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The National Agricultural Development Project in Jordan (AID Project No. 278-0264)

— Final Evaluation and Impact Assessment

Submitted to
The United States Agency for International Development Jordan

Under Contract No. LAG-4200-I-00-3056-00
Delivery Order No. 3

Submitted by
TROPICAL RESEARCH AND DEVELOPMENT, INC.

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The National Agricultural Development Project in Jordan (AID Project No. 278-0264) — Final Evaluation and Impact Assessment

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Contents

Acronyms

AAE	Association of Agricultural Engineers
ACC	Agriculture Credit Corporation
ACSAD	Arab Center for Studies on Arid Zones and Drylands
AD	Agricultural Directorate
ADC	Agricultural Development Council
AMO	Agriculture Marketing Organization
AMPCO	Agricultural Marketing and Process Co.
ATES	Agricultural Traninig and Extension Specialist
CCTSS	Center for Consultation Technical Services and Studies
DEID	Director of Extension and Information Directorate
DOS	Department of Statistics
DTTTD	Director of Technology Transfer and Training Directorate
EEC	European Economic Community
ESCWA	Economic and Social Commission for West Asia
FAO	Food and Agricultural Organization of the United Nations
GTZ	German Agency for Technical Cooperation
HADP	Highland Agricultural Development Project
HCST	Higher Council for Science and Technology
ICARDA	International Center for Agricultural Research in Dry Areas
JCO	Jordan Cooperative Organization
JUST	Jordan University for Science and Technology
JVA	Jordan Valley Authority
JVFA	Jordan Valley Farmers Association
MCM	million cubic meters
MOA	Ministry of Agriculture
MOF	Ministry of Finance
MOP	Ministry of Planning
MOS	Ministry of Supply
MOW&I	Ministry of Water and Irrigation
MPW	Ministry of Public Works
NADP	National Agriculture Development Project
NALIC	National Agricultural Library and Information Center
NCARTT	National Center for Agricultural Research and Technology Transfer
PACD	Project Assistance Completion Date
PPIP	Project Paper Implementation Plan
p/m	Person/months
RASC	Regional Agricultural Services Center
TA	Technical Assistant
TASO	Technical Assistance and Services Office
TC	Training Committee
TNGAE	Training for Newly Graduated Agricultural Engineers
UNDP	United Nations Development Programme
USAID	United States Agency for International Development

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Executive Summary

The National Agricultural Development Project is a US$ 48,415,000 (USAID $25,275,000/ Government of Jordan $ 23,140,000), nine-year (July 1985-September 1994) bilateral project with the Ministry of Agriculture of the Government of Jordan. The project has been both large in financial terms, as well as long in its implementation, compared to similar projects of this type. The purpose of the project has been to stimulate greater agricultural production through applied research, improved technology transfer methodologies, and various strategic activities aimed at strengthening institutional capabilities in the agricultural sector. Project inputs directed at achieving this purpose have included long- and short-term technical assistance, degree and nondegree training both locally and in the U.S., the construction and equipping of physical facilities, and the establishment of an agricultural development fund to finance various research activities and other 'targets of opportunity' in the agricultural sector. One of the principal achievements of the project was the establishment of the semiautonomous National Center for Agricultural Research and Technology Transfer (NCARTT) with its six regional agricultural services centers. NCARTT and these services centers are the principal subjects of the final evaluation.

The project was beleaguered by frequent delays, not the least of which were the Gulf War, the rapid turnover of Ministers of Agriculture, NCARTT directors and the technical assistance teams, and the lack of autonomous legal status on the part of NCARTT.

Major findings and conclusions are

1. While anecdotal evidence shows that some farmers have adopted practices based on NCARTT research, the transfer of technology to the average farmer has been weak.

2. The project design contained many good ideas but could have been improved by giving increased emphasis on: achieving fully autonomous status for NCARTT, or some other flexible mechanism, to resolve the low salary and short work day problems; providing for much greater participation by the private sector to guide NCARTT's research programs; building a constituency to lobby for governmental policy reforms and budgetary support; and, the early elaboration of an agricultural research and technology transfer strategy to set the context and direction for NCARTT programs.

3. The construction and equipping of the four regional agricultural services centers and the National Center building at Baq'a were, and still are, far behind schedule. The delays in construction and the lack of proper sequencing of events (construction, staff training, and ordering and arrival of the equipment), have most definitely hampered NCARTT's ability to conduct research, transfer technology, and provide needed services to the agricultural sector.

4. The Agricultural Research Strategy and Medium Term Plan represent an important first step in defining research needs and priorities.

5. The Training Program has been quite ambitious and successful involving a significant number of women.

Major recommendations are:

Identification, Development, Motivation, and Retention of High Quality Personnel-

1. The NCARTT Council should continue to push for legal full-autonomy, or some other flexible mechanism, to allow them to offer competitive salaries and benefits packages and to establish a working environment conducive to high levels of performance.

2. NCARTT should undertake a continuing effort to identify and recruit the highest quality employees through contacts with university staff, vacation employment programs for upper level university students and by offering opportunities for M.Sc. candidates to conduct their thesis work under NCARTT tutelage.

3. NCARTT should reduce its professional and support staff to a level which allows it to offer competitive salaries and professional upgrading opportunities within anticipated budgetary resources.

NCARTT Institutional Sustainability-

1. NCARTT should seek funding for joint research activities with local organizations such as the two universities with faculties of agriculture (University of Jordan and JUST), the HCST, and the Royal Scientific Society should most likely be the NCARTT's first priority in the short run.

Research Program Focus, Prioritization, and Monitoring-

1. The NCARTT Council and management should work with the Ministry of Agriculture, Faculties of Agriculture and the private sector to assure that the system for defining agricultural research priorities devotes sufficient attention to internal and external market demand and potential, and to cost-reducing technologies and quality control measures to improve the competitiveness of Jordan's agricultural products in domestic, regional, and European markets.

2. The NCARTT Council and management should establish a process for formal involvement of farmers in the identification and prioritization of specific problems requiring research by NCARTT.

Technology Transfer-

1. NCARTT should strengthen its capacity to carry out an expanded program of technology transfer, employing a variety of media and techniques to disseminate technology to many different technology transfer agents including Ministry of Agriculture extension personnel, innovative farmer/leaders, Jordan Cooperative Organization employees, Ministry of Agriculture plant production and plant protection personnel, owners and employees of agricultural supply firms, nursery owners and employees, custom equipment operators, instructors and students from the Faculties of Agriculture at the University of Jordan and JUST as well as vocational agricultural schools.

Use of NCARTT/regional agricultural services Laboratories-

1. NCARTT should form a committee to make a careful analysis of the numbers and kinds of laboratories that are essential to its research and technology transfer activities, both at the national headquarters, including the old and the new building, and at the regional agricultural services centers.

2. If the needed laboratories are to function, they will require a trained cadre of technicians for their operation and maintenance which is currently lacking.

Private Sector Participation-

1. NCARTT should institutionalize a process for formally involving farmers in the identification and prioritization of research needs.

2. USAID/Jordan and the Government of Jordan should consider providing funding to establish a research grants fund to address production and marketing research needs which would be administered by the Exporters' Association of Fresh Fruits and Vegetables.

Future Directions for NCARTT-

1. NCARTT should reduce its staff and program to a level at which its budget is adequate to employ a smaller, better paid, top quality staff which can carry out carefully selected, high priority research activities.

2. NCARTT should place much greater emphasis on research that addresses the problems related to water availability and quality such as studies on water harvesting, use of treated waste water in irrigation, problems associated with salinity and heavy metals, and crops and practices that are appropriate for low rainfall, low soil-moisture conditions.

As the Project moves towards its PACD, consideration should be given to a short list of high priority, relatively inexpensive post-Project activities which could be considered by the Mission, other donors, or a combination of the two. The list follows:

1. Long term Technical Assistance- NCARTT still critically requires the presence of an institutional advisor and a senior scientist.

2. Monitoring and Information System- Must be reinstated.

3. Economic Analysis Unit- Needs to be staffed and given training.

4. Laboratories- NCARTT will require assistance in setting up, calibrating, and maintaining a limited amount of laboratory equipment. Additionally, much attention needs to be given to the training of laboratory technicians who will operate the new laboratories.

1. Introduction

The National Agricultural Development Project (NADP) is a US $48,415,000 (USAID $25,275,000/Government of Jordan $23,140,000), nine-year (July 1985–September 1994) bilateral project with the Ministry of Agriculture of the Government of Jordan (Government of Jordan). The project has been both large in financial terms and long in its implementation compared to similar projects of this type. The purpose of the project has been to stimulate greater agricultural production through applied research, improved technology transfer methodologies, and various strategic activities aimed at strengthening institutional capabilities in the agricultural sector. Project inputs directed at achieving this purpose have included long- and short-term technical assistance, degree and non-degree training both locally and in the United States, the construction and equipping of physical facilities, and the establishment of an agricultural development fund to finance various research activities and other targets of opportunity in the agricultural sector. One of the principal achievements of the project was the establishment of the semi-autonomous National Center for Agricultural Research and Technology Transfer (NCARTT) with its six regional agricultural services centers. NCARTT and the regional agricultural services centers are the principal subjects of the evaluation.

The following evaluation of the NADP was conducted between the months of April and June, 1994, three months before the September Project Assistance Completion Date (PACD). In addition to this Evaluation Report, the evaluation team was also asked to prepare a stand-alone impact assessment (included in this report as annex 13.10). The evaluation team, composed of three Americans and four Jordanians, was fielded by Tropical Research and Development, Inc., through an Evaluation Indefinite Quantity Contract. All team members were senior-level professionals who had been involved with agricultural development projects of this type for many years.

The project had two distinct phases. The first, prior to 1990, was managed by an external institutional contractor; after 1990 and the Gulf War it has been managed through a local technical assistance team. A mid-term evaluation of the project was conducted in mid-1989 and only covered the first phase. In compliance with our scope of work, this evaluation concentrates primarily on the second phase, since 1991.

Fieldwork for the evaluation included an in-depth review of the project files at the USAID Mission and NCARTT, and meetings in Amman with project personnel, including two personal services contractors, those of the Technical Agricultural Service Organization (TASO) and NCARTT, the personnel of five ministries, the two universities with faculties of agriculture, and the private sector. Additionally, visits were made to the six regional agricultural services centers where staff were interviewed and research plots, both at the centers and on farmers' fields, were visited. On every fieldtrip an attempt was made to interview farmers.

In order to carry out the scope of work for the evaluation, the team was divided along three functional categories, namely economic issues, institutional issues, and technical issues. While each subgroup of the team concentrated on their assigned category, many meetings and most fieldtrips were made by at least one member of each group, with some fieldtrips having the participation of two or three of the subgroups. Each week, the entire team would meet to discuss the past week's findings and to plan the next week's activities. Toward the end of this process, these weekly meetings became a forum for the formulation of the conclusions and recommendations made in the body of this report.

Lastly, the team would like to mention that there were several additional areas of evaluation and impact assessment that we would liked to have followed up further had we had more time to do so. In reality, the team was beleaguered in its work on two fronts, first the evaluation began two weeks later than scheduled because of contractual problems. Since most of the team members had prior commitments, the evaluation itself had to be cut by two weeks. Additionally, as it turned out the evaluation period was scheduled over a significant number of holidays, some planned and some unplanned. Both of these factors limited the team's ability to carry out as detailed an evaluation as we would have liked.

2. Brief project history and background

The project, until 1988 entitled the Highlands Agricultural Development Project (HADP), was conceived in 1983–84 and first written down in what has come to be called the Post Report. This document was converted to standard project paper format in early 1985, and the project agreement was signed in July of that year. The initial conditions precedent were met in December 1985, allowing public bidding for the design and construction contracts to go forward. Nevertheless, these contracts were signed almost two years later in October of 1987. Running parallel to this was an effort to advertise and select a United States-based university consortium to provide technical assistance to the project and NCARTT. This process was concluded when Washington State University through the Consortium for International Development was selected. The first wave of technical advisors arrived in April 1987. A majority of the second wave of advisors arrived in late 1989, shortly before the Gulf War broke out. These advisors were evacuated in late 1990, and did not return.

Meanwhile, in 1988 the scope of the project was changed to include the entire country, dropping the word "Highlands" from the title, substituting the word "National" in its place. This change of scope also meant a relatively significant increase in planned project activities. This increase resulted in Amendment 3, which incrementally increased funding of the project by US $1.7 million, mostly for technical assistance.

With the departure of the Consortium for International Development, Washington State University, technical assistance team, the mission opted for a new project management structure that would reduce overall costs, while at the same time ensure the continuation of most of the project activities already begun. In December 1990, the Technical Assistance Service Organization (TASO) was created. This technical assistance unit, housed within NCARTT, was directly responsible to the Minister of Agriculture through a contract with the Higher Council for Science and Technology. Until the PACD, it has been comprised of five Jordanian professionals (a policy advisor, a training officer, a librarian, and an administrative officer) headed by the horticultural expert from the Consortium for International Development, Washington State University, team. Additionally, the responsibility for overseeing the agricultural development fund was vested in TASO. Additionally, the mission hired two personal services contractors as institutional advisors, one Jordanian and one American, to provide technical assistance to both TASO and NCARTT.

In March 1993, Amendment 4 was added to the project agreement. This provided an additional US $2.1 million to complete training, construction, and management work already started. The PACD was also extended to September 30, 1994.

The original goal of the project was to "increase food production and total incomes in the highlands of Jordan." The project purpose was to "stimulate greater agricultural production through applied research, improved extension methodologies, and various activities to enhance institutional capabilities. The project goal was changed in 1988 to include the entire country; this change came the change in name from HADP to NADP.

While the project purpose has remained the same over the nine-year life of the project, the means of achieving this purpose have changed substantially. In part these changes have been intentional, attributable to changing conditions and needs in the agricultural sector of Jordan, and in part due to conditions and events beyond the scope of the project's designers, its implementors, or the mission project monitors to foresee or control.

Central to this list of conditions and events were the Gulf War, the frequent turnover of key project decision-makers, especially the Minister of Agriculture and the NCARTT Director

General, and the Government of Jordan's rules, regulations, and procedures within which the project has operated. Over the nine years of the life of the project, the Minister of Agriculture was changed eleven times and the NCARTT Director General changed five times. In 1991, one Minister transferred 82 of NCARTT's core staff to different positions and geographic locations within the Ministry of Agriculture, while at the same time removing all extension activities from the NCARTT mandate. This meant that many of the ongoing research and technology transfer activities, many of which were funded by the agricultural development fund, came to a halt.

This meant that policies and procedures that had been planned or agreed to by the people in these two key decision-making positions were in an almost constant state of flux with project staff having to orient new decision-makers as to the goals of the project and gain their confidence on an almost continuous basis. In other cases, new decision makers arrived with different philosophies, strategies, or agendas which put them at odds with those of the project.

Other conditions and events which have reduced the potential success of the project are Government of Jordan policies and procedures which run counter to maximizing the potential benefits from the project. First and foremost of these has been the placement of NCARTT within the Ministry of Agriculture. In spite of a condition precedent in the project agreement suggesting autonomy, when NCARTT was created it was not given autonomous status from the Ministry of Agriculture, but rather was placed under the Projects Department of the ministry. This resulted in the NCARTT Director General having direct responsibility for the implementation of many project activities but almost no authority with which to exercise this responsibility. It also meant that NCARTT was forced to function within the strict bureaucratic regulations of the Ministry of Agriculture, often not conducive to proper scientific agricultural research and technology transfer. Additionally, it meant that the incentives that qualified professionals require in order to conduct sound scientific research and technology transfer activities could not be provided. Indeed, progress toward achievement of this important aspect of the project did not occur until June 1993 when NCARTT was given semi-autonomous status, affording it some degree of independence and authority over its activities.

Qualified personnel related to the project, as well as the evaluation team, estimate that the project is approximately four to five years behind schedule in achieving its optimal impact. Said differently, the project is currently at the stage it would have been in 1989 or 1990, had conditions been more favorable and these events not occurred.

The Gulf War and the necessary and permanent evacuation of the second wave of technical assistance advisors essentially truncated much of the work of the technical assistance team, in progress since 1987. Additionally, the relatively large amount of construction activities were put on hold for the period of the war, and in some cases the logical sequencing of events (for example, laboratory construction, equipment installation, and the technical assistance and training to operate them) was almost completely interrupted for 1990 and 1991.

A mid-term evaluation of the project was conducted in November 1989 and is discussed in Section 3.6 of this report.

3. Project inputs

The evaluation team looked at project inputs to compare the inputs included in the original Logical Framework Matrix with the level and quality of the actual inputs. The team also provided its assessment of the effectiveness, timeliness, and appropriateness of the inputs.

3.1. Technical assistance

The project paper called for 312 person/months (p/m) of technical assistance (TA) consisting of 150 p/m of long-term resident advisors, 90 p/m of short-term technical advisors, and 72 p/m of home-office logistical support for the project team. The initial Consortium for International Development, Washington State University, contract included 126 p/m of long-term TA. When the contract was amended in 1989, the level of long-term TA was increased to 318 p/m. Although the reasons for the major increase in the long-term level of effort are not well documented, it appears logical that the added TA was deemed necessary after the project focus was changed from the Highlands Agricultural Development Project to the National Agricultural Development Project and included the irrigated diversified-crop area in the Jordan Valley. Not only did the contract level of effort increase, but the types of expertise to be provided were also expanded.

Table 3.1, Technical Assistance for the HADP and the NADP, details the long-term TA levels included in the project paper, the levels as revised in the original and amended Consortium for International Development, Washington State University, contracts and the actual long term TA levels provided by Consortium for International Development, Washington State University, and TASO during the life of the project. The actual level of long-term TA was 298 p/m, quite close to the 318 p/m planned in the amended contract, although the final composition was quite different.

