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D R A F T

INCREASING EGYPTIAN AGRICULTURAL PRODUCTION
THROUGH STRENGTHENED RESEARCH
and EXTENSION PROGRAMS

A Report of a United States Team
of Consultants to the Ministry of Agriculture
of the Arab Republic of Egypt

In Cooperation with:

The U.S. Agency for International Development,
The World Bank, and
The International Agricultural Development Service

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GLOSSARY

AID (or USAID)	Agency for International Development (U.S.)
ADS	Agricultural Development Systems Project
AERI	Agricultural Economics Research Institute
AHRI	Animal Health Research Institute
AMP	Agricultural Mechanization Project
AMRI	Agricultural Mechanization Research Institute
AP	Agricultural Production, Division of Experiment Stations and Production, ARC
APRI	Animal Production Research Institute
ARC	Agricultural Research Council (of the MOA)
ARRI	Animal Reproduction Research Institute
ASRT	Academy for Scientific Research and Technology
CPL	Central Pesticide Laboratory
CSL	Central Statistical Laboratory
CRI	Cotton Research Institute
CRSP	Cooperative Research Support Program
CIMMYT	International Maize and Wheat Improvement Center
DRI	Drainage Research Institute
EMCIP	Egypt Major Cereals Improvement Project
EEC	European Economic Community
EPA	Environmental Protection Agency (U.S.)
EPAD	Egypt Public Authority for Drainage
ERS	Economic Research Service (of the USDA)
EWUP	Egypt Water Use Project
FAO	Food and Agriculture Organization (of the United Nations)

FCRO	Field Crops Research Institute
FDA	Federal Drug Administration (U.S.)
FRI	Flora Research Institute
FWS	Fish and Wildlife Service (U.S.)
GOE	Government of Egypt
GRI	Groundwater Research Institute
GTZ	Gesellschaft fur Technische Zusammenarbeit (Germany)
HRI	Horticulture Research Institute
IBRD	International Bank for Reconstruction and Development
ID	Irrigation Department (of the MOI)
IFAD	International Fund for Agricultural Development
IRC	International Research Center
IRI	Water Distribution and Irrigation Systems Research Institute
IRRI	International Rice Research Institute
LE	Egyptian Pound(s)
LOP	Life of Project
MOA	Ministry of Agriculture
MOI	Ministry of Irrigation
MOL	Ministry of Land Reclamation
NIH	National Institute of Health (U.S.)
NIOSH	National Institute for Occupational Safety and Health (U.S.)
NRC	National Research Center
NSF	National Science Foundation (U.S.)
ONR	Office of Naval Research (U.S.)
PLPR	Plant Protection Research Institute
PPRI	Plant Production Research Institute

REGWA	General Company for Research and Groundwater
RP	Rice Project
SAAD	Strategies for Accelerating Agricultural Development (Presidential Mission Report)
SAO	Soil Ameliorization Organization
SRI	Sugar Research Institute
SVRI	Serum and Vaccines Research Institute
SWRI	Soil and Water Research Institute
S&T	Science and Technology (Bureau or Division, respectively, of the AID)
UNDP	United Nations Development Program
USDA	United States Department of Agriculture
USAID (or AID)	United States Agency for International Development
WB	World Bank
WRC	Water Research Center (of the MOI)

1. FOREWORD

This report is developed by a team of U.S. consultants working in close conjunction with a counterpart team from the Government of Egypt (GOE), including representatives from the Ministry of Agriculture, the Ministry of Irrigation, the Agricultural Research Center and universities. The U.S. team was requested by the GOE and has been funded primarily by the U.S. Agency for International Development under a contract with the International Agricultural Development Service of Arlington, Virginia, U.S.A. One member of the Team was made available from the staff of the World Bank. A second member came from the staff of the USAID Near East Bureau, Washington, D.C.

The effort by the U.S. and Egyptian counterpart teams in part grows out of the work of two earlier USAID funded Missions. In 1981, a U.S. Team, with support and assistance from an Egyptian counterpart group, conducted a study of agricultural extension in Egypt and recommended actions to strengthen the extension system.^{1/}

Immediately following this extension study, GOE and USAID officials initiated plans for a comprehensive study of the entire agricultural sector in Egypt for the purpose of developing plans and strategies for accelerating agricultural development within the country. Agreement on the specifics of such a comprehensive effort was reached when President Mubarak

^{1/} "Recommendations for a Strengthened Agricultural Extension Program in Egypt." Report of a U.S. Extension Study Team to the Ministry of Agriculture and USAID. November 1981.

visited President Reagan in Washington early in February 1982. A 13 member Mission along with 11 consultants was named by President Reagan to carry out this effort, working with a counterpart Egyptian team.

This "Presidential Mission," during March and April 1982, made an extensive study of the total agricultural sector, giving particular attention to the potential for further agricultural development in Egypt along with the problems and constraints limiting the realization of this potential. The Mission also considered and recommended strategies for accelerating agricultural development and prepared a report which was officially presented to President Mubarak in early August 1982.^{1/} This effort has been referred to as the SAAD Mission and report-- relating to Strategies for Accelerating Agricultural Development.

Both the 1982 Extension Team and the 1982 SAAD Report emphasized the fact that, with limited areas of arable land, Egypt is very dependent upon improved technology to increase the productivity of existing arable lands as well as those which may be "reclaimed" and brought into production from the desert. The extension report stated that the country's "major hope lies in developing a high technology agriculture." In a similar

^{1/} "Strategies for Accelerating Agricultural Development-- A Report of the Presidential Mission on Agricultural Development in Egypt." Ministry of Agriculture, A.R.E. and the U.S. AID in cooperation with the International Agricultural Development Service and U.S. Department of Agriculture. July 1983 (Sometimes referred to as the SAAD Report).

manner the SAAD Mission emphasized "...because of its unique circumstances, Egypt is perhaps more dependent on improved (agricultural) technology than any other country in the world..."

Recognition of Egypt's heavy dependence upon improved technology has prompted the current study of ways and means of strengthening agricultural research and extension programs concerned with developing and using improved technology to increase the productivity of the nation's agriculture. It is well to note that some members of the current team were also involved in the two earlier missions.

In carrying out the current Mission, one member of the Team (Dr. Krezdorn) visited each of 14 institutes and 31 experimental stations of the ARC to review the scope of work, examine facilities and explore problems or constraints relating to each unit's research program. Furthermore, visits were made to several of the universities having agricultural programs. Other members of the Team have also visited some of the institutes and stations within the ARC as well as universities and programs in the Ministries of Irrigation, Agriculture, Land Reclamation and Health. Furthermore, Team members have visited the Academy of Scientific Research and Technology, the National Research Center, and the programs of some of the International Agricultural Research Centers. Discussions were held with President Mubarak and with several key officials of the GOE including the Ministers of Irrigation, Housing, Development and Land Reclamation, Supply, Economy, and Planning--in addition to extensive interactions with Minister Youssef Wally.

Team members have visited agricultural areas in the Nile Valley and the Delta as well as the reclamation regions in Nubaria and Salhaia. There have been opportunities for interaction with farmers, extension workers, private sector agribusiness representatives, and officials at various levels of government.

The Team expresses its appreciation for the splendid cooperation and support provided by the Egyptian Counterpart Team. Special recognition should be given the excellent paper prepared for the Team by the leadership of the ARC, setting forth some of the proposed plans and strategies for supporting agricultural development activities.^{1/} The Team also expresses its appreciation to all the other officials of the GOE and the other organizations who have been of assistance to the Team in so many different ways.

We are especially indebted to Dr. Youssef Wally, Minister of Agriculture and Food Security, for his personal interest in this effort and for the exceptional support and assistance provided by the MOA. We are also particularly grateful for assistance rendered by the staff of the International Relations Department within the MOA for arranging appointments and accompanying Team members on their many visits and trips.

The Team also expresses its deep gratitude to Director Michael P. Stone and his colleagues within the U.S. AID Mission in Cairo for their generous cooperation and support.

^{1/} "The Role of the Agricultural Research Center (ARC) in Attaining the Objectives of the Contemplated Agricultural Development." ARC, August 1983.

The views and interpretations expressed in this report are those of the Team members and should not be attributed to the United States Agency for International Development.

U.S. Team Members

- Dr. E. T. York, Team Leader. Chairman, Board for International Food and Agricultural Development, and Chancellor Emeritus of the State University System of Florida. (Also Leader of Egyptian Missions on Agricultural Extension in 1981 and Strategies for Accelerating Agricultural Development in 1982).
- Dr. Ludwig Eisgruber, Associate Dean of the College of Agricultural Sciences, Oregon State University-- currently on leave as Senior Economist with the Near East Bureau of U.S. AID, Washington. Formerly Professor of Agricultural Economics and Assistant Dean of the Graduate School, Purdue University.
- Dr. Francille Firebaugh, Associate Provost, Ohio State University. Formerly Director of the School of Home Economics and Acting Vice President for Agricultural Administration, Ohio State University
- Dr. S.R. Freiberg, Senior Agriculturist of the World Bank Formerly Vice President and Board of Directors of IRI Research Institute and Director of Central Research of the United Fruit Company.
- Dr. Al Krezdorn, Professor Emeritus and formerly Chairman of the Department of Fruit Crops, University of Florida.
- Dr. A. H. Moseman, Formerly Director of Crops Research, USDA; Director for Agricultural Sciences, the Rockefeller Foundation; and Assistant Administrator for Technical Cooperation and Research, USAID.
- Dr. M.B. Russell, Professor Emeritus, Soil Physics, and formerly Head of Department of Agronomy and Director of the Agricultural Experiment Station at the University of Illinois.
- Dr. K.L. Turk, Professor Emeritus, Animal Science, and formerly Head, Department of Animal Science, and Director of Programs in International Agriculture, Cornell University.

Egyptian Counterparts to U.S. Team

Team Leadership:

Dr. Ali Serry	Director, Agricultural Research Center (MOA)
Dr. Mahmoud Abou-Zaid	Council Chairman, Water Research Center (MOI)
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Dr. Ahmed K. El-Rafee	Deputy Director for Agricultural Extension
Mr. Ali Nashaat	General Administrator, Agricultural Research Center
Mr. Mohamed Desouki	Undersecretary for Foreign Agricultural Relations
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Dr. Mohamed K. Hindy	Former First Undersecretary, Ministry of Agriculture

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Dr. Ibrahim Anter	Director, Soils and Water Research Institute
Dr. Ahmed Momtaz	Director, Field Crops Research Institute
Dr. Mohamed El-Moghazy	Director, Cotton Research Institute
Dr. Ahmed H. Nour	Director, Sugar Crops Research Institute
Dr. Salah Bahaa El-Din	Director, Horticultural Crops Research Institute
Dr. Ibrahim Ismail	Director, Plant Protection Research Institute
Mr. Ibrahim Fouad	Director, Animal Production Research Institute
Dr. Saad Abd El-Ghafar	Director, Animal Health Research Institute
Dr. Said Abd El-Hamid Salama	Director, Vaccines & Serums
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2. SUMMARY

Historically, Egypt has been a great agricultural nation. Its bountiful harvests of wheat and other food commodities are recognized in many records of early Egyptian civilizations, including the Old Testament.

As late as 1960 Egypt was essentially self sufficient in food production. In the last two decades, however, food production has failed to keep pace with consumption, and the country has become increasingly dependent upon food imports to meet its needs.

A number of factors have contributed to this decline in performance of the agricultural sector and the rapidly widening gap between the production and consumption of agricultural commodities:

- Investment in the agricultural sector has not been optimal. There has been a relatively low level of investment in agricultural research and extension programs to develop and make available improved technology to the farmer.
- Growth in supply of food and agricultural products has been slow.
- Substantial increases in demand for food have resulted from both a rapid rate of population growth and large increases in per capita food consumption.

The SAAD report of 1982, pointed to the ever widening gap between food production and consumption and emphasized that this gap will continue to widen between now and the year 2000 if something substantial is not done to expand production and reduce the rate of increase in consumption. The report recognized the difficulties associated with reducing demand for food by limiting population growth and reducing per capita consumption, and focused on opportunities and strategies for expanding production as the primary means of narrowing the food deficit gap.

The SAAD report concluded:

"Ample and ever-increasing evidence suggests that Egypt has enormous potentials to further increase its agricultural output on existing arable lands, despite its relatively high levels of productivity by world standards or even by the standards of more developed nations. Such increases would be over and above what might be realized by bringing additional lands into production through reclamation efforts."

The SAAD report identified a number of major constraints limiting the realization of these potentials. The failure to develop and use improved production technology was recognized as one of the most important factors preventing the realization of agricultural development potentials in the country.

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The following excerpts from the SAAD report stress the vital roles which improved technology must play in further increasing the productivity of the agricultural sector:

"Egypt's future in agriculture depends on a continuing stream of improved technology. Because of the relatively high levels of productivity already achieved, the technological constraints on Egyptian agriculture are greater and more sophisticated than those operating on most other developing countries. Indeed, because of its unique circumstances, Egypt is perhaps more dependent upon improved agricultural technology than any other country in the world.

"Accordingly, any strategy for improving the agricultural sector must give high priority to removing whatever constraints limit the effectiveness of programs concerned with the generation and application of improved technology. To be specific, developing the strongest possible programs in agricultural research and extension is absolutely essential."

Our Team concurs fully with the foregoing assessment by the SAAD Mission.

In the course of its work, the Team made a detailed review and assessment of the agricultural research and extension programs in the country. Although primary attention was focused on the programs within the Ministry of Agriculture (MOA), the efforts of other organizations were also recognized, including those of the universities and other GOE Ministries. A summary of financial support, including that of external donors is provided in the report. Special attention was given the Agricultural Research Center (ARC) of the MOA because of its major responsibilities for agricultural research and extension.

The ARC has recently undergone extensive reorganization resulting directly from President Hosni Mubarak's Presidential Decree No. 19, dated January 19, 1983. This decree established the ARC as a scientific and extension institution and give it broad, general authority for agricultural research and extension activities in the country. An earlier Presidential Decree (Number 483 of 1982) gave the ARC responsibility for the production farms...formerly referred to as "State Farms" under the General Authority for Agricultural Production.

In the course of its work the Team made an assessment of the programs of the ARC institutes and research stations including their size, scope of work and other factors such as facilities and equipment which may influence the ability of these different units to carry on effective research.

The report summarizes the Team's assessment of the factors while a more detailed discussion of each unit is provided in the annexes to this report.

Although the Team was involved in assessing many of the factors which contribute to the success (and quality) of a research program, there was no effort to assess the quality of the research itself. Our assessment of the various factors which should contribute to the quality of the research effort in Egypt leads us to the following observations and conclusions:

- The size of the staff to carry out a desired level of research activity is adequate.
- The training of the staff is variable; there are, however, many well trained and dedicated research scientists around whom excellent programs can be built.
- With a few exceptions, the quality of the buildings laboratories, and other facilities is poor and needs to be substantially improved.
- The level of budgetary support for research operations, including equipment, supplies, maintenance, travel, etc., is extremely deficient and serves as a serious constraint to effective operations.

Given the relatively low level of investment in the research program and the problems associated therewith, the Team's general view is that the quality of the research effort

is probably better than might be expected. If this is the case, much credit is due the many competent staff involved in the research program who are performing well in face of many adverse circumstances.

The Team concluded that the current extension program remains weak, uncoordinated and relatively ineffective. The Team also concluded that there were serious problems associated with the Production Farms which resulted in average yield on those farms being significantly below those of private farmers. These low yields seemed to be associated with poor drainage and grossly inadequate machinery, equipment, and operating funds.

Over the period from 1979/80 to 1983/84 the budget for the ARC has increased by 73.7 percent or 21 percent per year (compounded). This rate of increase is close to the annual rate of inflation during that time period. Thus, the purchasing power of the overall budget stayed approximately constant. Further examination of the budget data reveals, however, that increases were largely in Chapters I (salaries) and IV, (donor support) whereas budgets for Chapter II (operating expenses) stayed essentially constant. As a result of inflation over the four-year period, their purchasing power fell from LE 5.6 million in 1980/81 to LE 3.3 million in 1983/84 (in 1980/81 LE's).

The universities, the National Research Council, the Academy for Scientific REsearch and Technology and certain GOE Ministries are all carrying on agricultural research

activities which seem to be essentially independent of each other and the work of the primary agricultural research organization in the country, the ARC.

It is also apparent that the research efforts of NRC and the ASRT are leading to crop production campaigns involving recommendations for farm practices different from those developed by the ARC.

Not only does there appear to be little coordination among the research organizations within the country, there is also little coordination within the donor community. Indeed, there appears to be little coordination of the support programs of a single donor, such as the U.S.

For many reasons there is need for careful, comprehensive, and continuing planning of the national research effort. The vital role which agricultural research must play in the development of the agricultural sector and the great importance of agriculture to the nation's economy point to the need for such planning.

One function of the planning effort would involve establishing research priorities that would be consistent with the development goals and overall needs of the country. However, research should not only be used to support established national policy goals or objectives, it should also serve to provide needed information for the formulation of new or revised objectives.

Although we would not suggest that some organization or group attempt to direct or dictate the nature of either the research efforts or donor support, we believe that appropriate national research planning can contribute to a framework within which both the research organizations and donors can, in a complementary manner, focus their efforts on high priority national objectives, with a minimum of unnecessary duplication and overlapping.

To achieve such an objective, we recommend that a high level council or other appropriate body be charged with continuing responsibility for identifying broad areas of agricultural research needs and establishing priorities for the conduct of such research to address these needs. Such a body should include the leadership of the major organizations concerned with agricultural research in the country, including the ARC of the Ministry of Agriculture, the Water Research Center (WRC) of the Ministry of Irrigation, the Ministry of Housing Development and Land Reclamation, the National Research Center, agricultural faculties of universities, the Academy for Scientific Research and Development, and any other major research entity. The Ministry of Planning or the National Planning Council might also be represented.

To carry out this planning function we recommend the creation of something like the National (or Supreme) Council on Agricultural Research under the chairmanship of the Minister of Agriculture.

The National (Supreme) Council on Agricultural Research could provide the vehicle for considering how all research efforts could be appropriately integrated in support of a mutually agreed upon national plan. Furthermore, such a council might also provide the vehicle for better focusing donor assistance on important national goals and needs. It should also provide a framework within which such multinational groups as the International Agricultural Research Centers could focus their efforts within the country.

The type of research planning proposed should facilitate a better coordinated and more sharply focused program of development assistance for research by the U.S. and other bilateral donors as well as multilateral support organizations such as the World Bank.

Our Team strongly recommends that appropriate mechanisms be developed to achieve better coordination of the total resources made available by the U.S. Government in support of agricultural research activities in Egypt. It would seem logical for this to be done through the Agricultural Division of the USAID Mission in Egypt which represents the principal point of contact between the U.S. Government and the GOE on matters relating to assistance for agricultural research.

We recommend that much of the agricultural research of the country be organized into comprehensive, interdisciplinary research programs which are truly national in scope and character. These programs would be concerned

with the improvement of specific crops or animals or with such problem oriented issues as soil and water management or cropping intensification.

The concept of the proposed national programs involves bringing together from many different disciplines the scientific personnel to work as a team in addressing the problems or constraints which, for example, might limit the production of a crop. Many of these problems are inter-related and must receive simultaneous attention from several disciplines.

The ultimate goal of such interdisciplinary work is to develop a set or "package" of production practices (including recommended varieties, fertilization and cultural practices, disease, insect and weed control, etc.). Such practices should provide the basis for substantially improving the yields of a crop or improving management practices leading to more efficient water management, cropping intensification or whatever the objective of the research might be.

In view of the leadership role the ARC has been given for agricultural research we recommend that the Center be given the responsibility for organizing the national interdisciplinary research programs. We further recommend, however, that in both planning and executing these national research programs the ARC involve other organizations which have an interest in and capability of contributing to these programs.

The interdisciplinary teams will be made up of research and extension personnel from all the disciplines required to address the set of problems or issues needing attention in a given program.

Most of the research team members for a given national program would likely come from within the ARC. However, we would encourage the involvement of personnel from other ministries (especially Irrigation and Land Reclamation) on programs relevant to those ministries, as well as from universities, the NRC and possibly other organizations.

One team member would be designated as leader or coordinator and it would be his or her responsibility to give general programmatic and administrative direction to the effort. Because of the size and scope of the ARC responsibility, it is likely that most program leaders would come from the ranks of that organization. However, if someone from one of the cooperating organizations was uniquely qualified to provide leadership to a given program, such an appointment should be considered.

Each national program would be assigned a specific budget under the administrative control of the program leader. The program budget would include support for salary incentives, operating expenses, equipment, training and other needs associated with the program. Base salaries along with support for maintenance of buildings, utilities, normal farm operations, etc., would be provided in the budgets of the ARC institutes and research stations. The cooperating ministries, universities or other research entities would provide similar support for personnel from their respective organizations.

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The members of national program teams should meet at least annually (and more often if needed) to evaluate progress and develop plans for the future.

President Mubarak's Decree Number 19 of 1983 sets forth a plan of organization for the ARC and the Minister of Agriculture has taken steps to implement the Decree.

We concur with the basic elements of the reorganization plan, especially the manner in which the research and extension functions have been brought together within the Center and the proposed relationships between the Center Institutes in Cairo and the outlying research stations. We offer the following observations and recommendations concerning the organization and function of ARC.

Although we do not consider this a major problem, we believe it would be appropriate and desirable to recognize explicitly the extension function in the name of the Center, perhaps with a designation of Agricultural Research and Extension Center (AREC).

The leadership of the ARC is vested in the Director and three Deputy Directors, one each for research and extension and a third for production and research stations. We are concerned that this organizational structure divides the responsibility for research between two deputies while serving little purpose in placing the research station and production responsibilities under a single deputy.



We recommend that there be deputies for research, for extension and for production, with each deputy having responsibility for one of the three functions. The integration or coordination of these three functions would be the responsibility of the Director of ARC.

We do not suggest major changes in the organization of the Institutes. Most institute personnel would carry on their research as members of interdisciplinary teams in one or more national research programs.

Budgets for base salaries (not including incentives), building maintenance, utilities, and other general support would be provided each institute. Budgets for the national programs would be allocated to the program leaders and would not be included in the institute budgets.

The Team endorses the proposal by the ARC administration to organize the 31 outlying research units into 7 regional groupings, with one unit designated as the regional headquarters center. We believe the regional centers, with their affiliated units, can provide an essential network of research stations, strategically located throughout the country, to support the series of national interdisciplinary research, extension, and training programs proposed herein.

To serve this purpose, however, these stations must be substantially upgraded in terms of land leveling and drainage, facilities, laboratories, machinery and equipment, housing, etc.

Furthermore, we believe there should be a much higher proportion of the ARC staff located at these stations than now is the case. Accordingly efforts should be made to make living and working conditions as attractive as possible on the stations so that more scientists might be willing to be stationed there.

We would recommend one departure from the proposed regional grouping of research stations. Instead of designating Bahtim as one of the regional headquarters centers, as proposed by the ARC leadership, we recommend that the stations at Bahtim, Kanater and Fayoum be considered field units of what might be considered a national research center--available for use by the Cairo-based staff of the ARC Institutes. All three of these stations are within commuting distance of Cairo for daily activities.

The research done at these stations would also serve the needs of the South and East Delta Region. In addition to research related to this region, however, land could also be available to personnel in the Cairo area for other work that did not have to be conducted in one of the more distant research locations. Since the staff could have access to laboratories at ARC headquarters in Giza, the need for laboratory facilities at the three stations in the Cairo area would be limited.

The major research efforts--those requiring highly trained scientists and costly specialized equipment--should be carried out at the regional research centers and at the national center in the Cairo area.

Careful consideration needs to be given to the role and function of the research units other than the primary center or station in each region. If these units are required for the research program, they should be upgraded to enable them to perform the needed functions. If they are not essential for the research program they should be modified to serve as testing farms, demonstration and training units, or for seed production.

There is a pervasive need to strengthen the support/technical services of ARC. Administrative services such as library, statistical services, service laboratories, building and grounds, operation and maintenance, machinery and equipment servicing and maintenance, purchasing and inventory control, personnel records, payroll, etc., All need to be organized and performed by professionally competent personnel. In a similar fashion the management and operation of the experimental fields and livestock research units calls for a high level of managerial ability, an adequate complement of equipment, facilities and supplies and a cadre of dedicated, well-trained technicians who understand the importance of their tasks vis-a-vis the research and training work being conducted.

We further recommend that every possible effort be made to consolidate or integrate research support facilities and functions so that each national program or project does not have to establish and maintain separate support functions at each research center. One service laboratory for routine soil, water and plant analyses at each research center should

be sufficient to serve all programs involved there. Considerations should also be given to setting up service laboratories involving even more sophisticated work than routine soil and plant analysis, if such a service might be needed by more than one program. In other words, every effort should be made to avoid unnecessary duplication of expensive laboratories when needs can be met by sharing such facilities.

There should be a farm operations unit at each station responsible for land leveling, land preparation, irrigation, cultivation, pest control and other general operations not specific to a given research program.

We also strongly recommend the development of a major national agricultural research library within ARC which could not only serve the needs of the Center but could be available for use by university personnel and others needing such facilities. Such a library located in Cairo could make available material to the outlying research stations by courier service or by more sophisticated devices such as electronic telecommunication systems. Pertinent periodicals and other limited reading materials would be maintained at the regional centers and stations.

Earlier Missions (BIFAD/Extension and SAAD) have emphasized the need to institutionalize the research and extension efforts associated with major USAID funded projects such as ADS, EMCIP, Rice Research and Training, EWUP and others.

The Team concurs with the assessments of earlier Missions and is delighted to see the commitments by both USAID and MOA to move from the project format for financing and carrying out these activities to incorporating them into the basic research and extension organizations. We believe that in the long run this will not only enable the country to achieve the short range programmatic objective of these efforts, but they should also contribute to developing stronger, self sustaining research and extension institutions for the long-term future.

As the projects are terminated, we would urge that every effort be made to incorporate the project staff and activities into the corresponding national programs proposed herein.

Although the production farms are not a part of the research program, they are a responsibility of the ARC. Furthermore, they complement the research program by providing land for research and by producing foundation and registered seed along with foundation animals. In addition the resources of the production farms have the potential to be used more effectively in advancing the agricultural development objectives of the country. These are the reasons we address the Production Farms issue in this report.

At the present, the Production Farms are falling far short of reaching their potential. We recommend that steps be taken to upgrade the production farms so that they could, in fact, serve as demonstrations of the best farming and livestock production practices available rather than as examples of what not to do.

In considering the future use of the Production Farms, we recommend the following:

- That first priority be given to the needs of the agricultural research program. Adequate land to meet the total research requirements--now and for the immediate future--should be assigned to and placed under the control and management of the Deputy Director for Research of ARC.
- That second priority be given to the needs of the extension program for field demonstrations.
- That third priority be given to the production of foundation and registered seed and for the propagation of improved stocks of trees as well as animal germ plasm.
- We recommend that land not needed to meet the above priorities could be used initially for certified seed production. However, in the long run, we believe the private sector (individual farmers or private companies) should be encouraged to produce most of the certified seed needs of the country.

Considering the major seed production responsibilities of the Production Farms, we recommend that consideration be given to transferring the Seed Production Department from within the MOA to the ARC.

The Team's review of ARC programs reveals a number of production and service functions intermingled with research activities. These are all important functions, but one

examining the budgets and numbers of personnel in these programs gets a very distorted view of the magnitude of the research programs. For many reasons, we believe that, to the extent possible, these production and services functions should be identified, budgeted and accounted for separately and apart from research activities and included along with other commercial operations such as field crop seed production in the Production Division of ARC.

Our Team has been charged with the primary task of recommending actions to strengthen the agricultural research system. However, it is readily apparent that such efforts may be relatively unproductive unless there is a major strengthening of agricultural extension programs as well.

An improved research program offers great promise for substantial medium-to-long-range contributions to agricultural development in Egypt. A strengthened extension program is essential for such medium-to-long-term agricultural improvement, but it also offers the promise of significant short-range improvements as well. In fact, it will be difficult to achieve, in the immediate future, the badly needed expansion in agricultural productivity unless major changes and improvements are made in agricultural extension.

The problems and weaknesses of the current extension program were discussed in detail in the BIFAD team report of November 1981 and the SAAD Mission report of 1982. They are further summarized in an earlier section of the current report. Significant steps were taken to provide the basis for improving the situation through Ministerial and Presidential Decrees referred to earlier. However, further action is greatly needed to make these decrees meaningful in terms of achieving the desired goals of a significantly strengthened program for Egypt. Major action is needed at two levels:

- In developing a unified system of extension that reaches from the national to the village level.
- In developing a strong corps of subject matter specialists, closely aligned with research personnel, who can give program leadership to extension throughout the country.

It should be recognized that the extension function should be a national program which reaches from its interface with research at the national and regional levels down to and through village level personnel to the farmer. Therefore, to be most effective, extension should be organized and operated as a single, well coordinated program--not the several separate and discrete administrative and program units which now exist. Accordingly field extension personnel should be linked administratively, programmatically, and budgetarily with the national extension office and be made an integral part of a total national program.

The process of generating new technology and getting it used by farmers should be a continuum, reaching, uninterrupted, from the researcher to the farmer or other user of new technology.

Just as the outlying research stations represent an extension of the research program from the national-level ARC institutes in Cairo throughout the country, so should field extension personnel represent the projection of the national extension program to various parts of the country. It would obviously be unsatisfactory to have outlying research stations separated administratively and programmatically from the national ARC institutes in Cairo. We believe it is equally unsatisfactory to have field programs of extension separated administratively and programmatically from the national office of extension.

We recommend that personnel currently considered to be primarily involved with extension (as opposed to regulatory functions), at the governorate, district and village levels be identified and placed administratively and budgetarily under the office of the Deputy Director of ARC for Extension. Such a change would leave many other agricultural personnel in place to carry out regulatory and service functions at the local level now being performed, in part, by extension personnel.

The field extension personnel, while administratively responsible to the national office for extension, would continue to function in a close, cooperative relationship with officials and programs at the local level (governorate, district and village).

Such a change along with appropriate training of field extension personnel could contribute much to strengthening this part of the overall extension effort. However, major attention must be directed to another segment of this extension program as well.

The extension service cannot be expected to improve its image and effectiveness unless it is substantially upgraded in terms of its training and level of technical competence. One of the greatest deficiencies of the present program is the virtual void with respect to subject matter specialists and program leaders. Such specialists must play extremely important roles in taking improved technology and developing effective means of interpreting it in such a manner that extension field personnel can understand it and, in turn, help farmers get it applied. Such extension specialists should have training equal to their research counterparts if they are to be most effective.

The virtual absence of such specialists results in extension field personnel either not receiving needed information concerning improved technology or, as frequently happens, receiving disjointed, incomplete or even conflicting and contradictory information.

We believe, therefore, that highest priority must be given to developing a strong corps of extension program leaders and subject matter specialists.

Fortunately the basis for the rapid development of such a group of extension leaders and subject matter specialists is already in place as a result of Presidential Decree 19 of January 1983. The concept embodied in this Decree now needs to be fully implemented. In view of the relatively large number of research personnel now in the ARC and the virtual absence of program leaders and subject matter specialists in extension, we believe it is most appropriate for a significant portion of the current research personnels' efforts to be reoriented towards extension, as the Decree mandates.

It should be emphasized that extension subject matter specialists would be expected to work very closely with their research counterpart involved in the national interdisciplinary research programs. In fact, some of the researchers participating in national programs would also have extension responsibilities, providing the opportunity for the closest possible integration of research and extension efforts.

The extension subject matter specialists would be charged with taking the results of research and developing recommendations for actions by farmers to achieve desired goals. In the case of research relating to crops or livestock, the subject matter specialist would develop a well integrated package of practices, reflecting the best known technology, to enable the farmer to increase production or achieve other desired objectives.

These "packages" of improved practices would become the basis for major campaigns to increase production.

There must be a major effort to expand and improve the effectiveness of village-level extension personnel. It is estimated that there are approximately 2000 to 2200 village level agents now employed. There are approximately 5000 villages in the country, many of which are not served by an extension agent.

Ministry of Agriculture officials are advocating the placing of one extension agent in each of some 4000 villages throughout the country.

Considering the fact that the size of villages and the numbers of farmers in each may vary significantly, we propose a modification of this approach. We suggest that the objective might be to provide extension programs and services to every village needing such assistance. This may mean that in some cases one agent will have responsibility for more than one village. In other cases, where the village is large and where the agriculture is particularly diverse, there may be need to have more than one extension agent serving a village.

We believe that first priority should be given to training and upgrading the support for currently employed agents before large numbers of additional agents are employed. With such training and with more adequate support, including means of transportation, a better evaluation can be made of the work capacities of the local extension agents (the number of farmers

or villages each might serve). With such experience, there can be a much better determination of the total number of village agents needed.

For the immediate future (e.g., the next five years), we suggest that priority attention be given to improving the capabilities of the present 2000 or so currently employed. When this is done, others could then be added if there is a demonstrated need.

The desired upgrading of extension will require a major sustained training effort, especially with village level personnel. Current field or village level employees need to be given training in both subject matter as well as extension methodology, including the use of demonstrations and other techniques of extension education.

Furthermore, when the results of national research programs are ready to be "extended" to the farmer--including the launching of major national campaigns--there must be intensive training of field personnel to prepare them to carry out such programs in their respective villages.

Much of the training of field personnel might be expected to take place at regional centers. The center at Sakha, for example, already has facilities for such training. There is a need for similar facilities at other regional centers.

Following are excerpts from the SAAD Mission report of 1982:

"We recommend that interdisciplinary teams in research and extension be formed to organize and carry out well-integrated programs involving "packages" of technological practices aimed at increasing productivity of principal agricultural commodities. These programs would constitute the basis for major national campaigns aimed at increasing agricultural output (e.g. and All-Egypt Rice Program, etc.).

"Similar campaigns have been remarkably successful in other countries and could contribute to a "Green Revolution" in Egypt in a manner similar to what has occurred elsewhere. For example, wheat yields in the Punjab in India were doubled in five years, and Philippine rice yields were increased dramatically in a short time as a result of major production campaigns."

As a result of a major rice production campaign in Indonesia, that country, which until quite recently was the largest importer of rice in the world, became self sufficient in that basic food crop last year.

We concur with the recommendation of the SAAD Mission concerning the desirability of conducting major production campaigns. Furthermore, we believe actions taken by the GOE since the SAAD Mission, along with the recommendation set forth in our report, provide the basis to launch such campaigns aimed at substantially increasing production of important agricultural commodities, with the objective of helping to close the food security gap discussed in the SAAD report.

We believe the implementation of the recommendations set forth herein would enable agricultural research and extension organizations in the country to provide the leadership for such efforts.

Specifically it is obvious that there are technological "packages" already available with several commodities which could provide a substantial basis for such campaigns. Furthermore, research programs will, continuously, be developing new technology to upgrade and improve these "packages" as campaigns proceed.

The ARC has proposed to organize 16 national research programs, involving all of the important crops and animals grown in the country. While this many national research programs can be carried out simultaneously, it would not be feasible to launch that many national campaigns at one time. We recommend, therefore, that only 5 or 6 national production campaigns be initiated at a time--involving those commodities where increased production would be most important to the country, where there is an adequate technological base to support such campaigns, and where there is the likelihood of significant financial gains to the producer.

It should be recognized that while a few commodities at a time might be singled out for major campaigns, research efforts would continue with other commodities. However, emphasis by extension would not be as great with the others as with the campaign commodities.

