies also underscored that effective agricultural research has a high and measurable economic effect.

In successful agricultural research activities, several common elements can be discerned:

--Strong host-government commitment to and support for research. The host government should carefully plan its research agenda. A proliferation of projects may be a symptom of lack of control.

--A long-run perspective. There must be willingness to stay with a strategy. Agricultural research projects need careful monitoring and management, and periodic evaluation.

--Clear policy goals by the host government with respect to the role of agricultural research activities.

--Involvement of all institutions that make up the agricultural research system, e.g., policy makers, farming community, and international organizations.

--Appropriate policy. That is different from commitment. Proper policies ensure that, when new technology is developed, there will be incentives that foster adoption and inputs that permit adoption. The need for appropriate policy, however, does not absolve the research agenda from being relevant to the existing constraints and imperfections of the economy.

Group reports:

How Can Agricultural Research Projects Maximize Impacts, Minimize Unintended Consequences, and Make Efficient Use of Resources?

1. Pre-project Identification and Planning Stage

Dr. Vincent Cusmano, USAID/Ecuador, and Dr. Budhoyo Sukotjo, Indonesia, rapporteurs
Dr. Arnold Radi, USAID/Egypt, chairman

For the sake of organization, the group categorized its response in terms of the process and the content of the pre-project phase of project development. Within the context of the process, three specific activities were discussed: the request, whether formal or informal, for assistance; the analysis of basic sectoral problems and constraints; and finally the formal presentation and defense of a project identification document. Although the request for financial/technical cooperation by the host government often follows the analysis, early engagement and discussion between the donor agency and the host country is paramount to this phase.

At the request stage, a joint effort to determine commitment, government priorities, and donor interest, is important. Equally important at the request stage is an assessment of the human resources, capital, and institutional capacities involved. In the analysis phase, problem identification, especially as it relates to farm-level constraints, market

inefficiency, and input supply are critical aspects of the assessment. In addition, the interface of research and policy as well as general aspects of nutritional and food policies are important variables in the analysis of the potential project. The issue of "what is it that we don't know?" was also discussed in an effort to call attention to the need to review the existing knowledge base worldwide.

In sum, the group concluded that the key ingredient to potential project success at early stages of the project development process is joint efforts in assessing the request for assistance in the agricultural research field.

2. Project Design and Preparation Stage

Dr. Henry Miles, AID/W, and Dr. Ben Ngundo, Kenya, rapporteurs
Dr. Edward Rice, chairman

1. Research is a long-term process that requires long-term commitment.

2. The strategy for design must fit the national objectives. This means that there may be country-specific answers to country-specific questions.

3. The strategy must fit the host government's political situation.

4. Design must take into account the project environment--taking a look at the entire context in which the project exists (backward and forward linkages).

5. Based on an analysis of the total environment of the agricultural research system, the design should identify strengths and constraints, address the constraints to the extent possible, and take account of strengths and constraints that will not be changed during the course of the project.

6. The project design should allow sufficient time for discussion both internally and externally. The host country may spend 6 months to a year before a donor sees it. This has implications for time, due to sometimes a strained host government capacity. Negotiations will have to take place between agricultural research and other parts of government, between donor country mission and home office, and between country and donor.

7. The project design should be as collaborative as possible to attain the support of all parties.

8. Since agricultural research is a long-term endeavor and needs a steady source of funds, two design items should be considered: that donors include funds for operating expenses in project, and that incentives

be built in for national governments to find sources of long-term support for these increments to the agricultural research system.

9. A realistic assessment of the resources the host country can provide, especially human resources and operating funds, should be made during the project design.

10. The staff for project design teams should be carefully selected so as not to overburden the design.

11. Farming-systems research may require different design considerations, e.g., staffing of a multidisciplinary team, and, in view of the general inexperience with farming-systems approaches, extra thought and attention should go into planning projects that are to use farming-systems research.

12. To try to minimize unintended consequences while maximizing impacts, project designs should incorporate an adequate baseline, monitoring plan, and evaluation plan, keeping in mind that it is difficult to disaggregate the impact of any one project, but that the strengthening of national research systems can be shown to have beneficial efforts on the technology generation and transfer process.