The evaluation team concluded that the overall effectiveness of the long-term technical assistance effort was less than desired. This can be attributed in part to the disruptions caused by political unrest and the Gulf War. Many of the second wave of Consortium for International Development, Washington State University, team members were in-country for only a short time before having to return to the United States because of the Gulf War. USAID/Jordan responded creatively to the problem by establishing the Technical Assistance Service Organization (TASO), which provided a flexible, low-cost mechanism for addressing project technical assistance. From late 1990 until mid-1992, there was only one long-term TASO advisor in-country. Since mid-1992 there has been a TASO team, small because of its limited mandate, that has worked quite effectively in selected areas, especially those areas that enhanced NCARTT's capability to provide services to the agricultural sector. However, they are not able to cover many of the areas listed in both the original and revised technical assistance plans from the project paper.

The evaluation team believes that both TA teams, particularly the Consortium for International Development, Washington State University, team, could have done more to assist in improving the administration and management of NCARTT and its ability to develop priority programs, plans of work, and procedures for the staff at NCARTT Baq'a and the regional agricultural services centers. Much more effort could have been devoted to providing assistance for the development of NCARTT as a national agricultural research institution capable of selecting priorities, preparing plans of operation, and so on. The USAID-contracted

institutional development advisor and the TASO staff have done some excellent work in this regard through their involvement in the preparation of the agricultural research strategy and medium-term implementation plan. However, this assistance came late in the project and would have been more effective if it had been provided throughout the period of project implementation.

Table 3.1 indicates the planned TA input compared to the actual provided by the two sources of TA, Consortium for International Development, Washington State University, and TASO, during the project.

Table 3.1. Technical assistance for the HADP and the NADP (planned and actual)

Position/specialty	Project paper (p/m)	Initial contract (p/m)	Amended contract (p/m)	CID/WSU*	TASO	Total
Chief of party	48	60	60	18	41	59
Extension advisor	36	24	54	30	22	52
Administrative advisor	24	0	0	0	14	14
Unspecified TA	18	0	0	0	0	0
Livestock production	0	0	24	14	0	14
Range specialist	24	24	24	24	0	24
Farming system research	0	18	54	17	0	17
Agribusiness	0	0	24	12	0	12
Tree fruit horticulture	0	0	18	12	0	12
Vegetable horticulture	0	0	18	8	0	8
Agronomy	0	0	24	8	0	8
Entomology	0	0	18	0	0	0
Economist	0	0	0	12	0	12
Training	0	0	0	0	26	26
Plant physiologist	0	0	0	0	12	12
Institutional program/agricultural development fund	0	0	0	0	28	28
Total	150	126	318	155	143	298

* Consortium for International Development, Washington State University

3.2. Training

The project paper budgeted $753,000 for training. including pre-service, in-service, specialized, and university-level non-degree and graduate training. Project-supported training programs have been active since late 1987 when the first Masters students started their studies at the University of Jordan. TASO has played a critical role in recent years in organizing and managing training programs within and outside Jordan. The NCARTT/NADP training program has clearly strengthened the technical capability of both NCARTT and the Ministry of Agriculture. The graduate level program has also strengthened the University of Jordan which provided project-funded training at MS and High Diploma levels.

Weaknesses in the training program were a lack of sufficient training in administration, management, program development, prioritization, and inadequate preparation of research proposals, research designs, and economic analyses.

At the early stages of project implementation no comprehensive plan covering all aspects of manpower training was formulated. This was a consequence of the lack of a well-defined strategy and medium-term implementation plan for research and technology transfer that could have provided guidance on the number and qualifications of personnel required to perform the various function necessary to achieve the objectives of the plan. Despite the lack of such a strategy, various training programs were carried out under the project. The most important activities are discussed below.

3.2.1. Graduate training

Academic graduate training took place at universities in the United States and at the University of Jordan, Faculty of Agriculture. Sixty-eight individuals were enrolled at three levels: High Diploma, M.Sc., and Ph.D. This number consisted of ten in the United States, forty-six High Diploma and MS degrees at the University of Jordan under the TASO training budget line item, and twelve for MS degrees under the TASO agricultural development fund.

Training in the U.S. started in 1989. Of the ten participants selected for such training, seven entered Ph.D. programs and three MS programs. Fields of study were soils, agronomy, animal production, plant production, extension education, and weed control. Of the four participants who have completed their studies in the U.S. and come back to Jordan, two were awarded doctorates in soils and two were awarded Masters degrees, one each in weed science and soils. Table 3.2 summarizes this information.

In Jordan, training was confined to two programs, MS and High Diploma. Thirty-one participants were enrolled in the Masters program and fifteen in the High Diploma program. Fields of study for those enrolled at the MS level included agricultural economics, plant production, plant protection, and animal production. Other fields of study provided at the High Diploma level included library science and field crops. Of the original thirty-one, twenty-three trainees completed the Masters program while eight dropped out for such reasons as health considerations or poor academic performance. At the High Diploma level, twelve trainees completed their study, while three participants dropped out. Table 3.3 summarizes this information.

Table 3.2. Training at United States universities.

Field of study	Ph.D. Completed	Ph.D. In progress	MS Completed	MS In progress
Soils	2	-	1	-
Agronomy	-	2	-	-
Weed Science	-	-	1	-
Extension Education	-	1	-	-
Animal Production	-	1	-	-
Plant Production	-	1	-	-
Total	2	5	2	-

Table 3.3. Project-sponsored training at the University of Jordan (Masters and High Diploma).

	started	in progress	completed	dropped
MS	31	6	17	8
High Diploma	15	0	12	3
Totals	46	6	29	11

The number of people who completed their studies and have returned to work are indicated in Table 3.4.

Table 3.4. Current employment of professionals trained under the project.

Place of employment	Ph.D.	M.Sc.	High Diploma
NCARTT	2	6	3
Regional agricultural services center	-	4	-
Ministry of Agriculture central directorates	-	6	3
Ministry of Agriculture district directorates	-	1	4
Other	-	-	2
Totals	2	17	12

Significant improvement was made in NCARTT in-service training programs in 1992 with the formation of a training committee and the establishment of an annual in-service training program for 1993 and 1994. Table 13.14.8 in the Tables Annex lists all seminars and in-service training courses implemented between May 1992 and April 1994.

Some observation by the evaluation team regarding graduate training in Jordan and the United States include:

a. Lack of qualified employees at NCARTT who were eligible for scholarships.
b. Selection of trainees was not entirely objective.
c. Failing exams in English proficiency eliminated many candidates for graduate training as well as for short-term training.
d. Heavy emphasis was placed on plant production. More than 65 percent of Masters candidates at University of Jordan Faculty of Agriculture were enrolled in this specialty. The corresponding ratio at the High Diploma level was 33 percent.
e. The government scholarship regulations allowed only permanent employees to obtain scholarships for graduate training. This excluded a number of promising contract employees from these opportunities for career development. However, an exception was later made to by-pass these stringent regulations so that twelve students received support in return for working at NCARTT after graduation.

3.2.3. Seminars and in-service training

In-service training was carried out at NCARTT beginning in 1986. Until mid-1991 about 130 training courses, field days, seminars, and opportunities for English-language enhancement were carried out. Training courses for researchers and extension agents have been carried out by NCARTT in which 1,415 employees participated for a total of 403 training days since 1992.

Table 3.5. In-service-training by NCARTT.

subject	no. of courses	participants	duration (days)
Research Strategies	3	117	3
Planning Research & Extension Programs	10	357	3-21
Administration	8	313	3-6
Training of Trainers	1	8	24
Training of New Employees	1	28	6
Agricultural Practices	16	335	1-13
Computer Science	5	102	7-60
Other	4	135	1-2
Total	48	1415	403

3.2.4. The Training of Newly Graduated Agricultural Engineers Program

The Training of Newly Graduated Agricultural Engineers (TNGAE) program is an innovative training activity with strong study-training-employment linkages funded by agricultural development fund and implemented and monitored by the Association of Agricultural Engineers (AAE). A coordination and monitoring committee of five members was appointed by the Minister of Agriculture. The committee consisted of two members from the AAE, one member from NCARTT, one member from TASO, and one representing the coordinating office. The program was started in April 1992 when fifty new graduates were assigned to public and private institutions and enterprises. The project paid 70 percent of their stipend of 100 Jordanian dinars per month and the employer paid 30 percent. The training specialties included fruits, vegetables, nurseries, agronomy, plant protection, animal husbandry and health, dairy science, food processing, agricultural economics, and agricultural marketing.

More than 70 percent of the first batch of trainees were employed by their host institution or company upon completion of the nine-month training program. The second batch of fifty trainees started their program in November 1992, the third and fourth batches of fifty-five trainees each is expected to complete training by August 31, 1994.

3.3. Construction

The project paper called for the construction of offices, laboratories, and other support facilities for NCARTT as well as offices, training areas, and logistical support facilities for four regional agricultural services centers to be located in the highlands. The estimated cost of construction was $5.812 million with $4.812 million provided through a USAID loan and the balance from the Government of Jordan.

The plans included in the project paper called for construction of an NCARTT headquarters building of 1,820 square meters. The project paper states that this size will be re-examined during project implementation. However, the building that was constructed, but which is not yet completed, is more than 10,000 square meters. The evaluation team had a problem finding out why the plans for the headquarters building at Baq'a had been increased more than five-fold during project implementation. The answer that the team pieced together was that the Consortium for International Development, Washington State University, consultants had asked each section of NCARTT what they wanted in the way of laboratories and office space and then used this needs assessment, conducted without any apparent critical analysis of need or NCARTT's capacity to staff, operate and maintain the facility, to work with civil engineers from the Ministry of Agriculture and MPW and a local design firm to come up with the plans for the greatly expanded facility. The interim evaluation explained the expansion as follows:

> The change in the scope of the project from a Highland Agricultural Development Project to a National project was reflected in a major change in the NCARTT headquarters building in Baq'a. Instead of supplementing existing buildings previously occupied by the Research and Extension Department of the Ministry of Agriculture (NCARTT's institutional predecessor) with additional office and laboratory facilities, it was apparently decided to construct a much larger building that would provide space

for present and future needs of agricultural research and technology transfer for Jordan as a whole.

In commenting on a draft of this report, a USAID engineer commented the following:

> During the early stage of the project, USAID/Jordan engaged Groupe & Hall and Consortium for International Development, Washington State University, consultants to determine the actual space area needed for the Baq'a NCARTT in coordination with the Ministry of Agriculture. This team had determined the needed space by making use of its vast experience in this field. This determination came as a result of hard and constructive efforts that involved the examination and analysis of several scenarios envisioned and presented by the Ministry of Agriculture's pertinent technical staff who are directly involved in the use of this space. USAID concurred with this determination.

Whatever the reason or reasons for the expansion, it is clear to the evaluation team that the offices and laboratories now available to NCARTT far exceed its capacity to staff, operate and maintain them. This problem is discussed in further detail in Section 11.5.

Construction of all regional agricultural services centers were completed more or less on schedule and in accordance with contract terms although there were many problems and delays in carrying out the construction, particularly of the headquarters building. The project paper implementation plan (PPIP) called for a contract for the design and supervision of the building to be signed by December 1985 with the design and plans completed by December 1986. The contract was actually signed in November of 1987 and the plans were completed in 1988, a delay of almost two years. The PPIC called for the construction of the facilities to be completed by 1989. In fact, the contract for the construction of the Baq'a headquarters building was awarded to Al-Arab Construction Company on February 2, 1989, and the building has not been completed as of this evaluation.

Construction of the Baq'a Headquarters was also delayed by the Gulf War and for other reasons associated with its construction contractor. The Gulf War reduced the availability and raised the prices of construction materials and labor in the local market. The application of United Nations sanctions on Iraq disrupted Jordan's market, produced higher freight costs, and virtually shut down the country's only seaport, and led to a severe shortage of construction materials and equipment required by the contractor for construction. Many foreign workers fled Jordan during the Gulf War Crises, resulting in construction labor shortages. This situation coupled with the contractor's financial problems greatly hindered progress. For example, prices of steel bars went up three fold, causing great losses to the contractor. In June 1991 the owner of the construction company died, the company was unable to complete the building, and the contract was eventually terminated.

In December 1991, after receiving USAID approval of a second set of bid documents, the Ministry of Agriculture invited proposals to complete the building. However, the Ministry of Agriculture felt it necessary to cancel the invitation due to what they concluded were exorbitant bid prices. In May 1992, after modifying its requirements and receiving USAID approval, the Ministry of Agriculture invited bids to complete construction. This time the construction contract for the completion of the NCARTT headquarters was awarded on December 3, 1992, to the Arab Business Corporation. Construction is scheduled to be completed by July 1994, but the evaluation team is skeptical that this date will be met.

Procurement of the design services and construction contractors for the NCARTT Headquarters and the regional agricultural services centers was also interrupted and delayed by the devaluation of the Jordanian dinar which unfortunately happened during the procurement stage. Also, due to the devaluation of the dinar, many competent contractors did not bid on this construction project because of uncertainty about future local and international prices.

See Tables 13.14.2 and 13.14.3 for further details on the construction of the facilities.

3.4. Commodities

The project paper budgeted $6,292,000 for commodities. The commodity procurement was to be undertaken in two steps. The first and principal procurement exercise was to be finalized after the arrival of the original technical assistance team in Jordan. The first procurement phase was budgeted at $3,710,000. The second procurement phase, budgeted at $1,596,000 and intended for the modernization of farm machinery, was scheduled for FY 1990 for the modernization of farm machinery. The commodities were to be used primarily for furnishing and equipping the NCARTT and regional agricultural services center laboratories and offices and to provide support to the technology transfer activities. Additional commodities mentioned in the PPIC were for farm equipment for the regional agricultural services centers and vehicles to support the applied research and extension activities.

As of late 1989, commitments for commodities totalled the original $3.7 million, with another $2.4 million in process for laboratory casework. This almost totally exhausted the $6.2 million budgeted. The second procurement phase was never implemented.

The changes in the scope and focus of the project from the HADP to the NADP and the major change in the number of laboratories that were constructed compared to what was planned greatly impacted commodity procurement. Equipment for the approximately 70 laboratories at the NCARTT center and the regional agricultural services centers was purchased mid-way through the project and most of it is still in the original packing crates. The inventory of the laboratory equipment purchased is in a 419-page document that can be reviewed at NCARTT.

The purchase of this vast inventory of laboratory equipment appears to have drained funds away from the purchase of other badly needed commodities such as vehicles, farm equipment, supplies, and so on.

NCARTT presently does not have the technical capability required to install, calibrate, use, and maintain the laboratory equipment that has been procured. There is clearly a question whether NCARTT itself can make good use of more than fifteen laboratories at the Baq'a center and the two to three laboratories at each of the regional agricultural services centers. NCARTT has no plan and has not identified financial means to adequately staff, use, manage, and maintain the large number of laboratories which have been constructed and equipped under the project.

In short, the procurement of the laboratory equipment exceeded substantiated needs. The procurement was completed far ahead of the completion of construction of space to house the equipment and the hiring and training of staff to operate and maintain it. Thus, nine years into the project, most of the laboratory equipment has not yet been used.

With respect to the other major commodities provided by the project, Table 3.6 gives the current inventory of project-funded vehicles, machinery, and equipment in NCARTT and the regional agricultural services center's.

Table 3.6. Commodities inventory: List of vehicles and equipment at NCARTT and regional agricultural services centers.*

equipment	Baqa'a	Marc	Ramtha	Khanasrt	Khaldiya	Mushaqar	Rabba	Ghowair	Ghor Essafi	Shobak	Wadi Yabis	Karama	Deir Alla
vehicles	18	2	4	1	4	5	3	1	1	3	1	1	6
tractors	-	4	5	-	3	4	3	2	2	6	2	1	2
cultivator for experimental plots						1							
seed drill for experimental plots						1	2						
spraying machine					2	1	1		1	3	1	2	2
knapsack sprayer		1	1										
grain combine		1				3	1						
grain harvester for exp. plots		1	1			1	1						
grain thresher			1			1							
mowing machine		1											
vacuum machine for seeds						1							
generator electricity unit				2									
water pump					1	1	1			1	1	2	2

*Includes some equipment from the Government of Jordan and other donors.
Source: NCARTT Inventory.

3.5. Agricultural Development Fund

As proposed in the project paper, the agricultural development fund was created "to accelerate implementation of policies approved by the Agricultural Development Council (ADC) and provide a flexible financing mechanism for mobilization of resources outlined in the various Action Plans." It was to have been funded at just over US $10.0 million with the Government of Jordan contributing approximately two-thirds and the project one-third in a *pari passu* arrangement (Government of Jordan $6.75 million and the project $3.5 million).

The types of projects to be financed from the fund included on-farm demonstrations, land aggregation, credit guarantees, and research contracts. It was also supposed to have been managed by the ADC through several financial alternatives depending on the type of loan to be given. Those projects, intended to generate income, would be considered part of a revolving fund that would be regenerated by this income.

In implementation, the fund had two incarnations. The first, financially managed by the Agricultural Credit Corporation (ACC), was active between the years 1987 and 1989. Only one financial of the proposed financial alternatives was employed and none of the thirty-three projects ever became part of a revolving fund. Furthermore, instead of being placed under the auspices of the ADC, it was established with a steering committee and housed in the projects office of the Ministry of Agriculture. This gave it much less public appeal and prestige for potential users of the fund. It was also much more controlled by the Ministry of Agriculture than the less political ADC.

Over the two years, the thirty-three projects were funded totaling more than $1,187,800. Of these, only five had NCARTT involvement in spite of the fact that the center was to have been one of the principal recipients from the fund. In fact, NCARTT did not even have a position on the steering committee until June 1993 when NCARTT attained semi-autonomous legal status.

Of the thirty-three projects, only six were properly completed, that is, the project proposal was implemented, results were achieved and disseminated, and the appropriate documentation was filed with the fund. Many projects were not well designed to begin with, no monitoring, evaluation, or supervision was provided by the steering committee, and in many cases, the principal involved left or was transferred from the Ministry of Agriculture, NCARTT, or other governmental organization.

The successful cases included on-farm wheat and barley demonstrations, onion and garlic varietal research in drylands and under irrigation, plant protection information dissemination, and research in biological control methods.