Research and extension must provide the foundation or primary basis for national campaigns by developing, organizing and extending the "package" of technological practices needed to make a campaign successful. We should emphasize, however, that many other organizations and groups must contribute to such campaigns if they hope to be successful. The need for such support and input by others is evident by the fact that the farmer must:

- be able to secure in a timely manner improved varieties along with the fertilizers, insecticides, fungicides, and herbicides recommended as part of a technological package;
- be able to prepare land, cultivate and harvest crops in a timely manner and in accordance with recommended practices;
- have access to credit in order to purchase the inputs and pay for the cost of renting or purchasing machinery to facilitate timely operations; and
- be assured of having irrigation water available when needed.

For these and other goods and services the farmer must depend on others. Accordingly for major campaigns, such as those proposed, to be successful, all the goods and services essential for the implementation of a technical package must be readily available to farmers when they need them.

This means that the suppliers of these goods and services must be strongly committed to supporting such campaigns, and the efforts of all must be carefully coordinated to ensure success.

We recommend that consideration be given to the following actions for the implementation and national production campaigns:

- The issuance of a decree by the President, announcing the campaigns, stressing their importance, and setting forth a mechanism or framework to assure full support of all the ministries and other government entities which can be supportive;
- The establishment of an inter-ministerial group, appointed by the President, chaired by the Minister of Agriculture, and involving all the ministries which could be supportive of such campaigns. Such a body would likely include the Ministers of Irrigation, Housing, Development and Land Reclamation, Supply, Planning, Economy, Transportation, Cooperatives, Industry, Local Government, and possibly others. This body would be concerned with attempting to make certain that there was nothing under the respective jurisdictions of the members of this body which would limit or serve as a constraint to the realization of campaign goals;

- The establishment of an inner-ministerial working group within the MOA, including representatives from relevant undersecretariats and semi-autonomous authorities and companies affiliated with the Ministry. This group would be chaired by a high official within the MOA, appointed by the Minister, and charged with the responsibility of giving day to day leadership and direction to the campaigns. Such a group would help to facilitate support needed for campaigns from within the MOA. The chairman of the group would speak for the Minister on matters related to campaigns;
- Members of interdisciplinary teams (research and extension) working on the national program related to the campaign commodity must put together and update the technological package of practices to be used. They will also work with the organizations providing the production inputs and other goods and services in determining estimates of needed inputs, the location within the country where needed, the time needed, etc.;
- Efforts should be made to have one or more demonstrations in each village where the campaign crop is a significant part of the agriculture. The farmers participating in the demonstration would be provided compensation in the form of seed, fertilizer or pesticides valued at approximately 15 LE per feddan for using recommended practices in the demonstration.

- As a means of further publicizing the campaign, special recognition might be given by the Governor to the farmer or farmers who produce the highest yields in demonstrations within each Governorate and by the President to those producing the highest yields in the country;
- The Minister of Agriculture would be responsible for submitting a report to the President at the end of each crop season, evaluating the results of the campaign, indicating the problems, if any, which may have limited the campaigns effectiveness and ultimate success. If problems were encountered, plans would be set forth for overcoming these problems during the next crop season.

Campaigns might normally be expected to run for 3 to 5 years--and possibly longer depending upon how rapidly a high percentage of the farmers accept and begin to use the package of production practices. As campaigns with some commodities are terminated, others could be initiated; the number at a given time being dependent upon the institutional capacity to carry them out.

Most campaigns would be related to efforts to increase the production of a given commodity. However, in view of the importance to agricultural production of on-farm land and water management, we believe that a major effort or campaign to address some of the serious land and water management problems would complement and, indeed, contribute in a major way to the success of production campaigns.

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Consideration was given to the types of expenditures needed to achieve the improvement recommended for upgrading research and extension programs. However, in setting forth the components of a plan for upgrading these programs, we have not assigned specific costs. At the beginning of our study we assumed that this could be done. However, it soon becomes apparent that it would be difficult, if not impossible, to develop meaningful cost estimates until many programmatic decisions had been made and until there had been a more detailed evaluation of specific problems and needs.

The Team has developed rough approximations of the costs of various components of the proposed strengthening program but more precise estimates must await decisions with regard to program implementation.

We have looked broadly at the agricultural research and extension needs of the country, including the potential contribution of a number of organizations. We have recognized, however, the major leadership role given the ARC in Presidential Decree No. 19 in early 1983. Accordingly, we have focused our recommended upgrading efforts on that organization, while, at the same time, providing a mechanism through the national interdisciplinary research programs for giving financial support to other research organizations which participate in these national programs.

In the report we discuss the components of the proposed upgrading effort for the three major functional areas of the ARC.

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A basic premise of this report is that a well designed and carefully implemented agricultural research program is an important contributor to agricultural and economic development. Evidence to support this premise is substantial.

A World Bank report states that "it is now widely accepted that a steady increase in agricultural productivity through technological change is indispensable to national economic growth. It is notable that increases in productivity in the past 100 years have come largely from science-based farm technology and from changes in management and inputs developed through organized research."

The report continues to say that formal studies of the returns to investment in research tell a consistent story--namely, that realized rates of return are much higher, generally two to three times greater, than likely return from most other alternative investment opportunities in the countries concerned.

After examining the linkages between research program size and impact on economic development, the World Bank study suggests that "a desirable investment target for research for many countries with poorly developed agricultural research systems would be an annual expenditure (recurrent plus capital) equivalent to 2 percent agricultural gross domestic product."

We are not aware of any formal studies on economic returns to agricultural research in Egypt. However, existing evidence indirectly suggests that payoff from agricultural research in Egypt is as impressive as it is elsewhere.

More specifically, through research, improved technological packages have been developed which will increase significantly productivity of and financial and economic returns from major crops. For instance it is estimated that the financial rate of return to the farm family's incremental capital required to implement the improved technological packages is in excess of 100 percent for such crops as maize, rice, tomatoes and wheat. It is further estimated that if 90 percent of the farmers were to adopt these improved technological packages, Egypt would save nearly LE 200 million in foreign currency annually from increased production of rice and wheat alone.

Given the characteristics of agricultural production, an effective agricultural research system must be complemented by an equally effective agricultural extension system to assure that the new information generated by research is made available to the farmer for implementation.

We believe the evidence at hand points to the opportunity and need for a significantly greater investment by the GOE in agricultural research and extension. Most evidence from other parts of the world as well as in Egypt would suggest that such increased investment would return significant dividends to the nation and its people.

3. INTRODUCTION

Historically, Egypt has been a great agricultural nation. Its bountiful harvests of wheat and other food commodities are recognized in many records of early Egyptian civilizations, including the Old Testament.

Over the centuries of recorded history agriculture has continued to be vital to Egypt. A high percentage of the people have lived in rural areas and have been engaged in farming; all the people have been dependent upon agriculture for food and fiber; and agriculture has been a major contributor to the national economy and to the welfare of the people.

As late as 1960 Egypt was essentially self sufficient in food production. In the last two decades, however, food production has failed to keep pace with consumption or utilization, and this country has become increasingly dependent upon food imports to meet its needs.

Prior to 1973, the value of Egyptian agricultural exports was substantially greater than the cost of agricultural imports. Since that time, however, the value of agricultural exports has remained essentially constant while the cost of importing agricultural commodities has increased almost ten-fold. In 1981 Egypt imported agricultural commodities valued at \$ 4 billion while exporting agricultural commodities valued at only \$ 700 million.

Even as late as the 1960's and early 1970's, Egypt's agricultural sector was a major contributor to the National economy and a major source of foreign exchange. In the period since the October War of 1973, the economic situation in Egypt has changed dramatically. Petroleum exports, remittances from Egyptians working abroad, tolls from the Suez Canal, and tourism have become the major sources of foreign exchange. Compared to the other sectors, agriculture has shown the slowest growth, with average increases of about 2½ percent per year between 1975 and 1980.

A number of factors have contributed to this decline in performance of the agricultural sector and the rapidly widening gap between the production and consumption of agricultural commodities:

1. Investment in the agricultural sector has not been optimal. Land reclamation efforts which have received 40 percent of funds available to the agricultural sector have given relatively low returns. Other funds have been used largely for infrastructural improvements, including the Aswan Dam, irrigation canals and drainage facilities. Relatively little investment has been made in agricultural research and extension programs to develop and make available improved technology to the farmer.
2. Growth in supply of food and agricultural products has been slow. Value-weighted agricultural output grew 25 percent from 1970 to 1981. During this period,

crop output value went up only 16 percent while animal product value increased 42 percent. Growth in output of crops was 1.5 percent annually. While growth in animal products was 3.8 percent.

Production in traditional field crops such as cotton, rice, wheat and sorghum showed little increase, but output of berseem clover, maize, fruits and vegetable and animal products expanded. These differential rates of growth were related to a number of factors including government policies involving low government set prices for certain commodities, little or no control of the prices of other commodities, subsidies for livestock feed, and other agricultural imports, and domination of the import markets by public sector agencies to the virtual exclusion of the private sector. Farmers have responded to economic incentives or disincentives by producing those commodities which offered greatest financial returns.

3. Substantial increases in demand for food have resulted from both a rapid rate of population growth (2.7-2.9 percent), and substantial increases in per capita food consumption. In the six year period from 1974 to 1980, per capita consumption of wheat went up 38 percent, sugar 69 percent, maize 24 percent, red meat 38 percent, white meat 67 percent, dairy products 41 percent and fish 76 percent.

This rapid increase in consumption and demand for food was due to a number of factors including increasing incomes and substantial government subsidies for food.

The effect of these various factors influencing production and utilization of agricultural commodities has resulted in a rapidly widening gap between the levels of production and utilization of food. Figure 3.1, from the SAAD report of 1982,^{1/} illustrates the nature of this gap and the manner in which it will continue to widen between now and the year 2000 if something substantial is not done to expand production and reduce the rate of increase in consumption.

The SAAD report ^{2/} recognized the difficulties associated with reducing demand for food by limiting population growth and reducing per capita consumption, and focused on opportunities and strategies for expanding production as the primary means of narrowing the food deficit gap. The following excerpts from the SAAD report emphasize the large potential for increasing the productivity and output of Egypt's agricultural sector:

^{1/} "Strategies for Accelerating Agricultural Development-- A Report of the Presidential Mission on Agricultural Development in Egypt." Ministry of Agriculture, A.R.E. and the U.S. AID in cooperation with the International Agricultural Development Service and U.S. Department of Agriculture. July 1983.

^{2/} Ibid.

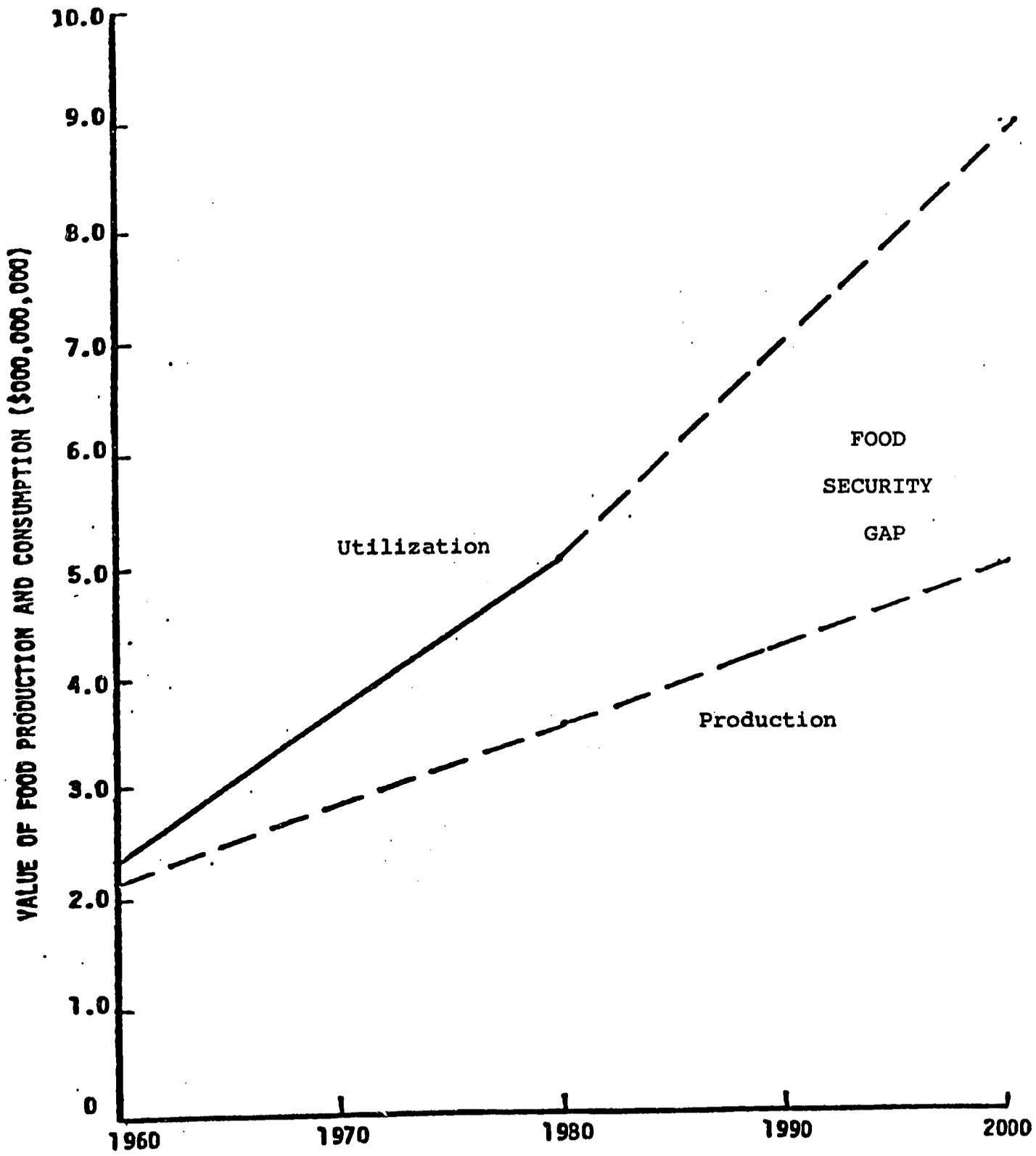


Figure 3.1 The value of food produced and consumed in Egypt from 1960-1980 with projections to 2000 A.D., assuming a continuation of the present rate of increase in production.

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"Prior assessments of Egyptian agriculture have often emphasized Egypt's unusually favorable land, water and climatic resources, along with the relatively high levels of agricultural productivity which these resources have enabled the country to achieve. Evidence of this relatively high productivity is suggested by the fact that yields of most Egyptian crops are shown to be substantially above average world yields.

"Other data further indicate that yields of many Egyptian crops compare very favorably with production in more developed regions of the world such as North America and Europe.^{1/} Many have assumed from such comparisons that the opportunities in Egypt for further increases in productivity per unit of land are limited. Such views have been reinforced by the fact that during the past decade yields of Egyptian crops generally have tended to level off or, in several instances, to decline.

"However, ample and ever-increasing evidence suggests that Egypt has enormous potentials to further increase its agricultural output on existing arable lands, despite its relatively high levels of productivity by world standards or even by the standards of more developed nations. Such increases would be over and above what might be realized by bringing additional lands into production through reclamation efforts."

1/ FAO Production Yearbook, 1973 and 1980.

There is a sound basis for such an optimistic assessment of the potential for increasing agricultural productivity and output. Some of the best evidence of this potential is found in research trials and large scale demonstrations conducted throughout the the country along with the actual experiences on farms.

Perhaps the best information available for cereals and vegetable crops are the data accumulated from extensive field demonstrations carried out in recent years by the MOA through the Rice, Major Cereals, Small Farmer Credit, Water Use, and Agricultural Development Systems projects supported by USAID. These demonstrations, involving thousands of feddans under farm conditions throughout the country, have indicated that by applying correct technology, output of cereals can be increased by 50 - 70 percent and certain vegetables by 160 - 260 percent.

It is believed that yield increases of this magnitude could be achieved in a relatively short time if the various constraints limiting production could be removed. Maximum yields observed in field demonstrations and research trials, as well as productivity levels reported by better farmers suggest that the long range potential for increasing productivity could be substantially higher than indicated under average conditions in the demonstrations cited above. Certainly a strong, well conceived and viable research program can be expected to develop the technology needed to increase yields far above the level now possible--and, of course, even further above the average levels now realized.

The 1982 SAAD report identified a number of major constraints limiting the realization of these potentials. The failure to develop and use improved production technology was recognized as one of the most important factors preventing the realization of agricultural development potentials in the country.

The following excerpts from the SAAD report stress the vital roles which improved technology must play in further increasing the productivity of the agricultural sector:

"Egypt's future in agriculture depends on a continuing stream of improved technology. Because of the relatively high levels of productivity already achieved, the technological constraints on Egyptian agriculture are greater and more sophisticated than those operating on most other developing countries. Indeed because of its unique circumstances, Egypt is perhaps more dependent upon improved agricultural technology than any other country in the world.

"Accordingly, any strategy for improving the agricultural sector must give high priority to removing whatever constraints limit the effectiveness of programs concerned with the generation and application of improved technology. To be specific, developing the strongest possible programs in agricultural research and extension is absolutely essential.

"It is obvious that there is much available but unused technology in Egypt which could readily be applied by Egyptian farmers. This emphasizes the need for strong and effective extension programs.

"While much improved technology is already available, it is likely that other technologies developed elsewhere and not yet evaluated in Egypt, could be adapted to Egyptian conditions. Strong programs in applied or adaptive research are needed to evaluate these technologies and to determine which might be used effectively.

"Furthermore, strong agricultural research programs that go beyond adapting or applying to Egyptian conditions technology developed elsewhere are needed. Programs that push back the frontiers of knowledge in agricultural science by exploring new and more advanced means of enhancing agricultural production and marketing are also needed. Many believe that agricultural science is on the threshold of major breakthroughs which could contribute substantially to advances in such areas as improved photosynthetic efficiency and nitrogen fixation by plants, genetic improvement of plants and animals through a variety of new techniques etc.

"Egypt has many well-trained agricultural scientists who can make significant contributions to such scientific endeavors. Research programs in Egypt should recognize and take advantage of such capabilities. Success in this type of endeavor could, in time, provide the basis for increased agricultural productivity substantially in excess of the short-range potentials considered in this report."

Our Team concurs fully with the foregoing assessment by the SAAD Mission. Furthermore, the critical nature of Egypt's dependence upon improved agricultural technology is highlighted by the fact that only 3 percent of the land is arable and the country MUST do everything possible to increase the productivity of existing arable lands.

While Egypt will continue to try to increase its arable areas through land reclamation efforts, it should be recognized that past reclamation efforts have been able to do little more than compensate for arable land taken out of agriculture as a result of urbanization. Considering the general lower productivity of the reclaimed lands, output from the reclaimed lands has not been as great as the production lost through urbanization.

At any rate, strong, effective research programs must be carried out to learn how "new" or reclaimed lands can be managed and used most effectively for agricultural purposes. The projected growth of the nation along with its limited land suitable for agriculture and its finite water resources strongly emphasized the need to maximize the productivity of agricultural lands. While many factors may contribute to the achievement of such high productivity, it should be recognized that no single factor is more vital than the improved technology required to overcome the problems or constraints limiting production.

This emphasizes the necessity for strong programs of agricultural research to develop or adopt new technology along with equally strong and effective extension programs directed towards getting such technology used by the farmer.

This report is concerned, first, with an assessment of the current agricultural research and extension programs in Egypt--followed by a review of recommendations for substantially strengthening and improving these programs so that they might more effectively serve the needs of the country. Finally, the report sets forth some recommendations concerning ways in which such strengthened research and extension programs might provide support and leadership to major commodity production campaigns. These campaigns are primarily aimed at significantly increasing the output of Egypt's agricultural sector, and in doing so they will facilitate the implementation of agricultural price policies which will move Egypt's agriculture closer to being not only technically, but also economically efficient.

4. AGRICULTURAL RESEARCH AND EXTENSION IN EGYPT

There is a significant level of research relating to food and agricultural production being conducted throughout the country and financed from many sources. Much of this work, however, does not appear to be carried out as a part of a carefully planned or well coordinated national effort, reflecting national goals and needs.

Similarly, there is a variety of extension efforts aimed at getting improved technology used by farmers. Many of these extension efforts appear to be uncoordinated and independent of the formal government extension service. Furthermore, even within the Government, the National extension office has no direct administrative responsibility for extension programs within the Governorates.

This section of the report will be concerned with describing the present agriculturally related research and extension activities within the country as a first step towards recommending ways in which current efforts might be strengthened and improved.

It should be recognized at the outset that all agricultural research and extension activities are not centered in the Ministry of Agriculture (or bodies relating to the MOA). Although MOA-related activities constitute a substantial part of the total agricultural research and extension effort, other organizations and institutions, both within and outside the Government of Egypt, are also

involved and must be considered as a vital part of the total national research and extension effort in agriculture.

The recently reorganized Agricultural Research Center (ARC), under the administrative responsibility of the Minister of Agriculture, has the primary responsibility for agricultural research and extension within the Government of Egypt (GOE). Other Ministries, such as Irrigation and Land Reclamation, because of their concerns with agriculture, have important research responsibilities as well. Furthermore, other Egyptian institutions such as the National Research Center, the Academy for Scientific Research and Technology, and universities are also involved in research--and, to a certain extent, extension. In addition, other organizations such as the International Agricultural Research Centers are conducting research in the country--either independently or in cooperation with government agencies. Following is a description of some of these organizations and their activities.

A. Agricultural Research Center (ARC)

1. General Organization

The ARC was initially established as a semi-autonomous organization with the Minister of Agriculture as Chairman of the Board. Technically it was outside the Ministry of Agriculture but was generally considered to be a part of the MOA since it was administratively responsible to the Ministry of Agriculture.

The ARC has recently undergone extensive reorganization resulting directly from President Hosni Mubarak's Presidential Decree No. 19, dated January 19, 1983. This decree established the ARC as a scientific and extension institution and gave it broad, general authority for agricultural research and extension activities in the country. An earlier Presidential Decree (Number 483 of 1982) gave the ARC responsibility for the production farms...formerly referred to as "State Farms" under the General Authority for Agricultural Production.

The current Board of Directors of ARC consists of the Minister of Agriculture (Chairman of the Board), the Director of the ARC, who is responsible for the day-to-day operation of the ARC, the three Deputy Directors, (for Research, Experiment Stations and Production, and Extension), the Directors of the Research Institutes, a representative of the Academy of Scientific Research and Technology and five consultants versed in agriculture, selected by the Minister of Agriculture.

Previously there were 14 research institutes located in Cairo under a Deputy Director for Research. There were 31 commodity-oriented research stations located throughout Egypt. Thirteen of these stations were designated agricultural research stations, each of which included staff from one or more of Field Crops, Cotton Production and Sugar Research Institutes. There were 6 horticultural and 12 animal research stations. Staff from the discipline-oriented ARC institutes as well as those with commodity orientation were located at the research stations.

Budget support flowed through the respective research institutes at Cairo and national research plans were jointly developed by staff members of the various institutes and stations. These stations were, in effect, extensions of the institutes.

The research stations were located on land owned by the General Authority for Agricultural Production, which made land assignments to the stations and farmed it for them. The latter included land preparation, cultivation and harvesting.

Agricultural extension was handled by an Undersecretary for Extension within the Ministry of Agriculture. (The previous organization for research and extension was described in detail in the SAAD Report.^{1/})

^{1/} Ibid.

2. Research

Following reorganization there are still 14 research institutes under a Deputy Director of Research; however, a number of changes have been made. The Desert Research Institute has been moved to the Ministry of Housing, Reconstruction and Land Reclamation. The Extension Research Institute has been abolished and the work moved under the Deputy Director for Extension. The Veterinary Research Institute is now the Animal Health Research Institute, and two new research institutes, Serum and Vaccines and Animal Reproduction, have been formed from Sections of Animal Health and Animal Production respectively. Current institutes are as follows:

Research Institutes

- | | |
|-------------------------------|-------------------------|
| 1. Agricultural Economics | 8. Field Crops |
| 2. Agricultural Mechanization | 9. Horticulture |
| 3. Animal Health | 10. Plant Pathology |
| 4. Animal Production | 11. Plant Protection |
| 5. Animal Reproduction | 12. Serums and Vaccines |
| 6. Cotton | 13. Soils and Water |
| 7. Flora | 14. Sugar |

The annexes to this report (page A1.1) contains a discussion of each of the institutes, including their size, scope of work, and other factors such as facilities and equipment which may influence their effectiveness as research organizations.

The research stations have been administratively removed from the research institutes; the General Authority for Agricultural Production has been abolished; and both the research stations and production farms are proposed to

be organized into seven regional groups under a Deputy Director for Experiment Stations and Production. Each region would have a regional director and an administrative unit at one of the research stations that is designated the regional headquarters. The operation and maintenance budgets for the research stations and production units would flow through the regional directors. Any special needs of a research program beyond the general operational support by the station, would be provided through the institutes.

The various research stations in a region would form a composite regional station, even though some are separated by a considerable distance. Each of the research stations designated by location (Sakha, Sabahia, etc.) often consisted of several commodity-oriented stations (units). The individual stations (units) at a given location have been melded into a multicommodity, multidiscipline station.

A strong linkage between the research stations and the institutes has been maintained even though they are administratively separated at the Deputy Director level. Staff at research stations remain as members of an appropriate institute. Research institute members at Cairo continue to conduct research on the stations and joint research planning and budgeting also continues. Research stations have been assigned specific land and are responsible for farming it and harvesting the crops.

Production units have their own budgets, managers and equipment for farming. This separation does not preclude rotation of land by research and production or assistance by one to the other.

It is envisioned that the above reorganization will facilitate the upgrading of research stations, improve management and use of limited resources and increase cooperation, while still retaining the professional identity of the individual staff member and a close linkage between research stations and the institutes.

A proposal is under consideration by the administration of ARC to group the various research stations under the previous organization into seven regional stations as follows:

1. Alexandria and North Coast Regional Station
 - *Horticultural Research Station (Sabahia)
 - Salinity Laboratory (Sabahia)
 - Sugar Cane Breeding Research Station (Sabahia)
 - Plant Quarantine Station (Sabahia)
 - Animal Production Research Station (Montaza)
2. New Lands Regional Station
 - *Agricultural Research Station (Nuberia)
 - Horticultural Research Station (Nuberia)
 - Horticultural Research Station (South Tahrir)
3. North Delta Regional Station
 - *Agricultural Research Station (Sakha)
 - Animal Production Research Station (Sakha)
 - Agricultural Research Station (Sirw)
 - Animal Production Research Station (Sirw)
 - Animal Production Research Station (Elsaro)
 - Animal Production Research Station (Mehalet Mosa)
 - Animal Production Research Station (Borg Elrab)

4. Middle Delta Regional Station
 - *Agricultural Research Station (Gammeiza)
 - Animal Production Research Station (Gammeiza)
 - Agricultural Research Station (Sers)
5. South and East Delta Regional Station
 - *Agricultural Research Station (Bahtim)
 - Horticultural Research Station (Bahtim)
 - Horticultural Research Station (Kanater)
 - Animal Production Research Station (Enchas)
 - Animal Production Research Station (Ilsheir Island)
 - Agricultural Research Station (Ismailia)
 - Agricultural Research Station (Ismailia)
6. Middle Egypt Regional Station
 - *Agricultural Research Station (Sids)
 - Animal Production Research Station (Sids)
 - Horticultural Research Station (Sids)
 - Agricultural Research Station (Malawi)
 - Animal Production Research Station (Malawi)
 - Agricultural Research Station (Fayoum)
 - Animal Production Research Station (Fayoum)
7. Upper Egypt Regional Station
 - *Agricultural Research Station (Shandaweel)
 - Agricultural Research Station (Mataana)
 - Sugar Cane Research Station (Kom Ombo)

*Regional Headquarters

The annexes to this report contain a discussion of each research station including their size, scope of work and other factors such as facilities and equipment which may influence the ability of the stations to do effective research.

3. Extension

As part of the recent reorganization, the Agricultural Extension Service was moved from the level of an under-secretariat in the Ministry of Agriculture to the ARC where it is a separate division under the Deputy Director for Extension. This move was made to facilitate a closer association between research and extension. Such close association is further encouraged by the Decree which specifies that the research staff of the ARC should devote a part of their time to extension activities.

Other than the merging of the national office of extension with research in the ARC, there appear to have been few other changes in the organization and function of Extension from that described in an earlier report.^{1/}

The current extension program in Egypt remains weak, uncoordinated and relatively ineffective.

Field personnel are administratively under local government (Governorates) and are required to perform a wide variety of regulatory and service functions which, normally, would not be considered appropriate extension functions. The National Extension Director and his office have no administrative responsibility for extension field personnel.

^{1/}"Recommendations for a Strengthened Agricultural Extension Program in Egypt." Report of a U.S. Extension Study Team to the Ministry of Agriculture and USAID. November 1981. (Sometimes referred to as the "BIFAD Report.")

Many different organizations talk about having extension programs or doing extension work. The Academy for Scientific Research and Technology and the National Research Center are both supporting extension activities aimed at improving agricultural production and nutrition. USAID sponsored projects, such as Rice and EMCIP, have extension components. Other ministries as well as universities also speak of extension activities. Most of these activities apparently have little connection with the national extension program now centered in the ARC, although some may include work with field personnel at the village level.

The move to place extension and research functions together administratively, as was done in the Presidential Decree in January 1983, is, we believe, a significant step towards the strengthening of the extension program. However, this must be accompanied by action in several other areas to address the problems contributing to the "weak, ineffective, and poorly coordinated extension system" described in the earlier BIFAD report. The report of the current Team will provide specific recommendations for further action needed to address these problems.

4. Agricultural Production

Agricultural Production (AP), previously under the General Authority for Agricultural Production, has recently been transferred to a division of Experiment Stations and Production in the ARC. AP consists of about 27,000 feddans of farms, orchards, tree nurseries and animal units located throughout Egypt. There is also an Agro-Industry unit at Giza.

Linkage between AP and the research units is strong, particularly in the case of seed production. Breeder and foundation seed for cotton and field crops is produced and processed on production farms jointly with research staff. Sugar cane "seed" is also produced in this manner. Some certified seed is also produced on the production farms; however, most certified seed is produced by the farmers in a seed production program under the direction of the Under-secretary for Seed Production of the MOA. Vegetable seed, on the other hand, is produced by the Horticultural Research Institute and private seed companies.

Nursery fruit trees are produced by the AP unit in 23 nurseries on 600 feddans located throughout Egypt. Seven of these nurseries also produce windbreak trees, such as casurina and eucalyptus, with technical assistance from the research staff. Trees for research may also be produced in these nurseries. These trees are sold for about 45 piasters each, well below the price of private sector trees which sell for one to two LE each.

The AP program has five balady cattle and one buffalo fattening units, two Friesien, one buffalo and one combination Friesien, balady and buffalo dairy units, one sheep breeding and one sheep fattening unit.

There are no poultry production units in the AP program; however, there are many poultry units in the ARC which are, in actuality, primarily producing chicks and chickens for sale to farmers.

The condition of many of the farms is extremely poor, particularly from the standpoint of drainage. No meaningful replacements or additions of tractors and other farm equipment has been made for many years. Equipment maintenance and repair shops are extremely inadequate. The situation has deteriorated to the point that private sector farmers are being contracted to do part of the work. More to the point, average production of crop land is only about 50 percent of that attained by the private sector. Much of this is a reflection of inadequate land drainage and equipment. We were also informed that the operating budget for the AP unit was so limited that recommended levels of fertilization, pest control and other desired management practices could not be followed--and that this was a major factor in the poor performance of the AP unit.

There are about 700 feddans of fruit farms in addition to the nurseries. Productivity is low here also. There is the need to carefully evaluate the orchards involved to determine which are suitable for routine maintenance, which can be

rejuvenated by improvement of drainage, irrigation and pruning, and which should be removed.

Nurseries are producing trees superior to those in most private sector nurseries. On the other hand production techniques leave much to be desired and sanitation is poor. There is a need to upgrade seed beds, propagation procedures, weed control and sanitation measures.

Animal production units are reasonably well maintained but are short of adequate equipment.

The agro-industry section at Giza produces such products as olive oil, pickled olives, tomato paste, fruit juices, jams, dried dates and dried legumes. The products are made from fruits and vegetables produced in ARC production orchards or farms. A limited amount of fruits and vegetables is purchased and processed.

The buildings in which the processing equipment is located are so old and have deteriorated to the point where it is questionable whether they can be economically renovated.

Most of the processing equipment is primitive; however, there are a few new pieces of equipment and some new cold storage rooms.

Cans are produced from tin plate purchased in France and England. Here, too, the equipment is outmoded and production is slow. As an example the seams of cans are being soldered by hand.

Sales of the products are made to individuals on ARC premises at Giza at prices below those of the private sector.

5. Assessment of Conditions within ARC

In the course of its work the Team has made an assessment of the programs of the ARC institutes and research stations including their size, scope of work and other factors such as facilities and equipment which may influence the ability of these different units to carry on effective research. A more detailed discussion of each unit is provided in the annexes to this report. Some of the more significant problems or constraints limiting the effectiveness of the programs of these units are discussed in the following sections.

a. Staff

There are about 700 staff members with PhD degrees, and many more at MS and BS levels. These numbers change continuously because staff with MS and BS degrees have the right to continue to the PhD level, if they wish, and to be retained in their unit at a salary commensurate with the new degree. Virtually all with MS and BS degrees are pursuing higher levels because this is the principal route to higher salaries. (See Table 4.1 for summary of ARC staff.)

The overall system would appear to have more staff than is needed. This results both in large amounts of resources devoted to salaries and in the need for higher levels of support funds and space.

Quality of the staff is variable. There is a cadre of very fine, highly motivated scientists, some with higher degrees from universities in foreign countries and some

Table 4.1: Number of ARC Employees, by Major Category
(August 1983)

	Occupied posts	Vacancies	Total
Top Officials	14	1	15
University Graduates	4452	52	4504
Technicians	2201	100	2301
Clerks	2884	40	2924
Skilled laborers	3432	50	3482
Laborers	8715	30	8745
Non Professionals	21,698	273	21,971
Professional Staff	2,472	31	2,503
Total	24,170	304	24,474

educated entirely in Egypt. There is an increasing tendency for research staff to study for higher degrees at nearby local universities, many of which are not equal to the best Egyptian universities, and to remain at their stations after completing the advanced degrees. This may result in a type of provincialism and a lack of diversity of background, training and experience which may work to the detriment of the program.

Also, the distribution of well-trained staff is not balanced at the various stations and institutes. For example, there are no PhD's at Kom Ombo and only one at the Mataana research stations, but 9 at Bahtim. The staff of the Animal Production Institute in Cairo has a staff with 55 PhD, 94 MS and 204 BS degrees, even though there are no animals at the Cairo location. Sakha, which is the largest animal research station, has a staff with only 3 PhD, 6 MS and 2 BS degrees. It is recognized that animal scientists at Cairo conduct much of their research at Sakha. Even so, there appears to be an imbalance of staff. Much the same situation exists throughout the ARC.

Staff members selected for education and training overseas are adequately supported; however, the percentage of staff selected for such programs is less than the need.

The above problems notwithstanding the large number of excellent scientists in the ARC is its main strength. Moreover, staff members appear to be highly dedicated to the national goal of improving the productivity of Egyptian agriculture as well as to their science.

b. Salary, Rank, Promotions and Incentives

Basic salaries for staff with PhD and MS degrees range from 100 - 250 LE per month. Maximum salary for those with BS degrees is 90 LE per month but 50 LE is common. The Director of a Research Institute gets about 25 LE per month additional. These salaries are set by law. Ranks of Assistant Researcher, Researcher and Senior Researcher in the ARC correspond to Assistant Professor, Associate Professor and Professor respectively, at universities. (See Table 4.2 for compensation level by rank).