13. Research projects should continue an informal appraisal of technology used in the area in order to project an idea of the effect of the introduction of the project's technology.

Also, we see a role for monitoring the project's impact on the research institution that might have short-term consequences for redesign.

14. Projects should be designed so that there is flexibility in implementation. Project designs are indicative of the way that implementation will proceed, and while agreement on certain commitments is important, all the details need not be seen as set in cement. This is an area in which the personnel involved will affect the decisions on changes to be made.

3. Project Implementation

Dr. Floyd Williams, ISNAR, and Dr. H. Hasnain, Pakistan, rapporteurs
Dr. John Mullenax, chairman

1. The discussion reached back to project design. Project targets need to be realistic, attainable and related to the real world. Indicators of progress for each sub-period of the project should be included in the design. The indicators should be realistic and revised if necessary. Host-country personnel who are to be responsible for implementing the project must be involved in designing the project and some may need to be trained in management.

2. AID mission personnel need to remember that the host country (with or without external help) is implementing the project. Conditions precedent should not be used to put off decisions or difficult issues. They often seriously inhibit orderly implementation. Hitches in implementation may reveal substantive issues that must be addressed through a dialogue on policy or process, thus contributing to the development process.

3. Project design should be influenced more by the implementation capability of the host country than by the theoretical considerations of the AID administration. Projects acquire appendages that inhibit their implementation. As projects go through the various clearance processes in AID/Washington, and each office looks at them from its particular viewpoint, they acquire appendages that inhibit their implemenation. Bangladesh has developed a project implementation document that responds to the project document, but that is related to government procedures and uses government vocabulary. It may be a useful model.

4. Training may need to be started well before other project activities if trainees are important in project implementation. A pre-selected pool of persons who have been cleared by their government to receive training may speed the training process.

5. Communication by project implementors with satellite institutions of related organizations may uncover opportunities for mutual supporting actions. U.S. universities can develop long-term relationships with countries only if they have a funded base for that function.

4. Project Management by AID

Dr. Guy B. Baird, rapporteur
Ms. Emmy Simmons, chairman

This group attempted to avoid addressing project design and implementation issues, but was not fully successful. For example, it was felt that area development projects probably should not be designed to include a research component, principally because of the long-range nature of the latter relative to achievement of objectives of the former.

After reviewing the responsibilities of mission-level project managers, the group identified three major issues and made corresponding recommendations.

1. AID's resources (particularly in-house talent and operating expenses) must be marshalled to support project managers in the field. Often managers for country-level research projects have insufficient technical experience, and thus require backstopping to do an effective job. They should have access to training, to technical assistance (including consultants), and to networks in research that permit them to draw on top expertise, both within the country and externally. In regard to technical assistance, closer relations should be developed between the international agricultural research centers and the mission--perhaps on a more formal basis.

2. Flexibility is the AID project manager's need; ways must be found (management options, redesign possibilities, etc.) to encourage it.

Management of research is different: there is less need for day-to-day interaction, more need for awareness of qualitative outputs. There is need to create an appropriate research atmosphere.

Greater flexibility in management does not mean increased business. An appropriate management plan is called for that is clearly understood and supported by the host country.

The host government and AID need to carefully work out a mutually agreeable implementation plan, and to revise it as appropriate.

AID must clearly and cogently communicate AID regulations to the host country. The project manager must use his authority in this regard and not shirk responsibility by referring unpleasant decisions to higher levels, including to AID/Washington.

3. The approach to AID's management of research projects should be revised.

The group did not categorically endorse Dr. Ruttan's proposal, but like its general idea of less rigid management procedures.

AID should more frequently joint multi-donor arrangements for management of research. It is inefficient and disruptive to a country when several donors stake out special areas of interest in support of research, and manage their inputs without real cooperation.

AID should move away from projectized, fragmented approaches to support of regional agricultural research systems. Recognition should be given to the long-range nature of research, and the corresponding need for long-term support.

Emphasis should be given to support for sound host-country research agendas and commitments, as opposed to agendas generated by donor interest and perceptions.