The second incarnation of the fund began in 1991 when its management was placed under TASO's mandate. Since then, TASO and the NCARTT board have approved fifteen projects totaling $834,175. Of those, some are traditional agricultural research projects while others represent various innovative approaches to solving a diverse range of bottlenecks in the agricultural sector. These include the Newly Graduated Agricultural Engineers Program explained above in Section 3.2, Masters training at the ADJ, supplementary support to Masters students at the ADJ for their thesis research, and the preparation of NCARTT's national research strategy and its medium-term implementation plan.

In summary, the concept of the fund was basically sound, although in the first phase of the implementation process it lacked inspired, dynamic management. Additionally, the original estimate of $10.0 million proved to be far larger than the agricultural sector's ability

to absorb it, at least through the mechanisms employed. See Table 13.14.7 in the Tables Annex to this report for a listing of projects during both phases.

3.6. Evaluation

An additional USAID contribution to the project was made to provide funding for two interim evaluations and one final evaluation and impact assessment of the project. In reality only one interim evaluation was conducted due to the late arrival of the technical assistance team and the disturbances and dislocations caused by the Gulf War.

The interim evaluation produced many well conceived recommendations and a majority of them were adopted. Nevertheless, the final evaluation team takes strong exception to the statement in the interim evaluation that the original project purpose was, "roughly the same" as the newer one being employed at the time. Originally, the purpose was to "stimulate agricultural production through applied research, improved extension methodologies, and various activities to enhance institutional capabilities," while the purpose being used at the time of the interim evaluation was "to stimulate sustainable improvements in agricultural productivity, profitability and equitable distribution of farm incomes through a more effective system of Agricultural Research and Technology Transfer."

To the evaluation team, this basic change in direction of the project from production to sustainable increases in productivity, profitability, and equitability, coupled with the increase in scope from just the highlands to the entire country, represented enormous changes that, if recognized at the time, could have led to more focused recommendations that considered and accommodated NCARTT's role and capacity to assume these new responsibilities.

3.7. Government of Jordan inputs

3.7.1. Personnel and operations support

The project paper called for the Government of Jordan to provide $14.148 million for personnel and operating costs over the life of the project. This figure was based on a counterpart personnel total of 194, including 84 professionals, 50 clerical/secretarial employees, and 60 farm technicians. Over the course of the project, NCARTT has covered all personnel and operating costs. The present personnel level of NCARTT is 645, comprised of 148 permanent staff, 138 on indefinite contract, and 69 on fixed term contracts, and includes 132 professionals and 158 daily workers. USAID Jordan's most recent financial statement for the project shows a total Government of Jordan contribution of $23,140,000 for personnel and operating costs.

3.7.2. Agricultural Development Fund

The project paper called for the Government of Jordan to contribute $6.75 million to the agricultural development fund. This type of contribution was most commonly in the form of matching contributions for projects identified for financing by the fund. Nevertheless, the agricultural research sector was not prepared to submit well-written fundable projects and the NCARTT structure was not capable of absorbing even a small portion of the funds potentially

available. USAID financial records credit the government with having contributed approximately $614,286 to the fund (JD 430,000).

3.7.3. Land and facility construction

A condition precedent to the project agreement called for the Government of Jordan to contribute to the construction component of the project by donating the required land for the NCARTT and regional agricultural services centers. In the case of the five parcels (headquarters + four regional agricultural services centers), this condition precedent was one of the first met.

3.8. Summary financial statement

Original Project Budget (US$'000)
Life of Project Total

	AID		Government	
	Grant	Loan	of Jordan	Total
Technical Assistance	4,445			4,445
Commodities	6,204		500	6,704
Training	753		59	812
Evaluation	125			125
Agricultural Development Fund	3,500		6,750	10,250
Land and Facility Construction		4,728	1,000	5,728
Government of Jordan (Personnel and Operations)			14,148	14,148
Contingency	1,953	1,336	2,321	5,610
Inflation	3,520	936	10,033	14,489
Totals	20,500	7,000	34,811	62,311

End of Project Budget (US$'000)
(as of May 23, 1994)

	AID		Government	
	Grant	Loan	of Jordan	Total
Technical Assistance	8,264			8,264
Commodities	6,854		3,550	10,404
Training	1,124		145	1,269
Evaluation	169			169
Agricultural Development Fund	1,961		1,500	3,461
Land and Facility Construction		6,150	1,545	7,695
Design Services		172		172
Construction Supervision		453		453
Government of Jordan Personnel and Operations			16,400	16,400
Other Costs	128			128
Contingency				
Inflation				
Totals	18,500	6,775	23,140	48,415

Source: Project paper and project staff.

4. Project outputs

Initially the evaluation team had some difficulty in determining which outputs to evaluate because of the changes that were made over the course of the project. According to the 1989 mid-term evaluation, the original logical framework, included in the project paper, was revised during the Project Implementation Startup Workshop in January 1987. New project purpose and project Outputs were developed for the new logical framework which was tacitly endorsed by USAID/Jordan as a working document and was used by the mid-term evaluation team as the basis for measuring progress toward achieving the project outputs and project purpose.

Following the disruptions associated with the Gulf War, the mission decided on a strategy that would concentrate on completing the construction of and equipment installation at the center at Baq'a and the four regional agricultural services centers plus upgrading the staff at NCARTT. This would have the physical base and a core staff in place by the September 1994 PACD. The mission also decided to devote project funds to an additional set of activities that included developing a comprehensive strategy and medium-term work plan for NCARTT, an Agricultural Sector Review and Policy Implementation plan, a baseline survey of the Zarqa Triangle, and construction of cold-storage facilities at Queen Alia International Airport.

After discussions with mission officials, the evaluation team decided to concentrate on assessing progress toward achievement of the outputs included in the original logical framework rather than the revised one used for the interim evaluation because the mission had never formally adopted the revised logical framework. The evaluation team also was asked to comment briefly on this set of additional activities which were funded under the project over the past two years.

4.1. Outputs in the original logical framework matrix

4.1.1. Improved institutional coordination and priority analysis

The project paper called for improved policy formulation and coordination to be brought about through the formation of the Agricultural Development Council chaired by the Minister of Agriculture. The council was to be supported by a secretariat and was to include the heads of semi-autonomous agencies such as the Agricultural Credit Corporation (ACC) and representatives from the private sector and cooperative groups such as the Jordan Cooperative Organization. It was to oversee the systematic commodity/resource analysis and development approach, formally review and approve action plans, and allocate institutional resources, some of which were to be provided through the project-supported agricultural development fund.

The Agricultural Development Council was never formed and the systematic commodity and resource analysis and development process was scrapped in 1987. The Agricultural Development Council concept was replaced first by a steering committee for the projects department in the Ministry of Agriculture which had initial responsibility for the NADP and NCARTT, then a NCARTT board of directors and finally, at present, an NCARTT council chaired by the Minister of Agriculture. The council includes the Director General of NCARTT as deputy chairman, the Secretaries General of the Ministry of Agriculture and the Higher Council for Science and Technology, representatives from the faculties of agriculture at the University of Jordan and Jordan University for Science and Technology, and a

representative with scientific credentials appointed by the Minister of Agriculture. There is no representation from the Agriculture Credit Corporation, the Jordan Cooperative Organization, or the private sector.

The systematic commodity and resource analysis and development process for setting priorities and implementing programs was dropped in 1987 and replaced by the Farming Systems Research/Extension methodology for determining priorities and acting upon them. Action plans were never prepared and institutional resources were not allocated to joint activities with the exception of the collaborative research work carried out with financing from the agricultural development fund between NCARTT and University of Jordan professionals.

As covered in more detail in Section 10.7, inter-institutional linkages and coordination are weak and based largely on personal interests and relationships. The recently drafted Agricultural Research Strategy calls for greater collaboration on research and provides some hope that this output may be achieved eventually and thus make a greater contribution to achievement of the project purpose. However, to date the progress in achieving this output is limited.

4.1.2. Establishing a National Center for Agricultural Research and Technology Transfer and four regional agricultural services centers

The project paper called for establishing a National Center for Agricultural Research and Technology Transfer (NCARTT) which was to have overall responsibility for the identification and testing of high-potential technologies for the highlands. The actual extension of production technologies to farmers was to be implemented through a network of regional agricultural services centers. The NCARTT was to form the administrative headquarters for institutional coordination of public agriculture sector services for the project. It was to house the administrative and planning staff, central research laboratories, and the subject-matter specialists who were to supervise the on-farm research, demonstrations, and training activities carried out at the various regional agricultural services centers. The objectively verifiable indicators were to be fully staffed and equipped NCARTT and regional agricultural services centers.

By the time the project is completed in September, 1994, NCARTT and the regional agricultural services centers should have completed construction and be in the process of equipping the NCARTT and the four new regional agricultural services centers. Most of the equipment for the laboratories was ordered in 1988 and delivered in 1989. Some of it has been unpacked and delivered to the regional agricultural services centers but most of it has remained in the original packing crates awaiting completion of the NCARTT building. Training staff to use the equipment will follow installation.

The project has provided academic degree training for seven NCARTT employees at the Ph.D. level, eleven at the MS level, and three at the High Diploma level, an intermediate title between the BS and MS. NCARTT employs 14 Ph.D.s, 49 M.Sc.s, and 69 B.Sc.s. This is considered more than enough people to carry out NCARTT's mandate but falls short in terms of quality and educational preparation. Thus, output by a fully staffed and equipped NCARTT and its regional agricultural services centers is only partially met.

The contribution of output by personnel to achievement of the project purpose has been diminished by a number of problems, including the discontinuity in program direction and content caused by frequent turnover at the Minister of Agriculture and Director General level,

the problems of low salary levels and lack of working environments conducive to good performance, and the lack of an overall strategy and implementation plan to guide NCARTT's work. All of these problems are discussed in further detail in Sections 10 and 11 of this report.

4.1.3. Development of appropriate demonstration methodologies

The Ministry of Agriculture has been conducting on-farm demonstrations since the 1960s, often in collaboration with the Jordan Cooperative Organization and the Faculty of Agriculture of the University of Jordan. These activities were continued and enhanced during project implementation. The on-farm demonstrations are important to achieve the project purpose because they acquaint large numbers of farmers with new technologies developed by NCARTT.

4.1.4. Improved Knowledge of Rangeland Management, Sheep and Goat Production, and Co-op Societies

The project paper called for providing funding for a pilot range-improvement project to be co-financed by UNEP and implemented by the Ministry of Agriculture in cooperation with the Jordan Cooperative Organization which was to organize grazing cooperatives. The project was to demonstrate controlled grazing conditions, re-vegetation, and improved livestock management techniques as practiced by members of a Jordan Cooperative Organization cooperative.

The Pilot Rangeland-Improvement Project was initiated in 1988 with technical assistance provided by the Consortium for International Development, Washington State University, range management advisor. The evaluation team received many favorable comments about this particular advisor, his technical knowledge and his effectiveness. The pilot project was completed and a detailed report was produced. The final report recommended the establishment of cooperative reserves as a successful model for range management.

In addition to this pilot project, the project funded ACC/agricultural development fund and TASO/agricultural development fund research activities to improve production of Baladi and Shami goats and Awasi sheep. The project also funded the preparation of a comprehensive report on range management in Jordan. This report provided information on a number of topics including a survey of all rangeland improvement project since 1955, an assessment of present range management activities in Jordan, an analysis of the current environment, resources, strengths, and constraints, and the role of range management and animal production and their impact on the national economy.

While these activities have contributed to increased knowledge about range management and animal production, their contribution to achievement of the project purpose has been limited because of the constraints discussed in other sections of this report. Future NCARTT research activities should expand upon this earlier work to advance efforts to improve range conditions and strengthen the national capacity to combat desertification. NCARTT needs to upgrade its staff capability or identify and support competent researchers in the university community or in the private sector with expertise in such areas as biometrics, animal nutrition, and livestock integration with improved range management practices.

4.1.5. Increased agricultural production

The amount of agricultural land under production, both irrigated and rainfed, as well as the productivity and profitability of most crops, have varied considerably over the life of the project. While some of these changes can be attributed to technological innovations, a majority of them have been due to changes in relative prices, yearly changes in climatic variables, and government policies including price supports, and the subsidized cost of inputs, especially water. Table 4.1 demonstrates changes in land area, production, and productivity for selected crops grown under both irrigated and rainfed conditions:

Table 4.1. Changes in land area, production, and productivity for selected irrigated and rainfed crops 1980-1993.*

	land area hectares ('000)		production metric tons ('000)		productivity metric tons/hectare	
crop	80/81	92/93	80/81	92/93	80/81	92/93
olives	23.81	75.94	18.9	49.2	0.79	0.65
grapes	9.83	13.59	45.9	54.8	4.67	4.03
apples	0.72	4.54	3.0	24.9	4.17	5.49
almonds	0.50	1.07	1.1	2.1	2.20	1.96
citrus	3.18	5.40	83.0	175.8	26.00	33.00
bananas	0.31	1.20	12.0	18.4	38.70	15.33
tomato	14.26	14.93	341.4	621.2	24.00	42.00
eggplant	3.86	2.05	99.3	70.4	26.00	34.00
cucumber	4.28	1.18	106.2	100.6	25.00	85.00
potato	0.42	4.90	9.11	17.6	22.00	24.00
onion	1.11	2.91	11.7	43.1	11.00	15.00
garlic	0.02	0.62	0.2	8.7	10.00	14.00
	83/84	92/93	83/84	92/93	83/84	92/93
wheat						
rainfed	43.00	66.38	25.0	37.4	0.58	0.56
irrigated	1.99	6.41	3.0	37.4	1.51	5.84
barley						
rainfed	19.03	66.39	4.8	33.3	0.25	0.50
irrigated	0.76	2.73	0.7	11.0	0.92	4.03

Source: Data Bank, Ministry of Agriculture, Amman, Jordan.

* The yearly changes in these indicators on a crop-by-crop basis can be found in the Statistical Annex to the Final Evaluation Report of this project.

As Table 4.1 demonstrates, there has been a measurable increase in land area and production, especially in the case of irrigated crops. Tree crops such as olives and apples have shown the most significant increases. It also shows that there has been a shift toward more intensive cultivation of vegetable crops, most likely due to the mass acceptance of greenhouse and plastichouse technologies. While no statistical data exists to enable the impact assessment team to attribute these increases to NCARTT research and technology transfer, anecdotal evidence does exist that the center's activities have been important in the cases of barley, onions, and garlic. Additionally, it is clear, also from anecdotal information, that NCARTT's research in the areas of biological control and disease resistant varieties has also had an impact on reduction of losses in both tomatoes and cucumbers.

4.2. Modifications since the Gulf War

Following the return of USAID personnel to Jordan in 1992, the mission undertook a re-evaluation of the National Agricultural Development Project to determine how to best use the time and money remaining between then and the PACD in September 1994. Based on this re-evaluation, the mission decided to add $2.1 million to the project and to concentrate on finishing the construction and equipment installation of the headquarters building at Baq'a and the four regional agricultural services centers, and the training of NCARTT staff. It also decided to fund the cost of preparing an Agricultural Research Strategy and Medium-Term Implementation Plan to guide the selection, prioritization, and implementation of NCARTT research programs. In addition, the mission decided to use NADP funds to finance the preparation of an Agricultural Sector Review and Policy Implementation Plan, a base-line study of the Zarqa River Basin, and the construction of a produce cooling unit at the Queen Alia International Airport at Amman. Nevertheless, the most significant modification since the Gulf War was the establishment of the Technical Assistance Service Organization (TASO) to take over the management of the project. This six-person team of locally-hired personnel proved to be not only more relevant to the work required but less costly as well. To achieve some level of continuity, the horticultural advisor to the Consortium for International Development, Washington State University, team was made the head of TASO.

4.2.1. National Agricultural Research Strategy

In 1992, the Minister of Agriculture requested USAID assistance to develop an Agricultural Research Strategy and Medium-Term Implementation Plan. A coordinating committee was established under the direction of the Director General of NCARTT. Five task forces were formed, composed of representatives from NCARTT, the Ministry of Agriculture, the national universities and the private sector. They were assigned to produce reports on research in irrigated agriculture, rainfed agriculture, low rainfall areas, integrated livestock production, and the organization and structure of NCARTT. The agricultural research strategy is now in final draft form and awaiting approval by the NCARTT council and the Minister of Agriculture; work is continuing on preparation of the Medium-Term Implementation Plan.

The Agricultural Research Strategy is a comprehensive document that provides a good starting point for elaboration of a Medium-Term Implementation Plan. The strategy is necessarily quite general but provides a good base for getting down to specific details in the implementation plan. For further discussion of the strategy see Sections 10.9 and 11.3.

4.2.2. Agricultural sector review and policy implementation plan

In the area of policy and planning analysis, the project has contributed in at least two ways toward assisting the Ministry of Agriculture and, by extension, NCARTT in the formulation and analysis of policies directed at the agricultural sector. The first was the use of project funds to purchase services from the USAID centrally-managed Agricultural Policy Analysis Project (APAP, II) which produced a detailed and comprehensive analysis of the country's agricultural sector, the first such analysis in over twenty years. This analysis changed the analysis of the sector from the traditional commodities-based approach to a systems approach that included irrigated agriculture, rainfed agriculture, low rainfall zones, integrated livestock production, and forestry. The major output of this activity, a six-volume set of documents, has already been used by the World Bank for an up-coming Agricultural Sector Adjustment Loan and its companion Agricultural Sector Technical Assistance Project. In addition to the Ministry of Agriculture itself, no doubt other donors will be able to use these documents to plan further projects that support the agricultural sector and attract financing for them.

In the area of policy and planning analysis, the second contribution of the project is to use agricultural development funds to develop a National Agricultural Research Strategy and a Medium-Term Plan for the strategy's implementation. This process includes the Ministry of Agriculture, NCARTT, the University of Jordan, JUST, and the private sector. When completed and formally accepted, the research strategy and the plan will be important cornerstones for the Ministry of Agriculture, and the Government of Jordan in general, to use as they develop future policies and priorities concerning research in the agricultural sector.

4.2.3. ISPAN baseline survey of the Zarka Triangle

In 1992, USAID/Jordan funded a buy-in to the Asia/Near East Bureau ISPAN Project to carry out a baseline survey of the Zarqa River Basin as part of the start-up activities related to the USAID-funded Water Quality Improvement and Conservation Project authorized in April 1993. The baseline survey monitored water use on 36 farms and did an economic survey on 400 farms. They looked at on-farm water management, water use efficiency, including the relative efficiency of drip and open ditch irrigation systems, and water quality, including levels of salinity and heavy metals. The baseline survey report is in final draft form and is scheduled for completion by June 1994.