Promotions require five years at a given rank and several research papers, with at least two published.

Research faculty can not legally hold a second job but it is possible to receive incentive pay up to three times their basic salary for special or additional work. However, it is unusual for staff to receive the maximum incentive level permitted by government regulations.

Salaries of support staff are, of course, much lower. A secretary may get 40 LE or less per month. Clerks, drivers and other nonprofessionals also receive low salaries. To illustrate the salary problem, a competent secretary in the private sector makes 250 LE or more a month. This is more than the basic salaries of most research staff.

Low salaries affect many other factors relating to an effective research program as pointed out elsewhere in this report.

Table 4.2: Numbers & Annual Compensation of
the Agricultural Research Centre's Researchers
(as of August 1983)

Grade	1983	1982	1981	1980	Average Annual Compensation (LE)		
					Salary	University Allowance	Total
	-----number-----				-----LE-----		
Research Chairmen	266	267	250	232	1800	450	2250
First Researcher	270	268	217	201	1500	360	1860
Researcher	385	142	130	121	1200	252	1452
Research Assistant	426	486	460	415	900	168	1068
Associate Researcher	1125	2179	2012	1989	700	108	808
Total	2472	3342	3069	2958	--	--	--

C. Staff Support

Research staff members frequently type their own manuscripts or pay to have the work done outside because of inadequate secretarial service. Moreover, the ARC does not pay for page charges in either Egyptian scientific journals or foreign ones. The staff bears these costs.

Vehicles for transportation between Cairo and the research stations are inadequate. This problem is compounded by the requirement that vehicles must be driven by official drivers. Drivers are in short supply because of low salaries. Thus, staff often use their own vehicles without compensation. There is no mechanism for either permitting staff to drive official vehicles or for reimbursement when personal ones are used.

There are guest houses on many of the stations where visiting staff can stay and eat inexpensively. These are invaluable because of the large number of Cairo-based staff who conduct their field work at the outlying stations. There are also recreational buildings and a certain amount of housing on some of the outlying research stations to compensate for their isolation. Housing is not always sufficient to meet demand. The ARC also provides schools and housing at certain locations.

d. Libraries

There is no agricultural library in Egypt that is completely adequate for a major research or educational institution. The library of the National Research Center

appears to be the best. It has a service whereby an individual can get a computer printout of abstracts of a literature search of a given subject within a week. This is done by telexing a service organization in Atlanta, Georgia, U.S.A. Each search costs 60 LE, with the individual paying 20 LE and USAID 40 LE. A random survey of acquisitions showed that not even the NRC library is uniformly up to date in journals of all fields of importance to agriculture.

Libraries of major universities rank next in importance but all are deficient to some extent in acquisitions of journals in some fields and in services rendered.

The ARC Central Library is very weak and limited in materials. Some journals have not been purchased for over a decade, and the array of other acquisitions is deficient. EMCIP is purchasing a large number of back issues of journals of special interest to its teams, for the ARC Central Library; however, this is insufficient to bring the library up to the level needed.

Every institute and research station has a library or reading room. This is usually a very large room, equal in size to three or four laboratories. It appears that no acquisitions of journals have been made for a number of years, sometimes not for a decade or more. Some libraries do not contain any journals and a few are virtually vacant rooms.

The Librarian Emeritus of the California/ADS Project made a comprehensive report of a suggested library or information center. It would be very expensive to develop and maintain such a library. Nevertheless, a significant improvement in library resources is needed.

e. Communications

Communication between research units is poor because of inadequate telephone and mail service. The ARC does not have a routine courier service. EMCIP has installed a radiotelephone system between units at Cairo, Shandoweel, Sedis, Sakha and Gammeiza, but the remainder of the units do not have this advantage.

f. Buildings

Buildings of the institutes and research stations vary in age and quality of construction. Many buildings are poorly designed. The primary problem is general deterioration due to lack of maintenance and periodic refurbishing. Most of the buildings would be satisfactory with appropriate refurbishing. However, some buildings have deteriorated beyond the point where renovation and refurbishing would appear to be economically sound.

EMCIP and the Rice Project are in the process of constructing several laboratory-administration buildings that will be designed for modern research laboratories, and the ARC is constructing or planning several new

buildings. There appear to be some design features in these building plans that could have been better from the standpoint of maintenance, convenience and utilization. Even so, they are considerably superior to those constructed earlier.

EMCIP and the Rice Project are also constructing some excellent seed processing and storage buildings at several locations; however, storage and equipment sheds are deficient at most locations.

g. Laboratories

Laboratory space is not of modern design and it has been inadequately maintained. Most are not suitable for certain instruments that require air conditioned and/or dust-free conditions.

Utilities usually consist of only cold water. There should be a hot water system in laboratories where glassware is used. Gas and compressed air should be available where appropriate.

Fume hoods are lacking or nonfunctional in many instances. Dangerous fumes were noted escaping into the laboratory at two locations. There is a dearth of sinks and dishwashing facilities. Drying racks are noticeably absent.

Laboratory benches are inadequate and there is usually very little cabinetry for glassware and chemical storage. There are no facilities for storing and handling concentrated acid and caustic solutions safely. There were no explosion-proof refrigerators.

Laboratories with scientific instruments often contained sacks of fertilizer or large amounts of drying plant materials. Old equipment, broken furniture and miscellaneous material are often jammed under benches or left in corners of the laboratory.

There is the need for greater cleanliness, better maintenance and better management of laboratories as well as the need to refurbish them and upgrade utilities and safety features.

Laboratory chemicals were usually in short supply and it is apparently difficult to get them on short notice. Stores of chemicals and glassware do not exist.

h. Laboratory Instruments and Supplies

Laboratory instrumentation varies with the laboratory; however, only those with recent, large inputs of donor assistance have instruments adequate for their purpose. There are some new instruments purchased with Egyptian Government and donor funds but instrumentation is, for the most part, inadequate.

Moreover, laboratories contain much outdated and non-repairable equipment that should be removed and disposed of. There should be a functioning system for removing worthless old equipment and disposing of it at scheduled intervals.

Many instruments were not functioning because of lack of bulbs, electrodes or other minor problems. This points out the need for a supply of spare parts, a service department for making instrument repairs and as much standardization of equipment as possible.

It was noted that some of the staff have limited knowledge of the design, care, and maintenance of much of their laboratory equipment. There should be periodic training courses for the staff and every laboratory should have a set of tools for minor repairs. Such tools are lacking.

Courses in instrument repair and maintenance are offered through the National Research Center in cooperation with the University of Wisconsin with USAID support. There is no apparent use of this service by the ARC.

Lack of instrumentation is not limited to the more complex types. There is a lack of large drying ovens, mills, balances, dissecting and research microscopes, autoclaves, water stills and all of the standard equipment found in various types of laboratories.

There is a dearth of calculators and desk type computers throughout the system. An Apple Computer was purchased under the California/ADS project and purchase of such equipment is planned by EMCIP. But availability, is generally inadequate. USAID is in the process of purchasing a main-frame computer for the MOA. But it is not clear whether the ARC will have access to this computer.

There is a central statistical laboratory in Cairo that will assist in research planning and experimental design. This laboratory could be very valuable but it is not as widely used as it could be. The reason for this is not clear. Support for and wider use of such a service would be desirable.

i. Land

The large amount of very excellent farm land available for research and production is a major strength of the ARC. There are approximately 27,000 feddans of lands in the production units of the ARC as well as the approximately 3000 feddans currently assigned to research. The production farms division assigns land for research use.

Unfortunately, very little land is available in Giza, the immediate vicinity of the Cairo research institutes, where a high percentage of the staff is located. There is adequate land available on the outlying stations, however, and the ARC organization facilitates use by Cairo-based staff as well as those members located at the research stations.

In addition to farm land, the production units contain a number of orchards and nurseries that could be used for research if the need arises.

A considerable portion of the research and production land is poorly drained. Field research at Sabahia, for example, is inhibited by an inadequate drainage system. A major effort to properly level and drain land

to provide proper water delivery systems is badly needed.

Research orchards at Kanater have, in the main, outlived their usefulness. Trees are old and usually suffering from virus diseases to an extent their usefulness for research is very limited. A plan should be developed for systematically eliminating most of the trees and replacing them with others useful for research. Many of the trees in production orchards have also outlived their usefulness and need removal and replacement.

j. Field Equipment

EMCIP and the Rice Project are furnishing excellent field equipment for both farming and conducting research on land assigned to them. They are also furnishing excellent maintenance shops to service equipment.

Other portions of research stations and production units are quite deficient in farm equipment and repair facilities. Some of the EMCIP and Rice Project equipment could be used to alleviate research needs in some instances, but lack of field equipment for farming and managing research plots is a major problem.

k. Post Harvest Handling and Processing Equipment for Horticultural Crops

The California/ADS Horticultural Subproject has furnished equipment, storage facilities and instrumentation at the central laboratory of the HRI at Giza. It also contributed equipment to post-harvest facilities at the University of Alexandria. These facilities are adequate for a research program in this field of work. The contract for this project has just ended and some members of the team, which included both university and ARC staff members, are uncertain as to what facilities will remain available to them.

There is a food processing plant in the HRI, but it is not being used for research. It, along with processing equipment in several other buildings, is used by the agro-industry production unit at Giza to produce processed fruit and vegetable products for sale.

Some of this equipment is functional, but much needs replacement to improve efficiency and sanitation if these functions are to be continued.

6. Quality of Research Effort

Although the Team has been involved in assessing many of the factors which contribute to the success (and quality) of a research program, there has been no effort to assess the quality of the research itself. This was not a part of the Team's terms of reference. Furthermore, a meaningful assessment of the quality of the Egyptian agricultural research would take more time than the Team has been allotted for its entire effort.

It should be noted that an assessment of research quality is an extremely difficult task and could be approached many different ways. One measure of quality might be the extent to which the research has generated significant new knowledge in the sciences related to agriculture. Another might be the degree to which the research has developed important new agricultural technology which results in increased production or improved quality of agricultural commodities, more efficient operations by the farmer, improved living standards of the farm family, etc. Still another approach would involve a detailed peer review of the research programs in each discipline, including an analysis of individual research programs and projects, how they were designed and are being carried out, and an appraisal of results.

Our assessment of the various factors which should contribute to the quality of the research effort in Egypt leads us to the following observation and conclusion:

1. The size of the staff to carry out a desired level of research activity is adequate.
2. The training of the staff is variable; there are, however, many well trained and dedicated research scientists around whom excellent programs can be built.
3. With a few exceptions, the quality of the buildings, laboratories, and other facilities is poor and needs to be substantially improved.
4. The level of budgetary support for research operations, including equipment, supplies, maintenance, travel, etc., is extremely deficient and serves as a serious constraint to effective operations.

Given the relatively low level of investment in the research program and the problems associated therewith, the Team's general view is that the quality of the research effort is probably better than might be expected. If this is the case, much credit is due the many competent staff involved in the research program who are performing well in face of many adverse circumstances.

B. Universities

Egypt's university system extends from Alexandria University on the north to Assiut University on the south and the Suez Canal University (Ismailia) on the east. Thirteen of the universities contain faculties of agriculture:

Ain Shams	Kafr-El Sheikh (Tanta)
Alexandria	Mansoura
Assiut	Menia
Al Azhar	Menoufia (Shebin El Kom)
Beni-Suef	Suez Canal
Cairo	Zagazig
Fayoum	

These universities are associated with and funded by the Ministry of Education and Scientific Research. They are not organized into a system, as is the ARC; however, many decisions concerning them are made by the Supreme Council of Universities, which consists of the Minister of Education as Chairman and Presidents of the Universities.

Each university agricultural program is administered by a Dean and includes a wide range of commodity-oriented and discipline-oriented departments.

The faculties of agriculture all have both undergraduate and graduate programs. The three largest faculties of agriculture and their approximate undergraduate enrollments are Alexandria (7000), Ain Shams (6000) and Cairo (5000). Others, such as Assiut, Shebin El Kom and Zagazig, have enrollments of around 2000. Some of the new universities, such as Fayoum, Beni-Suef, Mansoura and the Suez Canal, are much smaller. The Suez Canal University at Ismailia has only 500 undergraduates and 50 graduate students in agriculture.

The universities do not have an organized research program; however, they do conduct considerable agricultural research through their graduate students, many of whom are staff members of the ARC pursuing advanced degrees and who often use ARC as well as university facilities. There is also general recognition that academic faculties traditionally conduct research, and there is considerable independent research being conducted by the faculty; however, support from the Ministry of Education and Scientific Research is meager.

There are some excellent scientists on university faculties who could contribute greatly to agricultural research in addition to the teaching programs in which they are engaged.

Universities have considerable laboratory space for research, but it usually lacks such desirable features as hot water, compressed air, gas and air conditioning. Even so, there is much functional laboratory space.

There are some well-instrumented laboratories, and in addition there is a considerable amount of excellent equipment randomly located in the various departments of agriculture. Moreover, faculty in agriculture have the opportunity to utilize equipment of other faculties in the university. As an example, there are electron microscopes in the faculties of science at both the Suez Canal and Assiut University that are available to members in agriculture. Much equipment has been and can be obtained through foreign donor support. Universities have USAID-University Linkage Program funds, P1 480 funds and support from a number of foreign donors.

The academic staffs of the faculties of agriculture are varied in size; however, all faculties seem to be of adequate size in terms of staff. As examples, Cairo University has an agricultural faculty consisting of 109, 83 and 110 professors, associate professors and assistant professors, respectively. It also has 100 assistant lecturers and 100 demonstrators. The Suez Canal University, on the other hand, has a total faculty of only 50. Most of the faculty at professorial levels hold PhD degrees. Alexandria University, for example, has over 300 agricultural faculty members with the PhD degree.

Quality of education varies. As might be expected, the three older and larger faculties of agriculture (Alexandria, Ain Shams and Cairo) are generally considered to be the most prestigious and to have the highest quality faculty, teaching programs and facilities.

There are other universities, notably Assiut, that are becoming recognized as also having programs of high quality. Other universities have certain areas or departments of excellence but their programs are not considered of as high a quality as the three oldest and largest institutions.

The new Suez Canal University is impressive in the vigor and enthusiasm of its small faculty and the excellent facilities currently being developed. It is receiving extensive assistance in the form of laboratory equipment and training from West German's technical aid program, the GTZ. Fayoum University, on the other hand, appears to be having greater difficulty in securing badly needed support for laboratories and other facilities.

Most, but not all, universities have at least small farm areas for teaching and research. None compare in size to the large farms of the ARC, but some are 100 to 200 feddans in size and the Suez Canal University has over 1000 feddans being developed into a farm. Al Azhar University, on the other hand, has no farm; it has only a small amount of land for greenhouses, a nursery and a few plants. Cairo University has a small farm but it appears to be little used.

University libraries are in general better than those of the ARC Central Library but still deficient. Libraries at Alexandria, Cairo and Ain Shams are by far the best.

Massive funding would be required to bring all departments in all faculties of agriculture up to a satisfactory standard with regard to laboratories and land for research. However, there is a base of excellent faculty, laboratory space and instrumentation that could, with some well-directed support, make substantial contribution to a national agricultural research effort. Such research would also add to the excellence of the graduate programs in agriculture, which play a major role in furnishing the staff of the ARC.

C. Academy of Scientific Research and Technology

The Academy of Scientific Research and Technology (ASRT) cites the following activities in its efforts to strengthen programs relating to science and technology throughout the country:

1. support research directed towards solving problems of national interest
2. encourage application of modern technology
3. formulate policies that strengthen linkages between science and technology organizations
4. define priorities for research in scientific and technological aspects of major development areas
5. encourage basic research and support research schools
6. participate with universities in manpower development for training of researchers in specific areas
7. organize state awards in branches of science
8. organize scientific publishing and popularization of science
9. support scientific societies
10. develop international relations in science and technology

A broad based, prestigious Council gives overall guidance to Academy activities. The Council is made up of the President of ASRT, twelve University Rectors, representatives from fifteen ministries, the Directors of the three largest research institutes, one representative of the Union of Scientific Societies, two Vice Presidents of ASRT and ten "at large" members selected by the President of ASRT.

There are 10 somewhat autonomous research organizations included under the Academy "umbrella." These are the National Research Center, Theodor Bilharz Research Institute, Central Metallurgic R & D Institute, Institute of Oceanography and Fisheries, Institute of Astronomy and Geophysics, Egyptian Petroleum Research Institute, Technology Transfer Organization, Ophthalmology Research Institute, Electronics Research Institute, National Institute of Standards, and Remote Sensing Center.

Many of the Academy's activities and programs are formulated and carried out by the following 11 specialized councils:

1. Food and Agriculture
2. Industry
3. Petroleum Energy & Mining Res.
4. Health and Medicine
5. Environment
6. Transport and Communication
7. Construction and Housing
8. New Settlements
9. Management and Economics
10. Social Science and Demography
11. Basic Sciences

The Council on Food and Agriculture is a prestigious group including several former Ministers of Agriculture, the Director of the Agricultural Research Center, and others representing a broad range of agricultural activities.

The Academy has been involved recently in developing a five year plan to guide its activities and serve as a basis for securing financial support. Each specialized Council, such as the one on food and agriculture, has developed goals and objectives for the five year plan and is inviting proposals to address specific areas of research intent to meet these goals from organizations such as universities, government ministries and in-house research institutes.

We were informed that the Academy had requested some 47 million LE from the GOE to be used to support the projects developed in response to the five year plan. At this time the level of funding which might be expected is not known. However, in recent years the GOE funding for the Academy has been substantially below that currently requested.

The Vice President of the Council indicated that the agricultural program would receive the highest priority of the Academy. He pointed out that in the past agricultural programs had received over 50 percent of the funds allocated by the Academy and that the Food and Agriculture Council could expect to receive at least 25 percent of any new funding to implement the five year plan.

The Food and Agriculture Council has developed the following statement regarding its proposed activities and priorities for the Academy Five Year Plan.^{1/}

^{1/} Statement taken from draft of material prepared for the Academy Five Year Plan, 1983.

Food and Agriculture

The Research Plan included programs and studies in these fields:

- Plant Production
- Plant Protection
- Agricultural Natural Resources
- Fish and Animal Production
- Food and Feed Industries
- Agricultural Economics and Society Development

The five year research plan aims at the following:

To maximize the use of land and water resources and climatic conditions. To increase important field and fruit production.

Implementing the scientific approach in agricultural production.

Expanding mechanization.

Intensifying the vertical increase in production, and expanding the use of hybrid, high yield, and fast-growing seeds.

National effort to concentrate on applying specific results in the domain of producing strategic agricultural products.

Designing the means to counteract plant diseases, keeping in mind the integration between plant production and plant protection.

To study water requirements for different crops in the New Valley area and the other reclaimed areas and to compare the different irrigation systems.

To benefit from results of terminated projects.

To put more interest in the application of the results at all levels, including those of the farmer.

To raise the rate of local animal production and to pay more attention to fish farms and non-conventional sources of food (to participate in solving the national food shortage).

To raise the level of nutrition and to make sure that the produced food (both local and imported) reaches the consumer in good condition with high nutritive value.

To improve the rural food industrialization to prevent emigration to cities and to help increase the farmers' income through introduction of some farm industries and environmental industries to the village.

To improve the quality of Egyptian bread to raise its storage and dietary qualities.

To check the best period of storage of frozen protein foods imported for human use.

To integrate rural development.

Agricultural labor.

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Currently the Academy is supporting research and extension aimed at improving the production of rice and maize. In some cases the recommendations are different from those being advanced by the MOA. The scope of work embraced by the Food and Agriculture Council in its five year plan is very broad and obviously includes areas of work covered by the ARC and the research programs of the MOI. Yet officials of the Academy insist there is no overlapping and duplication because high officials of the other ministries, universities, etc. take an active part in the planning of Academy programs and have endorsed whatever the Academy undertakes to do.

The Council on Food and Agriculture has no "in house" research capability and must achieve its objectives through financial support provided other organizations.

D. National Research Center

The National Research Center (NRC) was organized in 1956 as a GOE program to "conduct basic and applied research in natural sciences" which would "contribute to the National welfare." It now functions as a unit under the "umbrella" of the Academy of Scientific Research and Technology.

Since 1975, research and development activities have been organized under the following five programs: technology transfer (with particular emphasis on the industrial sector), food and agriculture, health and environment, energy, and natural resources. The Center is also involved in scientific and technical consultancy, and technical advice as well as training and human resource development.

The NRC is under the management of a Director with policy guidance provided by a governing board.

The basic administrative unit is the laboratory. Currently there are some 52 laboratories grouped into some 13 divisions, including food industries, agricultural and biological, environmental, and basic science research.

The divisions dealing with food industries, agricultural and biological research, and basic science are involved in an array of research activities relating to food and agriculture. While most of the programs involve research, some are concerned with extension type efforts such as work to increase the production of certain crops. We could not determine the extent of cooperation, if any, between the NRC and the ARC in the conduct of these research and extension programs.

The food and agriculture programs are supported by a wide range of donor sources, including USAID. A summary of this support is provided in another section of this report.

There are a total of some 4000 people employed in the NRC. Approximately 25 percent of the research staff hold the PhD degree. The Agricultural Research Division is the largest with some 600 employees including 200 with PhD degrees.

A major rural development project being carried out in cooperation with the Ministry of Local Government involves efforts to improve the yields of corn and tomatoes. Work includes both research and extension. We were told that in programs such as this the NRC developed its own set of recommended farmer practices based on the work of the Center. Those recommendations might or might not be consistent with those of the ARC and the extension service.

One feature of the NRC that should be of particular interest to all research organizations in Egypt is its Service Laboratory. This laboratory has an impressive array of instrumentation and trained operators. For modest fees this laboratory will perform virtually every analysis that might be needed. Services range from such things as nematode identification through mineral analyses of soils and tissues to electron microscope sections and photographs. In many cases the ready availability of these services could make the development of similar functions by other organizations unnecessary. In other cases these services can be used to augment facilities of sister research organizations including those in agriculture.



Another service of the NRC is a training school for instrument repair and maintenance. This is a badly needed service that is infrequently used, if at all, by agricultural research institutions such as the ARC.

The NRC has what is recognized as the best technical library in Egypt, including journals related to agriculture and the biological and soil science.

It offers a computer literature search through an arrangement with a library service company in the U.S. and USAID support. For 20 LE any individual can obtain a computer printout of abstracts of research in a given field within one week. USAID currently pays an additional 40 LE for each search.

The library can be used by university students and research staff of the GOE at no charge.

E. The Ministry of Irrigation

Research in the Ministry of Irrigation was consolidated into the Water Research Center (WRC) by Presidential Decree in 1975. The WRC now consists of eleven research institutes, a project for the Water Master Plan, and Departments for Technical Training and for Research Services. Three of the institutes and the Water Master Plan are conducting studies which are closely related to research being done in the Soil and Water Research Institute and the Agricultural Mechanization Research Institute of the Agricultural Research Center (ARC). It is recognized by the directors of WRC and ARC and by the heads of the concerned institutes that coordination and cooperation is necessary in analyzing and studying problems of soil and water management at the basin level, i.e., between the branch canal and the drain. Means of more actively addressing such problems through a national interministerial program of research and extension focused on the improvement of on-farm land and water management is discussed elsewhere in this report. The Water Master Plan project and the activities of the three WRC institutes most directly related to agricultural production are described briefly in the following paragraphs.

The Water Master Plan is a UNDP-supported project that was initiated in 1977. Phase I, completed in 1981, met its objectives of establishing a data base and developing the planning tools needed for studies of:

- Upper Nile Model for flow routing
- Lake Nasser Model for reservoir operation

- Agro-economic Model for determining the effects of numerous planning policy options on agricultural production
- Groundwater Model of the Nile Valley for investigating the feasibility of vertical drainage and conjunctive re-use with surface water
- Distribution Model for determination of irrigation requirements downstream of Aswan and corresponding operation of the irrigation system
- Equatorial Lakes Model for assessing effects of changes in the Equatorial Lakes basin down to the Lake Albert outlet

Three planning scenarios were developed for new land development and the economic rate of return and the returns to water were used in ranking land development projects.

Since the completion of Phase I in 1981 the project has proceeded with data updating and has refined and made additional runs of the models. Additional development scenarios have been prepared and analyzed. The main report and the 20 technical reports constitute a valuable source of information on system-wide water use and management. Participation by MOA scientists in providing data and in the use of the agro-economic and the irrigation use models is essential and should be encouraged and expanded.

The Water Distribution and Irrigation Systems Research Institute (IRI) was established as part of the WRC when the latter was formed in 1975. It has responsibility to:

- conduct, at the national level, studies on water requirements to determine water duties that help to raise agricultural production
- develop irrigation methods and practices
- study and develop irrigation rotations
- study the methods of water delivery, the improvement of farm outlets and introduce modern systems as well as automatic control of the assigned shares of water

- study water losses by seepage and evaporation and means of reducing them

Field studies have been conducted for many years on a set of 11 water requirement field stations distributed throughout the Nile Valley and the Delta. These are used to establish the water requirements of individual crops and to compute the irrigation water needs of different cropping systems. These studies are similar to those being made by the Soil and Water Research Institute of the ARC, often at nearby field facilities. A careful evaluation should be made of the quality and utility of such studies with a view of redirecting much of the work and upgrading the research methodologies being used.

The institute is currently conducting a very productive multidisciplinary field study of on-farm water management (EWUP). This activity has shown the potential for substantial improvement in water use efficiency and in crop production through technically and economically feasible improvements of the meskas and field distribution system.

There is an obvious and extensive overlap of competence and responsibility between the IRI of the MOI and the Soil and Water and the Agricultural Mechanization Research Institutes of the MOA. Close cooperation and joint action by the field by personnel of both ministries is needed to insure that on-farm land and water management problems are analyzed, studied and effectively solved in an integrated holistic manner.

The Drainage Research Institute (DRI) was established as a unit of WRC in 1976. Prior to that time it functioned in the Egyptian Public Authority for Drainage (EPAD). DRI is composed of the following five divisions:

- drainage technology (covered drains)
- open drainage
- experiments and laboratory analysis
- economics and evaluation
- foreign public relations

Among its responsibilities are to:

- study and develop the best design and execution methods which are suitable for local physical, hydrologic and manpower conditions encountered in the field of drainage of agricultural land and to develop technologies for their use
- set up the standard specifications of drainage
- study the use of different materials, tools and machinery used in drainage works
- conduct research on re-use of drainage water, water management and drainage technology and to conduct evaluation studies of drainage projects
- give technical backstopping to EPAD and to assist in achieving better control of waterlogging and salinity in cultivated areas.

There are about 30 civil and agricultural engineers on the DRI staff. It is reasonably well-equipped with laboratories and other facilities needed for its mission. It monitors the hydraulic performance of various parts of the drainage system and is currently conducting a "crash program" on the effects of recently installed field drainage systems on crop production.

It conducts pilot area studies to test new materials and filters under diverse soil and hydrologic conditions and to measure groundwater behavior and soil salinity in relation to drain depth, spacing, and design. It studies the

socio-economic impact of drainage on farmers and conducts water management studies.

Considerable attention is directed to studies of drainage water quality as it relates to the feasibility of re-use in the irrigation system.

DRI conducts training programs for EPAD and DRI staff which include short courses for field supervisors and technicians on system installation, operation and maintenance.

As mentioned previously there is a considerable overlap between the work of DRI and that of the Soil and Water Research and Agricultural Mechanization Research Institutes of ARC and with some of the research done by the Soil Ameliorization Organization (SAO) of the MOA.

Studies of groundwater were initiated by the MOI in 1963 and were placed in the Groundwater Research Institute (GRI) of the newly created WRC in 1975. The institute has a professional staff of about 30 civil and agricultural engineers, geologists and chemists. Its objectives are to:

- study the development and management of groundwater resources
- compile and analyze hydrologic data
- study the feasibility of utilizing groundwater resources in different applications
- protect groundwater reservoirs from potential sources of contamination
- train personnel involved in groundwater research and related fields
- provide information and consultancy services in the field of groundwater hydrology

The main activities of the GRI include:

- monitoring of regional networks of observational wells
- conduct hydrogeological studies of the Nile Valley
- design groundwater use projects
- studies of changes in the groundwater regime due to the construction of Aswan High Dam
- studies of effects of land reclamation in the Kom Ombo plateau on the hydrogeology of the groundwater reservoir in the plateau and adjacent areas
- feasibility studies of use of groundwater in newly reclaimed areas and new cities in the desert fringe east and west of the Nile Delta.
- investigation of salt water intrusion in the northern part of the Delta
- develop mathematical models of the groundwater reservoirs underlying the Nile Valley and Delta
- study the seepage from main irrigation canals
- examine the feasibility of vertical drainage in the Nile Valley
- participate with other agencies in the study of the aquifers of the Nubian sandstone in northeastern Africa

The work of the GRI relates to that of ARC institutes on problems of conjunctive use of groundwater for irrigation and on questions of the effects of production practices on water quality and groundwater behavior.

F. Ministry of Land Reclamation

Until the Desert Research Institute was transferred to it recently, this Ministry has had little organized research capability. A few project-related studies have been conducted by the staff of the International Center for Rural Development for use in guiding the management and settlement of some of the new lands. Research on well drilling, groundwater and geological behavior, corrosion, pump performance and on soil surveys and land classification have been conducted by the General Company for Research and Ground Water (REGWA).

The Desert Research Institute was established in 1934 and was officially inaugurated in 1951. Its main objectives are to conduct studies useful for the development of the desert. It gives research emphasis to water and soil resources and to plant and animal production. Its research programs are conducted mainly in:

- the Sinai Peninsula where winter rainfall averages 100 mm and where there is adequate soil and range plant cover
- the New Valley on clayey soils of lacustrine origin underlain by a major artesian basin in the Nubian sandstone
- the marginal graveley plains of the Nile Delta there is a major groundwater basin
- the Mediterranean littoral zone having significant winter rainfall and adequate soil and natural plant cover
- the fringes of Lake Nassar in such valleys as Kurkur, Kalabsha, Tushka, et al.

The institute is organized in divisions of water resources, soil resources, plant production and animal production. The staff consists of 61 researchers, 40 assistant researchers, and 94 technicians. Of these, 53 have PhD with 35 others studying for the PhD. Fifty-five staff have MSc degrees and 87 are studying for the MSc. The institute has a library of about 5000 books and periodicals and publishes biannually "The Desert Institute Bulletin." It has a 50 hectare experimental station at Marriut in the Mediterranean littoral zone at which studies on sheep production, range management, horticulture, reclamation of saline soils, irrigation techniques and use of saline water for crop production have been studied. Another field station is under development in Sinai within the arid belt of the Gulf of Suez.

The Institute has published a study of the natural agricultural resources of the Sinai Peninsula and analyzed its future development to year 2000. This study discusses the geographical, geological and hydrological features of the area and gives particular attention to the types of soil and their distribution. It then discusses the possibilities of agricultural and animal use of the resources.

The need for more detailed and sustained research effort on problems of developing new lands and of creating a productive and economically viable agricultural production system on them was pointed out in the SAAD^{1/} report. It is unlikely that the Desert Research Institute can or should

^{1/} Op cit pp. 136, 143 and 188-189

be expected to meet this important need. It could, however, participate with appropriate with appropriate units from ARC and WRC in a well planned interministerial program of research and pilot scale studies in areas for potential development well in advance of the initiation of the land development work.

G. Financial Resources

1. Agricultural Research Center (ARC): Of the three ARC functions, extension has by far the smallest budget. For Fiscal Year (FY) 1984, for instance, the budget for extension is LE .8 million, as compared to the research budget of LE 28.1 million, and the production budget of LE 8.2 million (Annex 2, Table A 2.1). However, this budget is not indicative of the total extension effort in Egypt as it represents only that portion of the total extension budget for which ARC has responsibility. Considerably larger budgets go to extension outside the ARC.

Over the period from 1979/80 to 1983/84 the budget for the ARC has increased by 73.7 percent or 21 percent per year (compounded). This rate of increase is close to the annual rate of inflation during that time period. Thus, the purchasing power of the overall budget stayed approximately constant. Further examination of the budget data (Annex 2, Table A 2.1) reveals, however, that increases were largely in Chapters I and IV, whereas budgets for Chapter II stayed essentially constant.^{1/} Chapter II budgets were inadequate even in 1980/81. As a result of inflation over the four-year period, their purchasing power fell from LE 5.6 million in 1980/81 to LE 3.3 million in 1983/84 (in 1980/81 LE's).

^{1/} Chapter I includes salaries, wages and other payroll expenses; Chapter II contains operating expenses; Chapter III consists of capital expenditures; and Chapter IV shows those GOE expenditures which are due to international donor activities.

Within the research unit of the ARC, budgets differ greatly between institutes (Annex 2, Tables A 2.3 and A 2.4). They range from LE .26 million for 1983/84 for the Animal Reproduction Institute to LE 6.13 million for the Field Crops Institute. However, all of these budgets cannot appropriately be charged to research, as most institutes also perform some "service" or "production" function. For the Vaccination and Serum Institute, for instance, it is estimated that only 30 percent of the budget of the Institute can be viewed as being a research budget.

Budget projections for future years are not yet available. However, the Five-Year Plan projects Chapter III expenditures (Annex 2, Table A 2.4). If the projected 5-year expenditures were actually allocated in five equal tranches, this would represent a substantive increase (about threefold) in Chapter III expenditures over previous years and would permit significant upgrading of equipment and buildings. However, the actual allocations for the first two years of the Five-Year Plan amount only to about 50 percent of the projected amounts for each of the two years. Hence, unless allocations for the subsequent years are increased substantially (i.e., essentially tripled from the first two years), the projected amounts will not be realized. Such substantial increases appear unlikely.

The production farms, research stations, and some institutes generate revenues. These amounted to nearly LE 10 million in 1982/83 (Annex 2, Table A 2.5). The revenues generated by these units revert to the Ministry of Finance and are not available to the MOA.

2. Ministry of Irrigation (MOI): The MOI, like MOA, is crucial to the development of Egypt's agriculture. Budgets of the Irrigation Department and especially the Water Research Center within the MOI are of particular significance. For these two units, budgets are indicated in the amount of LE 154.8 million for the Irrigation Department (1983/84) and of LE 7.1 million for the Water Research Center (1982/83)-- (see Annex 2, Tables A 2.6 and A 2.7). As is the case with the ARC, overall budgets have increased at a much more rapid rate than budgets for Chapter II expenditures. Indeed, in the case of the Water Research Center, the Chapter II budget has stayed constant over the past three years, indicating decreased ability of the scientists to meet day to day operating expenditures as a result of inflation.

The MOI also performs a variety of functions. The activities of the Water Research Center, can be generally classified as research, whereas the Irrigation Department performs both research and extension type functions, but is more heavily involved in amelioration of irrigation systems. This is reflected in the quite different ratio of Chapter I/Chapter II Budgets relative to the Water Research Center and ARC.

3. Other Egyptian Institutions: In addition to the two Ministries and their research organizations mentioned, there are other institutions which engage in research and extension related to agricultural development. These include,

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but are not limited to, universities, other ministries (e.g., Ministry of Land Reclamation), and the National Research Center. (See Annex 2, Table A 2.8 for a list of agriculture-related research projects carried out by the National Research Center.)

4. Foreign Technical Assistance: U.S.: Foreign technical assistance plays an important role in the development of Egypt's agriculture through the provision of funds and expertise in research, extension, production, and credit administration. These resources are channelled to the agricultural sector through the MOA, the MOI, other ministries, the universities, and a variety of other institutions.

One of the largest technical assistance programs is carried out through USAID in cooperation with a number of Egyptian institutions. Those programs include major programs aimed directly at the agricultural sector, a University Linkage Project, Special Foreign Currency (PL-480) Projects, Cooperative Research Support Programs, programs supported by the Science and Technology (S & T) Bureau of AID, Washington, and University Strengthening Programs.