5. Project Monitoring and Support

Ms. Charlotte Suggs, AID/W, and Dr. Reuben Wani, Sudan, rapporteurs
Mr. William Nance, chairman

There is a great deal of overlap between project management and project monitoring. Usually the AID manager is responsible for day-to-day monitoring of funds and inputs inventory, and accordingly is best able to perform overall monitoring duties.

It is also necessary to distinguish between monitoring and evaluation. Too often, evaluation is used as a monitoring tool. Evaluation should show the progress of project toward meeting objectives (as stated in the project design) and should be performed routinely, not more than twice during the life of the project. Monitoring, on the other hand, should keep track of implementation (input/output inventory); and should be ongoing. Monitoring reviews should be periodic meetings of host-country managers and/or project leaders and donor counterparts to take stock of implementation. Efforts should be made to arrange these reviews so as not to duplicate the reviews already scheduled by host-country government.

Host-country administrators and scientists

1. Host-country scientists and administrators should help to see that reports of monitoring reviews reach levels of the institute and government where plans are made and funds allocated.

2. Host-country administrators of agricultural research should make sure that the project as being implemented coincides with national research objectives, that funds commited by the government are forthcoming, and that recurrent costs are met.

3. Host-country managers of projects can be more effective when working in the project area as opposed to a central facility.

AID mission administrators and agricultural professionals

(These suggestions apply to all donors.)

1. The AID administrator and the AID agricultural professional (project manager) should participate in the periodic monitoring review along with their host-country counterparts.

2. The donor professional should be assigned, ideally, through the life of a project (3-5 years). Too often host-country project personnel must adjust to succession of three or four project managers, each with a different purview and level of competency.

3. The qualifications of donor managers should be examined carefully. Technical competency should be stressed. Better research-oriented training of management professionals should be the rule: generalists may not know how to handle crises in research implementation. Further, donor personnel should be able to speak the language and be familiar with its customs. Assignment of AID agricultural professionals should be based on the appropriateness of their language skills, training, technical specialty, and geographic experience to the country in question.

4. More AID professionals should work at the project site, rather than remaining at the mission. At a minimum, the AID manager should be assigned to the same locality as his host-country counterpart (and as stated previously this counterpart should be in the field where the project is being implemented, away from central headquarters).

AID/Washington administrators and agricultural professionals

1. Project support should be provided so as to ensure timely delivery of project inputs (this responsibility is shared by AID missions).

2. Efforts should be made to bring AID and other donors together to discuss issues (implementation) both in the US and elsewhere.

3. AID/Washington and the missions should be more flexible in allowing time extensions to meet implementation objectives, when the situation warrants.

4. Technical backstopping in AID/Washington should be by people who are familiar with the country, its problems, and the specific research problem addressed by the project.

Representatives of other donor agencies, consulting firms, universities, international centers

All the points previously mentioned in regard to AID/Washington and AID missions apply as well to this group. In addition all donors should participate in some type of information networking on agricultural research implementation problems within the countries and in the regions where they are assisting in agricultural research.

6. Evaluation of Agricultural Research Projects

Dr. Jennifer Brewer, DAI, and Dr. John Liwenga, Tanzania, rapporteurs
Dr. Joe Hartman, chairman

The special nature of research projects places special demands on the evaluation process. Evaluation requires attention to several different aspects of project implementation, with varying evaluation designs to address immediate project concerns (such as delivery of inputs), planning of future project activities, and future requirements for program development.

Research projects have a dual goal: they seek to produce specific technological outputs as well as to develop the institutions involved. Both are long-term goals and their accomplishment cannot always be adequately measured within the scope of the project.

Later follow-up evaluations are necessary not only to determine project "success," but also to provide the broader policy guidance not attainable through standard project evaluations.

Research progress can only be measured adequately through sustained evaluation over time. One-shot evaluations are ineffective because perspective on research progress cannot be gained in such a setting.

Evaluations must focus on process as well as output to identify needed adjustments in project implementation.

Research projects require special technical competence that may be lacking in the donors as well as the host-country institutions. This complicates evaluation as well as project design and management.