4.2.4. Cold Storage Project at Queen Alia International Airport

The main objective of the Cold Storage Project is to facilitate Jordanian exports of fruits and vegetables to European markets. The absence of cold storage facility at the airport was a major hindrance to the expansion of Jordanian exports. A technical and economic study of the Cold Storage Project recommended building a cold storage facility measuring 10 x 34 meters near the southwest corner of the existing air cargo building. This recommendation was received favorably by representatives of the USAID staff and officials in the Agricultural Market Organization, Civil Aviation Authority, Royal Jordanian Airline, and private exporters.

The required total cost of the Cold Storage Project is estimated at $500,000. The amount of $230,000 has already been earmarked for the Cold Storage Project under the Agricultural Marketing Development project. The NADP became a participant of Cold Storage Project by reserving $120,000 for the project.

5. Progress toward achieving the project purpose

The project purpose was to "stimulate greater agricultural production through applied research, improved extension methodologies and various activities to enhance institutional capabilities." The objectively verifiable indicator was to "strengthen the capabilities of the National Center for Agricultural Research and Technology Transfer to develop and diffuse agricultural technologies for cereals, pulses, tree crops and livestock so as to reach 75 percent of highland farmers." While it is indisputable that agricultural production has increased over the nine years of the project, it is difficult to point to "applied research and improved extension methodologies" as the principal causative factor. As can be seen in Table 13.14.5 of Annex 13 to this report, agricultural production increased in all major crops between 1980/81 and 1992/93, most notably in citrus and tomatoes (doubled), onions and olives (tripled), barley (seven-fold), apples (eight-fold), potatoes (twelve-fold), and garlic (forty-fold). Many factors have impacted on these increases in production. In addition to improved technology, these factors include changing government policies on support prices, import restrictions, subsidies such as those on irrigation water, and highly variable climatic conditions. While it is difficult to establish a strong, direct, and verifiable causative link between NCARTT and increased production, the evaluation team encountered considerable anecdotal evidence to support NCARTT's contribution, particularly in barley, onions, garlic, olives, lentils, chickpeas, vetch, and apples, areas where there have been significant research and technology transfer programs over the years.

The project's original emphasis on cereals, pulses, tree crops, and livestock shifted somewhat when the project name and focus was changed from the Highlands Agricultural Development Project to the National Agricultural Development Project. In attempting to judge how well NCARTT had done in meeting the objectively verifiable indicator included in the logical framework, the team found that NCARTT had done some good work in cereals, pulses, and tree crops but had fallen short of reaching the target level of 75 percent of highland farmers.

The project has been instrumental in providing a physical base for NCARTT operations through construction of and equipment installation at the headquarters building at Baq'a and the four regional agricultural services centers. It has also established a good library and provided academic, technical and managerial training for NCARTT staff.

While NCARTT's capabilities have been strengthened by the project, there are continuing weaknesses in the organization that prevent it from realizing its potential. These weakness include the inability to offer salary levels and working environments that can attract top-quality scientific and technical staff, the frequent turn-over of Ministers of Agriculture and NCARTT Director Generals which causes disruptions in program content and direction, and the lack of a clear and systematic process for identifying, prioritizing, and implementing research programs. Some progress is being made in the last area through elaboration of the Agricultural Research Strategy and Medium-Term Implementation Plan. It is hoped that achievement of full autonomy or some other suitable mechanism will allow NCARTT to address the problems of salary levels and working environments and may also isolate it somewhat from disruptions caused by the frequent turn-over of top level leadership.

In the area of diffusion of technology and extension methodologies, the project record is not good, although some progress was made in the early stages of the project with that assistance of the Consortium for International Development, Washington State University, extension advisor. With the departure of the advisor, and the disruptions caused by the Gulf

War and changes in leadership at the Ministry of Agriculture and NCARTT, the technology transfer program went into a slump that was exacerbated by the transfer of subject-matter specialists from NCARTT and the regional agricultural services centers to the Ministry of Agriculture in 1991 and the transfer of responsibility for supervision of extension agents from NCARTT to the Ministry of Agriculture in late 1992. Despite these set backs, some good work has been done in technology transfer through workshops, seminars, and field days organized by NCARTT and TASO. The Mashreq Project has done a particularly good job of diffusing technology through on-farm demonstrations.

6. Relevance and appropriateness of project design

The evaluation team concluded that the original design of the project was basically sound. The concept of establishing and strengthening a National Center for Agricultural Research and Technology Transfer to stimulate agricultural production is as logical and appropriate in 1994 as it was in 1985. While the agricultural sector represents only 6 percent of GDP, when agribusiness activities are added to agricultural production, this figure jumps to 29 percent of GDP, making it a major sector. The agriculture/agribusiness sector also offers promising prospects for increasing Jordan's export base.

The project design included many good ideas. These include establishing an Agricultural Development Council to foster improved policy formulation and coordination, creating an agricultural development fund to promote collaborative research efforts and to provide a flexible response mechanism for addressing important problems related to research and extension, constructing regional agricultural services centers to bring research activities and related services to the key production areas of the Kingdom, upgrading technical and management skills through long-term degree programs and short-term training courses, upgrading laboratory services and access to scientific information, and promoting closer ties between NCARTT and national and international organizations involved in agricultural research. Some of these ideas turned out differently from the way they were envisioned in the project design, taking alternative forms such as establishing the NCARTT steering committee and later the NCARTT council to foster improved policy formulation and coordination rather than the Agricultural Development Council described in the project paper.

The project purpose, to "stimulate greater agricultural production through applied research, improved extension methodologies and various activities to enhance institutional capabilities" remains relevant to Jordan's needs in 1994. However, it is clear that the objective of simply "greater agricultural production" is no longer appropriate and should be modified to address improved agricultural productivity and profitability and the more efficient use of water within a context of responsiveness to changing domestic and external market conditions, natural resource management, and environmental concerns.

In examining project inputs and outputs to determine whether they were appropriate for achieving the project purpose, the team concluded that greater emphasis should have been given to three factors:

1) achieving autonomous status for NCARTT so that problems related to salary levels and the length of the work day could have been resolved,

2) providing for much greater private sector participation in identifying and prioritizing research needs and in advising on the policies and management of NCARTT, and

3) early elaboration of a strategy for agricultural research and technology transfer that could have guided research and extension focus, setting priorities, implementation and monitoring over the course of the project. The Agricultural Research Strategy that is currently in final draft form will be very helpful to NCARTT and other organizations concerned with agricultural research and extension.

As detailed in the impact assessment, the impact of the project to date has been modest. The potential impact is great, however, particularly if NCARTT can achieve full autonomy and include provision in its organic law to pay competitive salaries for an upgraded staff and can establish systems for greater collaboration with the local faculties of agriculture and the private sector.

7. Progress on recommendations in interim evaluation

The project evaluation summary for the interim evaluation stipulates three areas of recommendations which the mission and the Ministry of Agriculture agreed to implement: organizational, programmatic, and operational. Table 7.1. lists these categories of recommendations and notes progress on their implementation.

Table 7.1. Progress on recommendations in interim evaluation.

Organizational action decisions	Results
1. Revitalize the NCARTT board of directors and formally delegate to it the authorities agreed to by the Prime Minister's office in May 1988; in addition, assign authorities described on p. 6 of the mid-term evaluation.	NCARTT council meets regularly, makes decisions.
2. Remove NCARTT from the projects directorate and give it semi-autonomous status under the Ministry of Agriculture.	Done through By-law 42.
3. Appoint a permanent NCARTT director with full powers to administer NCARTT under the board's supervision.	Done partially, more autonomy still required.
4. Guarantee a dedicated budget line item for all of NCARTT's costs, both operational and capital expenditures.	Recently accomplished.
5. Transfer the Soil and Irrigation Section's non-research responsibilities to a suitable department in the Ministry of Agriculture.	Not done due to strengthening of the Ministry of Water and Irrigation.

Table 7.1. Progress on recommendations in interim evaluation (cont.).

Program Action Decisions	Results
1. Revise the existing restrictions on the apportionment of the agricultural development fund among various "specific purposes."	Restrictions eliminated when TASO created.
2. Review the Field Crops Section's research program to determine which activities should be pursued and which activities should be dropped.	Done under the new National Research Strategy
3. Establish a set of feasible, internally consistent, indicators of project progress and impact.	Not done due to the disbanding of the MIS and the transfer of 82 NCARTT staff.
4. Modify the JNAD project paper and amend the project agreement to reflect the national scope of the project, the shift from systematic commodity and resource analysis and development to FSRE research/extension methodologies, the project's revised organizational structure, and Jordan's changing economic climate.	Done with Amendment 3.

Operational Action Decisions	Results
1. Revise the NCARTT/regional agricultural services centers training plan, in accordance with the newly established training and extension priorities, to accelerate training at the High Diploma, MS, and Ph.D. levels to meet the near-term personnel and skill requirements of the various sections and field offices involved in the project.	Done.

Table 7.1. Progress on recommendations in interim evaluation (cont.).

Operational Action Decisions	Results
2. Reassess near-term current operating costs, especially for operation and maintenance of the new NCARTT building, equipment, and vehicles, to ensure adequate future budget provisions.	Not done.
3. Review planned financial commitments in order to ensure the availability of funds in the likely event of a no-cost extension of the project assistance completion date (PACD).	Done when PACD was extended.
4. Establish a multi-disciplinary committee to develop and disseminate formal guidelines for topics and research procedures in regard to AD projects. This committee should also review and make written recommendations on all AD proposals.	Done through the NCARTT council.
5. Address personnel needs in the following sections: Range/Livestock, Socioeconomic, Agricultural Information, and establish an expanded Soil and Water Section.	Recommended in the National Research Strategy.
6. Grant research and extension personnel self-drive privileges and facilitate after-hours work.	Not done.

8. Project management

Management of the project has suffered from a lack of continuity in program direction and inadequate monitoring during implementation. Unusually frequent changes of key personnel associated with the project had a negative impact on project implementation. The major change in the project (ie., starting as a project focusing on highlands agriculture and changing to the broader and different focus on national agricultural development made the project more difficult to manage. During the life of the project there have been eleven Ministers of Agriculture, six Executive Directors including acting Directors, three USAID Office Chiefs, and the two Technical Assistance groups, Consortium for International Development, Washington State University, followed by TASO. These many changes plus the disruption caused by the Gulf War adversely affected project management.

Much of the lack of continuity was political in nature and beyond the control of the Government of Jordan project management, the technical assistance teams, or USAID. Nevertheless, USAID could have more carefully documented changes in the expected outputs as the project was changed from the HADP to the NADP. A new logical framework with clearly stated objectives, inputs, and expected outputs should have been made a part of the project agreement.

USAID and Consortium for International Development, Washington State University, could have done a better job of monitoring the construction activities of the project, especially to expedite work during lengthy delays and to monitor equipment procurement, especially laboratory equipment. The mission also could have required more severe penalties for construction delays.

Although good work was done by some of the Consortium for International Development, Washington State University, advisors, the overall effectiveness of the Consortium for International Development, Washington State University, technical assistance team in providing assistance in administration and management was weak. They did not appear to be able to work with the NCARTT staff in a manner that would have helped to develop clearly defined strategies or programs. Detailed, clearly stated objectives were lacking, making programs and some staff very difficult to manage. Consortium for International Development, Washington State University, also could have done a better job of determining which laboratories and commodities were realistically needed by NCARTT and the regional agricultural services centers. It is possible, however, that part of the shortcomings of the Consortium for International Development, Washington State University, technical assistance team was due to the short time that they were in Jordan. That the team left early due to the Gulf War certainly contributed to their reduced effectiveness.

In stage two, after the Gulf War, TASO appears to have done a creditable job of implementing those aspects for which it was responsible under the project, especially the training activities, the agricultural development fund program, and the library. While the evaluation team recognizes that TASO's mandate was limited, there appears to have been several areas where USAID and TASO could have focused more of their attention. For example, TASO might have done more to help NCARTT to develop specific plans, with clearly stated objectives, staff assignments, and job descriptions at both the headquarters and regional agricultural services center levels. TASO also could have focused more attention on providing assistance to NCARTT to plan for staffing and equipping priority laboratories, as well as developing alternative uses of the additional laboratories.

9. Summary of impact assessment

9.1. Introduction

The impact assessment of the National Agricultural Development Project (NADP) was conducted between the months of April and June 1994 as part of the final evaluation of the project. The NADP, a $48,415,000 (USAID $25,275,000/Government of Jordan $23,140,000), nine-year (July 1985-September 1994) bi-lateral project with the Ministry of Agriculture of the Government of Jordan has been both large in financial terms and long in its implementation compared to similar projects. The purpose of the project has been to stimulate greater agricultural production through applied research, improved technology transfer methodologies, and various strategic activities aimed at strengthening institutional capabilities in the agricultural sector. Project inputs directed at achieving this purpose have included long- and short-term technical assistance, degree and non-degree training both locally and in the United States, construction and procurement of physical facilities, and establishment of an agricultural development fund to finance various research activities and other opportunities targeted in the agricultural sector.

While the project purpose has remained the same over the nine-year life of the project, the means for achieving this purpose have changed substantially. In part these changes have been intentional based on changing conditions and needs in the agricultural sector of Jordan, and in part due to conditions and events beyond the scope of either the project's designers, its implementors, or the mission's project monitors to foresee or control. Of greatest importance to the assessment of the impact of this project is the second category which, while not having negated the impact of many elements of the project, the elements of which have slowed progress toward achievement of its purpose and have made the measurement of the impact somewhat difficult, at least in quantitative terms. Included in this category is the Gulf War, the rapid and frequent turnover of all levels of NCARTT and Ministry of Agriculture staff, and the inability of NCARTT to attract and hold high quality staff.

9.2. Impact of NADP activities on NCARTT

The NADP played a key role in assisting the Ministry of Agriculture to establish the physical infrastructure for a National Center for Agricultural Research and Technology Transfer (NCARTT) within the Kingdom of Jordan. Currently NCARTT has a National Center in Baq'a, six regional agricultural services centers, and six regional substations where research is being carried out and services are being provided to farmers. This national-level system forms an institutional framework to provide area-specific, adaptive problem-solving research, as well as laboratory and other services needed for agriculture in the various production areas of the country.

While the organic structure of NCARTT is conducive to the management of a national research organization, major problems have existed, and continue to exist, which adversely impact on management's effectiveness. One problem is the ambiguity of NCARTT's status. While providing the director general with the responsibilities of a manager, the director general was never granted the authority and incentives necessary to carry out those responsibilities. Additionally, the frequent changes in leadership of the Ministry of Agriculture, as well as of NCARTT itself, have not allowed the necessary continuity of leadership and management of the organization.

The project's impact on the planning and development of NCARTT's Research and Technology Transfer Program has been mixed. There have been several changes in the approach used for the planning and development of NCARTT's capabilities over the course of the project. The project design called for utilizing the systematic commodity and resource analysis and development approach to identify production constraints and establish research and development priorities. In 1987, the project dropped the systematic commodity and resource analysis and development approach and replaced it with Farming Systems Research/Extension methodology to involve farmers in the process of identifying and prioritizing research and extension needs.

Over the past year, however, the project has had renewed and significant impact on NCARTT's decisions concerning research planning and development. This was accomplished mainly through the project's decision to fund the elaboration of an agricultural research strategy and medium-term implementation plan. The research strategy has set general guidelines for research planning which are being refined in the medium-term implementation plan. When completed, the strategy and plan should make a major contribution to NCARTT's approach to research planning and development.

The project has had some limited impact on those responsible for managing NCARTT's research and technology transfer programs, principally through their interaction with project-funded technical advisors and through short-term training courses. Nevertheless, the improvements in management have been frustrated by the frequent turnover of NCARTT directors and the lack of serious attention to tighter monitoring of research and technology transfer and supervision procedures within the organization.

The project has had significant impact on NCARTT's activities related to inter-institutional linkages and technology acquisition. The project's emphasis on promoting inter-institutional coordination took many forms, starting with the project design concept of establishing an Agricultural Development Council and continuing through the NCARTT Steering Committee to the present NCARTT Council.

NCARTT currently receives its financing from a core budget provided by the Ministry of Agriculture, the NADP which supplies a TASO staff of six, the agricultural development fund, and two institutional advisors, and several other donors, including the GTZ, UNDP, FAO, ICARDA and ACSAD, who support joint research activities. At this time it is doubtful that the resources currently provided through the project will be fully replaced by either the Government of Jordan or other donors after the PACD.

9.3. Impact of NCARTT on the agricultural sector

The amount of agricultural land under production, both irrigated and rainfed, as well as the productivity and profitability of most crops, has varied considerably over the life of the project. While some of these changes can be attributed to technological innovations, a majority of them have been due to changes in relative prices, government policies including price supports, the subsidized cost of inputs, especially water, and yearly variations in climate.

While no statistical data exist to enable the impact assessment team to attribute these changes to NCARTT research and technology transfer, anecdotal evidence suggests that the center's activities have been important in the cases of barley, onions, and garlic. Additionally, it is clear, also from anecdotal information, that NCARTT's research in the areas of biological control and disease-resistant varieties has also had an impact on the reduction of losses in the case of both tomatoes and cucumbers.

NCARTT's impact on technology transfer in the agricultural sector has been limited. With strong input from the Consortium for International Development, Washington State University, extension advisor, NCARTT was making some progress in improving its technology transfer programs in 1987-1989. When the advisor left, the program slipped and then deteriorated further when 82 NCARTT personnel were transferred out of NCARTT to other offices in the Ministry of Agriculture. There was also a serious lack of continuity in Ministry of Agriculture and NCARTT leadership which contributed to a further weakening of NCARTT extension programs. In late 1992, the responsibility for supervision of field extension agents was moved from NCARTT to the Ministry of Agriculture. Since then, very little has happened in technology transfer because of the lack of interest, support, and qualified personnel in NCARTT plus uncertainty about how NCARTT and the Ministry of Agriculture should work together on technology transfer.