By far the largest program is comprised of those projects which are administered by the Agricultural Office of USAID (see Annex 2, Table A 2.9). At present, those projects have an annual budget of nearly \$ 50 million. Not all of these funds can be considered as representing funds for research and for extension. However, a major portion of those funds can be so identified.

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The University Linkage Program, jointly administered by the Education Office of USAID and the Supreme Council of Universities, provides \$ 27 million (over a five-year period) for a wide range of research. Of those projects approved to date, at least 13 are totally or to a significant extent oriented towards agriculture. These 13 projects have an annual budget in excess of \$.5 million (Annex Table A 2.10).

The Special Foreign Currency Program (under PL 480) supports a considerable amount of research in or related to agriculture. Some of these research projects are coordinated through the USAID Program Office, the Agricultural Counsel, and the Foreign Relations Office of the MOA. Others flow through the office of the Science and Technology Counsel and appropriate Egyptian institutions, depending on the subject matter involved. During the past 9 years, approximately \$ 16 million of Special Currency Program funds have been devoted to projects with agricultural content (Annex Table A 2.11).

The S & T Bureau of USAID, Washington, funds a number of projects which may or may not be with traditional agricultural institutions of Egypt. The titles of some of these projects are "More and Better Foods," "Arid and Semi-Arid Land Development," "Food Technology," "Red Sea Fisheries," and "New Crops." Life of Project (LOP) budgets for these projects range from \$.5 million to several millions.

The Board for International Food and Agricultural Development (BIFAD) has initiated several Cooperative Research Programs (CRSP) which are carried out as cooperative projects between U.S. universities and developing country institutions. There is one such project in Egypt being carried out by the National Nutrition Institute and the Universities of Kansas, Arizona State and Purdue. The project is funded through the S & T Bureau of USAID Washington and has a LOP budget of \$ 3 million.

At least one U.S. university is cooperating with an Egyptian university under the Title XII Strengthening Grant Program, funded by USAID Washington.

5. Foreign Technical Assistance: World Bank: The World Bank, through its IBRD and IFAD, also is a major source of funds (see Annex Table A 2.12). The current LOP commitment is close to \$.5 billion.

While many of these projects have a production/implementation orientation, some of them have significant dimensions of research and extension. In either case, their existence is a major determinant of what the nature of Egypt's agricultural development will be in the future.

6. Foreign Technical Assistance: Other Donors: A number of other countries and organizations (e.g. International Research Centers, Foundations) provide technical assistance (Annex Table A 2.12). While the magnitude of these programs tends to be smaller than those sponsored by the World Bank or the U.S., this assistance has proven to be

able to make significant impact when properly targeted. In total, the LOP value of these projects is in excess of \$ 30 million, a significant budget.

In addition to the above effort there is informal cooperation with International Agricultural Research Centers. For instance, the International Maize and Wheat Improvement Center (CIMMYT) has provided improved cereal varieties collaborative work between scientists. Training programs, both in-service and at CIMMYT headquarters in Mexico, also have been of great value. Cooperative efforts between scientists of the International Rice Research Institute (IRRI) in the Philippines and scientists in Egypt with exchanges of germ plasm have resulted in higher yielding Egyptian varieties. Training scientists also has been an important feature of the work of these centers.

H. Apparent Lack of Coordination of Research Activities and Donor Support

The universities, the NRC, the ASRT and certain GOE Ministries are all carrying on agricultural research activities which seem to be essentially independent of each other and the work of the primary agricultural research organization in the country, the ARC. To illustrate the lack of coordination and focus of research efforts, a representative of one Ministry commented to the effect that universities had done a lot of work (primarily as graduate theses) on desert soils but that it was, in his opinion, of little value to the GOE land reclamation efforts because the research was not oriented towards addressing the real problems or needs associated with land reclamation.

It is also apparent that the research efforts of NRC and the ASRT are leading to crop production campaigns involving recommendations for farm practices different from those developed by the ARC. The ARC Deputy Director for Extension expressed the strong view that such divergent views needed to be reconciled so that a common set of recommendations might be made to farmers.

Not only does there appear to be little coordination among the research organizations within the country, there is also little coordination within the donor community. Indeed, there appears to be little coordination of the support programs of a single donor, such as the U.S.

For example, the agricultural office of the USAID Mission in Cairo is supporting a series of major research projects primarily centered in the Ministry of Agriculture. The Education Office in USAID/Cairo is providing funds as well to universities and other agencies for research activities relating to agriculture. The extent to which there is coordination, if any, of these two efforts within the Mission is not apparent. Furthermore, the USAID Science and Technology Bureau in Washington is supporting other programs, more or less independent of the Cairo Office. There are still other USAID funded research programs carried out by U.S. universities through the Title XII program. In addition to all of these efforts, there is a major research program with substantive agricultural content funded by U.S. PL 480 funds that is programatically and administratively independent of the agricultural programs of the USAID Mission in Cairo. The U.S. also provides approximately 25 percent of the funding of the International Agricultural Research Centers, several of which have activities in Egypt.

In raising this issue, we are not suggesting that the research conducted through these different programs is of little value or potential usefulness. We are merely suggesting that the returns from all of these research activities could be significantly increased if the various efforts were better coordinated and oriented toward some better defined national goals and objectives.

5. Strengthening and improving the Effectiveness of Agricultural Research

A. National Research Planning, Establishment of Priorities and Coordination of Research Effort.

For many reasons there is need for careful, comprehensive, and continuing planning of the national research effort. The vital role which agricultural research must play in the development of the agricultural sector and the great importance of agriculture to the nation's economy point to the need for such planning. The fact that research is expensive and may take years to complete emphasizes all the more the need for careful planning to try to maximize the returns from such efforts.

One function of the planning effort would involve establishing research priorities that would be consistent with the development goals and overall needs of the country. However, research should not only be used to support established national policy goals or objectives, it should also serve to provide needed information for the formulation of new or revised objectives. For example, research is needed in agricultural development planning to provide an assessment of the technical and economic feasibility of development projects such as those dealing with large scale land reclamation.

National research planning and the establishment of priorities is desirable and needed from another standpoint. Information in Chapter 4 points to the fact that many different organizations in Egypt are involved in carrying out

agricultural research, and many more organizations, nations, and multinational groups are providing financial support for research in the country. There is little evidence, however, of coordination of either research effort or donor support.

Although we would not suggest that some organization or group attempt to direct or dictate the nature of either the research efforts or donor support, we believe that appropriate national research planning can contribute to a framework within which both the research organizations and donors can, in a complementary manner, focus their efforts on high priority national objectives, with a minimum of unnecessary duplication and overlapping.

To achieve such an objective, we recommend that a high level council or other appropriate body be charged with continuing responsibility for identifying broad areas of agricultural research needs and establishing priorities for the conduct of such research to address these needs. Such a body should include the leadership of the major organizations concerned with agricultural research in the country, including the ARC of the Ministry of Agriculture, the Water Research Center (WRC) of the Ministry of Irrigation, the Ministry of Housing Development and Land Reclamation, the National Research Center, agricultural faculties of universities, the Academy for Scientific Research and Development, and any other major research entity. The Ministry of Planning or the National Planning Council might also be represented.

The body charged with this responsibility would be expected to meet periodically (at least annually) to receive progress reports on research activities, to review newly emerging problems or needs, and to consider how research programs might need to be modified or redirected to address changing needs.

To carry out this planning function we recommend the creation of something like the National (or Supreme) Council on Agricultural Research under the chairmanship of the Minister of Agriculture.

The type of broad representation on such a council would facilitate a thorough consideration of an overall research plan, including specific priorities, to address the needs of the country. The Council could also consider ways and means of implementing such a plan, taking into account the resources and capabilities of each organization having a research function. Possible sources of donor support could be identified for specific parts of a total program. In fact major donors might be invited to participate in the planning process. With all research entities present on the Council, there would be the opportunity to reach broad general agreement concerning segments of a total program each organization might assume.

Although the ARC, as the major agricultural research organization in the country, would be expected to have the primary role in the implementation of whatever plan might

evolve, other organizations have significant capabilities and, in fact, specific responsibilities. The MOI, for example, has major programs in irrigation and water management which need to be an integral part of an overall national research program. The land reclamation ministry has specific responsibility for research relating to new land development, and this work needs to be carefully integrated with that of the ARC. The universities and the NRC clearly have scientific manpower and other resources which can make significant contributions to a national research effort, and these resources should be used.

The National (Supreme) Council on Agricultural Research could provide the vehicle for considering how all of these efforts could be appropriately integrated in support of a mutually agreed upon national plan. Furthermore, as suggested earlier, such a council might also provide the vehicle for better focusing donor assistance on important national goals and needs. It should also provide a framework within which such multinational groups as the International Agricultural Research Centers could focus their efforts within the country.

Such a planning process would facilitate better coordination of the support provided by a single donor such as the United States. As indicated in Chapter 4, there are many segments of the total USAID organization providing support for agricultural research in Egypt--with what would appear to be little or no coordination among the various entities.

Furthermore, the significant research carried out under the PL 480 program in Egypt would appear to be essentially independent of the USAID development assistance effort.

Our Team strongly recommends that appropriate mechanisms be developed to achieve better coordination of the total resources made available by the U.S. Government in support of agricultural research activities in Egypt. It would seem logical for this to be done through the Agricultural Division of the USAID Mission in Egypt which represents the principal point of contact between the U.S. Government and the GOE on matters relating to assistance for agricultural research.

The type of research planning proposed should facilitate a better coordinated and more sharply focused program of development assistance for research by the U.S. and other bilateral donors as well as multilateral support organizations such as the World Bank.

B The Development of National Interdisciplinary
Research Programs

We recommend that much of the agricultural research of the country be organized into comprehensive, interdisciplinary research programs which are truly national in scope and character. These programs would be concerned with the improvement of specific crops or animals or with such problem oriented issues as soil and water management or cropping intensification.

National multidisciplinary research programs of this nature have been found to be the most effective way to apply research resources to remove or minimize constraints to agricultural growth and to furnish a continuing flow of new technology to increase productivity. Such programs have been a major factor in the growth of agriculture in the United States from the early years of this century. They have also provided the basis for the significant achievements and contributions of the International Agricultural Research Centers.

1. Concept

The concept of the proposed national programs involves bringing together from many different disciplines the scientific personnel to work as a team in addressing the problems or constraints which, for example, might limit the production of a crop. Many of these problems are interrelated and must receive simultaneous attention from several disciplines.

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Different strains or varieties of a crop may respond differently to varying fertility levels. Hence, the plant breeder needs to work closely with the person doing soil fertility research. Similarly the entomologist and plant pathologist need to work closely with the plant breeder to evaluate possible disease and insects resistance of breeding material. There is a comparable need for close relationships among the various disciplines working with animals.

2. Objective

The ultimate goal of such interdisciplinary work is to develop a set or "package" of production practices (including recommended varieties, fertilization and cultural practices, disease, insect and weed control, etc.). Such practices should provide the basis for substantially improving the yields of a crop or improving management practices leading to more efficient water management, cropping intensification or whatever the objective of the research might be. Such a "package" of recommended practices would incorporate the improved technology developed through a well-integrated research approach.

3. Organization of Teams

In view of the leadership role the ARC has been given for agricultural research we recommend that the Center be given the responsibility for organizing the national interdisciplinary research programs. We further recommend, however, that in both planning and executing these national research programs the ARC involve other organizations which have an

interest in and capability of contributing to these programs.

In organizing and carrying out such research programs, it may be helpful to have an advisory body or council made up not only of representatives of the organizations other than ARC involved in research, but also individuals or groups representing the "users" of the information generated by research. Such an advisory body can be extremely helpful in identifying major problems which need research attention and can, therefore, help to assure the relevancy of such research. Furthermore, each interdisciplinary research team should have as active participants appropriate extension subject matter specialists and program leaders. Such extension personnel serve two needs:

- To help identify the major problems needing research attention;
- To maintain close contact with the research effort so that extension personnel are fully aware of what is being done and can be ready, at the appropriate time to take the research results and help "extend" them to the field for farmer use.

This extension function will be discussed in greater detail in the next chapter.

The interdisciplinary teams will be made up of research and extension personnel from all the disciplines required to address the set of problems or issues needing attention in a given program.

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In addition to representation from the technical fields, there should also be provisions for participation of economists or socioeconomists in interdisciplinary teams. Such specialists may be required as members of national teams, some of whom might function at a regional station to give attention to economic and social factors important to the region.

Each national program will be executed through a series of projects, planned and conducted by scientists in the ARC Institutes or in one of the cooperating organizations. A project is, thus, a component part of a program. It represents a more detailed statement of the work to be done by one or more of the scientists. For example a National Rice Improvement Program may include a number of projects dealing with such concerns as variety improvement, fertilization, disease control, insect control, weed control, etc.

(See Annex 3 for a more detailed statement of the proposed organization and function of national programs.)

4. Composition and Leadership of Teams

Most of the research team members for a given national program would likely come from within the ARC. However, we would encourage the involvement of personnel from other ministries (especially Irrigation and Land Reclamation) on programs relevant to those ministries, as well as from universities, the NRC and possibly other organizations. The important consideration should be to try to use research personnel who have an interest and the ability to contribute to a given program, irrespective of their organizational

affiliation. Their individual efforts would be integrated into a single well coordinated program.

One team member would be designated as leader or coordinator and it would be his or her responsibility to give general programatic and administrative direction to the effort. This should be a capable and respected scientist who is aware of the nature and scope of problems in a given program area and who appreciates the significance of the several complementary scientific disciplines necessary to address them.

Because of the size and scope of the ARC responsibility, it is likely that most program leaders would come from the ranks of that organization. However, if someone from one of the cooperating organizations was uniquely qualified to provide leadership to a given program, such an appointment should be considered. For example, the leader for a national program on soil and water management might well come from MOI in view of the major responsibilities of that Ministry in this program area.

5. Program Budget

Each national program would be assigned a specific budget under the administrative control of the program leader. The program budget would include support for salary incentives, operating expenses, equipment, training and other needs associated with the program. Base salaries along with support for maintenance of buildings, utilities, normal farm operations, etc., would be provided in the budgets of the ARC institutes

and research stations. The cooperating ministries, universities or other research entities would provide similar support for personnel from their respective organizations.

6. Evaluation and Planning

The members of national program teams should meet at least annually (and more often if needed) to evaluate progress and develop plans for the future. If there is an advisory body for the program, this group should also meet at least annually to receive a report on progress and to make suggestions for future action.

7. Nature of Proposed Programs

a. Major National Programs

The leadership of the ARC has recently proposed to organize the following 16 national research programs.

- The National Cotton Improvement Program
- The National Maize and Sorghum Improvement Program
- The National Wheat and Barley Improvement Program
- The National Rice Improvement Program
- The National Sugar Crops Improvement Program
- The National Forages and Legumes Improvement Program
- The National Fruits Improvement Program
- The National Vegetables Improvement Program
- The National Soil Improvement and Fertility Program
- The National Agricultural Systems and Crop Intensification Program
- The National Program for Adaptive Mechanization
- The National Program for Egyptian Buffalo Improvement
- The National Program for Cattle and Milk Production Improvement
- The National Program for Poultry Improvement
- The National Program for Sheep and Goat Improvement

We believe this is a reasonable list of possible national programs. Such a list, however, does not suggest which might receive priority attention. One would expect the size of the proposed programs to differ greatly, depending on the importance of the effort and the scope of the work.

The Team suggests that consideration should be given to another major national program dealing with soil and water management. This could embrace many issues of concern not only to the MOA but also to the Ministries of Irrigation and Land Reclamation.

Because of their increasing significance and potential, consideration might also be given to organizing separate national programs for some of the more important horticultural crops such as citrus and tomatoes.

b. Special Studies

We fully agree that a very high percentage of the total research effort should be oriented toward the type of applied or mission oriented work suggested by the proposed national programs. However, there is the ability and potential within the research organizations in Egypt to carry on some more basic research which might ultimately be of substantial significance to the country.

To facilitate a limited amount of such work (perhaps no more than 5 to 10 percent of the total) we suggest the creation of a National Program of Special Studies which could be organized, funded and managed like the other national programs. Such investigations, however,

might or might not be of an interdisciplinary nature and could cover a wide range of problems or research interests. The individual investigations would be grouped together for ease of administration within the framework of the proposed national program structure.

c. Rural Development

We recommend that consideration be given to establishing a broad-based, interdisciplinary research and extension program dealing with the overall economic and social development of the rural areas of Egypt. Such a program would go beyond the concerns of individual commodities and production problems to address development issues more broadly--many of which impact agriculture.

Development in rural Egypt is dependent on agriculture and agricultural industries. The interdependence of increased agricultural productivity and an adequate infrastructure of farm to market roads, facilities for local cooperatives and the like is obvious. Perhaps less obvious but quite as essential is the need for a well-nourished, healthy and literate population forming the human resource base.

Factors contributing to increased complexity and importance of rural development include the reduced labor pool through the outflow of labor to oil producing countries and the increased length of schooling for children; the continued population growth although at a reduced rate; and growing expectations of villagers

for increased income and increased consumer goods. Stemming the tide of crowding into the cities is of concern and rural and new land development are essential to accomplishing that.

Research related to rural development is fragmented, limited in scope, design, and consequent usefulness. A number of Ministries and donor agencies have programs associated with resettlement and settlement of new lands, health and nutrition, income generating projects, housing alternative energy sources, and so on. Research, or at least baseline data, may be gathered in relation to various projects, but reports of the findings are often difficult to locate.

A research base is needed for decisions on land use in terms of agriculture, rural development, and/or new cities. The lack of cost/benefit analyses limits the effectiveness of policy makers.

The Organization for the Reconstruction and Development of the Egyptian Village (ORDEV) is charged with implementing the GOE program of economic and social development of rural villages, and it is further charged with collaboration with ministries, governorates, local governmental units and all agencies concerned with Egyptian villages. Case studies of Local Development Fund (the lending institution) are available and major financing projects include poultry raising.

production, animal production, aquaculture, agriculture, agricultural equipment, food processing, transportation, and other small industries. Loans are made to the Popular Councils in non-urban governorates and thus priorities are supposed to be decentrally set.

A Policy Steering Committee involves five GOE/USAID decentralization activities including Development Decentralization I (DD I), Basic Village Services (BVS), Decentralization Support Fund (DSF), Neighborhood Urban Services (NUS), and Provincial Cities Development (PCD). "The Steering Committee is charged with the direction of the entire program. The Committee will be assisted by a technical unit which will monitor the activities in the sector and collect data for periodic assessments."

The loan program is the major component of the Development Decentralization effort (DD I) and the funding is primarily from USAID. The working relationships with MOA research and extension (if any) are not clear. Recently a local consultant has been employed for an applied research/evaluation of best breeds of chickens suitable for Egypt. The mid-project evaluation of DD I recommended topics for further research, some of which seem central to questions related to agricultural and rural development. One recommendation was for a study of rural credit to place major focus on Egypt. Another important suggestion was the use of the accessible data base for "intensive research on production, financing, marketing, etc.

Programs and projects supported by USAID which relate to the social and economic development of villages abound. The project oversight is located in several units of USAID and the complexity of the projects plus the staff workload means that even internal to AID the knowledge of various projects much less any integrated effort is very difficult.

Further, other donor assistance such as UNDP, Ford Foundation, and PVO's such as Catholic Relief Services and Coptic Evangelical Social Services all have programs and projects directed toward the aim of rural and agricultural development.

The National Research Center project, "More and Better Food," aims to contribute to increased productivity in the Egyptian rural community; to provide highly profitable projects for farmers; and to provide more animal protein on the village level.

The project is limited in extent and could benefit from systematic evaluation.

The extension organization in MOA has a rural community research section and included in the five year plan are studies of rural leadership development in various agricultural areas (duration three years from 1984/85), and an explanatory study for determining suitable Egyptian rural communities development approaches.

In light of these observations we recommend the following:

- that ORDEV sharpen its collaborative responsibilities, including MOA to lessen the fragmented efforts of economic and social development of rural villages;
- that national campaigns for increased agricultural production be carefully evaluated for potential impacts on rural development; and
- that the research base for rural development be increased within ARC in terms of scope and applicability for the purpose of undergirding the proposed National Rural Development Research and Extension Program.

8. Research Emphasis or Priorities

Our Team has not attempted to provide an assessment of needed research emphasis or priorities. We have suggested in an earlier section a possible mechanism or process by which the GOE might establish such priorities. We would like to comment, however, on some policy issues that might relate to priorities for research.

(a) Land Reclamation

The SAAD Mission in 1982 suggested that higher priority should be given to vertical expansion of agricultural production on existing arable land than to horizontal expansion on new lands. Our Team has not considered this issue further; however, we would make some observations with regard to research implications relating to this issue.

It is obvious that the GOE plans to continue its horizontal expansion efforts through land reclamation programs. Given this fact, it is important that research be undertaken to provide the knowledge needed to guide such efforts so that they can be made as successful and productive as possible.

We would again emphasize a concern expressed by the SAAD Mission. From all indications there have been major land reclamation projects undertaken with little or no research information to guide these efforts and to suggest the nature of cropping patterns and management practices for a given set of conditions. Such on-site research should begin several years before a major development project is undertaken.

In this regard we would question what appears to be the division of responsibilities for research relating to new lands development. We understand such research is the responsibility of the Ministry of Housing, Development and Land Reclamation until the project is completed--at which time continuing responsibility is turned over to the ARC.

From many standpoints it would appear desirable for the ARC to have this responsibility from the very beginning rather than the sort of divided responsibility which exists. Even without this responsibility on specific development sites, we would encourage the ARC to intensify its research on problems relating to desert land management under irrigated conditions to help provide information for future reclamation efforts.

(b) Animal Research

Egypt has the largest concentration of animals per unit of arable land of any country in the world. Given this high density of animals and the need to increase production of crops, the SAAD Mission and others have questioned whether the continued emphasis on animal production except, perhaps, for poultry and fish is desirable.

While logic might argue for a substantial reduction in the ratio of livestock to crop production, there is nothing to suggest that this will occur very rapidly--especially under current price and subsidy policies. Accordingly, as long as the large population of animals is maintained, research is needed to try to make animal operations

as productive and efficient as possible. Research with ruminants will meet a continuing need. We would, therefore, recommend the strengthening of animal programs to serve such an objective.

C. The Organization and Function of the Agricultural Research Center

President Mubarak's Decree Number 19 of 1983 sets forth a plan of organization for the ARC which has been discussed earlier in this report. The Minister of Agriculture and the leadership of the ARC have taken further steps to implement the Decree.

We concur with the basic elements of the reorganization plan, especially the manner in which the research and extension functions have been brought together within the Center and the proposed relationships between the Center Institutes in Cairo and the outlying research stations. We offer the following observations and recommendations concerning the organization and function of ARC:

1. The Name of the Center

Although we do not consider this a major problem, we believe it would be appropriate and desirable to recognize explicitly the extension function in the name of the Center, perhaps with a designation of Agricultural Research and Extension Center (AREC). We recognize the close relationship which should exist between the research and extension activities and can understand the rationale for the name currently used. However, elsewhere in the world, extension is generally recognized as a separate function at a level equal to research in terms of organizational structure. We detect some concern or sensitivity among extension personnel,

feeling that they are considered as being something less than equal partners with research in the ARC. A recognition of the extension function in the name of the Center should be helpful in terms of relations between the two groups as well as being more descriptive of the functions involved.

2. Organization of Central Administration in ARC

The leadership of the ARC is vested in the Director and three Deputy Directors, one each for research and extension and a third for production and research stations. We are concerned that this organizational structure divides the responsibility for research between two deputies while serving little purpose in placing the research station and production responsibilities under a single deputy.

We recommend that there be deputies for research, for extension and for production, with each deputy having responsibility for one of the three functions. The integration or coordination of these three functions would be the responsibility of the Director of ARC. Since the institute directors and research center directors would have at least two and sometimes all three functions under their jurisdiction, they would have responsibility for coordination of the functions at their respective levels of operation.

3. Organization and Function of the Institutes

We do not suggest major changes in the organization of the Institutes. As proposed in an earlier section, most institute personnel would carry on their research as members

of interdisciplinary teams in one or more national research programs. With such a system, there would be logic in having all research personnel organized into discipline-oriented institutes--rather than the mixture of discipline and commodity-related units that now exists. However, such a reorganization, while possibly desirable, is not essential to the successful operation of national interdisciplinary programs where personnel can be drawn from the present commodity and disciplinary units as appropriate.

Budgets for base salaries (not including incentives), building maintenance, utilities, and other general support would be provided each institute. Budgets for the national programs would be allocated to the program leaders and would not be included in the institute budgets.

We suggest the following minor adjustment in the organization and function of the institutes:

- (a) Weed control The weed control unit now located in the Plant Protection Institute appears to be relatively weak and needs substantial strengthening. Some believe it is strongly subordinated to entomology in the institute and needs to be organized as a separate institute. If the unit cannot be strengthened within the Plant Protection Institute, perhaps it does need to be made a separate institute. By one means or another, however, it should be strengthened.

- (b) Agricultural Economics and Sociology The relatively small number of professional personnel in the Institute of Agricultural Economics appears to reflect an imbalance with the relatively large numbers of technical personnel in other institutes throughout the center. This small number seems to be reflected in what would appear to be little input of agricultural economists into interdisciplinary research programs or to farm management studies and feasibility analyses of research results and recommended practices which should be a part of a total agricultural research and extension effort. There also seems to be a dearth, if not a virtual void, in input and involvement of rural sociologists in the research effort of the ARC.

We recommend that a careful review be made of the adequacy of agricultural economics and rural sociology work within ARC and that consideration be given to strengthening these program areas.

- (c) Agricultural Mechanization Research Institute (AMRI)
- Funds should be provided for staff and facilities development of the newly established Agricultural Mechanization Research Institute to enable it to participate more fully in the research, training and extension activities of the national interdisciplinary research programs. The initial stage of the development of the AMRI would involve the "institutionalization" of the staff and activities of the Farm Mechanization Project.

4. Research Stations

The Team endorses the proposal by the ARC administration to organize the 31 outlying research units into 7 regional groupings, with one unit designated as the regional headquarters center. We believe the regional centers, with their affiliated units, can provide an essential network of research stations, strategically located throughout the country, to support the series of national interdisciplinary research, extension, and training programs proposed herein.

To serve this purpose, however, these stations must be substantially upgraded in terms of land leveling and drainage, facilities, laboratories, machinery and equipment, housing, etc. These needs will be summarized in a following section. Furthermore, we believe there should be a much higher proportion of the ARC staff located at these stations than now is the case. Accordingly efforts should be made to make living and working conditions as attractive as possible on the stations so that more scientists might be willing to be stationed there. This may require development of housing, health care, educational and recreational facilities for the professional and technical/support personnel. Such investments may be most worthwhile if they would help to attract and retain research and support personnel to the locations where more of the research should be done.

We would recommend one departure from the proposed regional grouping of research stations. As indicated above

we believe far too high a proportion of research personnel are living in Cairo in relation to the number at the regional stations. We say this for two reasons: First, more of the research needs to be done in the different agroecological zones of the country represented by the regional stations. Secondly, land for experimental purposes is extremely limited in the Giza area near the headquarters of the institutes. Hence, the amount of field work which can be carried out there is seriously constrained.

As desirable as it might be, we recognize the difficulty of getting large numbers of research personnel to move from Cairo to the outlying stations. However, it should be possible to provide more land for Cairo-based personnel by using stations in the vicinity as field units of the centrally-located staff of the ARC Institutes.

Accordingly, instead of designating Bahtim as one of the regional headquarters centers, as proposed by the ARC leadership, we recommend that the stations at Bahtim, Kanater and Fayoum be considered field units of what might be considered a national research center--available for use by the Cairo-based staff of the ARC Institutes. All three of these stations are within commuting distance of Cairo for daily activities.

The research done at these stations would also serve the needs of the South and East Delta Region. In addition to research related to this region, however, land could also be available to personnel in the Cairo area for other work that did not have to be conducted in one of the more distant research

locations. Since the staff could have access to laboratories at ARC headquarters in Giza, the need for laboratory facilities at the three stations in the Cairo area would be limited.

The major research efforts--those requiring highly trained scientists and costly specialized equipment--should be carried out at the regional research centers and at the national center in the Cairo area. The regional centers should have a full complement of multidisciplinary staff to permit work on all the major commodities and problems within the region.

Careful consideration needs to be given to the role and function of the research units other than the primary center or station in each region. If these units are required for the research program, they should be upgraded to enable them to perform the needed functions. If they are not essential for the research program they should be modified to serve as testing farms, demonstration and training units, or for seed production.

Investment in facilities should be coordinated with research program needs for the various stations. Laboratories should be designed for the numbers and research disciplines of the staff from multidisciplinary teams as well as for special research to serve the types of farming in the region.

6. Support Functions

There is a pervasive need to strengthen the support/technical services of ARC. Administrative services such as library, statistical services, service laboratories,

building and grounds, operation and maintenance, machinery and equipment servicing and maintenance, purchasing and inventory control, personnel records, payroll, etc., all need to be organized and performed by professionally competent personnel. In a similar fashion the management and operation of the experimental fields and livestock research units calls for a high level of managerial ability, an adequate complement of equipment, facilities and supplies and a cadre of dedicated, well-trained technicians who understand the importance of their tasks vis-a-vis the research and training work being conducted.

It is suggested, therefore, that funds be provided to conduct a broadly based series of pre-service and in-service training activities of field and laboratory technicians, machinery operators and maintenance personnel, supervisory staff, business and administrative services staff, et al. Such training programs should emphasize "hands on" development of skills, attitudes and work habits and should be explicitly focused on program-related functions and needs.

We further recommend that every possible effort be made to consolidate or integrate research support facilities and functions so that each national program or project does not have to establish and maintain separate support functions at each research center. One service laboratory for routine soil, water and plant analyses at each research center should be sufficient to serve all programs involved there. Considerations should also be given to setting up service laboratories,

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involving even more sophisticated work than routine soil and plant analysis, if such a service might be needed by more than one program. In other words, every effort should be made to avoid unnecessary duplication of expensive laboratories when needs can be met by sharing such facilities.

In view of the wide-range of analytical services offered by the National Research Center, we recommend that the scientists at ARC fully explore the use of research services and their relative cost before setting up duplicating programs.

There should be a farm operations unit at each station responsible for land leveling, land preparation, irrigation, cultivation, pest control and other general operations not specific to a given research program. The cost of such farm support operations should be considered a part of the overhead cost of operating the station, with the participating research program assuming the cost of any special treatment or efforts over and above the basic farming operations.

We also strongly recommend the development of a major national agricultural research library within ARC which could not only serve the needs of the Center but could be available for use by university personnel and others needing such facilities. Such a library located in Cairo could make available material to the outlying research stations by courier service or by more sophisticated devices such as electronic telecommunication systems. Pertinent periodicals and other limited reading materials would be maintained at the regional centers and stations.

We further recommend the establishment at the national center in Cairo of a laboratory instrument/equipment service and repair function. Such an operation would provide the ARC institutes and stations a badly needed service aimed at helping keep laboratory equipment functional. This unit could also conduct training programs in the operation and maintenance of scientific equipment. The feasibility of using the facilities and programs of the NRC for this important function should be considered before developing such operations within the ARC.

7. Institutionalizing Work of Projects

Earlier Missions (BIFAD/Extension and SAAD) have emphasized the need to institutionalize the research and extension efforts associated with major USAID funded projects such as ADS, EMCIP, Rice Research and Training, EWUP and others. The earlier Missions have observed that while these projects have served very useful purposes in demonstrating some of the production potentials through the work of well organized interdisciplinary research and extension teams, they have done little to strengthen the nation's basic institutions for research and extension. In fact, to the contrary, the projects have apparently weakened the organizations by taking away some of the better personnel for project activities.

The Team concurs with the assessments of earlier Missions and is delighted to see the commitments by both USAID and MOA

to move from the project format for financing and carrying out these activities to incorporating them into the basic research and extension organizations. We believe that in the long run this will not only enable the country to achieve the short range programmatic objective of these efforts, but they should also contribute to developing stronger, self sustaining research and extension institutions for the long-term future.

As the projects are terminated, we would urge that every effort be made to incorporate the project staff and activities into the corresponding national programs proposed herein. The trained project personnel and their experience can make very valuable contributions to the proposed national programs.

8. Production Farms

Although the production farms are not a part of the research program, they are a responsibility of the ARC. Furthermore, they complement the research program by providing land for research and by producing foundation and registered seed along with foundation animals. In addition the resources of the production farms have the potential to be used more effectively in advancing the agricultural development objectives of the country. These are the reasons we address the Production Farms issue in this report.

(a) Recommended upgrading

At the present, the Production Farms are falling far short of reaching their potential. We are told that yields on these farms are less than one-half those of the average

farmer in the area. Such low productivity becomes particularly serious when these low yields represent production of improved varieties being grown for seed. An earlier section addressed some of the possible reasons for the low yields. We recommend that steps be taken to upgrade the production farms so that they could, in fact, serve as demonstrations of the best farming and livestock production practices available rather than as examples of what not to do.

Specifically, steps should be taken to provide whatever land leveling and drainage is necessary. Adequate machinery and equipment is needed to allow farming operations to be carried out in a timely manner. Furthermore, adequate operating funds should be provided to make possible the use of recommended practices (fertilizers, pesticides, etc.).

We suggest that consideration be given to the establishment of a revolving fund sufficiently large to facilitate the efficient operation of the farms--with the fund to be replenished each year by the sale of commodities from the farm. Revenues in excess of the amount to replenish the revolving fund could be returned to the national treasury or could be designated for some specific purpose--such as a special fund for further strengthening the agricultural research program.

(b) Priorities for use of Production Farms

In considering the future use of the Production Farms, we recommend the following:

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- That first priority be given to the needs of the agricultural research program. Adequate land to meet the total research requirements--now and for the immediate future--should be assigned to and placed under the control and management of the Deputy Director for Research of ARC.
- That second priority be given to the needs of the extension program for field demonstrations. Because of the closeness of the research and extension program and the fact that many of the research station personnel will likely hold joint-research-extension appointments, the land for extension demonstrations might be included in that set aside for research.
- That third priority be given to the production of foundation and registered seed and for the propagation of improved stocks of trees as well as animal germ plasm.
- We recommend that land not needed to meet the above Priorities could be used initially for certified seed production. However, in the long run, we believe the private sector (individual farmers or private companies) should be encouraged to produce most of the certified seed needs of the country. Whenever land in production farms is no longer needed for either of the above three priorities or for seed production, we recommend it be sold to private farmers.

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(c) Price Policies

For as long as the production farms are involved in producing seed and other germ plasm, they should not sell their products below what might be considered a fair market price. To do so could discourage private sector producers. The price of seed, nursery stocks and breeding animals should be set at a level to permit the farms to operate on a self sustaining basis and to permit a reasonable return to private sector producers who must compete with the farmers.

(d) Seed Production Department

Considering the major seed production responsibilities of the Production Farms, we recommend that consideration be given to transferring the Seed Production Department from within the MOA to the ARC. Located administratively under the Deputy Director for Production, the Department, with its quality control functions, could effectively complement the seed production activities of the Production Farms.

(e) Consolidation of Productive Functions

The Team's review of ARC programs reveals a number of production and service functions intermingled with research activities. The Horticultural Research Institute, for example, is involved in producing vegetable seed for sale to farmers. The Serum and Vaccines Research Institute has a major responsibility for the production and sale of vaccines. The Animal Production Research Institute is producing eggs and baby chicks as well as bulls and rams for sale to farmers as a means of disseminating improved germ plasm.