Participation by host-country representatives, AID/mission personnel, AID/Washington managers, and outside experts is critical to evaluation success. Host-country participation is essential for meaningful evaluation, despite the political and technical difficulties that this may pose. Effective AID/Washington participation is hampered by the mismatch between personnel's technical skills and administrative duties. Inappropriate team composition frequently reduces evaluation effectiveness, with team members lacking necessary technical expertise, developing-country experience, or language skills.

Project design is the most critical factor in achieving an effective evaluation program. The design of the project itself is more important to evaluation than the design of evaluation per se. Without flexibility in the project design, evaluation is much less effective: there is little point in recommending changes in a research program if the project design does not have sufficient flexibility to permit such mid-course corrections without a major redesign effort. The project's institutional placement affects the willingness of host-country officials to participate actively in evaluation and in the project itself.

The evaluation program design should consider not only the type and scheduling of evaluations, but also the methodology to be used, the composition of the team, and the necessary pre-evaluation preparation. Project information systems must be established from the beginning of the project in order to provide the raw material for evaluation as well as project management. Data cannot be gathered by the team unless adequate preparation is made.

The evaluation team must receive an adequate orientation prior to departure. This requires the development of an improved evaluation methodology for agricultural research and sufficient pre-evaluation briefings in this methodology, the goals of the evaluation, and the specifics of the project involved.

Project targets should be realistic. Overly optimistic targets make useful evaluation more difficult and exacerbate the antagonisms inherent in evaluation.

Finally, evaluation is not an unmitigated good. Evaluations can be disruptive and divisive as well as constructive. This is particularly true when evaluation staff members do not have sufficient background to judge project achievements or when evaluators succumb to the temptation to make recommendations about matters outside their areas of competence. The group makes five recommendations to increase the effectiveness of evaluation:

1. Host-country representatives must be included in every evaluation. Wherever possible the team leader should be drawn from the host country.

2. Project design should establish a mechanism for sustained evaluation attention. This may take the form of a peer review committee drawn from host-country, AID, and other sources. It may also take the form of a contracted informal arrangement permitting a core group of individuals to be involved in several evaluations over time (regardless of their institutional location). This continued overview would increase both the value of the recommendations made and their acceptability to project staff.

3. Research projects must be more flexible so that, where evaluations identify change, these can be incorporated with little difficulty into project implementation. This implies the need for greater decentralization of project control to allow the AID mission and host-country managers to respond constructively to evaluation. The research process does not permit complete planning, but requires a flexible response to opportunities as they are identified.

4. Research evaluation requires an explicit methodology and a carefully developed plan to guide team performance. The overall guidelines for such evaluations should be revised and made more available, but this does not obviate the necessity for tailoring this design to specific needs and fully briefing teams on the job expected before they go out.

5. Donor competence must be strengthened as well as host-country capacity. AID's corps of technical officers needs immediate attention. The needs of its members must be recognized. On the one hand, they desire to use their technical skills, but AID neither makes use of these nor provides sufficient opportunities to maintain specialized skills. On the other hand, jobs require administrative and management abilities for which the technical officers have received little training.

7. Socio-economic and Political Context in Which Agricultural Research Systems Operate

Dr. John Cropper, CARDI, rapporteur
Dr. David Delgado, USAID/Guinea, chairman

The political considerations involved in the development and approval of projects--matters that can never be included in the project identification document or project paper--are the critical factor in the conception and birth of many projects, and they are often forgotten or reversed 1 or 2 years later. Since they are not recorded, they cannot be taken into account in the evaluation or impact studies, to the disadvantage of the project technicians and the host country. "Political" considerations are not going to disappear, but the assumptions column in the log frame, as well as the conditions precedent to the covenants ought to be so written that the project has some chance of being implemented. A systems approach to agricultural research would greatly assist in the formulation of a

sensible log frame. Forward and backward linkages are particularly relevant for the "assumptions" column.

Concern was expressed with AID's project review and approval process, in that projects continue to slip through that are not implementable. There should be high quality technical guidance in the approval process.