Each of the four regional agricultural services centers has five completed and equipped laboratories, although many small items, as well as reagents and other supplies, are missing and NCARTT does not have the resources to purchase them. Furthermore, there is an almost complete lack of trained technicians and the research staff has never been taught how to operate, calibrate, or maintain the equipment. For the most part, these laboratories stand idle with no services being provided. None of the laboratories at the Baq'a headquarters were functional as of the time of this assessment.

It is most likely that the Training Component of the NADP has had, and will continue to have, the most lasting impact on NCARTT and the agricultural sector. There is still, however, a great need to upgrade every category of employee including managers, administrators, technicians, researchers, and farm managers. Additionally, this upgrading will have to be done at all levels including degree training at the graduate and undergraduate levels, at the diploma level, seminars, workshops, and in-service training.

9.4. Impact of NADP activities on the Ministry of Agriculture

The impact of the NADP on the institutional capability, policy formulation, and effectiveness of the Ministry of Agriculture can be measured in two general areas: raising the technical capabilities of its staff through short- and long-term training and in supporting the ministry's efforts in policy and planning analysis. Over the life of the project, especially in its later years, thirteen current Ministry of Agriculture staff members received degrees at the University of Jordan; seven MS degrees as agricultural engineers and six High Diplomas in agricultural science. Additionally, a substantial number of Ministry of Agriculture staff received support to fund their thesis research as part of the University of Jordan masters degree program in Agricultural Engineering. Lastly, substantial numbers of Ministry of Agriculture personnel participated in a multitude of NCARTT-provided short courses, workshops, and seminars on a variety of agricultural topics.

9.5. Impact of ACC/agricultural development fund and TASO/agricultural development fund projects

The agricultural development fund has had two distinct phases, a first phase when its management was with a steering committee within the projects department of the Ministry of Agriculture and linked financially to the Agricultural Credit Corporation (ACC); and, a second phase when TASO was created and project approval, financed under the fund, passed

to the NCARTT Council with assistance from the TASO advisors. As designed, the agricultural development fund was funded at just over $10 million with two-thirds of the money coming from the Government of Jordan contribution and one-third coming from the project's grant funding. In its first phase, each individual project was to have been funded in these same proportions. The ACC's role was limited to that of a financial mechanism and it had no part in the selection of the projects to be funded or their monitoring. This activity began in 1987 and ended in 1989. Of the thirty-three research projects/activities funded during that time period, twenty-eight had no NCARTT involvement. The vast majority of these projects/activities were not completed for a variety of reasons, including the researchers going on study leave, the transfer of Ministry of Agriculture and NCARTT staff from one location to another, and a general lack of monitoring and supervision. Nevertheless, several of these projects/activities were successful and still continue. These include on-farm demonstrations of wheat and barley technologies, dryland and irrigated onion and garlic research, and plant protection and biological control measures published as extension bulletins for dissemination to farmers. A lack of leadership and monitoring of these activities appears to have been the missing ingredients in the implementation of the fund.

With the creation of the Technical Assistance Service Organization (TASO) in late 1990, the concept of the fund was changed. TASO was given responsibility for the management of the fund which was capitalized 100 percent through the project with no Government of Jordan contributions. Additionally, decision-making responsibility for the acceptance or rejection of proposals was given to the NCARTT Council. Of even greater importance was the expanded flexibility given to the concept of the fund which stimulated innovative approaches to addressing the problems of the agricultural sector.

All in all, the agricultural development fund did not have the impact that it was assumed it would have in the original project design. Of the $10 million originally allocated to it, only approximately $1.0 million will have been spent by the PACD.

10. Major findings and conclusions

10.1. Increases in agricultural production

Findings

Over the life of the project, NCARTT has conducted applied research on a variety of crops and cropping systems that demonstrate increased production per unit of land. The research areas include barley, wheat, lentils, chickpeas, onions, garlic, and olives. Additionally, other areas of applied research have developed varieties and cultural practices to boost resistance or tolerance to insects, diseases, or stress-increasing soil and water conditions for tomatoes, eggplants, and apples.

While anecdotal evidence shows that some farmers have adopted practices based on NCARTT research, the transfer of technology to the average farmer has been weak. This is partly due to the Ministry of Agriculture's decision midway through the life of the project to separate extension activities from NCARTT's mandate, a lack of clear technology transfer methodologies first at NCARTT and later at the Ministry of Agriculture's extension service, a lack of transportation for extension agents, and a lack of incentives to transfer information to farmers at either NCARTT or the Ministry of Agriculture's extension service.

A multitude of external factors impact on the ability of or incentives for farmers to increase production and productivity on their farms. These include government policies, especially subsidies and the impact of prices received by the farmer, climatic variables, land fragmentation, the availability and quality of irrigation water, problems with diseases and insects such as locusts and white fly, and the ineffectiveness of cooperative marketing organizations. These external factors make any assessment of the impact of NCARTT's research activities extremely difficult, if not impossible, to measure.

The two baseline surveys commissioned under the project to enable future evaluators to measure the impact of the project did not contain data on farm income, yields, or production. Additionally, the scope of work for the final evaluation did not provide for revisiting the original farmers interviewed in the two baseline surveys in order to measure change.

Conclusions

There is no doubt that NCARTT's research activities have increased agricultural production in some cases and reduced losses in production in others. However, the transfer of these research results could have, and should be in the future, greatly improved. Additionally, if the success of a project is to be seriously evaluated, a systematic monitoring and evaluation system needs to be put in place at the outset of a project and continued through to its end.

10.2. Project design

Findings

The project design contained many good ideas such as creating an Agricultural Development Council for improved policy formulation and coordination, establishing an agricultural development fund to promote collaborative research, creating regional agricultural

services centers to improve agricultural research and related services in key production areas, initiating training programs to upgrade technical and management skills, instituting improved laboratory and library services, and promoting increased ties between NCARTT and national and international organizations. Progress toward achievement of these objectives, however, was hampered by problems such as shifts in direction and lack of program continuity caused by frequent turn-over of Ministers of Agriculture and NCARTT Executive Directors, delays in construction, lack of English-language capability among potential trainees, and lack of a conducive working environment resulting from traditional constraints such as low salary levels, short work days and cumbersome administrative procedures. The project design could have been improved by giving increased emphasis to three factors: a) achieving fully autonomous status or some other flexible mechanism for NCARTT or some other agency to resolve the low salary and short work day problems; b) providing for much greater participation by the private sector to guide NCARTT's research programs and to build a constituency to lobby for governmental policy reforms and budgetary support; and c) early elaboration of an agricultural research and technology transfer strategy to set the context and direction for NCARTT programs.

Conclusions

The project design was, for the most part, quite good but encountered a number of problems in project implementation. The design could have been improved by placing more emphasis on private sector participation, full autonomy for NCARTT, and early elaboration of a research and technology transfer strategy.

10.3. NCARTT performance

Findings

The construction of the NCARTT headquarters building at Baq'a should be finished in June 1994. Four regional agricultural services centers were built with project funds. Six substations support the work done at three of the regional agricultural services centers. The facilities provide a physical base for carrying out a national agricultural research program. Although dissemination has been spotty because of the weak extension service and its transfer from NCARTT to the Ministry of Agriculture, over the course of the project useful technologies have been developed. In addition to constructing a physical infrastructure, the project has funded degree and short-term training for NCARTT personnel, procured laboratory equipment, vehicles, and farm equipment, and improved the NCARTT library and information center. While many resources are in place, much remains to be done. For example, NCARTT must continue to press for full autonomy within its organic law that would allow it to pay competitive salaries and create a working environment and work schedule that would be more conducive to high-quality agricultural research. These and other needs are discussed in detail in other sections of this evaluation.

Conclusions

NCARTT has the physical base, along with some of the trained personnel, equipment, and library resources, needed to carry out area-specific, problem-solving, adaptive research. Some useful technologies are being developed that have the potential to increase productivity and reduce costs. However, much remains to be done for NCARTT to realize its full potential.

10.4. NCARTT's lack of status as an autonomous institution

Findings

NCARTT's institutional status has evolved greatly over the life of the project. Its first placement within the Directorate for Projects of the Ministry of Agriculture was seen as a mistake almost from the beginning of project implementation. (Despite this, USAID did not present a request for change to the Government of Jordan.) Subsequently it was established as a directorate of its own, although still an integral part of the Ministry of Agriculture's organic structure. More recently, through the adoption of By-Law 42 in July 1993, NCARTT was given semi-autonomous status with its own core budget, although this status can be reversed at any time by the Council of Ministers. In the past, its lack of complete autonomous status has resulted in two main problems. First, it must compete with the other directorates for its core budget, often not receiving enough to cover even its minimum needs. Second, it must function within the strict confines of the Government of Jordan civil service, which in many cases is totally at odds with the demands of effective agricultural research and technology transfer activities. These confines include an 8:00 am to 2:00 pm work schedule, depressed pay scales, promotions and raises not tied to worker productivity, vehicles that require a driver, lack of per diem or expense allowances, and so on. This results in a lack of incentives, if not complete dis-incentives, at both the management and researcher levels. Additionally, this lack of incentives has led to a disturbing tendency for the more qualified managers and researchers to leave the organization to seek better opportunities in the private sector or at the universities.

NCARTT management is well aware of this situation and has begun the process of seeking true autonomous status. Nevertheless, this process will require the passage of a law, as opposed to the current by-law decreed by the Minister of Agriculture, a process that can be quite lengthy and involve many political decisions and negotiations.

Conclusions

The conditions precedent to the first disbursement of the grant funds under the project only required a high-level body be established and have representation from the Ministry of Agriculture, various other autonomous agencies, and the private sector. They did not address the issue of the independent, autonomous status of the organization itself. In the opinion of the evaluation team, this has led to low management and staff morale, a lack of incentives for effective applied research and technology transfer, and rapid turnover of both managers and researchers.

10.5. Lack of continuity in program direction

Findings

There were serious disruptions in the continuity of program direction and technical assistance over the course of the project. There were eleven Ministers of Agriculture, four NCARTT executive directors, three USAID office chiefs, and two technical assistance groups over the nine-year life of the project. In addition, there were the major dislocations associated with the Gulf War. As each personnel shift was made, there were changes in the focus and direction of the program. Procurement and construction activities were delayed, methodologies and systems were initiated and then dropped, and personnel performance and productivity were adversely affected by the uncertainty and anxiety caused by the changes of ministers and executive directors.

Conclusions

The frequent changes of key personnel associated with the project had a negative impact on project implementation. Unfortunately, much of the dislocation was political in nature and beyond the control of USAID and Government of Jordan program managers.

10.6. Delays in construction and equipment installation

Findings

The construction and equipping of the four regional agricultural services centers and the headquarters building at Baq'a were, and still are, far behind schedule. Although the causes of these delays are outside the scope of work for this evaluation, we can only assume that some of the reasons behind these delays were beyond the control of either the implementors of the project or the Ministry of Agriculture, while others were caused by a lack of proper planning and diligent oversight.

These delays have no doubt had a serious impact on NCARTT's ability to conduct research, transfer these research results to farmers, and provide services to the agricultural sector in general. As of the time of this evaluation (four months before the PACD), the main NCARTT building at Baq'a is not completed, and none of its equipment has been installed. At the four regional agricultural services centers, the buildings were completed, only slightly behind schedule, but varying proportions of the equipment have not been received, installed, or calibrated. NCARTT has not been able to staff the vast majority of the laboratories at the regional agricultural services centers and for the most part they stand idle.

The delays are only part of the problem concerning the issues of constructing the buildings, the installation of equipment, and the training of staff to use them. The other, and perhaps even more critical, issue is that of proper sequencing, or timing, of the construction, commodities procurement, and training activities under the project. In a normal sequencing of events of this type, the construction of the facilities would be initiated simultaneous with an analysis of the staffing needs required once the construction is completed. If the staffing needs are found to be lacking, then the hiring and training of future staff should be addressed. Once the construction and staff training are properly underway, the equipment should be

ordered and its arrival dates be set to coincide with the termination of the construction and the arrival of properly trained staff. In this case, the equipment was ordered and arrived far before the construction was completed and no staff were recruited or trained in the operation, management, or maintenance of the equipment. Lastly, the warranties and set-up responsibilities originally provided by the suppliers of the laboratory equipment have by now long since expired.

It is also clear that providing for the construction activities through a host country contract with the Ministry of Agriculture was not an effective mechanism for the efficient and timely implementation of this project component.

Conclusions

The delays in construction and the lack of proper sequencing of events (construction, staff training, and ordering and arrival of the equipment), have most definitely hampered NCARTT's ability to conduct research, transfer technology, and provide needed services to the agricultural sector.

10.7. Linkages

Findings

Inter-institutional linkages between NCARTT and other public and private organizations are generally weak. Some progress has been made in this respect with the creation of the NCARTT council, a body that has representatives from the Ministries of Agriculture, Planning, and Water and Irrigation, as well as from the faculties of agriculture at the University of Jordan and the Jordan University of Science and Technology. This body usually meets monthly to review and coordinate actions related to agricultural research and technology transfer.

Another positive step was the establishment of an ad hoc coordinating team with wide participation, including several private sector representative, to develop a national agricultural research strategy. Another ad hoc committee, led by the deputy director general of NCARTT and the director of Ministry of Agriculture extension, is looking at how to improve the linkages between research and extension. There also appears to be a fairly good linkage between NCARTT, the department of plant production in the Ministry of Agriculture and the Jordan Credit Organization to provide improved seed and technology to farmers associated with the Jordan Cooperative Organization. Additionally, a paper has already been submitted by the training and extension specialist on improving the linkages between NCARTT and the extension and information directorate of the Ministry of Agriculture.

Aside from these formal mechanisms for coordination, linkages are most often casual and spontaneous, based on personal interests and relationships. Such linkages are common among individual NCARTT and university researchers and to some extent between NCARTT field staff and extension personnel in the Ministry of Agriculture area directorates. NCARTT linkages to the private sector are weak or non-existent. Good continuing linkages have been established by NCARTT with ICARDA, ACSAD, UNDP, FAO, CIMMYT, and GTZ.

Conclusions

Some basic linkages, formal and informal, are in place and functioning, but considerable work needs to be done to forge and strengthen linkages between NCARTT and other public and private organizations within and outside Jordan. To establish and maintain effective linkages, NCARTT must improve its research environment and technical capabilities so that it is looked upon as a strong, competent collaborator. This will motivate organizations like the Ministry of Water and Irrigation and the Higher Council of Science and Technology as well as progressive private sector interests to look to (and, it is hoped, provide funding for) NCARTT to conduct research of interest to them.

10.8. Agricultural sector analysis and policy formulation

Findings

The project has contributed in at least two ways toward assisting the Ministry of Agriculture and NCARTT in the analysis and formulation of policies directed to the agricultural sector. The first was the use of project funds to purchase services from the centrally-managed USAID Agricultural Policy Analysis Project. This allowed a detailed and comprehensive analysis of the country's agricultural sector to be conducted, the first in over twenty years. This analysis also changed the analysis approach from a traditional, commodities-based approach to a systems approach that considering irrigated agriculture, rainfed agriculture, low rainfall zones, integrated livestock production, and forestry. The second contribution is using agricultural development funds to develop a national agricultural research strategy that includes NCARTT, the University of Jordan, JUST, and the private sector.

The sector analysis and review, together with the research strategy when completed, will be important cornerstones for the Ministry of Agriculture in particular, and the Government of Jordan in general, to use as they develop future policies and priorities for the agricultural sector. Additionally, donors other than USAID will be able to use these documents for future project formulation and assistance. In fact, the World Bank is using the sector analysis to formulate an up-coming Agricultural Sector Adjustment Loan and its companion Agricultural Sector Technical Assistance Project.

Conclusions

The flexible nature of the agricultural development fund and the NADP in general allowed planners in the USAID mission, the Ministry of Agriculture, and NCARTT to successfully take advantage of this opportunity to support the Government of Jordan in an analysis of its agricultural policies and programs.

10.9. Agricultural Research Strategy

Findings

The recently drafted agricultural research strategy is an important contribution toward the goal of achieving a more rational approach to the generation of agricultural technology that concentrates on the most important problems, eliminates lower-priority efforts, and makes the best use of existing resources. The process of preparing the report also served the useful purpose of bringing together researchers from different organizations and parts of the country to exchange ideas and to try to focus on the most pressing problems in agricultural research. The agricultural research strategy represents a vital first step in helping NCARTT to target its efforts and to identify areas where it needs to improve its capacity, including human resources development.

There were some important points that were not given sufficient emphasis in the strategy such as the need for greater private sector involvement in identifying, prioritizing and monitoring research activities and the importance of agroecological considerations, in particular the process of desertification, a problem that is becoming progressively more serious in Jordan.

The agricultural research strategy is still quite general, with too many research priorities. Additional work will need to be done during the preparation of the medium-term implementation plan to identify the crops and research problems that require truly high priority attention. The suggested analytical process to accomplish this is described in Section 11.3.

Conclusions

The Agricultural Research Strategy represents an important first step in defining research needs and priorities. Further work is needed to identify the highest priority crops and problems while paying close attention to external and internal market demand and potential, and to cost-reducing technologies and quality control measures to improve the competitiveness of Jordan's agricultural products in domestic, regional, and European markets. The setting of research priorities should provide for much greater formal involvement of farmers and agribusiness representatives in identifying the most pressing problems requiring research for the highest priority crops.

10.10. The agricultural development fund

Findings

Over the life of the project, the agricultural development fund has had two distinct lives. Originally, the agricultural development fund was established through a bank account at the Agricultural Credit Corporation (ACC). Funding for research and other related projects was approved by the steering committee of the Ministry of Agriculture using Government of Jordan and project funds at a 2:1 ratio. The funding by ACC began in 1987 and ended in 1989. Of the thirty-three research projects/activities funded, twenty-eight had no NCARTT involvement, although some sources state that NCARTT had full participation in all projects and activities. The vast majority of these projects/activities were not completed for a variety

of reasons including the researchers going on study leave, the transferring of Ministry of Agriculture and NCARTT staff from one location to another, and a general lack of monitoring and supervision. Nevertheless, several of these projects/activities were successful and are still continuing. These include on-farm demonstrations of wheat and barley technologies, dryland and irrigated onion and garlic research, and plant protection and biological control measures written and published for dissemination to farmers. A lack of leadership and monitoring of these activities appears to have been the missing ingredients in the implementation of the fund.