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These are all important functions, but one examining the budgets and numbers of personnel in these programs gets a very distorted view of the magnitude of the research programs. Furthermore, these production functions are quite different from research, they involve different types of administration and management functions and often require personnel with different levels of training than researchers. For many reasons, we believe that, to the extent possible, these production and services functions should be identified, budgeted and accounted for separately and apart from research activities and included along with other commercial operations such as field crop seed production in the Production Division of ARC.

The organization of the ARC into the three functional divisions should facilitate this separation and grouping of responsibilities. With such a separation, the Deputy Director for Research would be responsible for only research activities in ARC. The Deputy Director for Production, on the other hand, would have the responsibility for all the services or production functions within the ARC involving the sale of goods and services--except those crops or animals which are incidental products of the research program itself.

The production functions may still be carried out in the institutes where they are now located. If a person is involved in both research and production functions, as in the Serums and Vaccines Institute, he or she would hold joint research-production appointments just as other personnel in the ARC

may hold joint research-extension appointments. For that portion of a person's time devoted to research he would be budgeted from, and held accountable to, the research program in ARC. For that portion devoted to production, he would be budgeted from and held accountable to, the production program.

6. Strengthening and Improving the Effectiveness of Agricultural Extension

Our Team has been charged with the primary task of recommending actions to strengthen the agricultural research system. However, it is readily apparent that such efforts may be relatively unproductive unless there is a major strengthening of agricultural extension programs as well.

An improved research program offers great promise for substantial medium-to-long-range contributions to agricultural development in Egypt. A strengthened extension program is essential for such medium-to-long-term agricultural improvement, but it also offers the promise of significant short-range improvements as well. In fact, it will be difficult to achieve, in the immediate future, the badly needed expansion in agricultural productivity unless major changes and improvements are made in agricultural extension.

The problems and weaknesses of the current extension program were discussed in detail in the BIFAD team report of November 1981 and the SAAD Mission report of 1982.^{1/} They are further summarized in an earlier section of the current report. Significant steps were taken to provide the basis for improving the situation through Ministerial and Presidential Decrees referred to earlier. However, further action is greatly needed to make these decrees meaningful in terms of achieving the desired goals of a significantly

^{1/} Ibid.

strengthened extension program for Egypt. Major action is needed at two levels:

- In developing a unified system of extension that reaches from the national to the village level.
- In developing a strong corps of subject matter specialists, closely aligned with research personnel, who can give program leadership to extension throughout the country.

A. A Unified Program

It should be recognized that the extension function should be a national program which reaches from its interface with research at the national and regional levels down to and through village level personnel to the farmer. Therefore, to be most effective, extension should be organized and operated as a single, well coordinated program-- not the several separate and discrete administrative and program units which now exist. Accordingly field extension personnel should be linked administratively, programatically, and budgetarily with the national extension office and be made an integral part of a total national program. We believe the development of such a well integrated national program of extension is essential to the success of the national production campaigns discussed later in the report.

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The process of generating new technology and getting it used by farmers should be a continuum, reaching, uninterrupted, from the researcher to the farmer or other user of new technology. The ARC reorganization, which brings the research and extension functions together at the national level, recognizes the need for close interaction between the two. Yet the relatively small national extension office, with its limited responsibility for field programs, does not appear to have the authority or capacity to give appropriate leadership to a national extension program.

Just as the outlying research stations represent an extension of the research program from the national-level ARC institutes in Cairo throughout the country, so should field extension personnel represent the projection of the national extension program to various parts of the country. It would obviously be unsatisfactory to have outlying research stations separated administratively and programatically from the national ARC institutes in Cairo. We believe it is equally unsatisfactory to have field programs of extension separated administratively and programatically from the national office of extension.

We are aware of the commitment by the GOE to decentralize many government functions and, in general, strongly support the concept. However, we recognize that certain highly inter-related functions, elements of which may be carried out in the field, (e.g., the agricultural research program of ARC), should not be decentralized by putting elements of the program

under local government without appropriate linkages or mechanisms for coordination. For reasons indicated above, we believe extension, along with research, falls into such a category.

The proposed reorganization is not made so much an effort to "centralize" as it is to coordinate activities for more effective delivery of programs and services to farmers throughout the country. Furthermore, and very importantly, the proposed reorganization will establish channels of communication and influence from the farmers directly to the programs, including research, at the regional and national level which may impact farmers' operations. Such proposed linkages will make it possible for farmers and village officials to communicate through the extension organization the nature of the problems they are facing as the first step toward resolving their difficulties.

It would appear that with the reorganization of ARC there is an appropriate structure in place to effect needed change by putting extension in a parallel position to research in terms of its relationship between its national offices and field programs.

To implement the proposed changes, we recommend that personnel currently considered to be primarily involved with extension (as opposed to regulatory functions), at the governorate, district and village levels be identified and placed administratively and budgetarily under the office of the Deputy Director of ARC for Extension. Such a change

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would leave many other agricultural personnel in place to carry out regulatory and service functions at the local level now being performed, in part, by extension personnel.

The field extension personnel, while administratively responsible to the national office for extension, would continue to function in a close, cooperative relationship with officials and programs at the local level (governorate, district and village). The proposed change should make it possible to develop a significantly improved extension program to serve the needs of the governorates. Local government officials should welcome such a change since it should significantly improve the agriculture of their areas as well as provide a much improved channel of communication to influence national programs.

Such a change along with appropriate training of field extension personnel could contribute much to strengthening this part of the overall extension effort. However, major attention must be directed to another segment of this extension program as well.

B. Subject Matter Specialists

The extension service cannot be expected to improve its image and effectiveness unless it is substantially upgraded in terms of its training and level of technical competence. One of the greatest deficiencies of the present program is the virtual void with respect to subject matter specialists and program leaders. Such specialists must play extremely important roles in taking improved technology and developing

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effective means of interpreting it in such a manner that extension field personnel can understand it and, in turn, help farmers get it applied. Such extension specialists should have training equal to their research counterparts if they are to be most effective.

The virtual absence of such specialists results in extension field personnel either not receiving needed information concerning improved technology or, as frequently happens, receiving disjointed, incomplete or even conflicting and contradictory information. Except in special projects, there would appear to be few well organized extension programs being made available to field personnel to serve as a basis for their efforts at the local level.

We believe, therefore, that highest priority must be given to developing a strong corps of extension program leaders and subject matter specialists.

Fortunately the basis for the rapid development of such a group of extension leaders and subject matter specialists is already in place as a result of Presidential Decree 19 of January 1983. The concept embodied in this Decree now needs to be fully implemented. In view of the relatively large number of research personnel now in the ARC and the virtual absence of program leaders and subject matter specialists in extension, we believe it is most appropriate for a significant portion of the current research personnels' efforts to be reoriented towards extension, as the Decree mandates.

This division of time should be worked out on an individual basis, and extension responsibilities should be made an integral part of each person's job description. Such a division of responsibilities should also be reflected in budgets for research and extension. For example, research staff members who plan to devote 30 percent of their time to extension should have 30 percent of their salaries in the extension budget. Furthermore, the extension budget should include support funds, including incentives, for that portion of a person's time devoted to extension.

Salary and support funding should be tied fully to the functional responsibility. For example, if personnel with divided research-extension responsibilities were paid completely from the research budget (as they now are), they would less likely feel a responsibility for the extension function than if they were supported in part from extension funds. Personnel with divided responsibilities should be evaluated on their performance in each functional area.

Within the context of the above discussion, we propose the establishment of the following categories of extension subject matter leaders and specialists:

- The director of each ARC institute would be recognized as having an extension as well as a research leadership function and would receive a portion of his salary and support from extension. Similarly the director of each research center should be recognized as having a responsibility for extension as well as research at his center.

- National extension program leaders would be appointed to provide leadership and guidance to a national extension program relating to each major research program area. This could be on a commodity, discipline or problem basis and could coincide with major program areas in research discussed elsewhere. For example, such national leaders would serve on the national interdisciplinary teams concerned with the improvement of rice, maize or other commodities. A person in this position would be concerned with giving leadership to the development of a national extension program, including the responsibility for leading and coordinating the work of other subject matter specialists in his or her area of responsibility.
- National subject matter specialists would function in all the major subject matter areas. For example, there would be a national extension program leader for cotton along with subject matter specialists in cotton diseases, insects, agronomic practices, varieties, etc. These specialists might be full or part time, depending upon the scope of work to be covered and the number of other personnel available to work in a given area. These specialists would be responsible for developing and providing national leadership for an extension program in their area of specialization. This would involve leading and coordinating the work of regional

specialists in their respective areas of responsibility. These specialists would be part of the appropriate ARC institute.

- Regional subject matter specialists would have extension subject matter responsibility for specialized areas within given regions of the country--coinciding with regions designated for the research program. They could devote full or part time to extension and would most likely be located at one of the major regional research centers discussed in Chapter 4. Some such specialists, where justified, might also be located at universities in association with faculties of agriculture. (It is important that whatever extension work is done by universities be carried out as a part of a unified national program.) Regional specialists would work closely with the governorate and district level agricultural programs and would be responsible for helping to train district and village level extension personnel.

C. Relationship with National Research Programs

It should be emphasized that extension subject matter specialists would be expected to work very closely with their research counterpart involved in the national interdisciplinary research programs. In fact, some of the researchers participating in national programs would also have extension responsibilities, providing the opportunity for the closest possible integration of research and extension efforts.

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The extension subject matter specialists would be charged with taking the results of research and developing recommendations for actions by farmers to achieve desired goals. In the case of research relating to crops or livestock the subject matter specialist would develop a well integrated package of practices, reflecting the best known technology, to enable the farmer to increase production or achieve other desired objectives. For example, such a package might involve an early maturing variety of rice or wheat that might not yield more than "standard" varieties, but would permit a more intensive cropping pattern--perhaps facilitating three rather than two crops annually.

These "packages" of improved practices would become the basis for major campaigns to increase production which shall be considered in the following Chapter.

D. The Role of Regional Centers and Regional Subject Matter Specialists

Although prior discussion has alluded to the role of the regional research centers in carrying out extension programs some more explicit comments may be in order.

Although the outlying stations and the newly designated regional centers are considered to be research installations, it is obvious that there is the opportunity and need to incorporate a strong extension dimension. They should not only be multidisciplinary but also multifunctional centers--having extension and, in some cases, production functions as well as research.

These centers will serve as the focal point for extension program development in each region. The regional subject matter specialists (who will likely be jointly employed in research) will be stationed there. These specialists will serve as the link between research and extension and the agricultural programs at the governorate and district levels. The specialists will also work throughout the region in which they are located, not only in training and providing subject matter guidance to village land agents, they will also be available to deal with technical problems or issues too complex for the local agents. These specialists will also help to identify problems which may require attention in the research programs.

The centers need to have the facilities required to carry out the extension function in the region. This would include housing and office space for specialists, training facilities for field agents, rooms or an auditorium for farmer meetings, a service laboratory to analyze farmers' soil samples to determine fertilizer recommendations, etc. The specialists at the center also need automobiles for work-related travel throughout the region.

E. Village-Level Extension Personnel

There must be a major effort to expand and improve the effectiveness of village-level extension personnel. It is estimated that there are approximately 2000 to 2200 village level agents now employed. There are approximately 5,000 villages in the country, many of which are not served by an extension agent.

Ministry of Agriculture officials^{1/} are advocating the placing of one extension agent in each of some 4000 villages throughout the country. The approximately 1000 villages which would not have an extension agent under this plan presumably would not have sufficient agriculture to justify an agent or they might be served by an agent located elsewhere.

At first such a proposal would appear to be reasonable and logical. However, considering the fact that the size of villages and the numbers of farmers in each may vary significantly, we suggest a modification of this approach.

We suggest that the objective might be to provide extension programs and services to every village needing such assistance. This may mean that in some cases one agent will have responsibility for more than one vilalge. In other cases, where the village is large and where the agriculture is particularly diverse, there may be need to have more than one extension agent serving a village. Instead of having a goal of one agent per village, a more appropriate objective might be to have one agent for a given number of farmers.

At any rate, we believe that first priority should be given to training and upgrading the support for currently employed agents before large numbers of additional agents are employed. With such training and with more adequate support, including means of transportation, a better evaluation can be made of the work capacities of the local extension

^{1/} Discussions with ARC Deputy Director El Rafie and others from the MOA.

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agents (the number of farmers or villages each might serve). With such experience, there can be a much better determination of the total number of village agents needed.

For the immediate future (e.g., the next five years), we suggest that priority attention be given to improving the capabilities of the present 2000 or so currently employed. When this is done, others could then be added if there is a demonstrated need.

F. A Major Training Effort

The desired upgrading of extension will require a major, sustained training effort, especially with village level personnel.

Current field or village level employees need to be given training in both subject matter as well as extension methodology, including the use of demonstrations and other techniques of extension education. There should also be similar pre-service training as new personnel are being employed.

Furthermore, when the results of national research programs are ready to be "extended" to the farmer--including the launching of major national campaigns--there must be intensive training of field personnel to prepare them to carry out such programs in their respective villages. Such training would be expected to be led by the national and/or regional extension specialists who have been working closely with the related research programs.

Much of the training of field personnel might be expected to take place at regional centers. The center at Sakha, for example, already has facilities for such training. There is a need for similar facilities at other regional centers.

The subject matter specialists coming from the ranks of research, should have adequate technical training in their respective fields. However, they should be provided some in-service training in extension philosophy and methodology, including such things as the preparation and use of visual aids, the use of mass media, demonstration techniques, etc. To assist in the training we recommend that expatriates who have functioned as extension specialists (perhaps one in crops and one in livestock) be invited to spend a period here in helping to train the personnel who are assuming subject matter specialists roles.

G. Local Advisor/Support Groups

In many countries, it has been helpful to organize local, village-level advisory groups made up of representatives of farm families and business leaders in the area. Such groups have been found not only to be helpful in advising the agents with regard to extension program needs and priorities, they have also provided assistance to the agents in various other ways.

For example, such groups might take the leadership in building or renovating facilities in the village for holding farmer training meetings. They might also provide financial

assistance to an agent for travel or even incentive pay to get a well qualified person to live and work in a given village.

Experience has shown that when local people are intimately involved in advising and supporting extension, they are inclined to take greater interest in the work and are more inclined to accept and implement the recommendations made by extension personnel.

We recommend that the concept of forming Village Extension Councils to perform the types of functions indicated be explored and possibly implemented.

7. National Production Campaigns

Following are excerpts from the SAAD Mission report of 1982:

"We recommend that interdisciplinary teams in research and extension be formed to organize and carry out well-integrated programs involving "packages" of technological practices aimed at increasing productivity of principal agricultural commodities. These programs would constitute the basis for major national campaigns aimed at increasing agricultural output (e.g. and All-Egypt Rice Program, etc.).

"Similar campaigns have been remarkably successful in other countries and could contribute to a "Green Revolution" in Egypt in a manner similar to what has occurred elsewhere. For example, wheat yields in the Punjab in India were doubled in five years, and Philippine rice yields were increased dramatically in a short time as a result of major production campaigns."

As a result of a major rice production campaign in Indonesia, that country, which until quite recently was the largest importer of rice in the world, became self sufficient in that basic food crop last year.

We concur with the recommendation of the SAAD Mission concerning the desirability of conducting major production campaigns. Furthermore, we believe actions taken by the GOE since the SAAD Mission, along with the recommendation set forth in our report, provide the basis to launch such campaigns aimed at substantially increasing production of important agricultural commodities, with the objective of helping to close the food security gap discussed in the SAAD report.

A. Research and Extension Leadership

We believe the implementation of the recommendations set forth herein would enable agricultural research and extension organizations in the country to provide the leadership for such efforts.

Specifically it is obvious that there are technological "packages" already available with several commodities which could provide a substantial basis for such campaigns. This has been demonstrated in some of the USAID financed projects carried out by the GOE. Furthermore, research programs will, continuously, be developing new technology to upgrade and improve these "packages" as campaigns proceed.

As indicated earlier, the ARC has proposed to organize 16 national research programs, involving all of the important crops and animals grown in the country. While this many national research programs can be carried out simultaneously. It would not be feasible to launch that many national campaigns at one time. We recommend, therefore, that only 5 or 6 national production campaigns be initiated at a time-- involving those commodities where increased production would be most important to the country, where there is an adequate technological base to support such campaigns, and where there is the likelihood of significant financial financial gains to the producer.

With such criteria in mind we would assume that priority might be given to some of the following: rice, wheat, maize, food legumes, oil crops, certain horticultural crops, and possibly sugar. We would caution against overproduction of commodities for a relatively thin and seasonal market. Finally we recognize that no campaign is likely to be successful if price policies are such that they serve as a disincentive to higher production. Cotton could well fall into such a category.

It should be recognized that while a few commodities at a time might be singled out for major campaigns, research efforts would continue with other commodities. However, emphasis by extension would not be as great with the others as with the campaign commodities.

B. Contributions by Others

Research and extension must provide the foundation or primary basis for national campaigns by developing, organizing and extending the "package" of technological practices needed to make a campaign successful. We should emphasize, however, that many other organizations and groups must contribute to such campaigns if they hope to be successful. The need for such support and input by others is evident by the fact that the farmer must:

- be able to secure in a timely manner improved varieties along with the fertilizers, insecticides, fungicides, and herbicides recommended as a part of a technological package;

- be able to prepare land, cultivate and harvest crops in a timely manner and in accordance with recommended practices;
- have access to credit in order to purchase the inputs and pay for the cost of renting or purchasing machinery to facilitate timely operations; and
- be assured of having irrigation water available when needed.

For these and other goods and services the farmer must depend on others. Accordingly for major campaigns, such as those proposed, to be successful, all the goods and services essential for the implementation of a technical package must be readily available to farmers when they need them.

This means that the suppliers of these goods and services must be strongly committed to supporting such campaigns, and the efforts of all must be carefully coordinated to ensure success.

Campaign Implementation

We recommend that consideration be given to the following actions for the implementation and national production campaigns:

- The issuance of a decree by the President, announcing the campaigns, stressing their importance, and setting forth a mechanism or framework to assure full support of all the ministries and other government entities which can be supportive;
- The establishment of an inter-ministerial group, appointed by the President, chaired by the Minister of Agriculture, and involving all the ministries which could be supportive of such campaigns. Such a body would likely include the Ministers of Irrigation, Housing, Development and Land Reclamation, Supply, Planning, Economy, Transportation, Cooperatives, Industry, Local Government, and possibly others. This body would be concerned with attempting to make certain that there was nothing under the respective jurisdictions of the members of this body which would limit or serve as a constraint to the realization of campaign goals;
- The establishment of an inner-ministerial working group within the MOA, including representatives from relevant undersecretariats and semi-autonomous authorities and companies affiliated with the Ministry. This group would be chaired by a high official within the MOA, appointed by the Minister, and charged with the responsibility of giving day to day leadership and direction to the campaigns.

Such a group would help to facilitate support needed for campaigns from within the MOA. The chairman of the group would speak for the Minister on matters related to campaigns;

- Members of interdisciplinary teams (research and extension) working on the national program related to the campaign commodity must put together and update the technological package of practices to be used. Extension specialists, in particular, would also be involved in conducting training schools for village level extension personnel, planning and helping to conduct demonstrations, and developing other means of reaching farmers with information about the campaign including radio, television, newspapers, magazines, posters, etc. They will also work with the organizations providing the production inputs and other goods and services in determining estimates of needed inputs, the location within the country where needed, the time needed, etc.;
- Efforts should be made to have one or more demonstrations in each village where the campaign crop is a significant part of the agriculture. The farmers participating in the demonstration would be provided compensation in the form of seed, fertilizer or pesticides valued at approximately 15 LE per feddan for using recommended practices in the demonstration.

Demonstrations should normally be at least 5 feddans in size. Efforts should be made to have at least 20,000 to 25,000 feddans in demonstration areas for each campaign crop each year;

- As a means of further publicizing the campaign, special recognition might be given by the Governor to the farmer or farmers who produce the highest yields in demonstrations within each Governorate and by the President to those producing the highest yields in the country;
- The Minister of Agriculture would be responsible for submitting a report to the President at the end of each crop season, evaluating the results of the campaign, indicating the problems, if any, which may have limited the campaigns effectiveness and ultimate success. If problems were encountered, plans would be set forth for overcoming these problems during the next crop season.

Campaigns might normally be expected to run for 3 to 5 years--and possibly longer depending upon how rapidly a high percentage of the farmers accept and begin to use the package of production practices. As campaigns with some commodities are terminated, others could be initiated; the number at a given time being dependent upon the institutional capacity to carry them out.

A Complementary Non-Commodity "Campaign"

Most campaigns would be related to efforts to increase the production of a given commodity. However, in view of the importance to agricultural production of on-farm land and water management, we believe that a major effort or campaign to address some of the serious land and water management problems would complement and, indeed, contribute in a major way to the success of production campaigns.

A high degree of complementarity exists between drainage, soil amelioration, land shaping, meska modernization and the package of production practices used for increasing crop production. Therefore, it is necessary to diagnose and correct the entire set of potential production constraints in a holistic fashion.

The characteristics which affect the basic land and water management system can not, in general, be treated on an individual small field basis. Rather they should be analyzed and improved on a basin-wide basis. Experience gained under the EWUP project supports this view and has demonstrated in a convincing fashion, the feasibility of such an approach. Similar results from the land-leveling subproject of the Farm Mechanization project and the field work of the Soil Ameliorization Organization support the use of the basin as a unit for planning and implementation of land and water improvement practices.

It is recommended therefore, that a coordinated inter-ministerial program for systematic improvement of irrigation, drainage and on-water land and water management system be implemented on one or more pilot areas of 20,000 to 50,000 feddans in size. An interministerial task force should be formed which would determine the improvements needed in the canal and drainage subsystems serving the area, the improvements required in the meskas and field drains, the land shaping needed to improve on-farm water distribution, and the soil treatments required to correct salinity and/or compaction. Field diagnosis should be made on a basin-by-basin basis and the needed set of improvements made as a basin-wide package. Accompanying the physical improvement package a set of crop production practices appropriate for the cropping system of the unit should be developed as part of the on-going extension and crop promotion programs of the region.

It would be important to incorporate a vigorous interdisciplinary training component in the proposed project and to keep the technical aspects of the work closely linked with a continuing applied interdisciplinary research effort similar to that now being conducted by the EWUP and Farm Mechanization projects. A project proposal which embodies many of these ideas is now being considered for funding by CIDA for a 65,000 feddan area at an estimated project cost of LE 35 million.

The activity proposed herein would seem to be compatible with the MOI five-year plan proposal for improving the delivery and on-farm use of water in which they call for close cooperation with MOA for supporting action on farm production practices.

In summary it appears that this activity would build on the major World Bank-funded drainage improvement program, already well advanced and would be a logical next step in the implementation, ultimately nation-wide, of a major investment in the rebuilding and modernization of the water delivery, use, and disposal system upon which the entire Egyptian agricultural (and in fact socio-economic) system is fundamentally dependent. It would "institutionalize" and build on the work that has been initiated under the EWUP and land leveling activity of the Farm Mechanization project and the work of the Soil Ameliorization Organization. It should be linked with and complement the intensified extension effort increasing farmer adoption of yield-enhancing production practices.

8. Recommended Action to Strengthen Agricultural Research and Extension

Our report has pointed to problems and weaknesses in the present agricultural research and extension program and has recommended a number of actions to strengthen and improve these programs. We have also discussed how these strengthened programs could contribute to major national campaigns aimed at substantially increasing the output of the agricultural sector. We turn now to the issue of implementing these recommendations--and more specifically to the types of improvements needed to achieve the recommended upgrading of research and extension programs.

In setting forth the components of a plan for upgrading these programs, we have not assigned specific costs. At the beginning of our study we assumed that this could be done. However, it soon becomes apparent that it would be difficult, if not impossible, to develop meaningful cost estimates until many programmatic decisions had been made and until there had been a more detailed evaluation of specific problems and needs.

For example, it is impossible to estimate the cost of facilities at a regional centers until the level and scope of research activity is known. Furthermore, precise estimates of the cost of land leveling and drainage at a research center could not be made until a more detailed analysis of the problem is made.

The Team has developed rough approximations of the costs of various components of the proposed strengthening program but more precise estimates must await decisions with regard to program implementation.

We have looked broadly at the agricultural research and extension needs of the country, including the potential contribution of a number of organizations. We have recognized, however, the major leadership role given the ARC in Presidential Decree No. 19 in early 1983. Accordingly, we have focused our recommended upgrading efforts on that organization, while, at the same time, providing a mechanism through the national interdisciplinary research programs for giving financial support to other research organizations which participate in these national programs.

In the following sections we discuss the component of the proposed upgrading effort for the three major functional areas of the ARC.

A. Research

The proposals for research are based upon upgrading many of the facilities at the National Center in Cairo plus major emphasis on developing seven regional centers to serve the different agroecological zones of Egypt. The regions and the main centers to be strengthened are as follows:

- Alexandria and the North Coast Regional Agricultural Research Center--Sabahia
- North Delta Regional Agricultural Research Center--Sakha

- Middle Delta Regional Agricultural Research Center--
Gammeiza
- South and East Delta Regional Agricultural Research Center. This region will be served by the research institutes in Dokki and Giza and by the research farms at Bahtim, Kanater, and Fayoum. The research farms will also be considered a part of the National Center used by Cairo-based staff of the ARC.
- Central Egypt Regional Agricultural Research Center--
Sids
- Upper Egypt Regional Agricultural Research Center--
Shandoweel. The research station at Mataana or Kom Ombo would also be developed as a sugar cane research center
- New Lands Regional Agricultural Research Center--
Nubaria

1. Civil Works

Six of the seven regional research center stations listed above (excluding the one served by Cairo-based staff) would be provided with additional research buildings for offices and laboratories as required. Farm buildings, housing for staff and recreational facilities would also be provided as necessary. Similar civil works would be provided at either Mataana or Kom Ombo to serve as a center for sugar cane research. The center near Cairo could be serviced primarily by the facilities of the institutes at Giza.

A national agricultural research library is recommended to serve the needs of ARC. An adequate building would be constructed (or renovated) to house the existing materials

and would be expanded to house additional books, journals and abstracts. It would be fully air conditioned with a large reading room and abstracting services, copiers, microfiches and other required equipment. It would serve the needs of the research institutes and the regional research centers which would have only basic libraries for journals and books of immediate need for the researchers. The national research library would also house the documentation and printing center where bulletins and other audiovisual aids would be produced for use by extension staff in disseminating improved technology to farmers.

There would also be some renovation of existing research facilities of the research institutes in the greater Cairo area in order for them to carry out their functions more effectively. In some of the institutes, additional facilities may be needed.

2. Research Center Development

A minimum of 500 and up to 1,000 feddans should be set aside for conducting applied field research at each of the regional research centers. The larger land areas are particularly necessary where livestock research trials are to be conducted as at Sakha, Gammeiza and Sids. In total it is estimated that ARC requires about 5,000 feddans to properly carry out applied research in the seven agro-ecological zones of Egypt. Funds for research center development must include resources for land leveling, tiles, drains, improved irrigation and access roads.

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3. Farm Equipment

All regional research stations as well as Mataana would be provided with farm equipment to properly conduct field research trials. Such equipment would be independent of the production farm equipment although both could use the same maintenance and repair service facilities.

4. Laboratory, Testing and other Equipment

There is a need for a major upgrading of equipment for research laboratories. We recommend that laboratories for crops, and where appropriate, animal research would be developed at the seven regional research centers. This would include service laboratories for routine analyses as proposed earlier. Each regional center should also have a soil and plant analytical laboratory for providing fertilizer recommendations to farmers in the area. Laboratories, computer facilities, etc., would also be provided or upgraded within the ARC Institutes centered in Giza.

5. Vehicles

Vehicles for transport, including trucks for hauling planting, cultivation and harvest equipment and materials for research trials in farmers fields would be provided for each of the regional centers and for Mataana.

6. Training

Development of the human resources is probably the most important and long lasting component of the proposed program.

Accordingly, we recommend that some 100 Egyptian scientists be sent abroad for PhD level training in various agricultural research disciplines. In addition, some 200 postdoctoral or MS degree Egyptian scientists would spend time at international agricultural research centers, universities and other institutions to learn a particular technique or discipline. There would also be provision for, attendance at international research conferences. Training would also be provided for technicians, farm managers and other sub-professional staff mainly through in-country programs.

7. Visiting Scientists

We propose that visiting scientists and research administrators be invited to assist ARC in strengthening its total research program, and especially in the areas of research planning and evaluation, management, research techniques and administering the fellowship PhD program abroad. We believe an average of 6 man years annually for a 5 year period could be used most effectively for terms ranging from a few weeks to as long as one year for each visitor.

8. Operating Funds

Operating funds (Chapter II funds) for research at ARC are extremely low and completely insufficient to conduct viable agricultural research programs. Such programs require sufficient funding to accommodate the following operating expenses:

- funds for seeds, fertilizers and chemicals for field research trials;

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- funds for the operations (fuel and oil), repair and maintenance of vehicles, farm equipment, laboratory equipment, and office and building equipment;
- funds for maintenance and repair of buildings;
- funds for adequate payment of temporary labor to permit accurate development of field research trials;
- funds for depreciation of facilities and all equipment to permit replacement which is generally depreciated annually at 5 percent of original cost for civil works and 10 percent of original cost for equipment; and
- funds for office, laboratory, housing and farm buildings supplies.

9. Chapter I Salary Incentives

Salaries of all staff of ARC are extremely low. In order to establish viable national research programs, it is recommended that base salaries be augmented to act as incentives for participation in the multidisciplinary teams. Such incentives would be provided professionals, subprofessionals, and all support personnel. In addition to the incentives for participation in the national research program, consideration might be given to providing additional salary supplements (location differentials) to encourage more of the research staff to live away from Cairo at the regional research centers.

B. Extension

The action needed to upgrade extension programs relate to the recommendation made in an earlier section of this report. To a certain extent they parallel the needs for research. However, they include significant additional dimensions.

1. Personnel

If the extension personnel currently under the administration of the governates can be transferred (along with their salary and support budgets) to the ARC as proposed, there should be no additional salary costs for extension field personnel in the immediate future (except for incentives). In time, however, it may be desirable to add more field personnel once the present staff has been better trained and given better support and after there has been a more careful appraisal of need.

Furthermore, since it is envisaged that the subject matter specialists will come from the present ranks of research personnel in the ARC, there should be no additional salary costs (other than for incentives) for extension subject matter specialists. It is assumed, however, that there will be a transfer of funds from the research salary budget to the extension budget in an amount equal to the portion of research personnel's time that will be devoted to extension. Such an adjustment is desirable so that budgets for the two functions will reflect personnel time devoted to the two functions.

2. Civil Works

Facilities (office and housing) should be provided at the regional centers to accommodate subject matter specialists-- most of whom will be jointly employed by research. There should also be facilities (large rooms and an auditorium) for meetings of farmers, village-level extension agents or other groups visiting the centers for information and training. (We understand that such facilities are being provided at some stations through the EMCIP project.)

Consideration also needs to be given to the need for additional facilities similar to the one at Sakha, for extension training programs.

A careful study should be made of the need for offices and housing for extension supervisory staff at all levels between the village personnel and the national office (district, governorate and/or regional center levels).

Similarly a study should be made of the feasibility of providing housing/office facilities for village level personnel. This may be very desirable, but we are not in a position to recommend such facilities until there is such a study along with a more clearly defined field program for extension.

Obviously office and work facilities are needed for the national extension staff in Cairo. The subject matter specialists should be housed in their respective institutes. The administrative and supervisory staff along with the

extension research unit should be provided adequate office and work space--together in one building if possible. There should be special facilities for a communication department or unit, with audio-visual laboratories and special facilities for the preparation of publications, visual aids and instructional materials.

3. Vehicles

Automobiles are needed for subject matter specialists at the national and regional levels, and for administrative and supervisory personnel at all levels. Some small trucks may also be needed for hauling materials for demonstrations and other field work. Motorcycles should be provided village level workers. In the case of women who are serving as local agents, some provisions for light cars may have to be made.

4. Equipment

The extension program will need substantial quantities of visual aids, equipment, including cameras, movie and slide projectors, overhead projectors, tape recorders, loud speakers, etc.

The field units will need equipment for demonstrations including sprayers, dusters and possibly some small tractors, implements and harvesters.

5. Training

There must be a major, sustained training program for personnel at all levels. This will be especially needed for

for village land personnel. The subject matter specialist, coming from the ranks of research personnel should have good technical training but will need some updating in technical fields as well as training in extension methodology. Consideration should also be given to training local leaders who can assist in carrying out extension programs.

We believe most of the training can be accommodated within Egypt although it may be desirable to send a few key personnel abroad.

6. Support Funds

Adequate support funds must be made available for operating expenses including such things as travel, supplies, minor equipment. Costs associated with conducting demonstrations, etc.

7. Salary Incentives

Incentives will be essential to supplement base salaries and to encourage personnel to support the major program thrusts undertaken. These incentives would be tied to participation by extension personnel in the national programs aimed at increasing agricultural productivity--as discussed in earlier sections.

8. Demonstration Costs

The extension budget should contain the funds involved in conducting farm demonstrations. A major cost of such demonstrations is the amount given the farmer (normally in the form of seed, fertilizer or chemicals) for participating in the demonstrations.

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9. Visiting Specialists/Consultants in Extension

We believe it would be most helpful during the next five years to involve as consultants a limited number of expatriates who have knowledge and experience in extension work at all levels, including administrators, supervisors, subject matter specialists, and local agents. Such personnel can assist in training and provide counsel and advise in organizing and implementing all aspects of an improved extension program.

C. Production Farms

We propose that the production farms be upgraded in a manner consistent with the recommendation made in an earlier section of this report. This would involve leveling of land, the purchase of farm equipment and making available adequate operating funds to permit efficient and effective operations. A study has been made by ARC to indicate the cost of such improvements.

Beyond the land needed for research and extension, the production farms would be used first for foundation, registered, and certified seed production and for the multiplication of improved germ plasm for both animals and nursery tree stocks.

9. The Case for Investment in Agricultural Research

A basic premise of this report is that a well designed and carefully implemented agricultural research program is an important contributor to agricultural and economic development. Evidence to support this premise is substantial.

A World Bank report^{1/} states that "it is now widely accepted that a steady increase in agricultural productivity through technological change is indispensable to national economic growth. It is notable that increases in productivity in the past 100 years have come largely from science-based farm technology and from changes in management and inputs developed through organized research."

The report continues to say that formal studies of the returns to investment in research tell a consistent story--namely, that realized rates of return are much higher, generally two to three times greater, than likely return from most other alternative investment opportunities in the countries concerned. Economic returns to particular research activities typically exceed 20 percent a year and frequently are greater than 40 percent. Thus, there are probably few investment opportunities to which national and international funds could be dedicated that could so consistently yield returns as high as those from investment in carefully designed and managed agricultural research programs.

^{1/} T.J. Goering, Agricultural Research Sector Policy Paper
World Bank, Washington, D.C., 1981.

After examining the linkages between research program size and impact on economic development, the World Bank study suggests that "a desirable investment target for research for many countries with poorly developed agricultural research systems would be an annual expenditure (recurrent plus capital) equivalent to 2 percent agricultural gross domestic product."^{1/}

The World Bank assessment is strongly supported by other studies. For instance, Evenson, et al.^{2/} report annual rates of return for all agricultural research in India to be between 40 and 63 percent; for wheat research in Mexico, 90 percent; for cotton in Brazil, more than 77 percent; for rice in Colombia, between 79 and 96 percent; for maize in Peru between 35 and 55 percent; and for sheep in Bolivia, 44 percent.

We are not aware of any formal studies on economic returns to agricultural research in Egypt. However, existing evidence indirectly suggests that payoff from agricultural research in Egypt is as impressive as it is elsewhere.