It is likely that long-term commitments, if only in principle, to agricultural research programs will be more acceptable at the political and technical level to host countries. But in order for this to be acceptable to, and manageable by, AID there must be a rational agricultural research program with assigned priorities and definite goals. AID is urged to work with donor agencies, ISNAR, and regional agencies to make this a reality. Funding can continue to be on a project basis, within this overall framework.

With long-term approval, in principle, projects could have 3- or 5-year cutoffs based on the results of an in-depth technical review.

Although a socio-economic analysis is included in the project design and is sometimes a part of the project itself, there should be, even in relatively basic agricultural research projects, a socio-economic component --the nature of which will depend on the type of research. This should help to keep the research scientist down to earth.

Finally, research scientists should be conscious of the need to demonstrate early, visible results in order that the minister of agriculture need not "stand naked" before the minister of finance when the agricultural research budget is being discussed.

Responses from AID Leaders

Dr. Joseph Wheeler underscored the importance of the policy dialogue. It must be recognized that agricultural research operates in a political context. Until the top political leaders of a country pay attention to agriculture--through correct policies and financial support--not much can come out of the agricultural sector. Sometimes agriculture is regarded as a great cow to be milked but not fed. There needs to be the right kind of communication with political leaders--communication that captures their attention.

Another important area is research cooperation across borders. The international agricultural research centers are fostering this to an extent. But there should be more. One encouraging example is the Sahel where ministers are talking to ministers, linking research and development activities in common agricultural zones.

Finally Dr. Wheeler noted that AID/Washington is sympathetic to the idea of commitment of interest for long-term projects or ideas.

Dr. Nyle Brady observed that a common theme of the workshop was the essentiality for the donors to understand host-country desires and to do what they want. But there is a divergence within developing countries about what is wanted. The scientists, agricultural leaders, and political leaders of the developing countries tend to see problems from different vantage points. AID needs be clear about which groups it is working with.

A second important theme was that continuity of personnel--both donor and host country--is important. One of the strengths of the international agricultural development centers is their staff stability.

On the project approach to agricultural research, Dr. Brady remarked that agricultural research projects cannot be organized and managed as if they were a road building project. Moreover agricultural research projects should not created in isolation--they should be a unit in a larger scheme.

Finally, Dr. Brady called for moving more individuals who have research backgrounds or interests into decision-making positions in AID.

XI. AFTER DINNER ADDRESS

June 14, 1982
Dr. Nyle Brady
Senior Assistant Administrator
Science and Technology Bureau AID/W

Dr. Brady began by referring to the exceptionally rapid agricultural gains developing countries such as India and Indonesia have made since the 1960's. The primary causes, he said, were research-based technology, such as the new wheat and rice varieties, and the establishment of sound policies and necessary infrastructure. With adverse policies and inadequate infrastructure, Dr. Brady observed, new technology is unlikely to have much of an impact. On the other hand, the development of better technology often provides an impetus for improving policies and infrastructure.

Turning to AID's role in agricultural research, Dr. Brady deplored the notion that sufficient new technology is available to developing countries and that it merely has to be applied. While adaptation and extension of existing improved technology have greatly increased yields in many countries, the challenge of increasing agricultural productivity under adverse agro-ecological conditions, such as prevail in large areas of the developing world, has yet to be met. Said Dr. Brady, "To put it bluntly, we have tackled only the easy problems so far." Moreover, even in better-endowed regions, population pressure will in the future force farmers to cultivate marginal land more intensively, and productive technology is needed for such areas.

AID should continue to support the development of technology for the poor farmers of such regions. Moreover, rapid changes in biological science taking place in developed countries may have significant implications for agriculture in developing countries, and AID has a responsibility to make sure that LDCs share in the benefits of these technologies.

Dr. Brady said the aim of the AID agricultural program is to help developing countries increase their ability to feed themselves and the aim of the AID's efforts in agricultural research is to help developing countries build the capacity to do a larger share of their own research. Dr. Brady outlined three steps that would improve the impact of AID's support for agricultural research. First, the nature and quality of research now under way with AID support should be classified more precisely. Second, priorities, by sector and geographic area, need to be set for the efficient use of AID's finite financial and human resources. Third, AID should find the best procedures for achieving the priority goals, and should draw on scientists and planners from developing countries for advice.