With the creation of the Technical Assistance Service Organization (TASO) in late 1990, the concept of the fund was changed. TASO was given responsibility for the fund's management. The fund was capitalized 100 percent through the project with no Government of Jordan contributions. Additionally, decision-making responsibility for the approval of proposals was given to the NCARTT council. Of even greater importance was the revised concept of the fund and its expanded flexibility, both of which stimulated more innovative approaches to addressing the problems of the agricultural sector. In addition to several projects such as research on capnodis disease in stone fruits, research on baladi and shami goats, and research on Phyloxera-resistant grape rootstock, which could be considered standard research activities, other less standard activities were added. These included a grant to develop the NCARTT national agricultural research strategy, a program to provide on-the-job training for newly graduated agricultural engineers, a program to support MS-level agricultural thesis research at the University of Jordan and JUST, a program to support graduate level studies in the agricultural sciences at the University of Jordan and JUST, and a program to teach researchers how to write research proposals.

Conclusions

The first attempt to establish the agricultural development fund was not generally successful for many of the reasons that still affect NCARTT today: a lack of a sound institutional grounding, a lack of clear incentives to conduct and disseminate proper research results, and a failure of management to monitor and critically evaluate the program in general. On the other hand, the TASO/agricultural development fund projects are better selected and monitored and the program has the flexibility to target specific opportunities and to take advantage of them with a minimum of bureaucratic influence and control.

10.11. Training

Findings

One of the most useful activities of the NADP has been training. Although no comprehensive plan for human resource development was specified in the project design, or was one formulated early in the project, training activities have been very useful to NCARTT, the Ministry of Agriculture, the universities, and the private sector.

These training activities included graduate level degree programs in the United States and Jordan, university level High Diploma programs, short courses, seminars and workshops, and on-the-job training. Graduate-level training took place, and continues to take place in the

United States for ten students while thirty-five Masters and High Diploma students have completed, or will soon complete, their studies at the University of Jordan.

At the time of this report, thirty-three students at the graduate level have successfully completed their studies. Eighteen are now working for NCARTT and fifteen for the Ministry of Agriculture. Four of the ten graduate students that studied in the United States have returned to work in NCARTT. The other six are still at various stages in their degree programs. Three are scheduled to return in June 1994 and one in September 1994. Two will remain until December 1997 if other arrangements can be worked out after the PACD for them to continue their studies.

In addition to graduate-level training, short-term overseas training was provided for ten participants in the United Stakes, and eighteen in other countries, including Greece, Syria, Tunisia, Italy, Holland, Egypt, Cyprus, and Morocco. In-service training between 1986 and 1991 was provided by NCARTT through approximately 130 training courses, field days, seminars, workshops, and English-language practice. Additionally, between May 1992 and April 1994, 48 special in-service courses involving 1,415 participants were carried out in the areas of research strategies, planning, research, extension, administration, training-the-trainer programs, new employee orientation, agricultural production methods, and the use of computers.

Last, and perhaps most innovative, was the on-the-job training provided to newly graduated agricultural engineers through the agricultural development fund/TASO. Fifty graduates were assigned to private sector enterprises to get practical training in the fields of fruit and vegetable production, nursery management, agronomy, plant protection, animal husbandry, health, dairy science, food processing, agricultural economics, and agricultural marketing. This program has been very successful. More than 35 of the first group of 50 have been hired by the private sector companies with which they were placed.

Conclusions

The training programs have been quite ambitious and successful. An additional benefit is that they involved a significant number of women. The programs have helped both NCARTT and the Ministry of Agriculture to up-grade the technical capability of their staff. The project's graduate level program at the University of Jordan also enabled the university to greatly expand its programs. It is recommended that this type of program continue, perhaps through the assistance of the Government of Jordan or an external donor.

Once a National Agricultural Research Strategy is formulated, it should allow NCARTT to more clearly define its role and develop specific plans of action. Once this is done, a new training plan should be developed and implemented to further up-grade the NCARTT/regional agricultural services center staff to help them to better accomplish their objectives. An adequate budget with a specific line item for training is required if such a training program is to be implemented successfully.

10.12. The National Agricultural Library and Information Center

Findings

The NCARTT council has recently issued a resolution to upgrade the NCARTT library to the National Agricultural Library and Information Center (NALIC). Detailed plans have been drawn up to move to the new building when it is finished, to upgrade the library, and to expand its concept to include an information center. These plans specify space allocated for each area or function, the preparation of a preliminary budget for 1994-95, a plan for establishing automated linkages to other libraries and information centers within Jordan and aboard, software and hardware requirements, and job descriptions for the center's staff.

Conclusions

NCARTT management has developed sound plans to support the NALIC concept. While funds have been committed and contracts signed, it is of the utmost importance that project funds for upgrading and installation be used quickly, before the arrival of the PACD.

11. Issues

11.1. Identification, development, motivation, and retention of high quality personnel

Discussion

A research organization is only as good as its professional personnel and management. This makes it imperative that NCARTT try to identify, attract, motivate, and retain the highest quality personnel possible. This implies the need for action in a number of areas. Among the most important actions is offering a salary level and benefits package that is at least as attractive as those offered by competing sources of employment. NCARTT has been sorely hampered in this area, offering salaries that are one-half or less than those offered by the national universities or the private sector. As a result, many individuals who started their careers in the Ministry of Agriculture or NCARTT are now working elsewhere. As discussed in Section 10.4, it is critically important that NCARTT vigorously pursue legal fully-autonomous status, or some other flexible mechanism, that will allow it to set competitive salary levels and benefits packages. When full autonomy is obtained, NCARTT will have to reduce its staffing levels to free up the budgetary resources necessary to pay higher salaries.

NCARTT's goal should be to have a smaller, more highly qualified and motivated staff working in an environment that is conducive to carrying out research and technology transfer. The quality of the working environment is an important ingredient in retaining and motivating personnel. Once again, achievement of fully autonomous status should allow NCARTT to establish a more realistic working day, to reduce the administrative red-tape which saps initiative and energy, and to allow professional personnel to drive organizational vehicles and to work in offices, laboratories, and the library when they need to rather than when current office hours and practices dictate.

NCARTT needs to think carefully about how to identify the kinds of people they want to work in the organization. A few will come to NCARTT with full professional Ph.D.-level credentials but most will start at the BS entry level or perhaps at the MS level. NCARTT program leaders and management should maintain contacts with instructors at the national universities to get their help in identifying the intelligent, hard-working, self-starting individuals who are an asset to any organization. These people, once identified, should be encouraged to present themselves as candidates for periodic public announcements of job openings. NCARTT's best, most productive staff members should be involved in screening and interviewing candidates for employment to assure that they hire the best available people.

NCARTT should consider offering temporary jobs during vacation periods to promising third- and fourth-year university students recommended for such employment by their professors. NCARTT should also find ways for outstanding MS candidates to work on their theses under the direction of NCARTT researchers. Both of these avenues would allow NCARTT staff to observe and evaluate the quality of individuals who might be good candidates for employment. The agricultural development fund could be used to support such an approach.

Working with individuals who show promise or demonstrate proficiency, NCARTT could then develop individual training and career development plans which would introduce them to the academic study, training, and work experiences that would prepare them to perform at the highest professional levels.

The career progression plan discussed in the Agricultural Research Strategy is essential to provide employees with the structure and incentives to maintain a high level of performance. Promotions should be based upon professional competence and productivity. Annual performance reviews are an important part of this process.

Mid-career and senior employees should be afforded opportunities to refresh and update their technical skills through periodic sabbatical leaves both within and outside Jordan. Attendance at local and international professional conferences and workshops are also important ways to upgrade skills and build personal motivation and enthusiasm. Of course, all of this costs money, but trying to save money in these areas would be a false economy if NCARTT is serious about attracting, retaining, and motivating the highest quality personnel. Once again, reductions in staff may be necessary if they are to be able to afford these programs.

Recommendations

1. The NCARTT Council should continue to push for legal full-autonomy, or some other flexible mechanism, to allow them to offer competitive salaries and benefits packages and to establish a working environment conducive to high levels of performance.

2. NCARTT should undertake a continuing effort to identify and recruit the highest quality employees through maintaining contacts with university staff, initiating vacation employment programs for upper level university students, and offering opportunities for MS candidates to conduct their thesis work under NCARTT tutelage.

3. NCARTT should institute a career progression structure, an annual employee evaluation process, and a career development program to upgrade its overall personnel management system.

4. NCARTT should institute a sabbatical program and provide other local and international opportunities to professionally upgrade its staff.

5. NCARTT should reduce its professional and support staff to a level that allows it to offer competitive salaries and professional upgrading opportunities within anticipated budgetary resources.

11.2. NCARTT institutional sustainability

Discussion

NCARTT currently receives its financial resources from a core budget provided by the Ministry of Agriculture, from the NADP that includes a TASO staff of six, the agricultural development fund, and two institutional advisors, and from several other donors and international organizations who support joint research activities, including GTZ, UNDP, FAO, ICARDA, and ACSAD. At this time it is doubtful that the resources currently provided through the project will be fully replaced after the PACD by either the Government of Jordan or other donors.

This leaves NCARTT with essentially two options if a level of quality research and technology transfer is to be provided. The first would be to perform a careful analysis of its research and technology transfer priorities together with its actual level of financial and human resources. Wherever internationally accepted levels of quality cannot be maintained, these activities should be dropped. The second would be to initiate a well-planned and well-targeted fund-raising and income-generating campaign nationally, regionally, and internationally.

In terms of the second option, three alternatives are possible: 1) seek funding within Jordan from various governmental and quasi-governmental organizations for joint research activities, 2) initiate a strong, well-focused campaign among the donor community to support specific, targeted research activities and, 3) re-orient its current philosophy toward the provision of selected services on a fee-for-service basis.

Recommendations

1. Seek funding for joint research activities with local organizations such as the two universities with faculties of agriculture (University of Jordan and JUST), the HCST, and the Royal Scientific Society should most likely be NCARTT's first priority in the short run. Additionally, convincing the Ministry of Agriculture and MOP of the need for a larger core budget to partially replace the resources of the project should also be a first priority.

2. To attract additional resources, other international donors should be the center's second priority. Among the donor community there is often a built-in bias against projects or organizations that are already receiving support from one donor or another. This has especially been the case with NCARTT which is seen as a USAID-supported organization. Now that the NADP is ending, and NCARTT is faced with a substantial loss of outside resources, other donors might be more willing to fill in the gap. Nevertheless, it is the consensus of the evaluation team that further requests for support will have to target specific activities with well identified goals in mind. The chances of donations for general budgetary support for items such as staff salaries or the agricultural development fund are likely to be minimal.

3. A longer-term strategy for the center's sustainability lies in its ability to convert the services that it already provides for free, or at subsidized prices, into income-generating activities. Those services that might generate income include custom use of its agricultural machinery, a program of seed multiplication and the sale of seed and nursery stock to farmers at real prices, soil testing, chemical residue testing, disease identification, and other services that would utilize their laboratories. Additionally, these services should be established and administered, to the extent possible, as independent operations with their own staff. Their functions should be kept separate from the resources and staff assigned to research and technology transfer and services should only be provided after proper planning, staffing, and physical infrastructure are in place.

At present all income received by NCARTT for the services it provides must, by law, be returned to the national treasury. To be allowed to retain all, or a portion, of these funds,

NCARTT must be established as an independent, autonomous legal entity, with its organic law specifically providing that it can retain and use all income that it generates.

11.3. Research program focus, prioritization, and monitoring

Discussion

NCARTT's current research program is determined by varying levels of interaction between program leaders at the Baq'a headquarters, the regional agricultural services center and substation researchers, and NCARTT management. The experience, interests, and inclinations of the program leader appear to play a major role in setting the annual research agenda. The degree of influence exerted by the field researchers depends upon their knowledge, experience, and forcefulness. This influence appears to be increasing as more personnel trained to the MS level are assigned to field stations. NCARTT management and the NCARTT council review the proposed annual program and have final approval rights.

The research program is not currently guided by a systematic process to identify priority crops and problems based upon an analysis of factors such as market demands with respect to price, volume, timing and quality, present and anticipated water quality and availability, environmental consequences of current agricultural practices, crop-forage-livestock trade-offs, labor availability versus mechanization, and so on. The draft agricultural research strategy employs such a systematic approach which the evaluation team strongly endorses for use to establish research priorities.

In addition to the need for such a systematic analysis, the evaluation team was concerned that there is no formal farmer involvement in defining NCARTT's research priorities. Although, to varying degrees, program leaders and field researchers are aware of farmers' problems either through direct contact with farmers or through Ministry of Agriculture extension agents or both. There needs to be a systematic process for formal farmer involvement in identifying and prioritizing problems that require research. In 1989, NCARTT, with the assistance of the Washington State University Farming Systems Advisor, conducted a country-wide survey of 279 farmers to identify their problems and set priorities. This information was then used by program leaders and NCARTT management to develop a research agenda that was responsive to these priorities. Unfortunately, when the revised agenda was being developed in 1991, 82 NCARTT personnel were transferred to the Ministry of Agriculture, essentially ending that effort. There is continued interest among NCARTT management and researchers to apply the farming systems approach to identify research problems and set priorities, but there is no institutionalized, systematic effort to do so.

Unlike research programs in many other countries, NCARTT's current research program is focused on a manageable number of activities in line with existing personnel and budget levels. Research program monitoring, however, is uneven and depends on the interest and diligence of the program leader and NCARTT management. In addition, there is no peer review of research design or results.

Recommendations

1. The NCARTT council and management should work with the Ministry of Agriculture, faculties of agriculture at University of Jordan and JUST, and the private sector to assure

that the system for defining agricultural research priorities devotes sufficient attention to internal and external market demand and potential, and to cost-reducing technologies and quality control measures to improve the competitiveness of Jordan's agricultural products in domestic, regional, and European markets. Consideration should be given to obtaining short-term technical assistance from an expert experienced in carrying out such analyses. Such an effort should build upon the excellent work already done for the Agricultural Research Strategy and Medium Term Implementation Plan.

2. The NCARTT council and management should establish a process for formal involvement of farmers in the identification and prioritization of specific problems requiring research by NCARTT.

3. The NCARTT council and management should work with the faculties of agriculture at University of Jordan and JUST to develop a strategy for peer review of research activities carried out by NCARTT and university personnel.

11.4. Technology transfer

Discussion

The current system for agricultural technology transfer in Jordan is weak. While NCARTT is called the National Center for Agricultural Research and Technology Transfer, all of the public sector extension agents are assigned to the Ministry of Agriculture. There are some 100 extension agents assigned to the various area directorates around the country. The extension agents are poorly paid, poorly trained, lack experience and technical knowledge, and have limited mobility. They have access to transportation perhaps one or two times a week and spend most of their time in the agency directorate offices. They do, however, attend to farmers who come to the offices for advice. Linkages with NCARTT are weak, based on personal relationship rather than any clear-cut system of inter-institutional coordination. The result is the extension agents do not have much research to extend. A committees has been established to work to improve research/extension linkages, but progress is slow.

Many developing and developed countries are moving away from the traditional extension agent approach and toward technology transfer because of the generally low technical competence and motivation of extension personnel, the lack of mobility, the high cost of maintaining a country-wide operation, and the overall ineffectiveness of the program. To counter these problems, some countries are moving to build what might be called a technology wholesaling capacity within the public sector research organization. Under this approach, the research organization develops the capacity to utilize a variety of media and techniques such as radio, television, newspapers, field days, on-farm demonstrations, seminars, workshops, and training programs that involve not only farmers but a wide array of potential technology disseminators such as agricultural supply firms, equipment operators and sales firms, and agricultural vocational school and university instructors and their students. With this approach, a few well qualified technology transfer specialists prepare useful, relevant technical information in various forms and target its diffusion to the potential technology disseminators mentioned above. Through this system, the disseminators in the sector can transfer appropriate technology to hundreds or even thousands of farmers in the

normal course of their everyday activities. For example, a seed supplier selling an NCARTT-recommended variety is transferring technology to his many customers on a daily basis in a natural, effective manner.

Recommendations

NCARTT should strengthen its capacity to carry out an expanded program of technology transfer, employing a variety of media and techniques to disseminate technology to many different technology transfer agents, including Ministry of Agriculture extension personnel, innovative farmer/leaders, Jordan Cooperative Organization employees, Ministry of Agriculture plant production and plant protection personnel, owners and employees of agricultural supply firms, nursery owners and employees, custom equipment operators, instructors and students from the faculties of agriculture at University of Jordan and JUST as well as vocational agricultural schools. NCARTT should form a small core group of technology transfer specialists in the NALIC to prepare information for easy use by various media and by the regional agricultural services centers. NCARTT should assign a creative, energetic technology transfer coordinator to each of the regional agricultural services centers to design and implement an area-specific technology dissemination program for the regional agricultural services center area of influence.

11.5. Use of NCARTT/regional agricultural services center laboratories

Discussion

With the completion of the new NCARTT building at Baq'a, the center will be able to accommodate its necessary staff in research, technology transfer, administrative, library, and support far into the next century. Indeed, if one combines the facilities currently occupied by the organization with those it will have once the new building is completed, the evaluation team cannot avoid asking the question, "what will be done with all of the space; especially that space that is dedicated to laboratory use?" (The best estimates that the team was able to determine is that the current facilities at Baq'a will contain 12 laboratories, plus 30 among the six regional agricultural services centers, plus 48 in the new building for a total of 90 laboratories nationwide.

An additional question to be asked concerning the laboratories is, once the building is completed, will the laboratory equipment which was ordered in 1988 and received in 1989 be appropriate for use in 1994 and beyond? Furthermore, it is clear that NCARTT's current staffing levels, together with the academic and experience levels of the staff, will not even begin to be able to install, calibrate, operate, or maintain all of these laboratories and their equipment.