More specifically, through research, improved technological packages have been developed which will increase significantly productivity of and financial ~~and~~ economic returns from major crops. For instance it is estimated^{3/} that the financial rate of return to the farm family's incremental capital required to implement the improved technological packages is in excess of 100 percent for such

^{1/} Ibid, p. 8

^{2/} R.E. Evenson, P.E. Waggoner and U.W. Ruthan, "Economic Benefits from Research: An Example from Agriculture." Science, September 1979.

^{3/} Unpublished report, USAID/Cairo, 1983.

crops as maize, rice, tomatoes and wheat. It is further estimated that if 90 percent of the farmers were to adopt these improved technological packages, Egypt would save nearly LE 200 million in foreign currency annually from increased production of rice and wheat alone.

In assessing the role of agricultural research in economic development, several additional considerations are important.

First, research failure due to poor project design and implementation are not uncommon. However, this does not change the very positive results of the studies reviewed above. It merely points out the need for better research planning and implementation.

Second, research involves a time lag between implementation of research and availability of results and is generally a long-term effort. To expect quick results in all areas or to "turn research on and off" guarantees failure and disappointment.

Third, in most countries, including Egypt, agriculture is characterized by a large number of small producers with relatively little economic or political power. Individual producers cannot undertake research because it is far too expensive in relation to their operations. Also a substantial share of the benefits of technological change in agriculture goes to the consumer. Because social benefits are potentially large and because producers are unable or unwilling to finance it, research in most developing countries is mainly a public sector activity.

Fourth, "when new technologies are disappointingly slow to be adopted....the basic problem is often the government's price policies.... Persistent underpricing of food grains in many countries is an important force that limits both the demand for research and the diffusion of available technology.... Too often the tendency has been for national economic planners to ignore the impact of their policies on the research establishment and for the research managers to retreat into the more comfortable confines of the research institutes. One consequence is that an efficient source of economic growth (agricultural research) is sacrificed and food deficiencies are larger than they need be."^{1/}

Fifth, given the characteristics of agricultural production, an effective agricultural research system must be complemented by an equally effective agricultural extension system to assure that the new information generated by research is made available to the farmer for implementation.

We believe the evidence at hand points to the opportunity and need for a significantly greater investment by the GOE in agricultural research and extension. Most evidence from other parts of the world as well as in Egypt would suggest that such increased investment would return significant dividends to the nation and its people.

^{1/} Goering, Op. Cif., P. 31-32

D R A F T

INCREASING EGYPTIAN AGRICULTURAL PRODUCTION
THROUGH STRENGTHENED RESEARCH
and EXTENSION PROGRAMS

ANNEXES

A Report of a United States Team
of Consultants to the Ministry of Agriculture
of the Arab Republic of Egypt

In Cooperation with:

The U.S. Agency for International Development,
The World Bank, and
The International Agricultural Development Service

September 1983

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ANNEX 1

**A Description of Research Institutes, Central Laboratories
and Stations Within the Agricultural Research Center**

Research Institutes

Some of the research institutes at Cairo have been in existence for many years. For example, the Cotton Research Institute was created in 1900. As Cairo has grown, increasing amounts of land once available for institute use have been taken, leaving only about 70 feddans available for research purposes at Giza. Land available will continue to diminish, making the outlying research stations increasingly important. Even so, the research institutes at Cairo will continue to be important to the research effort because of their extensive facilities, their large staffs, and their proximity to major universities and other important government agencies.

1. Cotton Research Institute (CRI)

The CRI is a large, well-established institute (68 PhD, 59 MS, 58 BS). The institute is housed in buildings with ample space; however, they are old and difficult to maintain.

The research has been and continues to be heavily oriented to breeding, which has been highly successful. All cotton varieties grown in Egypt have been developed by the CRI. Some of the breeders are located at Cairo (Giza) but others are located at the research stations and all field testing is done at the latter.

The technology section conducts extensive tests on hybrids and new lines as part of the evaluation program. Tests include such things as fiber color, strength and elongation, and various yarn characteristics. There is also a building with several gins, some extremely old.

The equipment for fiber tests is functioning even though it is old and outdated. These laboratories are in need of updating,

considering the age of the equipment and the superior equipment available on the market. Two greenhouses, extensive screenhouses and a limited amount of land are available.

There are also sections of chemical modification and plant physiology. These laboratories are very deficient in equipment and in need of refurbishing.

The CRI is not supported by any large donor project at present.

2. Field Crop Research Institute (FCRI)

The FCRI staff (86 PhD, 135 MS and 110 BS) conducts research on a wide range of highly important crops and there are eight crop-related sections: maize and sorghum, wheat and barley, legumes, rice, oil crops, fiber crops, forage crops and onions. Onion, which is usually considered a horticultural crop, is included in this institute because it is often grown with cotton.

There are also sections of seed technology and plant physiology. Seed technology is involved with milling and testing of the various hybrids, breeding lines and varieties for their milling and processing characteristics.

Research is heavily oriented to breeding, as indicated by the fact that there are twelve maize breeders, in addition to breeders of other field crops. There are, however, other important lines of research.

The FCRI is receiving large amounts of assistance in the development of research facilities through two USAID-supported projects. These are the Egyptian Major Cereals Improvement Projects (EMCIP) and the Rice Project (RP).

EMCIP is developing excellent facilities at the FCRI at Giza and at research stations at Sakha (North Delta), Gammeiza (Middle Delta), Sids (Middle Egypt), and Shandoweel (Upper Egypt). A complex of buildings is being constructed at each location. Only facilities for Giza are discussed here.

EMCIP is a multidisciplinary team project with members not only from the FCRI but from discipline-oriented institutes and universities as well. It also has a strong extension component. Thus, the main building will have entomology, pathology, and soils laboratories as well as those for breeding and agronomic work. There will also be laboratories for chemistry, cytology, physiology, and biochemistry and cell biology.

In addition, there will be an auditorium, publication room, dark rooms, conference room, a library, mail room and cafeteria. There will be other buildings for field equipment, storage, maintenance and seed handling.

EMCIP has added a number of vehicles and installed a radio telephone system to connect Giza and the four research stations at which other EMCIP team members are located.

A study of the plans and equipment lists clearly indicates the laboratories will be furnished with excellent instruments and materials and that the laboratories will have all needed utilities, such as cold and hot water, electricity, compressed air and gas.

EMCIP is developing a library for the project and is also purchasing back issues of a number of journals for the ARC Central Library.

Building construction is behind schedule, so several laboratories in existing buildings were refurbished and an excellent array of new instruments placed in them. Virtually all instruments for laboratories at all locations have been purchased and placed on storage in Egypt. Egyptian staff members of the team receive salary incentives from project funds.

The team is functioning well and there is no question but that the project is developing superb facilities for the sections involved, which are corn and sorghum, wheat and barley, forage, legumes and seed technology.

A new administration building has recently been constructed at Giza with GOE funds for the rice section. However, all research staff is located at the Sakha station where a complex of buildings, laboratories, vehicles, field equipment and machinery repair facilities comparable to those constructed by EMCIP for other sections is being developed for the rice section by the RP. All of the staff members in the rice section are members of an interdisciplinary team formed by the RP. This team has a fine extension component that will be housed in the new buildings at Sakha.

Other sections, such as onion, oil seeds, fiber crops and plant physiology, do not have adequate laboratories, and building space is generally substandard. This is not to say all other facilities in the FCRI are non-functional. The existing laboratory for milling and related work is functioning even though equipment and instrumentation are old and outdated.

On the other hand, laboratories for the plant physiology and oil crops sections are very inadequate, making it difficult to conduct

meaningful research in them. Those for fiber crops and onion, while better, are still inadequate.

3. Sugar Research Institute (SRI)

The SRI was formed from the sugar section of the FCRI in 1981. About 30 of the professional staff (10 PhD, 30 MS and 40 BS) are located at Giza and the remainder on research stations.

Breeding and testing of exotic varieties of sugar cane is the largest part of the research program. All breeding, with the exception of a small amount being conducted in greenhouses at Giza, is done at the Sabahia (Alexandria) station, because this is the only location in Egypt where sugar cane flowers naturally. All agronomic work on sugar cane is conducted at stations in Upper Egypt (Kom Ombo and Mataana). There is also some interesting work on sugar beets at Nuberia.

The SRI building at Giza is substandard; however, money from the GOE has been allocated for construction of a new one. Laboratories and instrumentation are poor. There is a large walk-in growth room but it has not functioned for a number of years.

The SRI has no major foreign donor funding.

4. Horticultural Research Station (HRI)

The HRI has one of the largest in the ARC with a total staff of over 3,000 (98 PhD, 206 MS, and 172 BS); however, it has responsibilities for a number of things that are peripheral to research, such as a large seed production unit and maintenance of botanical gardens at Aswan and Orman.

Most of the staff is located in the institute at Cairo. This is partly because Kanater, one of the largest Horticultural Research Stations, is very near Cairo and is to a large extent a farm for HRI staff at Giza.

The HRI encompasses a large array of crops with widely varying cultural and climatic requirements. Thus there are sections of minor fruits, citrus, grape, pomology, tropical fruits and date palm, mineral nutrition, fruit handling, packing and storage, olives, botanical garden maintenance, ornamentals, forestry, tomato and self-pollinated crops, cucurbit and cross-pollinated crops, potatoes and vegetatively propagated vegetable crops, vegetable handling, vegetable production under controlled conditions, medicinal and aromatic crops, vegetable processing, olive oil processing, pesticide residues, meat and fish products. There is also a vegetable seed production unit.

The HRI is housed in 10 buildings at Giza and Dokki in Cairo. Most of the buildings at Giza are substandard but usable with refurbishing. The meat and fish laboratories are extremely poor and beyond the point of mere repairs.

The HRI contains its own maintenance shops which, while functional, are in a state of disrepair. Cold storage rooms have deteriorated to a point where they would need complete rebuilding to function.

The HRI has an auditorium it once used for extension when it had an extension component.

There is a canning plant, but it is used only for production and not research. It is not well-maintained. Buildings at Dokki, which

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house vegetable and medicinal crops research, are newer and in better condition than those at Giza; however, they are still in need of renovation. There is a battery of walk-in growth chambers, but they have not functioned for years.

The Horticulture Subproject of the University of California, Davis, Agricultural Development Systems (ADS) project, was managed somewhat differently than EMCIP. ADS rented a large building from the University of Cairo that had been constructed by FAO some years ago as a post harvest handling laboratory. This building, known as the Central Laboratory, was refurbished and laboratories fitted with a wide range of modern scientific equipment. There are well-equipped tissue culture, post harvest handling, biochemical and analytical laboratories in the central laboratory that are available for use by team members. There is also a battery of cold storage units. A relatively small amount of new instrumentation was added to existing laboratories of the HRI but emphasis was placed on equipping the central laboratory. An excellent library of horticultural publications was developed. Several greenhouses were constructed that were assigned on a need basis rather than to specific groups. A certain amount of farm equipment and a number of vehicles for transport were also purchased.

Like EMCIP, the ADS project developed interdisciplinary teams; however, ADS emphasized smaller teams called "activities". These were composed of U.S. and Egyptian co-team leaders and Egyptian team members. There were, as examples, citrus, olive, mango, date, deciduous fruit, tomato, cucurbit, garlic and medicinal and aromatic crop activities.

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The U.S. co-team leaders visited Egypt only periodically during the year. Egyptian and U.S. counterparts often conducted research jointly and co-authored papers stemming from the results.

The precise future of the interdisciplinary teams is not certain, other than that USAID will continue to fund the project through the MOA for another year. It is assumed the central laboratory and associated facilities will become a part of the HRI. If so, many of the current laboratory deficiencies would be overcome. However, there is a possibility the central laboratory building and instruments will become the property of Cairo University. Moreover, the HRI has such a large and varied program that there is still need to refurbish some of the old laboratories and for additional instruments and greenhouses.

5. Plant Pathology Research Institute (PPRI)

The PPRI has a large professional staff (78 PhD, 98 MS and 124 BS) and a large number of support staff. The institute is divided into two main groups: (1) field crops and (2) horticulture and general research. The former contains five sections that cover the various field crops, cotton and sugar cane. The latter division contains twelve sections, four of which cover broad groups of horticultural crops and seven of which are discipline-oriented. These are: virus diseases, bacterial diseases and biological control, nematology, post harvest diseases, mycology and disease survey, fungicides and seed pathology. The PPRI has a modest portion of its staff located at the research stations, but the main thrust of its work is at Giza because much of the research requires good

greenhouse and laboratory facilities rather than extensive areas of land.

The staff is scattered through a number of buildings and would profit from being housed together. The buildings and laboratories are substandard. It is to the credit of the staff that laboratories are functioning well, despite severe limitations. There is a modest number of modern instruments and they are used well. Some of the instrumentation has been obtained from donor organizations from time to time but there has not been major support given the program.

The PPRI has a relatively large number of greenhouses which need better maintenance. More and better greenhouses are needed. Staff of the PPRI would like to do more basic, discipline-oriented research while retaining a heavy responsibility for commodity-oriented problems in cooperation with appropriate other institutes and research stations. The PPRI needs new housing or, at least, considerable refurbishing of existing space and a major increase in funding for scientific instruments and supplies.

6. Plant Protection Research Institute (PLPRI)

The PLPRI has a large staff (212 PhD, 114 MS, 211 BS) and a support staff of over 300. The institute is concerned with insect and weed control. It also includes bee culture and a unit north of Cairo for silkworm cultivation.

A great portion of the staff is located at the institute at Cairo just as is the case with the PPRI and for the same reasons. The institute has members on the EMCIP team at Giza and at the research stations.

The institute is divided into twenty sections. Some, such as cotton leafworm and cotton mites sections, relate to specific problems. Others, such as the field crops and vegetable crops insect research sections are broader in scope, and others, exemplified by the biological control and insect physiology research divisions, are discipline-oriented. There is also a weed control section that appears weak.

7. Soils and Water Research Institute (SWRI)

This institute is large (100 PhD, 241 MS, 185 BS) and extremely important because of the major problems related to soil, water and plant relationships in the country. About 40% of the staff is located at research stations. Virtually all research stations have a component of the SWRI. The institute has two main divisions: soil research and soil technology. There are a number of sections or problem areas under each division. There are eight sections: soil physics and chemistry, soil survey and classification, agricultural microbiology, soil/fertility and plant nutrition, saline and alkaline soils, sandy and calcereous soils, water requirements, and development and conservation of cultivated soils.

Much applied work, such as nitrogen fixation, establishing optimum fertilizer rates, the impact of pesticides on soils, utilization of agricultural wastes and land reclamation is conducted. The institute also analyzes over 12,000 soil samples per year, both for research and as a service.

The institute building space is adequate, but the quality of facilities and maintenance are deficient. Some laboratories are

equipped with modern instruments that are functioning and used regularly. The staff has done a commendable job of maintaining its instruments. Even so, there is a deficiency of modern instrumentation.

The SWRI has received considerable foreign donor assistance but not a major input such as EMCIP and the Rice Project have made to the FCRI.

8. Animal Production Research Institute (APRI)

The professional staff (55 PhD, 94 MS, 204 BS) with a large support staff is largely located in Cairo. There are ten research sections: dairy technology, chemistry, microbiology, animal and poultry nutrition, sheep, cattle, buffalo, rabbits, poultry and poultry breeding.

Cattle and buffalo programs emphasize improving milk production and dairy technology rather than the production of red meat. There are feeding trials, some in cooperation with the forage crop section of the FCRI, trials on the use of ammoniated straw for feed, artificial insemination, embryo transfer and other related work.

Much of the work of the APRI is related to herd improvement through the use of superior sires and balady cattle, sheep and goats. Careful records are kept of milk production at Sakha and elsewhere to determine performance of exotic breeds, crosses of balady and exotic breeds and of buffalo selections. Crosses of balady chickens, such as Fayoum, with exotic breeds, are made to furnish small farmers with dual purpose chickens that produce well under the rigorous condition of the small farm. There are neither

animals or poultry at Cairo so staff conduct all of this work at research stations.

Building space at Cairo has not been well maintained and laboratories are below standard.

There is a certain amount of donor assistance from various foreign countries that has played a major role in attaining the current level of performance of the APRI. Even with this assistance, it is difficult for the institute to maintain an adequate research program, and major increases in support are needed.

9. Animal Reproduction Research Institute (ARRI)

The ARRI staff (12 PhD, 21 MVS, 9 BS and BVS) is located at what is known as the Pyramid Research Institute for Animal Reproduction at Cairo. This institute has recently been formed from a section in the APRI. All of the staff are located at Cairo but the ARRI has strong linkages with staff members of the APRI at research stations and utilizes animals and other facilities there.

The institute has sections on interfertility field investigations, biology of reproduction, pathology of reproduction, artificial insemination, reproductive diseases, and diseases of neonates and mastitis. It also has proposed a new section on auxiliary production units that would involve an extension unit.

The institute has received considerable money for building renovation, instrumentation and transport from the MOA and it has been well used. The main building has been refurbished. The laboratories are not fully equipped but modern instruments are being put in place and additional instruments have been ordered. Evenso,

additional equipment will be needed. There are definite, comprehensive plans for developing the institute that are sound.

The institute is some distance from Cairo proper and transport is needed daily to collect workers for the institute. Current vehicles are adequate, but maintenance is a problem and it is difficult to obtain drivers.

There are well kept pens for a limited number of cattle, buffalo, sheep and goats.

10. Animal Health Research Institute (AHRI)

The AHRI staff (60 PhD, 60 MS, 80 BS) and veterinarians (11 PhD, 29 MS and 75 BS) are primarily concerned with diagnosis and treatment of animals and poultry. Vaccination is particularly important because it is not considered feasible under Egyptian conditions to resort to widespread destruction of animals as a means of controlling diseases. Although some research is conducted, emphasis is on animal protection. Much of the veterinary staff is located in some 20 provincial laboratories where over 200,000 animals are examined annually and many thousands treated.

There is a training program at Cairo in which members of the provincial laboratories receive one to two months training annually. Several hundred university veterinary students also receive short periods of training each year.

Laboratories and instrumentation at Cairo are seriously deficient from the standpoint of research. Diagnostic laboratories in the provinces were not visited. Cairo staff members have indicated a need for considerable instrument replacement and

upgrading. They have also indicated a pressing need for mobile laboratories and vehicles for transportation.

11. Serums and Vaccines Research Institute (SVRI)

The professional staff (25 PhD, 52 MS and 51 BS) are supported by 25 technical assistants. All of the staff is located at Cairo.

The SVRI conducts a certain amount of research, but most of its activities involve the production of huge quantities of serums and vaccines for use not only in Egypt but in other Arab countries as well. The institute occupies a number of buildings that house sections or laboratories for newcastle disease, foot and mouth disease, cattle plague, rift valley disease, rinderpest-like disease, african horse sickness, pox and bacteriology.

Buildings are substandard but usable. Laboratories contain equipment and instrumentation for producing massive amounts of serums and vaccines; however, much of the equipment is outdated. A modest amount of donor support is currently furnishing a small amount of instruments for research.

The institute badly needs to have laboratories refurbished with much of the equipment and instrumentation replaced with new, more efficient types. There is also the need for much additional equipment if the institute is to attain its full potential.

12. Agricultural Economics Research Institute (AERI)

The AERI staff (15 PhD, 30 MS, 50 BS) is located on parts of two floors of the MOA building in Cairo. There appears to be little if any coordination or joint research with commodity-oriented production research institutes or with research stations.

An organizational chart prepared by the AERI shows twenty sections in a Division of Agricultural Economics Research and nine sections in a Division of Agricultural Statistics. It is difficult to envision how such a comprehensive program can be conducted with the current number of staff.

Agricultural economic research does not require extensive laboratories and land as is the case for most agricultural research institutes; however, the AERI does require and is seriously short of space, support staff and programmable computers.

The AERI has been part of a USAID-supported Agricultural Economics Subproject that, along with the Horticultural Subproject, was conducted under a contract with the University of California, Davis. Apparently this subproject involved large amounts of cooperative research by Egyptian and short-term U.S. counterparts but little equipment.

Agricultural economics is an important component of any large agricultural research organization. In the case of the AERI, it has not been developed adequately to serve the needs of Egyptian Agriculture.

13. Agricultural Mechanization Institute (AMRI)

This institute was authorized in 1977 but only activated within the past year. There are currently only two or three well-trained professional staff in crowded office space in the Foreign Relations Building in Cairo. A prefabricated administration building is to be erected for the AMRI in front of the Foreign Relations Building within the next few months.

The AMRI is currently cooperating with the USAID-supported Agricultural Mechanization Project (AMP) in the areas of land improvement and developing farm machinery for Egyptian conditions. Facilities developed by the AMP near Alexandria for testing tractors and modifying farm machinery will be added to the AMRI. Evenso, the AMRI is in the first stage of development. It has no facilities and needs major support for buildings, equipment, funds and staff if it is to have a meaningful role in the mechanization of Egyptian agriculture. The institute would appear to have a particularly valuable role in developing farming equipment and methods for small Egyptian farms.

14. Flora Institute (FRI)

The FRI is a small taxonomic unit with only one professional staff member. This institute is located near the Agricultural Museum and the MOA Building in Dokki. Its herbarium emphasizes desert plants and its primary usefulness has been to land reclamation.

The FRI could enhance weed control research in the ARC if a modest amount of additional support were given it and staff conducting weed control research utilized it.

Central Laboratories

1. Central Pesticide Laboratory (CPL)

The CPL has a relatively large staff (17 PhD, 45 MS, 60 BS).

All are located in inadequate laboratory space in Cairo.

The CPL has important responsibilities. It conducts analyses of pesticides, fertilizers and herbicides for purity. It also determines efficacy of materials, but it does not set minimum residue levels.

The CPL has laboratories for determining formulations and residues and for conducting bioassays and toxicological studies. The poor condition of the laboratories and lack of laboratory instruments raises questions as to the effectiveness of the work. The director of the laboratory estimated it would take 1-3 million dollars to adequately refurbish and equip the laboratories.

This entire laboratory needs to be studied to determine its function and what is needed to bring it to a level at which it will be effective.

2. Central Statistical Laboratory (CSL)

The CSL is an independent organization attached to the ARC. It has a small staff (5 PhD, 8 MS, 11 BS). CSL has four primary research functions: assisting ARC staff in designing experiments; statistical analysis of experimental data generated by ARC staff; determining arithmetic models for statistical analyses; conducting research in applied statistics to improve efficiency of agricultural experiments. It also stores research data and is involved in budgetary and fiscal matters.

The staff appears competent and it has access to computer facilities. It needs added computer capacity and additional staff. This unit is not used nearly as much by ARC staff as it should be; however, this will undoubtedly change in the future as the value of its services become better recognized.

The activity of the staff and the potential for the laboratory are great.

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Research Stations

The ARC has an extensive system of research stations located in the principal areas of production. Staff at the stations are members of the various research institutes in Cairo and Cairo-based staff conduct most of their field research on the stations.

Previous to a recent organization, that is just now being put into place, there were 31 research stations, primarily commodity-oriented, at 16 locations. For example, there were Horticulture, Animal and Agriculture (cotton, field crops) Research Stations at Sedis. The stations at each location have been or will be combined into a single station designated by the name of the location; e.g., the three stations at Sedis are now the Sedis Research Station. These stations have been grouped into seven regions, one of which is designated as the regional station or center.

Some of the stations are old and physical facilities were developed without a specific plan. However, a standard ARC design has been used at most locations during the past two decades. Each station has a two-story laboratory-administration building with nine laboratories, offices and a library. There is a guest house, a recreation building, and equipment storage and repair buildings. There are either four or six buildings with 16 and 24 apartments, respectively, and another building for unmarried staff. There are hospitals and schools at the same locations.

Research stations are usually associated with a production farm which provide land for conducting research. There is usually an adequate amount of land, but some of it is inadequately drained or lacks a proper irrigation delivery system.

Brief descriptions of the research stations and research capabilities are given below.

1. Upper Egypt Region

Kom Ombo is a new station located about 30 to 40 km north of Aswan. The staff is small (2 MS, 6 BS). The Director is working on his PhD, traveling by train each week to the University of Assiut where he spends two days.

The station is devoted to sugar cane research for which it is well located. Other field crops, such as sunflowers and legumes, are studied from the standpoint of how they can be intercropped and rotated with sugar cane. The major research, however, is testing progeny from the sugar cane breeding program at Sabahia.

Land is adequate but field machinery is deficient. Tractors, ridgers, disc plows, chisel plows, land leveling equipment, and sprayers are needed.

The layout of buildings is the standard ARC design, but some of the buildings are smaller and some have not yet been built.

Utilities consist of only cold water and electricity. Laboratory benches and storage space are substandard or lacking. Laboratory instrumentation is negligible.

There is no sugar cane mill for extracting juice from large samples. Such equipment is now located only at the Mataana Research Station which is an appreciable distance north of Kom Ombo.

Kom Ombo is more attractive than Mataana to research staff because of its proximity to the city of Aswan. Kom Ombo has the potential to be a good research station, but it would need a major

increase in financial support for equipment and laboratory instruments. It would also need more and better trained staff.

Mataana

This well-established station has a staff of 1 PhD, 1 MS and 8 BS. Qualified staff are difficult to attract because of its isolation. Mataana is located in the heart of the sugar cane region between Kom Ombo and Shandoweel.

Its major emphasis is on testing sugar cane selections; however, research on field crops is also conducted. It is obvious from the lack of staff that the research program is deficient.

The station was developed according to the standard ARC plan. Buildings have deteriorated because of lack of maintenance. Housing for staff is inadequate.

There is equipment for crushing and extracting sugar cane juice and a few instruments for sugar measurement. Laboratory space is, however, well below standard and instrumentation virtually lacking, except for a few pieces relating to sugar cane analyses.

Field equipment is old and badly in need of replacements and additions.

There is sufficient land for crops and there are interesting plantings of citrus and mango on an adjacent production farm that could be used for research. Thus, Mataana Research Station is well located from an agricultural standpoint but is confronted with a serious staffing problem. Major funding is needed to refurbish buildings and to obtain adequate field and laboratory equipment and vehicles.

Shandoweel

Shandoweel is designated the research center of the Upper Egypt Region. The professional staff of 26 (3 PhD, 10 MS, 13 BS) are involved in field crops or related disciplines, such as plant protection, plant pathology and soils and water.

The staffing situation is not as difficult as at Mataana and Kom Ombo but still serious. About 90% of the staff and the Regional Director were born or grew up on the Shandoweel area.

Research is directed entirely toward field crops, soils and water, plant protection and plant pathology. In fact, there is no research in horticultural crops or animals in the Upper Egypt Region, even though both are important commercially.

Land is adequate but farm equipment is not. The experiment station has the standard ARC building layout. Maintenance is poor.

An EMCIP unit is being constructed at Shandoweel that will have the same general design as EMCIP units at Sedis, Gammeiza and Sakha. This includes a two-story administration-laboratory building. There are about 28 offices, considerable space for support staff, conference rooms, library and well equipped laboratories for both commodity-oriented and discipline-oriented staff.

It also has a machinery storage building, repair and maintenance shops, fertilizer and pesticide storage, a large seed cleaning building, generators, guard rooms and security gates. EMCIP also refurbished the guest house.

Shandoweel is a logical choice for a regional stations and EMCIP's location there is appropriate.

There is a need to refurbish and equip laboratories in existing buildings and to add to the field equipment and housing even though EMCIP has overcome many deficiencies.

2. Middle Egypt Region

Mallawy

Mallawy is a field crop-cotton station located between Assiut and Sedis with a relatively small staff (3 PhD, 12 MS, 10 BS). Staffing is a problem just as in Upper Egypt and most of the staff is from the immediate area. However, it is a much stronger station than Kom Ombo and Mataana. It has very active cotton and field crop research programs.

Mallawy has the standard ARC building layout. Building maintenance, laboratory instrumentation, and field equipment are poor. This station would need heavy funding to bring it up to a reasonable functioning level if it is to serve the purpose envisioned by the Director and staff there. It would, of course, be far less expensive to furnish only transport, field machinery and routine laboratory equipment.

Sedis

Sedis has been designated the regional center for Middle Egypt. The staff is small (2 PhD, 22 MS and 27 BS), exclusive of animal scientists.

Sedis is the only station with field crops, cotton, fruit, vegetable and animal units. There is adequate land for farming, citrus orchards and grape vineyards.

Major efforts are directed at variety improvement of crops through breeding and testing but there is also excellent agronomic work. Animal and poultry work is heavily oriented to animal improvement but there are also nutritional studies.

The building layout is standard ARC with slight modifications. The administration-laboratory building has three instead of four floors. The third floor is allocated to horticultural crops and the first two to field crops. There are no animal and poultry laboratories of consequence. Laboratories devoted to field and horticultural crops are, like most others, deficient and poorly used. For example, fertilizer for field experiments was being stored and weighed in a laboratory with scientific instruments. The horticultural laboratories were filled with drying garlic. Such work should be done in rooms without instruments. In general, the laboratories need refurbishing and appropriate instruments. Some of the farm equipment also needs replacement.

An EMCIP unit is being developed similar to the one described in Shandoweel. This unit should contribute to a substantial improvement in the station's facilities. Evenso, existing laboratories must be upgraded and field equipment added if the station is to become a major regional research center.

3. North and East Delta Region

Bahtim

Bahtim, located less than an hour from the center of Cairo is designated the regional center. There is a relatively large staff considering its proximity to Cairo (9 PhD, 15 MS and 27 BS).

Bahtim is a famous old station and the building layout is different from the standard ARC design. Primarily, there is an administration-laboratory building. Laboratories and equipment are poor by any standards. The fumehood in the nutrition laboratory is inoperable as is much of the instrumentation. The farm of 450 feddans includes research on both field crops and vegetables. Some members of the institutes in Cairo contend the Bahtim location should be used only for such purposes as a germ plasm bank for breeders because of encroachment of Cairo and water pollution. Whether the latter is true or not, the development of Bahtim as a regional research center is questionable because most of the staff lives in Cairo where there are already laboratories and libraries. Bahtim's situation should be given careful study before a decision is made to refurbish and develop the laboratories at considerable expense.

Kanater

This station, often called the Barrage, is an old station and about as close to Cairo proper as Bahtim. It has a professional staff of 42 (7 PhD, 19 MS and 16 BS).

Kanater is the most important station for citrus research, which is by far the most important fruit crop in Egypt both for local consumption and export. In addition, Kanater is important for dates, mangos, deciduous fruits, vegetables and medicinal and aromatic crops. There is a small poultry research unit located there also.

The proper use of Kanater will require study. There is a large administration-laboratory building for fruits and vegetables that is in moderately good condition but virtually devoid of

instrumentation. Considerable funding would be required to develop the laboratories. One option would be to meld it with the fruit sections of the HRI and place all laboratory instrumentation at Kanater. Another option would be to use Kanater as a farm and orchard only with administration in the HRI at Cairo.

There are reasonably good laboratory facilities and equipment in the building housing medicinal and aromatic plants that is located next to fine collections and plantings of these plants. There are other laboratory facilities close by in Cairo.

Whatever is done from an administrative or laboratory standpoint, the land and trees at Kanater are vital to the horticulture research program. Maintenance and upgrading of the farm and orchards is needed. Particularly, there is the need to remove a number of old tree plantings and replace them with new ones.

Ismailia

This station, located near the town of Ismailia on the Suez Canal, is new and consists of both field crops and horticultural units separated by 40 km. The latter has not yet been fully developed.

The field crop unit has a small staff (2 PhD, 5 MS, 13 BS) to work with onions, forage and oil crops on the sandy, desert soils of the region. There are also soils and water, plant pathology, and nutrition sections. There is adequate land and a new building, but the laboratory instrumentation is quite inadequate. The library has no books. This station represents an irrigated desert region not served by any other station. Considerable money will need to be expended, however, if it is to function well.

4. Middle Delta Region

Sers

Sers is a new station with a small staff (3 MS, 6 BS). Under present conditions, it is difficult to envision this as a viable research station. There are about 20 feddans of land: 5 in cotton, 6 in maize, 5 in wheat and barley, 5 in clover and .75 in onions.

The buildings are very inadequate. There are no laboratories and very little field equipment.

Gammeiza

Gammeiza is the regional center for the Middle Delta Region, an obvious choice because the only other station is Sens. The staff is relatively large (14 PhD, 32 MS, 39 BS). Gammeiza is well located to serve its purpose and staffing is far less difficult than in Upper and Middle Egypt.

The station conducts research on cotton, rice and other field crops. There is also a large animal unit with cattle, buffalo, sheep, goats, rabbits and poultry. Emphasis is placed on breeding and variety improvement of crops but with attention also to pest control, agronomic work and soil and water research. Animal work is oriented toward animal improvement. There are limited nutritional studies and there is minor research on cheese production.

The land available is adequate. The building layout is standard ARC. Building conditions has suffered from lack of maintenance. Laboratory instrumentation is substandard and instrumentation inadequate even for routine work.

An EMCIP unit is being constructed at Gammeiza and it will satisfy many needs. As elsewhere, however, it leaves other units deficient.

The cotton section would like to have more equipment for testing breeding lines and selections for quality. These tests are conducted now at the CRI at Cairo. This and other discussions with the staff all suggest the desire for more sophisticated laboratories which in effect would change the role of the station.

Animal pens and field facilities are adequate for present purposes but need upgrading. The dairy products unit is in very poor condition and extremely deficient in modern equipment.

5. New Lands Region

South Tahrir

The South Tahrir research station has a small staff (2 PhD, 4 MS). It is located in the southern part of Nuberia Governorate between the Desert Road and the western edge of the Delta.

The research program is devoted almost entirely to citrus. There is no land assigned to the station. Orchard trees and field equipment belonging to a government company are available for research upon request. A small amount of land was furnished by the company for long-term rootstock research.

The building layout is different from the standard ARC design. There is a relatively new administration-laboratory building. Instrumentation is inadequate for even the most routine analyses. Not even cold water is available in the laboratory. The laboratories were almost devoid of glassware or laboratory chemicals.

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This station could be made very useful with proper planning of field research, modest refurbishing of laboratory space and a small amount of laboratory instrumentation. The station is of minor value in its present condition.

Nuberia

The Nuberia Station consists of a field crop unit on the Desert Road at the north end of Nuberia Governorate and a horticultural station about 18 km east of there. Nuberia is designated the regional center of the New Lands and the regional director is located at the field crops unit. The staff is relatively large (17 PhD, 95 MS, 18 BS).

The station is sufficiently close to Alexandria to permit commuting. Some do. The trip requires 1.5 hours each way.

A wide range of variety testing and agronomic research is conducted on field and forage crops. There is also a limited amount of research on sugar beets and on cattle feeding. There are soil and water, plant nutrition, plant protection and plant pathology laboratories. All need upgrading.

Research at the horticulture unit involves citrus, deciduous fruit trees and grapes. Some of the more meaningful horticultural research is a search for superior selections of citrus that might have arisen in the thousands of acres of citrus in the area. This is part of a national program. There is also citrus rootstock research, testing of exotic varieties of deciduous fruits and a certain amount of work related to cultural practices.

Laboratories at the horticultural unit are in poor condition and lack instruments, glassware and chemicals.

The roles of both field crop and horticulture stations need to be studied and clearly defined to determine the level of support justified. These units, along with the South Tahrir Station, serve as a unique, reclaimed area with large field crop and citrus plantings that is badly in need of research to solve a number of problems. There is a linkage with the University of Alexandria that could be further strengthened.

6. North Delta Region

Sakha

Sakha is designated the North Delta regional center. It is a large research station (29 PhD, 41 MS, 26 BS). Sakha does not have the serious staffing problem of Upper Egypt. The station consists of a number of units that involve animals, field crops, rice and cotton. There is a wide range of research but variety and animal improvement is emphasized throughout.