On the subject of AID research projects, Dr. Brady discussed several critical issues. He said that the time horizons for research projects may

be too short, and thus place excessive stress on the achievement of quick results to the detriment of more significant results that may take longer to bring about. The project approach encourages this tendency; a better mix of projects and programs would improve the balance between short-term results and long-term results, which are likely to have a more lasting effect.

Another need is closer attention to farm-level constraints and conditions, so that AID support could be concentrated on research that helps the most neglected members of society.

Finally, collaboration by regional groupings of countries should be fostered by AID. Regional networks can be an important tool in raising national research capacities, Dr. Brady said.

P R O G R A M

WORKSHOP ON IMPACT OF AGRICULTURAL RESEARCH

U.S. Agency for International Development
June 13 - 17, 1982

Xerox International Center for Training and Management
Leesburg, VA 22075

Sunday, June 13

	Participants arrive Washington, D.C.	
4:00 PM	Buses depart from 21st Street Entrance State Department for Xerox Center near Leesburg, VA	
2:00 - 6:00	Registration at Xerox Center	
6:30	Dinner	
7:30 - 10:00	Get acquainted period in recreation area	
8:00	Orientation sessions for participants with special assignments (See individual memos)	

Monday, June 14

7:00 - 8:00 AM	Breakfast	
8:30	Plenary Session	
	o Welcome and Announcements	Richard Blue, AID/W
	o Introduction to Work Groups	F. C. Byrnes, IADS
9:00	Work Groups Meet	
10:00	Break	
10:30	Plenary Session	
	o Reports of Work Groups	F. C. Byrnes, IADS
	o "Why Evaluate AID-Sponsored Agricultural Research?"	Twig Johnson, AID/W
12:00 PM	Lunch	

1:00	Plenary Session
	"Technology Generation and Transfer"
	Donald Plucknett, CGIAR, Moderator Robert Jackson, AID/W
3:00	Break
3:30	Work Groups Meet
5:30	Informal Reception
6:30	Dinner
	Speaker: Nyle Brady, Senior Assistant Administrator Bureau for Science and Technology, AID/W

Tuesday, June 15

7:00 - 8:00 AM	Breakfast
8:30	Assigned Reading Period
10:00	Break
10:30	Plenary Session
	"Impact of Research on Development" E. Walter Coward, Cornell University Josette Murphy, AID/W
12:00 PM	Lunch
1:00	Work Groups Meet
3:00	Break
3:30	Plenary Session
	o David Steinberg, AID/W, Discussion Leader o Reports of Work Groups
6:30	Dinner
	Panel: "Training for Farming Systems Research"
	Donald Winkelman, CIMMYT, Moderator Bede Okigbo, IITA (Nigeria) Winter Chibasa, Dept. of Agriculture, Zambia Fernando Bernardo, Visayas State College of Agriculture (Philippines)

Wednesday, June 16

7:00 - 8:00 AM	Breakfast
8:30	Plenary Session
	"Institutional and Management Issues"
	Joseph Madamba, SEARCA, Moderator Harlan Hobgood, AID/Haiti
10:00	Break
10:30	Plenary Session
	"Macro Policy Issues"
	Per Pinstrup-Andersen, IFPRI, Moderator Emmy Simmons, AID/W
12:00	Lunch
1:00	Work Groups Meet
3:00	Break
3:30	Plenary Session
	Twig Johnson, Discussion Leader Work Group Reports
6:30	Dinner
	Panel: "New Dimensions in National Agricultural Research"
	Curt Farrar, AID/W, Moderator Vernon Ruttan, University of Minnesota Floyd Williams, ISNAR John Monyo, FAO

Thursday, June 17

7:00 - 8:00 AM	Breakfast
8:30	Work Groups Meet
9:45	Break

10:15	**Plenary Session**
	Richard Blue, Discussion Leader
	o Reports of Groups o Recommendations o Agency Response o Adjournment
1:00 PM	Lunch
3:00	Buses depart for Washington, D.C.

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