The evaluation team strongly agrees with the most recent draft of the National Agricultural Research Strategy dated 11 May 1994 when it calls for a reassessment of the Center's laboratory and equipment needs,

> NCARTT must ensure that the laboratory facilities at the Center and the regional agricultural services centers are equipped, staffed, operated and maintained in a sustainable way. To achieve these objectives, the Center should reassess the needs for

laboratory space and laboratory equipment which are necessary to carry out these activities and develop space requirements and an updated list of required laboratory equipment. A great deal of effort should be taken to ensure that unnecessary laboratory equipment is not placed in laboratories where it will be unused or under-utilized.

Furthermore, for the most part the laboratories at the regional agricultural services centers either stand idle or are very much under-utilized. Taken from on-site interviews, the reasons for this are two: a lack of minor pieces of equipment or expendable supplies essential to the operation of the laboratories, and a lack of trained technicians to operate, calibrate, or maintain the equipment. NCARTT at this point simply does not have the financial resources to rectify either situation.

Recommendations

1. The evaluation team recommends that the statements contained in the National Agricultural Research Strategy concerning the future use of NCARTT's physical facilities, especially the laboratories, be implemented. Said differently, the center should form a committee to make a careful analysis of the numbers and kinds of laboratories that are essential to its research and technology transfer activities both at the national headquarters, including the old and the new building, and at the regional agricultural services centers.

2. Once the first recommendation is implemented, the remaining space should be offered to other organizations, both public and private, on either a cost-sharing or rental basis if permitted by law. If an organization is public or a university, the arrangement should most likely be on a cost-sharing basis, on the other hand, if it is private, then it should be on a rental basis.

3. In the case of equipment, only those laboratories identified in the first recommendation should be equipped in accordance with NCARTT's needs. The remaining equipment could either be rented or sold to public and private organizations choosing to utilize space in NCARTT's facilities. Another alternative would be to rent or sell excess equipment to public and private organizations that require it. No doubt, when the analysis stemming from the first recommendation is performed, some equipment items or expendable supplies will be found to be missing, as is currently the case at the regional agricultural services centers. The proceeds from the sale or rental of excess equipment could then be used to purchase required equipment and supplies.

4. If the needed laboratories are to function, they will require a trained staff of technicians for their operation and maintenance. This is currently lacking. Recruiting and training this type of personnel should be a high priority in NCARTT's plans. A plan for funding this type of training would be an excellent candidate to present to a potential donor or international research organization.

11.6. Private sector participation

The evaluation team believes that the project would have been strengthened by pressing for greater private sector participation in identifying and prioritizing research needs and in guiding NCARTT policies and management. As pointed out in other sections, there are no formal mechanisms for farmer and agribusiness participation in selecting research priorities. Similarly, the nine-member NCARTT council is composed entirely of public sector representatives, with the possible exception of the member specialized in scientific research named by the Minister of Agriculture, who may or may not be from the private sector.

To assure that its research activities are addressing real problems and not merely the interests and inclinations of its research staff, NCARTT should follow through on institutionalizing the farming systems research methodology. This methodology can provide a formal mechanism to involve farmers in identifying and prioritizing research needs. This process should be carried out at the regional agricultural services center and substation level. Researchers should meet with farmers and extension agents on the basis of a crop or research area to identify the principal problems constraining increased productivity and profitability. Many of these problems can be addressed with existing technologies. These should be provided to farmers following the meetings. Other problems will require research and priorities will need to be set to conform with available resources. These farmer-identified research needs should then be discussed within each research program area to guide preparation of a medium-term research agenda. The initial selection of crop and research areas to be discussed with farmers should flow from the systematic analysis of research priorities based on market, income, employment, natural resources, and environmental considerations, as was done in the preparation of the Agricultural Research Strategy and discussed in Section 11.3.

The evaluation team believes that the NCARTT Council would benefit greatly from the addition of private sector representatives to its membership. Consideration should be given to adding several respected and recognized leaders in irrigated agriculture, rain-fed agriculture, and livestock production as well as from the agribusiness sector with one representative each involved in export of fresh produce and in processing agricultural products for domestic and external markets. An NCARTT nominating committee composed of representatives from NCARTT, Ministry of Agriculture, the faculties of agriculture and the Association of Agricultural Engineers could propose three candidates for each position with the final selection made by the Minister of Agriculture. The appointment period could be for two years, extendable for one additional two-year period. The inclusion of private sector representatives would help assure that NCARTT programs are truly responsive to farmer and agribusiness needs. It would also have the additional advantage of building a support base for agricultural research within the private sector to lobby government leaders for needed reforms and improved budget levels.

As an added stimulus for increased private sector participation in determining agricultural research needs and in recognition of the long-term importance of fresh fruit and vegetable exports, the evaluation team believes that consideration should be given to establishing a research grant fund to be administered by the Exporters' Association of Fresh Fruits and Vegetables. Under such an arrangement, which could be administered through the agricultural development fund by NCARTT and the association; the association could request proposals from university, NCARTT, or private sector researchers to address pressing problems constraining the production or marketing of fresh fruits and vegetables. A panel of producers

and scientists would be convened to evaluate the proposal and recommend modifications or approval to the Association Executive Committee. USAID/Jordan should explore the possibility of making funding available to establish such a fund.

Recommendations

1. NCARTT should institutionalize a process for formally involving farmers in the identification and prioritization of research needs and setting priorities. Consideration should be given to contract the services of a specialist to help NCARTT set up such a process.

2. The NCARTT council should consider amending its by-laws to provide for the addition of several private sector representatives to its membership. These members should be recognized and respected leaders in irrigated agriculture, rain-fed agriculture, livestock production, fresh fruit and vegetable exports, and processing of agricultural products for domestic and external markets.

3. USAID/Jordan and the Government of Jordan should consider providing funding to establish a research grant fund to address production and marketing research needs. This would be administered by the Exporters' Association of Fresh Fruits and Vegetables. Consideration should be given to contracting the services of a specialist knowledgeable in the establishing and managing a research grant fund to assist the Exporter's Association in setting up such a fund.

11.7. Future directions for NCARTT

Discussion

NCARTT must make some hard decisions about its future. Given the relatively low current budget and the uncertainty of future funding levels as well as acknowledged short-falls in management and technical staff, NCARTT has two basic choices: 1) continue to operate as it has with a shortage of budgetary resources and qualified technical personnel, or 2) reduce its activities and staff to a level at which its budget is adequate to employ a smaller, well paid, top quality technical and scientific staff who can conduct carefully selected, high priority research activities. Then what NCARTT decides to do, it can do well. Some have compared doing research to flying an airplane or doing brain surgery. That is, if it can't be done well, it shouldn't be done at all. This applies in the case of agricultural research because of the potential for damaging consequences to farmers, domestic food supply, and export earnings resulting from mistaken or misguided research recommendations.

NCARTT's future status depends on its ability to provide top quality leadership for agricultural research and technology transfer in Jordan. To do this, NCARTT must define its role, select its tasks carefully, and strive for excellence in conducting or underwriting scientific research and technology transfer activities. For NCARTT to attract the financial support it needs in the medium and long term, it is imperative that its image be that of a competent, effective, and efficient scientific organization that can manage funds and programs that others are willing to finance and support. These include Government of Jordan ministries,

farmers, agroindustries, exporters, and regional and international organizations. NCARTT must strive to meet the needs of this array of potential clients or its future prospects will be limited.

In rethinking its role, the NCARTT council should seriously consider new approaches for conducting research and technology transfer activities. One interesting model that is being used by a number of developing and developed countries is a research grant or contracting-out approach. Under such a model, NCARTT would be responsible for working with the universities, the public sector organizations, and the private sector to define a medium-term research agenda using the techniques suggested in Section 11.3. Once the agenda was set, the NCARTT council would decide which activities fell within NCARTT's competence and would then make a public solicitation for proposals to undertake the other research identified in the agenda. Upon receipt of the proposals, NCARTT would determine how and where specific research activities should be carried out based upon the capability, experience and comparative advantage of potential researchers. In many cases, the most competent scientist(s) to carry out a particular research program would be found in the faculties of agriculture at University of Jordan or JUST, or perhaps in the private sector. In such instances, the research project could be assigned to the proper university professor or private individual under an agricultural development fund-type grant to be monitored by the appropriate researcher in NCARTT or the regional agricultural services centers. NCARTT could then concentrate on directly carrying out research activities where it had the appropriate high-quality staff. In many instances, collaborative research activities could be funded through an agricultural development fund-type grant to researchers in two or more organizations. In this way, the best use could be made of existing scientific personnel regardless of where they worked. Assigning responsibility for different research activities would be a dynamic process, adjusting to changes in circumstances, including upgrading NCARTT personnel or the movement of researchers from public organizations or universities to the private sector or vice versa. NCARTT should establish a technical advisory group that would have responsibility for reviewing research requirements and proposals and for recommending appropriate action by the NCARTT council and management.

NCARTT should conduct some research utilizing its own personnel but only if it has top quality management and technical staff to do the job effectively. NCARTT should also be responsible for monitoring and making use of the research conducted by others. It would receive and analyze results and be responsible for using the results in the different types of technology transfer programs described in Section 11.4.

NCARTT should decide on the most appropriate role for the Regional Agricultural Research Centers. Logical responsibilities would include assisting in NCARTT's own research program, providing land and local laboratory services, completing basic seed production, and conducting on-farm verification trials and demonstrations and arranging for field days as part of the technology transfer process. The regional agricultural services center should conduct and provide facilities for training programs. No matter what the regional agricultural services centers are eventually assigned to do, the roles of the regional agricultural services centers should be clearly defined as soon as possible.

As a final thought, and perhaps the most important point, NCARTT should increasingly concentrate on the effects of diminishing water availability and quality and the impact of this over-riding problem on agriculture in Jordan. It was very apparent to this evaluation team that this is already a serious problem in Jordan and is getting more serious each day. Much more work needs to done on research in water harvesting, water storage, water use efficiency, use

of treated waste water in irrigation, dealing with the problems of salinity and heavy metals, and utilizing crop varieties and practices that are appropriate for low rainfall and soil moisture conditions.

Recommendations

1. NCARTT should reduce its staff and program to a level at which its budget is adequate to employ a smaller, better paid, top quality staff which can carry out carefully selected, high priority research activities.

2. The NCARTT council and management should consider adopting a revised model for carrying out agricultural research. This model should involve assigning responsibility for specific activities on NCARTT's medium-term research agenda to researchers from NCARTT, the national universities, or the private sector depending upon their comparative advantage and technical competence. Non-NCARTT research would be funded through agricultural development fund-type research grants or contracts. The research project design would be developed or approved by NCARTT and would be monitored by NCARTT staff. NCARTT would also be responsible for receiving and analyzing the results and arranging for their use in various technology transfer programs.

3. NCARTT should establish a technical advisory group composed of experienced researchers who will review research requirements and proposals both from NCARTT and elsewhere, and recommend appropriate actions to the NCARTT council and management.

4. NCARTT should place much greater emphasis on research that addresses such problems related to water availability and quality as studies on water harvesting, use of treated waste water in irrigation, problems associated with salinity and heavy metals, and utilizing crops and practices that are appropriate for low rainfall, low soil moisture conditions.

11.8. Follow-on activities

As the project moves toward its PACD, consideration should be given to a short list of high priority, relatively inexpensive post-project activities which could be considered by the Mission, other donors, or a combination of the two. The list includes:

1. Long-term technical assistance. NCARTT still critically requires the presence of two advisors of international stature. The first should be an institutional advisor assisting in planning and programming the center's activities. The second should be a senior scientist who would assist in maintaining quality standards of research, research proposals, and the selection of NCARTT research priorities.

2. Monitoring and information system. The project and NCARTT both had a management information system in the past, but it was discontinued when the Consortium for International Development, Washington State University, advisors left Jordan. This needs to be reinstated, possibly with the assistance of short-term technical assistance.

3. Economic Analysis Unit. NCARTT currently has a small Economic Analysis Unit but its resources are minimal. This unit needs to be better staffed and given additional technical training.

4. Laboratories. NCARTT will most likely require assistance in setting-up, calibrating, and maintaining a limited amount of laboratory equipment due to be installed in the Baq'a headquarters. Additionally, much attention needs to be given to training laboratory technicians who will operate the new laboratories.

12. Lessons learned

(1) In projects such as this where major changes are made altering focus, scope, and the number and type of components, a new logical framework should be developed and made a part of the amended project agreement.

(2) Baseline data must be available before, or very early in, a project for all areas of work and for issues where specific increases such as increased yields, production, income, employment, and the sale or use of farm machinery are to be verified. This information is also important for cases when impact assessments are to be made.

(3) Scheduling the arrival of inputs must be carefully planned to avoid damaging delays in project implementation, to assure the efficient and effective use of the inputs, to avoid having inputs arrive before needed resulting in the need for storage, and to ensure that technical assistance is provided when it is most needed and when the project is best able to effectively utilize it.

(4) At every step in project design and implementation, care should be taken to evaluate the need for such physical facilities as laboratory construction as well as equipment so that, on completion, they do not exceed the host country's capacity to utilize them.

(5) Technical assistance selection and scopes of work must be carefully tailored to fit specific project goals, objectives, and expected outputs.

(6) In projects where a public institution such as NCARTT is to be established and the purpose of which is to serve farmers and other people in the private sector, representatives from that sector should have significant involvement and input into project design and implementation.

13. Annexes

13.1. Scope of Work for Impact Assessment and Final Evaluation

13.1.1. Background

The National Agricultural Development Project (NADP) is a US$ 48,415,000 million (USAID $25,275,000; Government of Jordan $23,140,000), nine-year bilateral project with the Government of Jordan. (See table 13.1-1 for the project USAID budget.) The purpose of the project is to stimulate greater agricultural production through applied research, improved extension methodologies, and various activities designed to strengthen institutional capabilities.

Major project outputs include:

- Improved institutional coordination and priority analysis
- Establishment of a National Center for Agricultural Research and Technology Transfer (NCARTT)
- Development of appropriate demonstration methodologies
- Establishment of four regional agricultural research centers
- Improved knowledge of rangeland management and co-op organization
- Increased agricultural production

The National Agricultural Development Project was authorized in mid–1985. Implementation got underway in January 1987. A U.S. contractor, the Consortium for International Development, with Washington State University as the lead agency, provided technical assistance to the project until August, 1990, when the Consortium for International Development, Washington State University, team of 5 long-term advisors left Jordan as a result of the Gulf crisis. The contract with Consortium for International Development, Washington State University, was later terminated. All other contracts which had been previously entered into for various goods and services, and financed under the Grant component of the project, with the exception of a contract with a U.S. firm, Hamilton Inc., for the supply and installation of laboratory furniture had been completed prior to the termination of the Consortium for International Development, Washington State University, contract. Work under the Hamilton contract is still underway and expected to be completed early in 1994.

Following the termination of the Consortium for International Development contract, a Technical Assistance and Services Office was established in December, 1990 with a Jordanian contracted to head that Office. Since that time, The Technical Assistance and Services Office has served as the principal mechanism through which USAID inputs, in the form of local currency-financed goods and services, have been provided. The Technical Assistance and Services Office's responsibilities included, among other things, the recruitment of staff, both technical and administrative, for the continuation of services previously carried out by the U.S. contractor (Consortium for International Development) including local training and the management of a number of ADF activities financed through The Technical Assistance and Services Office.

Table 13.1-1. Projected USAID budget.

	Thousands of U.S. Dollars (as revised)
a. Technical Assistance	8,064
b. Construction[1] (Loan funded)	6,775
c. Commodities	6,854
d. Agricultural Development Fund	1,961
e. Training	1,124
f. Contingency	200
h. Evaluation	169
i. Other Costs	128
Subtotal	25,275
Government of Jordan inputs consist of the following: ($000)	
a. Commodities	3,550
b. Training	145
c. Agricultural Development Fund	1,500
d. Land and Facility Construction	1,545
e. Personnel and Operational Costs	16,400
Subtotal	23,140
USAID + Government of Jordan Total inputs	48,415

In addition, USAID entered into contracts with:

(a) A U.S. Institutional Advisor for two and half years beginning April 8, 1992, to assist in the institutional development of NCARTT.

(b) Abt Associates (through a buy-in under the USAID Washington centrally funded Agricultural Policy and Analysis Project, Phase II) for the development of an Agricultural Sector Review and Policy Implementation Plan for Jordan. This study was later expanded to include a component to measure the contribution of agribusiness toward Jordan's national income.

(c) The Irrigation Support Project for Asia and the Near East, a centrally funded project, to conduct a Baseline Survey under buy-in arrangement to provide a

[1] The US$6.775 million (originally US$7.000 million) construction loan under the project, which commenced in February 1989, is the responsibility of local contractors. Construction on the four Regional Agricultural Services Centers (now re-named Regional Centers for Agricultural Research and Technology Transfer "RCARTT") has been completed. The main building at Baqa' which is to serve as the technical and administrative headquarters for NCARTT is still under construction with completion expected by March 1994.

comprehensive picture of irrigation practices, farm management and water use patterns and efficiency in the Zarqa Triangle of the Jordan Valley.

(d) A Cooperating Country National PSC to serve as Program Advisor for the National Agricultural Development Project.

13.1.2. Objectives

The purpose of this activity is:

(a) to conduct an impact assessment which has been requested by the Minister of Planning which will focus on research, technology transfer and training activities carried out under the project, and

(b) to prepare a final evaluation of the National Agricultural Development Project. Both reports will stand on their own and will enable USAID and the Government of Jordan to determine whether the level and direction of progress especially since the Interim Evaluation conducted in November, 1989, was appropriate for achieving the project's purpose; whether the project design was relevant and appropriate; and what actions the Government of Jordan should take in the future to achieve the project objectives envisioned by the project in order to ensure sustainability of project outputs.

Inasmuch as the final evaluation comes at the final stage of the project and considering the fact that there is limited time for the project to do much in terms of making necessary modifications or adjustments, the main focus of the evaluation should be on recommendations that will guide the Government of Jordan and provide it with a rational basis for making decisions on follow-up actions regarding policy, procedures and appropriate mechanisms that contribute to the sustainability of project outputs. These include, but are not limited to, institutionalization, organization and management of NCARTT, its budget, incentives to attract and maintain qualified staff and their motivation. In this connection, a special effort needs to be made to study bylaw No. 42 issued June 19, 1993 which established NCARTT as an autonomous entity and its implications and determine the extent to which autonomy as envisioned in the bylaw meets NCARTT's needs.