A large rice program is centered at Sakha. There is no research on rice at the FCRI in Cairo. There is a USAID-supported Rice Project in cooperation with the University of California that is constructing excellent facilities for rice research. These include an extensive administration-laboratory-extension building with a wide array of laboratories, a library, conference rooms, auditorium, offices and support facilities. There are buildings for storage of chemicals and pesticides, seed processing and machinery repair. The laboratories will be equipped with modern instruments to conduct a wide range of analytical and other analyses. Extensive equipment for routine farming and field research is being supplied and a large number of vehicles purchased.

There is an extension component with twenty regional rice specialists closely linked to the station and a subject matter specialist housed there. Extension facilities are excellent. Adequate land is assigned directly to the rice project.

Thus, the rice section at Sakha is virtually a self-contained experiment station with administrative headquarters located in Cairo.

There is also an EMCIP unit at Sakha located close to the rice project. The basic components of the EMCIP are described under the Shandoweel Station.

Thus, there are two exceptionally well equipped research complexes adjacent to each other with considerable duplication of facilities. For example, each has its own equipment repair and maintenance shops.

The rest of the field crop sections and the cotton section are poorly equipped, even though equipment and instrumentation is better than at most stations. Much of the instrumentation is not functional. For examples there is an old atomic absorption unit and two pH meters that have not been operable for many months in the soils and water laboratory.

The animal research pens and shelters are clean and well-maintained. Animal performance records are well kept. There is an artificial insemination unit that functions well but needs upgrading.

Laboratories for animal research are inadequate and the large program at Sakha justifies a higher level of support. Thus, a portion of the staff will be housed in modern facilities and supported well. The remainder have an adequate quantity of space in

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several buildings, but most of the substandard and laboratory instrumentation is inadequate.

Sirw

This is a small station located in the far northeastern Delta. The station has a small staff (2 PhD, 4 MS, 15 BS). The location is of particular significance because of soil salinity problems. Rice breeding lines from Sakha are tested at Sirw for salt tolerance. There is a field crop unit with soils and water, plant protection and plant pathology sections and an animal unit with cattle, buffalo, sheep and poultry. The research programs are small, as compared to Sakha. There appears to be a close working relationship with some members of the Sakha station, which is about a 1.5 hour drive from Sirw, particularly in the case of animal and rice research.

There are 40 feddans for land farmed for research but more is available from the production farm. Field equipment is available for the research program. Buildings, particularly a small one for animal staff, are well below standard. Animal pens need upgrading. The small cheese unit has little research value and is in very poor condition.

Laboratories for field crop and associated sections are very poorly instrumented. The staff is anxious to add considerable equipment so as to do such things as soil and plant tissue analyses. The pathologists and entomologists would also like to be much better equipped.

The station has an important role as a testing location, but whether it warrants extensive laboratory instrumentation needs to be determined.

7. Alexandria and North Coast Region

Sabahia

Sabahia is designated the regional center. It is a large (34 PhD, 90 MS, 100 BS) station with horticulture, sugar cane breeding, plant quarantine, soil salinity, and poultry units.

Horticultural research is conducted on citrus and a range of tropical and deciduous fruit trees, vegetables, medicinal and aromatic crops and ornamentals. The scope of research is broad, including both production and post harvest handling studies.

The plant quarantine unit is the only one in Egypt and, as its name implies, is devoted to the quarantine and inspection of plant introductions.

Sugar cane research is located at Sabahia because it is the only region with a climate that results in natural flowering. A minor amount of other kinds of research is done with pot grown cane.

Soil salinity research is located there because of salinity problems existing in the region. It undertakes a wide range of research from basic to very applied. It contains soil chemistry, soil physics, plant nutrition and physiology, irrigation and drainage and applied research sections.

The Montazah poultry research unit is a completely isolated unit located in the Montazah Palace (Alexandria). It is different from other poultry units in that it is conducting programs on physiology, immune genetics, nutrition and microbiology, rather than on just applied production practices and bird improvement.

Sabahia is an old station representing a distinct area. The buildings have been developed independently and do not form a planned

design. They also vary in quality but have been better maintained than most. Even so, they are, in general, substandard.

There is no production farm associated with Sabahia. The land available is sufficient in quantity (160 feddans) but so poorly drained that research with fruits is extremely limited, even though this is one of the primary purposes of the station.

Laboratory instrumentation is extremely deficient. Very little assistance in developing physical facilities resulted from the California/ADS Horticulture Subproject, even though a number of staff members were participants in citrus, deciduous fruits, ornamental crop, medicinal crop and various vegetable crop activities. It is to the group's credit that they have maintained their laboratories and utilized their limited equipment so well.

Sugar cane research is conducted in large greenhouses that are well constructed and adequate for their limited objectives. The plant quarantine greenhouse is appropriately constructed but far too small. There should be at least ten such greenhouses for accommodating the large amounts of material being introduced. Associated laboratories are well below standard. This important facility needs a much higher level of support. It is not accomplishing its purpose in its current condition. The soil salinity and water research facilities have also been maintained better and the instruments are in better condition than in most laboratories on other research stations. The laboratory also has more and better equipment than most. Even so, the relatively large building in which it is housed badly needs refurbishing and the instruments should be modernized and added to. This laboratory could

become extremely important as salt problems increase, which they surely will. Also, it is located in a region of poor drainage and near to sandy calcareous soil regions. Thus, its location has particular relevance.

It is not clear why a poultry unit devoted to such basic research should be located at Sabahia (Montazah), but the instrumentation and support are inadequate for such work.

In general, the Sabahia station is involved in commodity-oriented research for a distinct region. It has the largest vegetable program, one of the largest tree fruit programs and virtually the only ornamental research that is conducted on a research station in Egypt. Its plant quarantine and sugar breeding programs are unique and the soil salinity and water programs are particularly relevant. Thus, there is reason to support a program for improving soil drainage, increasing greenhouse space for quarantine work and for large increase of instrumentation in horticulture, plant quarantine, soil salinity and poultry laboratories.

It would be highly desirable to strengthen its linkage with the nearby University of Alexandria which is one of the best universities in Egypt.

ANNEX 2

**Budgetary Support for
Agricultural Research In Egypt**

Agricultural Research Council (ARC)
Summary Budget, 1980-84. (in Million LE)

Division		80/81	81/82	82/83	83/84
	Chapter				
Research	1	9.7	12.6	15.0	16.3
	2	2.2	2.7	2.5	2.6
	3	2.4	2.9	4.5	4.6
	4	<u>1.1</u>	<u>3.3</u>	<u>2.5</u>	<u>4.6</u>
	Subtotal	15.4	21.5	24.5	28.1
Extension	1	0.4	0.4	0.5	0.6
	2	0.1	0.1	0.1	0.1
	3	-	-	-	-
	Subtotal	<u>0.5</u>	<u>0.5</u>	<u>0.6</u>	<u>0.7</u>
Production	1	2.1	3.1	3.7	4.4
	2	2.9	3.2	2.8	3.2
	3	0.4	0.7	0.5	0.6
	4	<u>-</u>	<u>0.2</u>	<u>0.2</u>	<u>-</u>
	Subtotal	5.4	7.2	7.2	8.2
Total		21.3	29.2	32.3	37.0

Table A 2.2
 Agricultural Research Council (ARC) Expenditures,
 1979/83, and Budget, 1983/84
 (in million LE)

Budget Center	1979/80	1980/81	1981/82	1982/83	1983/84
Extension ^{1/}	0.43	0.50	0.50	0.60	.76
Institutes					
Soils and Water	1.06	1.17	1.52	1.60	1.64
Field Crops	1.00	2.00	4.60	6.03	6.13
Cotton	0.68	0.76	0.82	0.90	.97
Sugar Crops	0.16	0.18	0.20	0.25	.27
Horticultural Crops	2.82	3.00	3.30	3.50	3.65
Plant Protection	1.15	1.24	1.32	1.40	1.46
Plant Disease	0.50	0.57	0.60	0.65	.73
Animal Production	1.29	1.40	1.49	1.58	1.70
Animal Health	0.53	0.60	0.69	0.75	.85
Vaccination & Serum	0.51	0.58	0.63	0.70	.81
Animal Reproduction	0.11	0.14	0.17	0.20	.26
Agricultural Economics	0.39	0.42	0.45	0.50	.55
Agricultural Mech.	-	0.15	0.22	0.25	.30
Experiment Stations	1.86	2.07	2.69	2.90	3.00
Production Farms	5.00	4.90	7.20	7.60	9.00
Other, ARC ^{2/}	1.09	1.15	2.78	1.90	4.19 ^{3/}
Total ARC	19.08	21.33	29.18	32.31	37.27
Total MOA ^{4/}	n.a.	42.3	47.8	42.6	n.a.
Total GOE Expenditures ^{5/}	n.a.	10.3	12.3 ^{6/}	13.9 ^{7/}	n.a.

Source: ARC (Sept. 1983), except as otherwise indicated.

- ^{1/} Includes only expenditures channelled through ARC. Does not include fund for extension activities channelled directly to the governorates, either through the Ministry of Agriculture or through another Ministry
- ^{2/} Includes ARC Head Office, Flora Unit, and the Central Statistical Unit
- ^{3/} This increase over the previous year is due to an accounting transfer of personnel, an increase in fringe benefits which is distributed through the "head office" during the first year, and salaries for new personnel which will have been distributed to the various units before the end of the fiscal year.
- ^{4/} Source: Undersecretary of Finance, MOA.
- ^{5/} In billion LE, Source: World Bank, "Current Economic and Adjustment Policies," May 1983.
- ^{6/} Preliminary
- ^{7/} Budget

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Table A 2.3

Agricultural Research Council (ARC) Budget, 1983/84
(in million LE)

Budget Center	Chapter				Total	Research Budget (% of total) (Estimated)
	I	II	III	IV		
Extension ^{1/} Institutes	0.7	0.06	-	-	0.76	-0-
Soils and water	1.10	0.04	0.40	0.10	1.64	n.a.
Field Crops	1.10	0.05	0.08	4.90	6.13	n.a.
Cotton	0.7	0.07	0.20	-	0.97	n.a.
Sugar Crops	0.1	-	0.17	-	0.27	n.a.
Horticultural Crops	2.7	0.60	0.35	-	3.65	n.a.
Plant Protection	1.3	0.04	0.12	-	1.46	n.a.
Plant Diseases	0.6	0.03	0.10	-	0.73	n.a.
Animal Production	1.3	0.20	1.20	-	1.70	n.a.
Animal Health	0.6	0.10	0.15	-	0.85	n.a.
Vaccination & Serum	0.4	0.16	0.25	-	0.81	30
Animal Reproduction	0.1	0.06	0.10	-	0.26	n.a.
Agricultural Economics	0.5	x	0.05	-	0.55	n.a.
Agricultural Mech.	-	0.02	0.28	-	0.30	n.a.
Experiment Stations	1.2	1.00	0.80	-	3.00	n.a.
Production Farms	5.1	3.20	0.70	-	9.00	-0-
Other, ARC ^{2/}	3.7	^{3/} 0.24	0.25	-	4.19	n.a.
Total ARC	21.2	5.87	5.20	5.00	37.27	n.a.

Source: ARC (September 1983)

- ^{1/} Includes only expenditures channelled through ARC. Does not include fund for extension activities channelled directly to the governorates, either through the Ministry of Agriculture or through another Ministry.
- ^{2/} Includes ARC Head Office, Flora Unit, Central Statistical Unit.
- ^{3/} This increase over the previous year is due to an accounting transfer of personnel, an increase in fringe benefits which is distributed through the "head office" during the first year, and salaries for new personnel which will have been distributed to the various units before the end of the fiscal year.

Table A 2.4
 Agricultural Research Council (ARC) 5-Year Plan,
 Chapter III Budgets,
 1982 - 1987
 (in million LE)

Budget Center	1982/83	1983/84	Total Five-Year Plan (Targeted)
	(actual)	(actual)	
Extension ^{1/}	--	--	0.50
Institutes			
Soils and Water	0.32	0.40	3.50
Field Crops	0.10	0.08	1.25
Cotton	0.17	0.20	2.50
Sugar Crops	0.05	0.17	0.50
Horticultural Crops	0.52	0.35	2.35
Plant Protection	0.12	0.12	9.51
Plant Diseases	0.09	0.10	0.61
Animal Production	1.45	1.20	2.20
Animal Health	0.12	0.15	1.00
Vaccination & Serum	0.20	0.25	1.75
Animal Reproduction	0.08	0.10	0.75
Agricultural Economics	0.06	0.05	0.70
Agricultural Mech.	0.18	0.28	1.00
Experiment Stations	0.80	0.80	5.45
Production Farms	0.60	0.70	7.63
Other, ARC ^{2/}	0.34	0.25	1.80
Total ARC	5.20	5.20	53.00

Source: ARC (September 1983)

^{1/} Includes only expenditures channelled through ARC. Does not include fund for extension activities channelled directly to the governorates, either through the Ministry of Agriculture or through another Ministry.

^{2/} Includes ARC Head Office, Flora Unit, Central Statistical Unit

Table A 2.5

Revenues Generated by ARC Units, 1982/83

(1,000 LE)

Budget Center	Revenue Generated (1982/1983)
Extension	--
Institutes	
Soils and Water	24
Field Crops	4
Cotton	12
Sugar Crops	--
Horticultural Crops	70
Plant Protection	8
Plant Diseases	--
Animal Health	--
Vaccination & Serum	929
Animal Reproduction	20
Agricultural Economics	--
Agricultural Mechanization	--
Experiment Stations	464
Production Farms	7,649
Other, ARC <u>1/</u>	--
Total ARC	9,980

Source: ARC (September 1983)

1/ Includes ARC Head Office, Flora Unit, Central Statistical Unit

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Table A 2.6: Obligated and Projected Expenditures, Ministry of Irrigation, 1980-87
(Million LE)

	80/81 Obligated	81/82 Obligated	82/83 Obligated	83/84 Obligated	84/85 Projected	85/86 Projected	86/87 Projected
Irrigation Dept.							
Chapter I	13.5	22.1	23.9	25.5	10 % yearly increase		
Chapter II	23.7	28.1	28.2	34.8			
Chapter III	54.9	67.5	92.4	94.4	118.40	119.40	113.20
Chapter IV	0.0	0.0	0.0	0.1			
Subtotal	92.1	117.7	144.5	154.8			
Water Research Center							
Chapter I	1.1	2.0	2.2		10 % yearly increase		
Chapter II	0.2	0.2	0.2				
Chapter III	2.0	2.0	4.7	3.6	3.7	3.9	4.0
Chapter IV	0.2	0.0	0.0				
Subtotal	3.5	4.2	7.1	--	--	--	--
Total MOI							
Chapter I	33.9	46.8	58.3		10 % yearly increase		
Chapter II	34.8	39.2	46.4				
Chapter III	176.0	190.0	230.3	240.00	285.90	278.10	272.65
Chapter IV	2.2	2.0	5.2				
Total	246.9	218.0	340.2				

Source: MOI (August 1983)

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Table A 2.7: Foreign Exchange Expenditures, Ministry of Irrigation,
Irrigation Department (ID) and Water Research Center (WRC), 1980-83

	80/81		81/82		82/83	
	W.R.C.	I.D.	W.R.C.	I.D.	W.R.C.	I.D.
Chapter II	-	1.2	-	1.1	-	3.0
Chapter III	1.19	15.9	1.2	20.4	3.6	36.5
Free	.49	13.3	.2	15.7	0.1	18.8
Facilities	.70	2.6	1.0	4.7	3.5	17.7
Total I.D.						
+ W.R.C.	17.1		21.6		40.1	
Free	13.8		15.9		18.9	
Facilities	3.3		5.7		21.2	
Total M.O.I.	73.30		79.70		90.60	
Free	20.9		21.7		29.6	
Facilities	52.4		58.0		61.0	

Source: MOI (August 1983)

Table A 2.8: Food and Agriculture Research Projects

Carried out by the National Research Center
in Cooperation with Foreign Agencies

Title	Cooperating Agency	Level of Funding
1. Utilization of cane sugar bagasses	U.S.D.A.	171,115 LE
2. Aflatoxin residues in Egyptian food and feed derived from plant and animal sources	FDA	92,957 LE
3. Distribution and inactivation of parasitic and bacterial pathogens in edible fish	FDA	47,217 LE
4. Poisonous plants contaminating edible ones and toxic substances in plant foods	FDA	306,844 LE
5. Biological Pest control in Egypt	U.S.D.A.	183,673 LE
6. Micronutrients and plant nutrition problems in Egypt	GTZ (Ministry of Technical Cooperation)	Equipment
7. Production of proteins from algae	GSF, FRG (Dept. of Algal Research)	Equipment
8. Solar dehydration of agricultural products	IDRC	131,798 LE
9. Improvement of soil properties in Egypt	EEC & ASRT (Commission of European Communities)	1.65 million EAU (Equipment & Training + 54,000 LE (ASRT))
10. Advanced technology for using sewage water in irrigation	Karlsruhe University W. Germany	26,885 LE
1. More and better food	AID (ST program)	Equipment (within 3 million dollars) + budget for training, material & supplies & incentives
12. New crops for arid and semi-arid zones	AID (ST program)	Equipment (within ½ million dollars) + budget for training, material & incentives

(September 1983)

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Table A 2.9: USAID/Egypt Technical Assistance Projects in
the Agricultural Sector ^{1/}

Project Title	Completion Date	Life of Project (LOP) Obligations (million US \$)
<u>Agriculture Office/Bureau:</u>		
Agricultural Development Systems	9/1/83	12.9
Agricultural Cooperative Marketing	9/1/83	5.0
Small Scale Activities	6/30/84	1.7
Water Use & Management	6/30/84	13.0
Agricultural Data Collection	5/31/85	5.0
Aquaculture	8/31/85	27.5
Small Farmer Production	9/ 1/85	25.0
Agricultural Management	6/30/85	5.0
Major Cereals	6/30/85	47.0
Rice Research and Training	9/ 1/85	21.0
Agricultural Mechanization	9/ 1/85	40.0
Irrigation Management	7/31/86	38.0
Total		241.1
<u>Science and Technology Office/Bureau:</u>		
University Linkages Program (see Annex Table 2.10)	FY 86	27.0
More and Better Foods	n.a.	n.a.
Arid and Semi-Arid Lands	r.a.	n.a.
Food Technology	n.a.	n.a.
Red Sea Fisheries	n.a.	n.a.
New Crops	n.a.	n.a.
Nutrition (CRSP)	n.a.	3.0
Special Foreign Currency (PL 480)	FY 84	Variable
Regional Cooperation Project (Egypt/Israel/U.S.)	FY 89	5.0

^{1/} As of July 1983

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Table A 2.10: Ongoing Agricultural Research,
University Linkages Project (USAID funded)

Project Title	Egyptian University	Linkage University	Funding Level/ p.a. (1,000 US\$)
Biological control of corn borers	Cairo U. Assiut U.	U. of Maryland College Park	50.0
Survey and studies of arthropod pests infesting medicinal and aromatic plants in southern Egypt	Assiut U. Minia U.	Duke University Durham, N.C.	50.0
Improvement of productivity and nutritive value of forage crops	Menoufia U.	--	50.0
Utilization of cheese whey for animal feeding	Cairo U.	--	50.0
Improving fig production in southern coastal areas	Alexandria University	--	50.0
Improving peanut production by controlling disease	Alexandria University	--	50.0
Improving fig production in Upper Egypt	Assiut U.	--	30.0
Utilization of agricultural wastes as fuel for domestic use	Ain Shams U.	Purdue Indiana	50.0
Design and development of agricultural equipment for small scale farms in Egypt	Cairo U.	U. of Illinois Urbana, Ill.	18.0
Unit operation of mechanization & electrification of small/medium farms and required technical training	Menoufia U.	--	10.0
Investigating the degradation of Polyvinyl chloride (PVC) pipes used in subsoil agricultural drainage	Cairo U.	MIT Cambridge, Mass.	10.0
The effect of industrial waste products in Upper Egypt on conditional health of farm animals	Assiut U.	--	50.0 ^{1/}
The establishment of a wildlife area as a model for the management of wildlife in arid	Assiut U.	U. of Arizona Tuscon	50.0 ^{1/}

Table A 2.11: Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Desert Erosion & Sand Movement in Egypt	Ain Shams University Smithsonian Institution	1/78 - 12/81	64.1
Arboviruses in Egypt	Egyptian Organization for Biolog. & Vaccine ONR	6/74 - 6/81	481.1
Lysogeny & Bacteriocirogeny in Salmonella, Shigella Bacillus	Al Azhar University ONR	4/73 - 3/81 Terminated	303.4
Study the Present Arbovirus Prevalence Around Lake Nasser & Upper Egypt and Determine Transport of Virus from Africa to Egypt	Egyptian Organization for Biological and Vaccine Products ONR	6/78 - 5/81 Terminated	429.8
To Isolate & Identify the Factors in the Bean Lupinus Termis that Produce Excellent Bacterial Growth	Egyptian Organization for Biological & Vaccine Products ONR	6/78 - 5/83	185.7
Use of Modern Remote Sensing Techniques in Monitoring Desertification and Natural Resources	Academy for Scientific Research and Technology NSF	4/80 - 8/83	218.2
Study of Interaction of Pesticides with Cholinergic Proteins	Alexandria University University of Maryland	8/78 - 12/81 Terminated	180.6

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
A Botanical and Chemical Investigation of Toxic Egyptian Terrestrial and Marine Weeds	Cairo University University of Rhode Island	2/79 - 1/83	87.3
Bovine Adaptation to the Sahara	Atomic Energy Establishment University of Missouri	6/4 - 11/82	197.5
Endangered Species Conservation Plan	Ministry of Agriculture FWS	1/78 - 4/82	150.3
Field Management & Operations Support	Ministry of Agriculture National Park Service	1/78 - 6/81	42.0
Conservation Themes & Public Education	Ministry of Agriculture National Park Service	7/80 - 7/81	21.7
Cooperative Agreement Between the U.S. Fish & Wildlife Service and the Dept. of Fishery & Wildlife Biology - CSU	Colorado State Univ. U.S. Fish & Wildlife Service	8/80 - 7/81	20.0
Genetic & Cytogenetic Changes Induced by Chemicals in the Environment	Alexandria University Faculty of Agriculture EPA, North Carolina	5/78 - 5/83	240.9
Cytogenetic Studies on Pesticides Effect on Cell Cultures	National Research Center EPA, North Carolina	3/79 - 2/84	335.6

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Analysis & Management of Arid Ecosystems of the Western Desert of Egypt	Under sponsorship of ASRT National Ecological Research Laboratory	9/78 - 9/82	630.5
Multi-disciplinary Environmental Studies	National Research Center EPA - Oklahoma	9/79 - 6/83	366.6
Water Quality Studies on River Nile and Lake Nasser	University of Michigan EPA - Washington, D.C.	3/74 - 6/82	1,171.3
Investigation of Level and Effects of Pollution in Saline Lakes and Littoral Marine Environments	ASRT EPA/Gulf Breeze Research Laboratory	9/77 - 3/83	637.4
International Workshop and Symposium on Mycotoxins	National Research Center FDA	2/81 - 2/83	98.7
Distribution and Inactivation of Parasitic and Bacterial Pathogens in Edible Fish	National Research Center FDA	8/76 - 12/81 Terminated	51.2
Poisonous Plants Contaminating Edible Ones and Toxic Substances in Plant Foods	National Research Center FDA	12/76 - 12/83	283.5
Aflatoxin Residues in Egyptian Food and Feed Derived from Plant and Animal Sources	National Research Center FDA	7/76 - 7/81 Terminated	111.0

Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Microbiology Contamination of Foods	Nutrition Institute CDC	7/75 - 7/82	205.8
Information Unit for Environmental Impact Assessment	Environmental Health Center Min/Health NIH	6/81 - 6/86	105.0
Seminar on Environmental Management	Ministry of Health Medical Center University of Kansas	10/81 - 10/82 Terminated	20.2
Workshop on Trace Metals and their Biological Significance	Subcommittee for Environmental & Occupational Health University of Washington	6/81 - 6/82 Terminated	10.9
Evaluation of Exposure to Cotton and Flax Dusts	High Institute of Public Health - Alex. University NIOSH	7/76 - 7/83	273.8
Integrated Program for Control of White Rot Disease of Onion Caused by Sclerotium Cepivorum in Egypt	Ministry of Agriculture USDA - Maryland	4/80 - 3/85	100.7
Response of Sunflower Genotypes to Diseases and Nematodes as Influenced by Different Levels of Salinity and Water Deficit	Ministry of Agriculture USDA - Maryland	2/80 - 1/85	140.8

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Investigations on the Role of Predators and Parasites in Controlling Dung Breeding Flies	Ministry of Agriculture USDA - Texas	3/80 - 2/83	78.4
Cercospora Leaf Spot Disease of Peanuts	Alexandria University Crop Genetics Research Oklahoma	3/80 - 3/83	62.5
Conventional and Unconventional Protein Sources for NPN Utilization in Ruminants	Alexandria University U.S. Meat Animal Research Center, Nebraska	4/80 - 4/84	97.7
Biological Pest Control in Egypt	National Research Center USDA - Texas	4/79 - 4/84	183.7
Integrated Control of Scale Insects and Red Spider Mites Attacking Citrus in Egypt	Ministry of Agriculture USDA - Texas	7/79 - 7/84	83.5
Biology & Ecology of the Principal Natural Enemies of Stored Product Insects in Egypt	Cairo University USDA - Georgia	10/79 - 9/84	91.4
Development of High Salt Tolerant Rice Varieties Adapted to N. Coastal Area in Egypt	Ministry of Agriculture USDA - Riverside, Calif.	12/79 - 11/84	125.3
Environmental Pollution with Pesticides and Chemical Fertilizers	Ministry of Agriculture USDA - Maryland	1/80 - 12/84	171.8

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Methods for Detecting Meats from 5-D Slaughter Animals	Ministry of Agriculture USDA - Maryland	1/80 - 3/84	129.7
Improvement of Tomato Crop in Egypt	Menoufia University USDA - Maryland	2/80 - 1/85	132.1
Field Studies on Sodic Soil Reclamation to Determine the Most Effective Placement of Amendment in Terms of Soil Location	Ministry of Agriculture USDA - California	7/78 - 7/83	149.6
The Epidemiology, Diagnosis & Control of Rift Valley Fever in Egyptian Livestock	Ministry of Agriculture USDA - New York	7/78 - 7/83	336.9
Collection & Evaluation of Cereal Germ-Plasm in Egypt	Assiut University USDA - Maryland	9/78 - 9/83	-239.9
Chemical Factors Affecting Soil Release from Cotton Containing Durable Press Fabrics	National Research Center USDA - New Orleans	1/79 - 6/83	129.4
Studies on Horizontal & Specific Resistance to Rice Blast & Brown Spot Diseases & Isolating New Resistance Genes from Local and Foreign Cultivars	Agricultural Research Institute USDA - Texas	3/79 - 3/84	126.4
Insect Resistant Packages for Processed Cereals	Agricultural Research Center USDA - Georgia	3/79 - 12/83	150.5

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Investigation on a Bovine Skin Disease Called "Odematous Skin Disease"	Ministry of Agriculture USDA - IOWA	4/79 - 4/83	172.1
Developing Durum Wheat Varieties with Higher Yield & Superior Quality	Ministry of Agriculture North Dakota State University	5/78 - 5/83	166.9
Effects of Micronutriants on some Field & Horticulture Crops	Ministry of Agriculture USDA - Montana	4/78 - 4/83	133.4
Microeconomic Study of the Egyptian Farm System	Ministry of Agriculture Foreign Demand & Competition Div., ERS Washington, D.C.	6/78 - 5/82	201.6
Natural Enemies of Lygus & Associated Plant Bugs in Upper Egypt	Assiut University USDA - Arizona	6/78 - 6/83	246.8
Survey of Organisms Associated with Aquatic Weeds & Introduction & Evaluation of....for Biological Control of Water Hyacinth in Egypt	Ministry of Agriculture USDA - Washington, D.C.	7/78 - 7/83	111.3
Termites as Related to Food & Agriculture in Egypt	Assiut University USDA - S. Forest Experimental Station	7/78 - 7/83	342.1

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Mechanism of Degradation of Cotton & Effects of Mercerization Stretching Upon the Course of These Mechanisms	National Research Center USDA - Louisiana	10/77 - 6/83	142.0
Production of Heat-Resistant Lettuce	Assiut University USDA - California	1/78 - 12/82	81.5
Survey, Epidemiology & Therapeutic Studies on Equine Babesiosis in Egypt and its Control	Cairo University USDA - Maryland	2/78 - 2/83	193.4
Investigations on Immuno-Deficiency in Young Arabian Horses	Animal Health Research Center - MOA USDA - IOWA	2/78 - 2/83	169.1
Plant Pest Trapping Project	Alexandria University USDA - Maryland	3/78 - 3/82	124.1
Development of Data for Utilization of Traps as a Safeguard Measure Against Newly Introduced Pests	Plant Protection Research Institute - MOA USDA - Maryland	4/78 - 8/83	96.9
Production of Onions Resistant to White Rot Diseases	Assiut University USDA - Wisconsin	4/78 - 4/86	211.1

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Weed & Wild Plants as Hosts of Some Economic Insects & Mites	Menoufia University USDA - South Carolina	5/77 - 5/82	64.8
Utilization of Non-Apis Bees as Crop Pollinators	Cairo University USDA - Utah	5/77 - 12/82	86.8
Interaction Between Soil-Borne Pathogens & Herbicidal Treatments in Cotton Culture	Tanta University USDA - Maryland	5/77 - 5/82	62.0
Effect of Herbi-Fungi Interactions & Hot Water Treatment on Seed and Soil-Borne Plant Patho-Organisms of Economic Crops	Alexandria University USDA - Maryland	7/77 - 7/83	80.8
Productivity & High Temperature Storage for Seed & Ware Potatoes of Introduced Cultivators in the Sub-Tropical Climate of Egypt	Ministry of Agriculture USDA - Minnesota	9/77 - 9/82	101.7
Studies of Species & Biotypes of Root-Knot Nematodes and their Relationships to Economic Host Plants in N. Egypt	Alexandria University USDA - Maryland	8/77 - 8/84	113.9
The Use of Insect Juvenile Hormone Analogs for Control of Egyptian Insect Pests	Cairo University USDA - Maryland	12/77 - 12/82	105.4
Utilization of Cane Sugar Bagasses	National Research Center USDA - Illinois	10/77 - 9/82	172.6

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Ecological Studies to Develop the Sterile Insect Technique for control of Mediterranean Fruit Fly <i>Ceratitis Capitata</i> : (WIED.) in Government Farms in the Reclaimed Area of Western Desert, A.R.E.	Ministry of Agriculture USDA - Hawaii	9/76 - 9/82	95.9
Investigations on the Epidemiology of Newcastle Disease "The Viscerotropic Velogenic Strain" in Egypt	Ministry of Agriculture USDA - Long Island New York	10/76 - 4/82	144.2
The Role of Some Domestic Animals & Birds in the Epizootiology of Foot & Mouth Diseases in Egypt	Ministry of Agriculture USDA - Maryland	10/76 - 4/82	166.2
Production of Early Maturing Garlic	Assiut University USDA - Wisconsin	10/76 - 10/82	85.2
Epidemiology & Immunological Studies on South African Horse Sickness Disease & Trials of Production of an Inactivated Vaccine	Ministry of Agriculture USDA - New York	10/76 - 4/83	186.8
The Development & Use of Varietal Resistant and Other Non-Chemical Control Methods to Reduce Yield Losses Due to Stalk Borers in Maize	Ministry of Agriculture USDA - IOWA	4/77 - 4/83	75.7

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Agricultural Research in Egypt

(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
An Appraisal of Losses Caused by Important Diseases in Major Crops in Egypt	Ministry of Agriculture USDA - Maryland	4/77 - 4/84	117.0
Comparative Study on Methods of Combating Parasites of Ruminants Under U.S. & Egyptian Conditions	Alexandria University USDA - Maryland	5/76 - 5/83	128.3
Genetic Improvement of Eucalyptus & a Few Other Fast Growing Species in Egypt	Alexandria University USDA - Washington, D.C.	5/77 - 5/83	91.7
Maximizing the Efficiency of Atmospheric Fumigation	Cairo University USDA - Savannah, GA	5/76 - 5/82	76.3
Reaction & Adaptation of Spring Wheat & Barley Germplasm to Salt Affected Conditions	Ministry of Agriculture USDA - Maryland	10/76 - 10/82	137.2
Persistence of Some Insecticides in Semi-Arid Conditions in Egypt	Medical Entomology Research Institute, MOH USDA - Maryland	4/77 - 9/84	146.6
Survey of Leaf Rust, Net Blotch, BSMV & BYD Virus.....& Develop Barley Varieties Resistant to These Diseases	Ministry of Agriculture USDA - North Dakota State University	9/76 - 3/82	102.3
The Interrelationship Between Water Management & Plant Nutrition for Maximizing Crop Production	Alexandria University USDA - Idaho	10/76 - 12/83	192.8

Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Protein Improvement in the Main Egyptian Field Crops	Alexandria University USDA - Nebraska	8/75 - 5/83	181.9
Towards Developing High Quality & Quantity Protein Maize Populations at High Yield Levels with Reference to Implications in Animal & Human Nutrition	Ministry of Agriculture USDA - IOWA	7/75 - 1/82	69.8
Criteria for Design of Drainage Systems - Depth & Spacing Requirements of Sub-surface Drains for Proper Soil Drainage	Ministry of Agriculture USDA - California	7/75 - 7/85	264.9
Utilization of Nematodes in Biological Control of Pests	Cairo University USDA - Maryland	11/75 - 11/82	105.6
Studies on Virus Diseases of Legume Plant	Ministry of Agriculture USDA - Wash. State U.	4/76 - 2/82	116.0
Evaluation of Methods & Materials for Draining Waterlogged Soils - Field Evaluation of Pipe & Envelope Materials for Effective Drainage	Ministry of Agriculture USDA - California	8/75 - 8/84	172.4
Biological & Chemical Changes in Semen as Affected by Freezing & Storage at 196° C	Al Azhar University USDA - Maryland	5/76 - 3/82	96.2
Control of Major Diseases of Corn (Zea Mays)	Ministry of Agriculture Perdue University	6/75 - 6/81	96.3

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Agricultural Research in Egypt
(Funded Under PL-480)

Project Title	Participating Institution(s)	Project Period	Life of Project (LOP) Budget (1,000 LE)
Windbreaks and Shelterbelts - Their Effect in a Useful Way on the Agricultural Crops & Soil Conservation	Ministry of Agriculture USDA - Washington, D.C.	4/75 - 4/82	82.1
Control of Major Stalk, Foliar & Grain Diseases of Sorghum....Including Studies on the Genetic nature of Resistance	Ministry of Agriculture Texas A & M University	6/75 - 1/83	112.7
Surveying & Ecological Studies on Phytophagous, Predaceous & Soil Mites in Egypt with Special Consideration to New Reclaimed Land	Ministry of Agriculture USDA - Maryland	6/75 - 6/83	152.4
Drying and Storing of Rice	Alexandria University USDA - Kansas	6/75 - 8/83	141.7
Biotic Factors Affecting Different Species in the General Heliothis & Spodoptera in Egypt	Plant Protection Institute, Giza Delta States Ag. Research Center, Miss.	4/79 - 3/84	135.1

Table A 2.12 List of Donor (Excluding USAID)
Activities in Agriculture
(\$'000)

Donor	Activity	Project Amount	Total Amount	Date
IBRD/IFAD			465,200	
	Fruit & Vegetable Development	50,000		1976-
	Upper Egypt Drainage II	50,000		1976-
	Nile Delta Drainage II	66,000		1977-
	Sohag-Menoufia Agri. Devt.	32,000		1978-
	Agro-Industries I	45,000		1980-
	New Lands Development	80,000		1981-
	Fish Farming	14,000		1981-
	Agro-Industries II	81,200		1982/83-
	Minya Agricultural Devt.	47,000		1983-86
West Germany (GTZ)			9,352	
	Field Rat Control	7,730		1982-88
	Maryout Extension Communica.	1,057		1976-85
	Maamoura Agricultural Mech.	565		1981-84
Holland			6,005	
	El Fayoum Poultry	5,815		NA
	Potato Production Improvement	190		1981-84
FAO/UNDP			2,800	
	El Morra Oasis Desettlement	800		1981-83
	NW Coastal Development	800		1980-84
	Beef Industry Devt. II	800		1982-84
	Drainage Water Utilization	400		1981-83
Other Donors*			14,718	
	Rice Mechanization (Japan)	5,910		1981-86
	Dakahlia Storage Facility (EEC)	5,377		NA
	Experimental Protein Lab (Denmark)	114		1980-92
	Goat Breeding (France)	118		1982-86
	Sakha Training Center (UK)	192		1982-85
	Medfly Eradication (Italy)	7		NA
	Faba Bean Project (ICARDA)	2,500 (approx)		5 years
	Potato Project (CIP, GTZ and IDRC Cooperating)	500 (approx)		NA
<u>Total Assistance</u>			498,075	

*Information not available on several donors, including Canada (CIDA and International Development Resource Center), Australia, Eastern Bloc donors.

Sources: Office of Foreign Relations (MOA);

UNDP Development Programme, 1981; IBRD Reports.

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ANNEX 3

**Organizing, Planning and Managing
the Activities of ARC**

M.B. Russell

Organizing, Planning and Managing the Activities of ARC

The ARC will conduct interdisciplinary programs of problem-oriented research, training and extension designed to accelerate the production of food and fiber, and improve rural well being. Structurally ARC consists of a set of disciplinary Institutes and Regional multi-purpose Centers and field stations at which its work is conducted. The work of ARC will be organized into a set of coordinated interdisciplinary problem-oriented Programs which will involve training and extension activities as well as applied and adaptive research. Each such Program will be implemented through a set of Projects, each of which will involve a set of detailed Work Plans. This hierarchical array of Programs, Projects and Work Plans is defined and described in the following paragraphs.

Programs are defined as interdisciplinary areas of research, training or outreach in which work will be conducted on a continuing basis by the ARC professional staff. Examples would be Coordinated Wheat Improvement Program, Coordinated Oilseed Improvement Program, Coordinated Training Program for Extension Workers, etc. It is anticipated that ARC will organize and conduct fifteen or more such interdisciplinary programs. For each of those Programs, the staff of ARC will develop a comprehensive Program Statement. This will set forth the needs for the activity, the objectives and broad outline of the work to be done, and will specify the criteria to be used to measure achievement of the objectives and hence, the success of the Program. Each Program will be executed through Projects which are planned and conducted by scientists in the various Institutes and Regional Centers.

A Project is thus a component part of a Program. It is a more detailed statement of the work to be done by one or more scientists of an

ARC Institute or cooperating institution on a specific part of one of the Coordinated Programs. A Project would also serve to define and describe work done extramurally by scientists of other institutions who are cooperating with the staff of the Institute. Each research Project Outline should include a set of objectives, an outline of the variables to be studied, a description of the methodology to be used, and an estimate of the time, personnel, facilities and funds needed to conduct the work. The duration of a research Project will vary, but most should fall in a three to five year range in a dynamic research organization. Training and Outreach Projects also should give the objectives, the subject matter to be covered, the clientele to be served, the methodology to be used and an estimate of the time, personnel, facilities and funds needed to conduct the work. The specific operational details for conducting the Projects are given in a set of Work Plans.

A Work Plan gives detailed and explicit answers to the who, what, when, where, how and how much type of questions concerning all of the activities involved in conducting the work of a Project. For each research Project, a detailed Work Plan should be prepared for each experiment to be conducted each cropping season. Thus, the Work Plan for a field experiment should give the hypotheses to be tested, the treatments to be studied, the number, size and location of the plots, the variety of crop to be grown, the seeding rate, method of sowing, fertilization, cultural practices and all details concerning the growing and harvesting of the crop. It should specify the measurements and observations to be made and the methods for calculating, analyzing and interpreting the data collected. In a similar fashion, a Work Plan for a Project in the Coordinated Training Program should set forth the details

of the subject matter, the number, time and location for the various lectures, demonstrations, discussions, etc., and the methods to be used to evaluate the performance of the trainees.

Some of the procedures to be used in developing, conducting and evaluating the Programs, Projects and Work Plans described above are briefly discussed in the following paragraphs. Since these activities represent a very critical part of the administrative management of the Institute, it may be advisable to designate an Associate Director for Program Planning, Monitoring and Evaluation as a staff officer to the Director of ARC to give continuing attention to this important activity.

The Program

The effective operation of interdisciplinary Programs of research, training and outreach requires that continuing creative attention be given to the planning and evaluation of them. The overall responsibility for Program planning and evaluation should rest with the Director of the Center. For each of the Programs a staff Task Force consisting of three or more senior scientists selected from the subject matter Institutes most directly involved should be designated by the Director and given the responsibility of formulating the Program and developing the Program Statement under the leadership of the Associate Director for Program Planning and Evaluation.

In analyzing the needs, establishing priorities and formulating the Program, each Task Force should obtain policy guidance from the Director and should actively solicit ideas and suggestions from the entire professional staff of ARC and from knowledgeable professionals in other related organizations both domestic and foreign. Each Task Force also

should carefully review and evaluate the existing knowledge and experience pertaining to the Program area and clearly state its relevance to achieving national development goals.

Such information should be summarized in the Program Statement together with a listing of assumptions used by the Task Force in establishing the objectives and priorities incorporated in the Program Statement. The latter also should include the criteria to be used in evaluation of the Program and should set target dates for achievement of Program objectives. Each Program Statement thus becomes a strategic plan of work. It should be carefully reviewed each year by the Task Force in light of new information, emerging needs and altered priorities and reformulated for a full five-year period. During the annual review and reformulation, the ideas and suggestions of other informed persons both inside and outside ARC should be solicited in a systematic manner.

It is vitally important that the principal objectives of all of the ARC Programs be understood by the entire professional staff. Every effort should be made to encourage broad-based staff participation in the continuing process of Program planning and evaluation. It is suggested that a series of staff seminars be conducted at which each of the Programs of the Institute is discussed at least once each year. It is further suggested that comprehensive in-depth reviews of each Program involving experienced persons from outside the ARC be conducted at three to five year intervals.

Project Development

Projects are used to implement programs. They are developed by the staff members who execute them and are conducted in the various ARC

laboratories and field facilities. Hence, the work of each Institute and of each Regional Center or Field Station becomes the sum of the activities done under the Projects from those ARC Programs in which the staff of that Institute, Center or field station participated. In similar fashion, each ARC Program is the sum of the work done under its component projects by scientists of the several participating Institutes, Centers and Stations.

Thus, each Project is simultaneously a part of a Program and also is part of the work of an Institute. This dichotomy of organization provides for the desired interdisciplinary focus and emphasis in program formulation and evaluation and at the same time provides for the essential disciplinary integrity and specialization in Program implementation.

Projects for executing each of the research Programs should be developed by individual staff members. It would be expected that each senior scientist would be the leader of one or more Projects and would have prime responsibility for planning, conducting and evaluating the work done thereon. In formulating the Project Outline, the staff member should actively seek ideas and suggestions from his colleagues both within his Institute and from others. In particular, he should obtain guidance and assistance from members of the Task Force which has responsibility for the Program of which his project is a part.

Each Project Outline should consist of a title, a set of objectives, a statement of justification showing its relation to the Program objectives to which it will contribute and an estimate of the professional and subprofessional manpower, facilities, supporting services and funds needed to conduct the work. Each research Project

Outline also should specify the phenomena to be studied, the observation and measurement to be made, and the methods to be used to analyze and interpret the data. Each training and extension project should specify the clientele to be served, the substantive content of the training to be imparted, the information to be extended, the methods to be employed and criteria to be used in evaluating the results of the project's activity. Prior to submission to the ARC Director for approval, each Project Outline should be reviewed both by the relevant Program leader and by the heads of the Institute and the Regional Center at which the work will be conducted. The Program leader's review should focus on the relevance and significance of the proposed Project to the objectives and priorities of the Program. The Institute or Regional Center review should center on the disciplinary validity and adequacy of the proposal and on the realism of the estimate of personnel, facilities, support services and funds included in the Project Outline. In cases where either of the reviews reveals inadequacies or weakness in the proposal, suitable revisions should be made in consultation with the project leader who submitted it. After it has been approved by the Program Leader and by the Institute and/or Regional Center, the Project Outline should be submitted to the appropriate ARC Deputy Director for approval.

Work Plans for Project Execution

As discussed at _____, the details of the work to be done are set forth in Work Plans for each experiment, training course or outreach activity. These should be prepared by the staff member who actually performs the experiment, instructs the trainees or conducts the outreach meetings or demonstrations. For research projects usually one or more experiments

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Each Project Outline should consist of a title, a set of objectives, a statement of justification showing its relation to the Program or objectives to which it will contribute and an estimate of the professional and subprofessional manpower, facilities, supporting services and funds needed to conduct the work. Each research Project

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Work Plans for Project Execution

As discussed at _____, the details of the work to be done are set forth in Work Plans for _____ experiment, training course or outreach activity. These should be prepared by the staff member who actually performs the _____ experiment, instructs the trainees or conducts the outreach meetings or demonstrations. For research projects usually one or more experiments

will be conducted each season, hence a Work Plan should be developed for each experiment. A training project may involve participation in several different training courses and an outreach project might consist of different kinds of demonstrations, exhibits, or farmer meetings during the year. For each of these, detailed answers to the what, when who, where and how questions should be decided in advance and set forth in a plan for each experiment or activity. Such plans should be reviewed by the Project Leader and a careful check should be made ahead of time to verify the availability of the necessary materials, personnel, facilities, support services and funds.

The Projects constitute the basic units for planning, managing and evaluating the work of ARC. They can be considered as the "building blocks" of a three dimensional unit whose dimensions are the Institutes, the Coordinated Programs and the Regional Centers. A Project defines the work performed on a Program by an Institute scientist at a Regional Center. Consequently, each Project is simultaneously a constituent part of the work of an Institute, a Regional Center and a Program.

It should be recognized that the Institute - Program - Location matrix being developed for ARC is provisional and may change as the Center develops and as the needs and priorities of the agricultural sector evolve. It is essential, therefore, that the process of program planning and evaluation be made a continuing part of the work of ARC so that its programs remain relevant to and focused on the high priority needs of Egypt.

The three-way matrix provides a rational basis for developing the ARC staffing pattern. Experienced scientists should be designated as leaders, for each Program and for each Institute and Regional Center.

The amount of scientific effort, facilities, and funds available should be distributed among the cells of the matrix in accordance with the needs and priorities as determined in the continuing interdisciplinary analysis by the staff of each of its Programs. Not all of the "cells" in the matrix will necessarily be filled, and individual scientists may, in fact, distribute their work over more than one Program, i.e. be budgeted to more than one cell in the matrix.

The three-way organizational matrix focuses attention on the importance of continuously using three sets of criteria in planning and evaluating the activities of ARC and of budgeting its resources. Each decision concerning program content, staff needs or budget allocation should be based on (a) program relevance, (b) scientific integrity, and (c) operational feasibility. Program relevance is the primary concern of the leader of each Program, scientific integrity is the prime responsibility of the leader of disciplinary Institute, and operational feasibility is judged by the head of the facility at which it is performed.

Such continuing interplay of these three criteria for decision-making is essential if an interdisciplinary problem-oriented organization such as ARC is to remain dynamically productive and responsive to the evolving development needs of Egyptian agriculture.

In this paper attention has been given to the work to be done in the process of organizing and planning the work of ARC. Obviously this is an important element in making it as an effective agent for the growth and development of Egyptian agriculture. There are, however, other critically important elements in the development of ARC that must receive

high priority if the results of the program planning described herein are to be productive.

One such element is that of administrative flexibility and support services. The burden of bureaucratic red-tape must be removed from the scientists if they are to be fully productive. The routine "housekeeping" details of purchasing, accounting, maintenance of facilities, transportation, etc., should be provided by a cadre of trained professionals whose role is that of supporting the technical programs of scientific staff.

Another essential component of the institutional development process is facilities. This includes buildings, research plots, equipment, transport, etc. In planning the physical facilities, support services and administrative organization and procedures, it is important to remember that such facilities, services, and procedures exist only as means for the efficient execution of the Programs by the scientists of the Institutes and Regional Centers. Therefore, all of the plans for them should be rigorously tested against the criterion of relevance to the real needs of the Program work to be done.

The importance of the role played by the support staff on the productivity of ARC cannot be overemphasized. It is vitally important that the administrative and business affairs of ARC, the operation and maintenance of buildings and equipment and the day-to-day management of the experimental fields and livestock units be performed in a timely professional manner. Steps should be taken to create posts with salaries and terms of employment that will attract and retain persons who will perform the vital technical tasks and program support activities in a dedicated professional manner.

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It is suggested that a systematic program of training for the various categories of support and technical staff be organized and operated on a continuing basis by ARC to meet this vital need. Such a program should involve pre- and in-service training with emphasis on "hands-on" development of the requisite skills, attitudes and work habits required. The scientists and administrators at all levels should more actively acknowledge the role of the support/technical staff and endeavour to make them feel that they are "members of the team" in the conduct o. work of ARC.

ANNEX 4

Institutionalizing the National Research System

A.H. Moseman

Agricultural research must have continuity, stability, and dependable funding and resources to achieve long-term objectives in increasing productivity. This does not preclude some change or evolution of new organizational structures as required to address new problems or goals. The ARC has been reorganized under authority of Presidential Decree No. 19, dated January 19, 1983. The new organization and leadership is still in a formative stage and will require another year or more to function as a well integrated national research system.

External support to strengthen agricultural research has been provided to Egypt from different organizations for many years. An FAO wheat breeder was assisting with that program in 1950 and various cooperating projects have been undertaken since that time. Most such activities have been carried out on a single commodity or problem basis. The 1982 SAAD Mission and report considered the broad scope of agricultural development in Egypt, including the national research capabilities. The current Team review is concerned with the greater in-depth assessment of the present resources and the further needs for strengthening the national research system.

A matter of increasing concern on the part of donor organizations and some cooperating developing nations is the lack of a sustained or ongoing capability in the cooperative research project when external assistance is terminated. The project support, therefore, becomes a short-term expenditure rather than a long-term investment. This is equally unsatisfactory to the cooperating donor and to the host country--but should be moreso to the latter because the joint expenditure should leave a capability that did not exist when the project was started.

This situation reflects a lack of attention and commitment to the longer term objective of building the national institution to ensure an ongoing capability. One aspect of the problem may be the short-term goal as stated by the donor organization--"to increase production of the commodity by 25% at the end of the five year project term." Another factor may be the lack of a program operation and management structure in the host institution.

Concern about this issue is presented very well by Dr. M.L. Peterson of the University of California at Davis in the paper, The Role of Institution Building in Agricultural Development, at the Third National Rice Institute Conference, on February 21-24, 1983 in Cairo.

Dr. Peterson pointed out that at the mid-point of the cooperative Rice Research and Training Project, with two and one-half years remaining (in February 1983):

The technology part of the project is working. But technology is developed by institutions. We have not made equivalent progress in developing the institutional structures and procedures. I understand that the institutional structure for the rice project has not yet been formalized.

Dr. Peterson urged that necessary action be taken soon and presented principles to follow:

1. The goals or objectives should precede and determine organizational structure.
2. Services should be provided for non-research and extension education activities so that the time and talent of professionals are reserved for program activities.
3. A system of permanent research records should be devised and made accessible to all who are interested in them.

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4. A reward system for superior performance of staff members should be formalized.
 5. The delegation of duties to staff according to their interests and talents to improve efficiency, staff morale and to allow more time for leadership on program direction.
 6. Budget preparation according to program should be the responsibility of program co-leaders.
 7. Use of "outside" advisory committees to evaluate program direction and progress to ensure that the program is meeting vital needs as viewed by the public.
 8. Training on a continuous basis to improve staff competence and to keep up with new research and educational techniques.
- Freedom to conduct research aimed toward established goals according to well-made plans of the investigator and his colleagues.

Different agricultural research administrators might include other factors, but the foregoing are excellent basic guidelines.

The question with respect to the ongoing capability or institutionalizing of the present Maize and Sorghum Research Program, and other EMCIP activities, should be given prompt attention--jointly by the ARC and USAID. Is the support for this project, with one year until termination, another "expenditure" or will it be an "investment" in the longer-term building of the national research system.

Evidence of the present limitations in the institutionalizing of the national research system is reflected in (1) the lack of clear objectives in some research activities, (2) inadequate budget support--particularly for operations, (3) restrictions on use of vehicles and equipment, and (4) cumbersome procedures for procurement of supplies and materials.

The establishment of a research program and project structure in the ARC would provide for program planning: cost estimates and budgeting for personnel, facilities and equipment, supplies and materials, labor and travel for the research institutes, the national research programs, and the research stations. The project structure provides the basic management tool for allocation of staff, funds and other resources for monitoring and evaluating progress in the research, and for reporting. It supplies the mechanism for understanding and operation of research from planning and finance officials in the GOE through the ARC Directorate to the research field operations. A research structure usually includes about three levels of definition of work:

- (1) The Program. Describing the broad objectives, plan of work, etc., of a major unit of the ARC--an Institute, a national research program, a regional or other field station.
- (2) The Project. The second order of operation--a Section of an Institute, the discipline component of a multidisciplinary national program, and an activity conducted under the direction and initiative of the regional or other field station.
- (3) The Experiment. The description of the specific study (studies) to be undertaken under the Project.

The principal operational or management unit is the Project. This is usually planned for a five year term to provide stability, yet is subject to review and revision to ensure adjustment of research to meet changing objectives or problems. Dr. Peterson, in his paper at the aforementioned Third National Rice Institute Conference (page 17 of the Proceedings) presented the following guidelines or outline:

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GUIDELINES FOR PREPARATION OF A RESEARCH PROJECT

1. Title: A brief description of the subject of the research.
2. Principal Investigator: Full name, title, and address.
3. Organization: Name and address of the performing organization.
4. Objectives: Give the overall objective of long-term goal of the proposed research. The focus can be further sharpened by listing specific subobjectives. These should be clear, concise statements logically arranged.
5. Importance: This is a statement of the current level of technology and pertinent data to substantiate the significance of the research. It should indicate changes that will occur if the research reaches a successful conclusion.
6. Resume of Previous Work: The resume should describe the most advanced level of technology known at the present time. It should not be a statement of current practices which may be below the level of knowledge. The more important research advances should be cited and references listed at the end of the proposal.
7. Plan of Work: This is a description in detail of how the research is to be conducted. Where appropriate, indicate the experimental designs to be used under each subobjective. The research plan should stretch to the end of the research activity, i.e., until the goals have been achieved or modification of the project is needed.
8. Cost Estimates: Cost estimates are normally required to cover the entire life of the project, normally two or three years.* Categories of costs are personnel (salary and fringe benefits), equipment, supplies, travel, and in some cases consultant costs. These costs are detailed by years.
9. References: Follow the system of citing references used by the Journal in which the research is likely to be published.

*May be to a maximum of five years.

There is differing information on the adequacy of budget support for research, particularly for operations. It has been pointed out that while operating funds have been increased, they have not kept pace with inflation and increased costs. An example is the cost of labor at a field station--about L.E. 5.00 in 1983 as against L.E. .50 some years ago. Other advice is that the operating funds are not utilized effectively, that 20 to 40% of some research budgets remain unspent at the end of a year. If the latter is the case it indicates an inadequacy in management, in allocation of funds, in delegation of authority for expenditures, in procurement procedures--in general in furnishing the financial and business support service for the research.

The utilization of vehicles has been mentioned as a problem, apparently because of procedures and controls for authorizing and permitting their use. It was stated that vehicles available to a project were being utilized only about 25% of the potential time because of such restrictions. The limited use of research equipment--in the country but in storage--is due primarily to delay in construction or reconditioning of laboratories. These matters would be resolved by improving administrative support services.

Procedures for procurement of supplies and materials should be given attention. One station officer reported that as much as a full day is required to procure an item, available locally, that costs only L.E. 1.00 because of paperwork and authorizations involved. Another continuing problem is the clearance of equipment and supplies through customs--requiring many months. Such "problems" may be considered minutiae, but when equipment or supplies are needed for seasonal or time constrained treatments in research, they may cause the loss of experimental results for the year. The foregoing are all embraced within the broad scope of institutionalizing the national research organization and operations.

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ANNEX 5

RESEARCH AND EXTENSION
IN
ANIMAL PRODUCTION

Kenneth L. Turk

Research and Extension in Animal Production

Summary

As in the past, animals will continue to occupy a place of importance in Egyptian agriculture.

Investments in research and extension in livestock will yield high returns to farmers and to the national economy. It is essential that greater emphasis be given to applied, adaptive research to produce new technology that when transferred to farmers will improve the productivity of livestock, especially ruminants, for milk, meat and other functions.

Major efforts in research and extension should be directed at the problems of village farmers.

Greater support must be given to livestock research and extension if increased livestock production is to be attained. Animal research facilities need to be modified or designed in accordance with the requirements of projects that are to be conducted. Increased operational funds are needed; facilities need to be improved; laboratories need renovating; new and modern equipment must be added; and most importantly, there needs to be a system that rewards the most productive scientists with higher salaries, incentives and promotions. Proper recognition and incentives must also be given to extension specialists.

Animal research and extension needs to be coordinated with other national improvement programs, especially with forages and legumes. Where appropriate, a multi-disciplinary approach should be utilized.

Of all components necessary for success in national agricultural research and extension programs, none is any more important than development of human resources. Well-trained people are essential at all levels.

Research and Extension in Animal Production

I. Introduction

For centuries farm animals in Egypt have supplied milk, meat, eggs, wool, hides, manure for fertilizer and fuel, and farm power and transport. There is an interdependence of soils, crops, livestock and people. Egypt's land, water, and climate resources, along with human resources, support a relatively large animal population which provides about 35 percent⁽¹⁾ of total agricultural production.

The 1982 Report, Strategies for Accelerating Agricultural Development in Egypt (SAAD), pointed out that growth in the supply of food and agricultural production has been slow. A 25 percent gain in value-weighted agricultural output was experienced between 1970 and 1981. Over this period crop output value expanded 16 percent while animal product value grew 42 percent. Output of berseem clover and animal products expanded along with maize, fruits and vegetables while field crops, such as cotton, rice, wheat and sorghum, showed little increase. These production shifts were related to government policies, feed subsidies and prices, and the response of farmers to production incentives and increased consumer demands. Policies have been favorable to livestock producers and they have responded to the incentives.

The SAAD Report outlined the potentials of livestock production to meet increased consumer demands as continued population growth occurs. The major constraints and problems were summarized, with recommendations and strategies for solving them for increased animal productivity. Implementation of the recommendations and transfer of technology to village farmers are essential if animal production potentials are to be realized.

(1) SAAD Report, 1982.

This paper addresses itself to the place of research, extension, and training in animal production as part of a multi-disciplinary approach directed at increased productivity of Egyptian livestock and crops.

II. Role of Animals in Egypt's Agricultural Economy and Food Production

In its future overall strategy the ARC proposes to organize and adequately finance sixteen national research programs. Of these, four programs directly involve livestock: Egyptian buffalo improvement; cattle and milk production improvement; poultry improvement; and sheep and goat improvement. In addition, a national program on forages and legumes improvement is closely allied with livestock since animals are the main consumers of forages. It is clear, therefore, the GOE and the Ministry of Agriculture will continue to support research and extension on livestock production.

Government policies with subsidized feed prices in recent years have been favorable to livestock production, resulting in some shifts in crop production. If the government should change its policy and permit agricultural output and input prices to move towards world price levels, this could make conditions less favorable to milk, meat and egg production.

The basic interdependence of animals, soils, crops and people would continue to exist, however, as it has in the past, and make it essential that greater emphasis be given to applied, adaptive research to produce new technology that when transferred to farmers through extension would help improve the productivity of livestock, especially ruminants, for milk and meat.

Animals will continue to occupy a place of importance in Egyptian agriculture. They supply high quality protein to meet the needs of consumers; but ruminants also supply far more than foods; they provide wool, hides, manure for fertilizer and fuel, and still provide a major source of farm power and transport in Egypt. Animals are a source of wealth and security for farm families.

It is recommended, therefore, that among the animal species, ruminants (cattle, buffalo, sheep, goats) should receive priority in research and extension because they transform low quality forages and crop residues and other ligno-cellulosic materials, which have no value for direct human consumption, into high quality food, fiber and fuel. Thus, ruminants compete less than other species for available food supplies.

Among the ruminants, research emphasis should be given to increasing milk production in buffaloes and cattle, and in some valley areas to dairy goats, since efficiency of feed utilization is greater for this function than for meat production.

Conversion of feed to meat production from cattle and buffaloes is relatively low; therefore, cattle feeding operations probably should not extend beyond those levels which can be supported primarily by using crop residues and by-products for feed. Economics of production and processing will determine whether or not it is profitable to expand meat production in Egypt to meet increasing consumer demands.

Research and extension with poultry should be directed at the village farmer who has relatively small flocks that presently are producing at a low levels. Large commercial operations, both government and private, have expanded rapidly and give high efficiency in terms of effective

conversion rates of feed to meat. These operations import baby chicks with high genetic capabilities and also import feed formulation technology; therefore, their need for research in Egypt on genetic improvement and nutrition is reduced. An exception to this would be research on poultry diseases, including serums and vaccines.

III. Nature of Constraints

Major constraints to livestock production continue to exist in Egypt. They are of ecological, biological, and socio-economic origin. Ecological constraints include those related to land and climate; biological include livestock nutrition, genotype, and health; socio-economic include labor availability and skills, consumer preference and disposable income, credit, market infrastructure, and policies on prices, land tenure and on trade.

The principal biological constraints to growth, reproduction and other production functions of animals that are amenable to change are (1) quality and quantity of feed supply, (2) genetic potential, (3) livestock management practices, and (4) control of diseases, parasites and other pests.

Of these constraints, feed supply appears to be most critical in Egypt, especially in summer. Inadequate nutrition is the most important factor limiting growth and reproduction rate and often aggravating and/or predisposing disease problems, especially in young animals. An adequate year around feed supply, which includes forage crops, crop-residues and by-products, is a production requisite.

Livestock management constraints are many faceted and are largely of socio-cultural origin. Livestock populations are not producing up to

their potential from existing feed resources and genetic capabilities because of poor management practices.

Germ plasm improvement becomes the limiting factor as higher order constraints are removed.

Control of disease and pests is basic. While effective vaccines and controls have been developed in Egypt for most animal diseases, especially ruminants, some constraints still occur.

The national livestock improvement programs are intended to deal effectively through research and extension efforts with removing as many as possible of these constraints.

The plans of the ARC include the use of multidisciplinary teams for each of the commodity programs and for specific projects. This approach for animal improvement should be utilized when appropriate. For example, a collaborative team composed of specialists in animal nutrition, agronomy, forage crops, agricultural economics and/or rural sociology could design and implement a series of projects to remove many of the constraints of summer feed supply for ruminants. Some animal improvement projects, however, such as research on artificial insemination and reproductive physiology, may need only the collaboration of veterinary research specialists and animal scientists, and in field application would involve extension personnel. It is important to have cooperation and teamwork among the scientists in all of the disciplines within animal science.

IV. Strengthening the Animal Research Stations

Animal production research presently is being conducted at twelve of the ARC field stations, in the Research Institutes in Cairo (Animal Production, Animal Health, Vaccines and Serums, and Animal Reproduction),

and in some of the university faculties of agriculture, and in the Desert Research Institute (Ministry of Land Reclamation). The staff of the Animal Production Research Institute have their laboratories in Cairo but their direct work with animals is done at research stations and production farms.

As discussed in more detail elsewhere (pages), the research stations have been administratively removed from the Research Institutes and are now organized into seven regional groups. In each of the groups, one of the stations is designated as regional headquarters or Center.

The largest animal programs are located at three of the regional centers (Sakha, Sids, and Gammeiza) with smaller activities at outlying stations in five of the regions. Scientists in the Animal Production Research Institute will continue to do most of the work with animals at one or more of these stations.

The recent decree by the Minister of Agriculture that research staff should devote part of their time to extension should make the field stations more effective in the transfer of new livestock technology for the use of farmers.

The number of scientific staff at each of the stations varies greatly, with an insufficient number at some locations and more than necessary for the research and extension functions at others. Capabilities may also vary, based upon training, experience and research productiveness. There is an imbalance of the most highly trained, capable scientists at some stations compared with others.

Facilities for high quality animal research are lacking at several of the stations. Suitable animals, shelters and facilities are often not available for nutritional and other experiments, as well as routine

management. Laboratories, in general, need refurbishing and new equipment is essential to meet the needs of research. Operational funds are extremely low in almost all cases except for a limited number of projects where donor funds are provided.

As the national programs for animal improvement are developed, it is recommended that major support be given to three or four stations where the greatest returns on the investment might be expected. Gradually over the next five years, major inputs of operational funds, equipment, facilities, and staff (both scientific and supportive) should be provided in order that expanded research and extension can be conducted in animal nutrition, breeding and genetics, and management. The basic objective should be to increase the scientific capacity in animal science at each of these stations.

1. Special consideration should be given to the following:
 - a. Transfer or add three to five well-trained animal scientists to the Sakha regional station, North Delta, to complement the limited number of capable scientists already stationed there.
 - b. Transfer or add a similar number of scientists and supporting staff to Middle Egypt regional station at Sids.
 - c. Develop an animal station to serve the New Lands region at Nuberia, or other suitable location. Also, develop the field station that serves the North Coastal area, primarily for sheep and goats.
 - d. If (c) is not feasible, an alternate would be to expand the staff and animal program at Gammeiza which serves the Middle Delta Region.

2. Analytical laboratories will need to be renovated or established at each of these stations, with appropriate equipment according to the research to be conducted.
3. For an effective research program adequate numbers of high quality animals (buffaloes, cattle, sheep, goats and poultry) should be available, along with the necessary facilities for proper care and management at each of the stations.
4. Improved facilities for experimental, individual feeding studies with buffaloes, cattle, sheep and goats are needed at each station; also, a building with units for digestion and metabolism units, preparation and drying rooms at one or two stations.
5. Proximity of scientists and animals is desirable for high quality research. Good housing for the staff and improved research facilities should help make these field stations more attractive for promising young scientists to live and work there.
6. Animal production (subject matter) specialists, both men and women, for applied, adaptive research and extension should be located at each of the major stations, and also at some of the other outlying stations in each of the regions. They need experience and special training in animal production technology, including management practices, if they are to be effective in gaining the confidence of village farmers to accept improved practices. They must have the ability to interpret research results and to formulate recommendations for actions by farmers that will attain increased productivity.

7. Most of the research laboratories in the Animal Production Research Institute in Cairo also need renovation and new equipment. The more expensive and sophisticated pieces of equipment should be centralized there to avoid unnecessary duplication at the field stations. Renovation of the laboratories and new equipment also are needed at the Research Institutes for Animal Health, Vaccines and Serums, and Animal Reproduction. If it could be established, a revolving fund from the sales of vaccines and serums would be advantageous to the operation of this Institute.
8. Animal production farms play an important role in the sale of improved animals (bulls, breeding females, and baby chicks) to farmers. These animals should be sold at market prices, rather than at reduced prices as presently practiced. These animal production farms can serve as effective demonstrations for desirable feeding, breeding and management practices. To do so, however, requires that the quality of animals and the husbandry practices be superior to those of the average farmer.
9. Gradual upgrading of the smaller stations in each region where animal research is conducted should take place, but not to the same degree as suggested for the three to four major stations above.
10. Priorities in animal research and extension at the field stations should be directed to the problems of the village farmers. Interaction of research workers with village leaders is a useful tool for the identification of problems.

Each of the Animal Research Institutes of the ARC has developed a five-year plan, 1982-1986, outlining the major research projects. Two of the plans that were reviewed--Animal Production and Animal Reproduction Research Institutes--indicate that the scientists have identified many of the major problems and have established research priorities. But research is of little value unless the results are used by farmers to increase their animal productivity. The challenge is to develop linkages with extension, using animal production specialists, for the transfer of new technology to village farmers as an integral part of national livestock improvement programs. Also, it is essential that animal research and extension be coordinated with other improvement programs, especially with forages and legumes.

V. Training and Cooperative Relationships

Of all ingredients essential for success in national agricultural research and extension programs, none is any more important than development of human resources. This applies equally to all disciplines, including those embraced in animal production.

Observations indicate a relatively high degree of "inbreeding" of the animal scientists in ARC and the universities. With this situation, especially among the younger scientists, efforts should be made to expand the opportunities as rapidly as possible for post-doctoral work in the United Kingdom and the United States for those who are most productive. Visiting scientists often bring new ideas and perspectives to specific research projects that can be helpful to local scientists. Increased funds for additional scholarships for PhD level training in these countries also is highly desirable in order to broaden the experience and training of the future scientists.

Additional linkages with universities and research institutes in the United States for cooperative research on problem areas of mutual interest and benefits should be developed. For example, discussions have been held on possible relationships in the small ruminant collaborative research program (CRSP) of the US/AID program. Establishment of this CRSP would be mutually beneficial and would provide some support for small ruminant research in the universities and/or ARC stations, in cooperation with U.S. universities.

Opportunities also are available for cooperation in research with the International Agricultural Research Institutes (discussed elsewhere). Of particular value to animal scientists would be collaborative work in research and training with ILCA in Kenya and ICARDA in Syria.

Closer cooperation and relationships between scientists in the Universities and ARC are desirable in research and training in animal production. Mutual interest in a subject, and personal respect, confidence, and improved communications, are essential. Utilization of leading animal scientists from the universities on national multidisciplinary teams and national research and extension programs would be appropriate and mutually beneficial to the ARC, the universities, the programs, and farmers.

VI. Developments in Aquaculture

Substantial steps have been taken in recent years to increase the availability of high quality protein by developing the fish farming industry and its supporting institutions. Among these developments is a National Aquaculture Center presently being established in Abbasa under the Administration of the Authority for Fisheries Resources Development.

Formerly, the work in Aquaculture was under the administration of the Ministry of Agriculture.

This Center is being constructed on a 1500 feddan site and will include 160 ponds and a research, training and production building. When completed, the project will conduct research in four areas: breeding, diseases, nutrition and hatching for inland fisheries. Extension services and training will be provided to homestead fish farmers, along with credit facilities through the Principal Bank and Development and Agricultural Credit.

Extension agents have been recruited and trained. Field demonstrations on yield trials and with rice-fish culture have shown promising results.

Several candidates have been sent to the U.S. for graduate study in fish culture. Also, some senior project administrators have been sent abroad for short-term training.

In addition to the Center, there are five main stations at different locations, with one of them at Lake Nasser.

Several universities are cooperating in research and development of fisheries. An excellent example was observed at the Canal Zone University, Ismailia, where the results of research on fish poly-culture are being taken directly to farmers in the area. The scientist is giving them advice on pond construction and management, providing them with fish fry, and giving recommendations on fish nutrition.

Egypt's resources in inland waters for aquacultural operations are such that continuing growth in research and extension may result in the production of substantial sources of protein for human consumption.