13.1.3. Detailed Scope of Work

A. Impact Assessment

This assessment will:

(a) analyze and evaluate the impact of the project research and technology transfer activities and training on agricultural production and productivity and

(b) assess the changes and improvements brought about by these activities on farmers practices and income as well as on other beneficiaries, including women, with a focus on access to introduced innovative technologies.

B. Final Evaluation

The principal task of the evaluation team will be to review not only the original project documents but also, and more importantly, the Interim Evaluation and the project activities implemented since November 1989. A special focus should be made on those ADF activities to determine whether the planned results and outputs have been achieved and what impact, positive or negative, intended or otherwise, they have had. The analysis should come up with recommendations as to the effectiveness of the ADF as a "a flexible mechanism" for supporting research and other related activities. Were the projects financed under the ADF well developed, efficiently and effectively implemented, monitored and evaluated and what have been the shortfalls?

The evaluating team will

1. Determine if the project purpose has been achieved. Special focus should be made on the actions and progress taken by the Government of Jordan as recommended in the interim evaluation conducted in November, 1989. These recommendations were mainly concerned with organizational, programmatic, and operational areas that are detailed in Attachment III. The evaluation team will:

    a. Examine the relationship between project inputs and outputs to determine whether inputs were provided in sufficient amounts and in a timely manner to obtain desired outputs.

    b. Study the relationship between project outputs and purpose to determine whether the outputs were accomplished and contributed to the achievement of the project purpose.

    c. Identify constraints and make recommendations for overcoming these constraints e.g., institutional, organizational, resources (manpower, financial, physical), etc. Assess the effects of external and unanticipated actions and events on the overall implementation of the project.

2. Assess the relevancy and appropriateness of project design. The evaluation team should:

    a. Review the project purpose to determine its continued relevance to Jordan's needs in light of changes in the past several years in agricultural technology, government policy, economic conditions, and similar chains.

    b. Examine the project design to determine if the planned inputs and outputs are appropriate for achieving the project purpose given any changes noted above.

3. Assess the impact of the project to date as well as the likely potential impact in the long term particularly as a result of: the autonomous status which has been

granted to NCARTT; the impact of returning participants; and the completion and equipping of NCARTT's facilities. Within this context, the evaluating team will:

a. Analyze and evaluate the impact of overall project activities on the NCARTT including its institutional framework and management, manpower including women, physical resources and infrastructure, internal structure, research and technology transfer program planning and development, research and technology transfer capability and management, technology acquisition, linkages, and resource mobilization.

b. Analyze and evaluate the impact of project activities on the agricultural sector including changes in agricultural production and productivity in Jordan, provision of extension services, laboratory services, improved support for research and technology transfer activities, publications, training as well as the development of the Ministry of Agriculture, its policies and its effectiveness in carrying out its responsibilities.

c. Analyze and evaluate the impact and contribution to the development of research and technology transfer.

The following evaluation questions shall be considered and addressed in the team's report. The discussion of each questions is to be concise, and should identify important factors affecting implementation, and place them in the context of achieving the project purpose. Recommendations shall be based on specific information or examples, and be directed to increasing the chances of success of future activities or projects.

1. To what extent did the delays in construction, laboratory equipment installation and the provision of technical assistance affect the progress of achieving project objectives; and how could these delays have been avoided.

2. The project has a large institution-building component as well as heavy emphasis on construction (US$ 6.775 million loan) and commodities (US$6.854 million grant). Given the size of Jordan, the limited importance of agriculture, and other factors, was the design appropriate? What steps should be taken to ensure that this large investment is maximized? Have economic realities in the agriculture sector shifted? Has appropriate research emphasis been given to market realities?

3. To what extent have the institutional relationships and links (i.e., structural arrangements) between NCARTT, the Steering Committee, NCARTT Council and the Ministry of Agriculture promoted or impeded project implementation? Was project design realistic in addressing this issue? In particular, has the Steering Committee or the NCARTT Council or both played the role expected of them? If not, why? What should be the role, if any, of the Steering Committee and the role of the NCARTT Council? What progress has been

made in establishing effective institutional relationships, and what are the prospects of these "newer" or proposed relationships for facilitating project implementation and achieving project objectives, especially after the issuance of NCARTT's Bylaw No. 42 issued June 19, 1993 in Jordan's Official Gazette.

4. The project will terminate on September 30, 1994 (project Assistance Completion Date). What specific steps and actions need to be taken by the Government of Jordan to ensure sustainability of project outputs as may relate to budget allocation, institutionalization, organization and management, staff training and incentives, prioritization of research programs, authorities and powers of the NCARTT Council and Director of NCARTT?

5. Has Government of Jordan budget support for this project been adequate to attain project objectives. Was the Government of Jordan contribution realistic? What are recurrent cost implications for the Government of Jordan?

6. Training in the U.S. (both short- and long-term academic) has been a particular problem throughout the project in terms of identifying qualified personnel and getting Government of Jordan approval for those so identified. What are the implications of this problem? What can or should be done to improve the process? What adjustments does the evaluation team recommend to the existing Government of Jordan training rules and regulations which would enable the attraction of personnel with potential to serve with NCARTT in the future?

7. Technical assistance under this project has come from a wide range of sources including Consortium for International Development, Washington State University, and locally funded Technical Assistance and Services Office. Was recruitment of consultants for the project well planned, were scopes of work appropriate, and were assignments relevant to the needs of the project at the time?

8. Has USAID or the implementing agency or both managed the project well? What improvements, if any, could have been made that would have improved management? Have Consortium for International Development, Washington State University, and later the Technical Assistance and Services Office, managed their components of the project well? What improvements, if any, could Government of Jordan and USAID, Consortium for International Development, Washington State University, or the Technical Assistance and Services Office or both have made to better and more effectively implement the project?

9. What are the important "Lessons Learned" and the "Unplanned Effects" from the evaluation?

13.1.4. Time frame

The team leader should arrive on or about April 1, 1994 to prepare the ground for the impact assessment and the final evaluation. The team leader will assist in the selection of the individuals who will be locally recruited under subcontract, or as otherwise agreed, to participate in conducting the impact assessment and final evaluation. The team leader will stay in Jordan through completion of this activity, which is expected to be around May 31, 1994. The remaining two U.S. consultants will arrive in week two and depart upon completion of the final evaluation report, approximately one week before the team leader. A 6-day 48 hour work week is authorized.

13.1.5. Team composition

The impact assessment and evaluation team will be multidisciplinary in composition, with a mixture of U.S. and Jordanian consultants. The U.S. team will consist of a team leader plus two additional U.S. senior specialists from a U.S. consulting firm and will be contracted through an IQC with a Gray amendment firm if possible, or other appropriate means.

The U.S.-based impact assessment and evaluation team will consist of the following members:

1. An agricultural planner or team leader (minimum level 4 qualification)–This individual will have overall responsibility for the preparation of both the impact assessment and the final evaluation. These two activities are considered to be discrete and will be conducted sequentially. The team leader must also coordinate the efforts of all team members to insure that the objectives of the impact assessment and the evaluation are met and that the final report is comprehensive in regard to the specific terms of reference described above.

   The team leader should have wide experience in the design, implementation and evaluation of agricultural development projects, which involve the establishment of national centers for research and technology transfer and extension and the institution-building efforts necessary to make such centers effective. The team leader must have an advanced degree (preferably a PhD) in agriculture or related discipline and a solid background in applied research and technology transfer management, as well as institutional development and management. Experience in extension and a knowledge of farming systems research methodology is desirable.

   This individual will also be responsible for examining the project's institution building and other efforts being undertaken to improve NCARTT's capability in designing and implementing research and Ministry of Agriculture and NCARTT capability in transferring technical knowledge and information to farmers. Of particular concern is the relevance and appropriateness of current agricultural research to farmers' problems.

2. Agricultural Research and Technology Transfer Specialist (Minimum level 3 qualification)–This individual will examine project's efforts to establish the NCARTT research and technology transfer programs, as well as their impact

and relevance to the agricultural sector. The research and technology transfer specialist must have an advanced degree (preferably a PhD) in agricultural research and a solid background in applied research, technology transfer and research management. Experience in extension and a knowledge of farming systems research methodology is desirable.

3. Agricultural Economist (Minimum level 3 qualification)–This individual should have an advanced degree in agricultural economics (preferably a Ph.D.) and experience with agricultural development projects involving institution building. This individual will be responsible for examining certain cost-benefit issues involved in the project regarding construction, equipment, technical assistance, training, and other components, to determine if the amount of inputs was appropriate for project objectives. This person should also examine certain aspects of the project from an economic perspective, e.g., the cost effectiveness of the Agricultural Development Fund (for the entire life of the project); the relative effectiveness of project resource investment in rainfed agriculture, irrigated agriculture, and livestock; review the need for marketing interventions to support the project's emphasis on diversification into noncereal agricultural production; and comment on the continued economic justification for the project.

Government of Jordan Agricultural Program Officer, the Ministry of Agriculture and NCARTT, and other Government of Jordan agencies, including the Ministry of Planning, will assign senior technical staff with appropriate background and experience who will be made available to provide information to the team during the preparation of the impact assessment and evaluation reports. The Jordanian team will be recruited by the U.S. consultants through a subcontract to carry out this activity. This team shall consist of three senior Jordanian agriculturalists with the following specializations, qualifications, and experiences.

1. Institution-building and Management Specialist—This specialist should have thorough knowledge and experience with Jordan's agencies and institutions serving the agriculture sector, and preferably have previously worked in a senior position involving institution-building of an agricultural institution. The specialist must have a degree (preferably a Ph.D.) in agriculture or related disciplines.

2. Applied Research and Technology Transfer Specialist–The person who fills this position must have pertinent knowledge about the history of Jordan's agricultural research and minimum of ten years experience in implementing and evaluating agricultural research and extension programs in Jordan. An advanced degree (preferably Ph.D.) in agriculture and a solid background in applied research and technology transfer management are required. Experience in extension is desirable.

3. Agricultural Economist–The agricultural economist should have experience in economic aspects of agricultural development projects within Jordan or the region or both. It would be highly desirable if this experience included

institutional building. An advanced degree (preferably a Ph.D.) in agricultural economics is required.

13.1.6. Reports

There shall be two reports prepared, one covering the impact assessment, which stands on its own with the other covering the final evaluation which will incorporate and synthesize the results of the impact assessment into it.

It will be the responsibility of the evaluation team leader to prepare a final evaluation report and to complete the relevant portions of USAID's project Evaluation Summary (PES) Report (i.e., the Abstract, and the Executive Summary), which should serve as the face sheet for impact assessment and final evaluation. The team leader shall prepare a draft of both the impact assessment and final evaluation reports, with Executive Summary and PES Face Sheet. The Abstract and the Executive Summary should each be limited in length to fit within the space allotted on the PES form. These shall be submitted by the team leader to USAID and the Government of Jordan, Ministry of Agriculture in a formal briefing before departure.

A final report (which will incorporate the comments of USAID and the Ministry of Agriculture) of no less than 30 double-spaced pages, including an executive summary not to exceed 3 pages and the PES Report shall be submitted to USAID no later than 30 days after departure from Jordan. The report should present in clear, brief fashion the team's findings, conclusions, and recommendations. These shall be substantiated in the body of the report. The report shall also describe the methodology employed and the types of data used in the evaluation. Detailed information, data sheets, and other reference material should be placed in appendices. The Contractor shall transmit thirty copies of the final report to USAID Jordan.

13.2. Bio-sketch of evaluation team members

Clarence J. Murphrey (Jim)—team leader

Jim Murphrey is an agriculture, agroindustry, export marketing, and private-sector development specialist. He has served as team leader, chief of party, or consultant in 18 countries in Asia, the Caribbean, Central America, Middle East, South and North America. He was on the staff over 20 years at Texas A&M University jointly with the United States Department of Agriculture (USDA), of which 15 were in international agriculture. Since retiring from Texas A&M University, USDA, he has been a private consultant. His clients include USAID, USDA, VIAT, NCBC, Agricultural Bank of Jamaica, Agro-21-Jamaica, private investors in Saudi Arabia and USA-Texas, Texas A&M University, and the University of Georgia.

Education

Texas A&M University, postgraduate studies, ag. Education 1965–66
West Texas State University, postgraduate studies, economics 1966
Michigan State University, postgraduate studies, ag. Economics policy 1959
Texas A&M University, Masters of Education degree, agricultural education 1953
Texas A&M University, B.Sc., agricultural education 1948

Ahmad A. Abu-Shaikha—Institutional Advisor

Dr. Abu-Shaika is an experienced senior-level economic planning and development specialist. He has a Ph.D. degree in economics from George Washington University (1978), a M.S. in economics from North Carolina State University (1976), a M.S. in agricultural economics from the American University in Beirut (1971), and a B.Sc. degree in agriculture from Cairo University in Egypt (1960).

He is currently acting president of the Al-Quds Open University. In recent years he has held important positions such as the director of planning at Al-Quads Open University; director of regional planning, Ministry of Planning, Amman, Jordan; and director of research and foreign relations, Ministry of Labor, Amman, Jordan. He has also published works on economic development in Jordan, Syria, the Sudan, Egypt, Morocco, and Iraq.

Jamal M. Salem Ghaith—Agricultural Economist

Born in Haditha, Palestine. Received M.Sc. degree in agricultural economics from Ohio State University, 1964, and a B.Sc. degree in agr. sciences and agr. econ. from Baghdad University, 1961. Presently a freelance consultant, has recently worked for: PRIDE, Chemonics International, IFAD, GTZ, and TR&D, Inc. Worked as an economic researcher, agricultural production manager, agricultural economic advisor for the private sector; also head of the Credit and Studies Department, branch manager, and agricultural credit supervisor for the Agricultural Credit Corporation.

He has received the following training programs:

- A regional industrial development course, EDI of the World Bank and the Royal Scientific Society, Amman, 1984.
- A rural project development course, EDI of the World Bank, Washington D.C., 1982.
- Agricultural planning, the Arab Institute of Economic and Social Planing, Amman, 1975.
- A course in the analysis of agricultural projects, USAID and USDA, Amman, 1973.

Donald R. Jackson—Agricultural economist

Dr. Jackson is a development economist with almost 30 years of experience working in more than 35 developing countries in Africa, Asia, and Latin America. He is an expert in the design and implementation of development assistance projects with particular emphasis on the use of information systems to monitor project performance. His clientele covers a broad range of developmental organizations including USAID, the World Bank, FAO, and various Nongovernmental organizations and national governments. Over the course of his career he has written more than 40 book-length documents and manuscripts on related development activities including his doctoral thesis on the topic of communal production cooperatives. He currently holds a half-time appointment with the Midwest Universities Consortium for International Activities (MUCIA) and works as an independent consultant.

Education

B.S. Oklahoma State University, business administration, 1966
M.S. University of Wisconsin, agricultural economics, 1972
Ph.D. University of Wisconsin, development studies, 1980

John B. O'Donnell

John O'Donnell is a retired USAID Senior Foreign Service Officer with over 30 years experience in the design, implementation, and evaluation of agricultural and rural development projects, principally in Latin America and Southeast Asia. During his USAID career, Mr. O'Donnell served as chief of the Agriculture and Rural Development Offices in Peru (1977–82) and Ecuador (1985–87) and as deputy chief in Guatemala (1974–77). He was deputy director of the Office of Rural Development (1982–85) and the Agency Directorate for Human Resources (1987–91) in the Science and Technology Bureau in USAID Washington and held other technical and management positions in USAID Washington, Hawaii, Peru, Thailand and Vietnam. He received USAID's Meritorious and Superior Honor Awards and was decorated by the governments of Vietnam and Peru. Since his retirement from USAID in 1991, Mr. O'Donnell has led or participated in the preparation of project papers, project evaluations and concept papers for USAID missions in Ecuador, Peru, the Eastern Caribbean, Jamaica, Bolivia, Nicaragua, and USAID Washington.

Education

B.A., Stanford University, economics and history, 1956
University of Hawaii, graduate studies, economics, 1959–60
Cornell University, graduate studies, agricultural economics, 1973–74

Rahmatullah Ali Shahidi—Agriculturalist

Mr. Shahidi is an experienced farm manager, having worked on large farms for over fifteen years in both Jordan and Saudi Arabia. He was also employed in the Horticulture Division of the Ministry of Agriculture, where he was the department head from 1978-79. He has a M.Sc. in Horticulture from the American University of Beirut (1974), and a B.S. in Agricultural Sciences from Cairo University, Egypt (1956).

Awni Taimeh—Soil scientist

Born in 1948, Safut, Jordan, Mr. Taimeh has a Ph.D. in soil classification from Oklahoma State University. He joined the Department of Soil and Irrigation, Faculty of Agriculture, University of Jordan in 1980. He worked for the Ministry of Agriculture from 1971 to 1975. Currently, he is a full professor and head of the Soils Department. Duties include teaching of several undergraduate and graduate courses in soil classification,

management, land use, and advanced classification. Conducted research since 1980. Coordinator of an integrated developmental project in desertified regions of Jordan since 1986 with participation of 18 faculty members, principle investigator in other international joint project on modeling of land and water resources in arid region in Jordan. Supervisor of several graduate students. Participated in a leading position in the preparation of policy and strategy for document such as national strategy for environmental, agricultural land use policy (author) and water for various government ministries. Conducted evaluation of several national projects; head of a technical team to assess major crop failure in Jordan Valley.

Has published several scientific papers in local and international journals and written several books on soils of Jordan, desertification, and policy for land use, preservation, and development in Jordan.

13.3. Evaluation team schedule

April 16	Jim Murphrey and Don Jackson arrive Amman.
April 17	Initial briefings with USAID Jordan.
April 18	Initial briefings with NCARTT and The Technical Assistance and Services Office.
April 19	John O'Donnell arrives Amman. Meeting with Munthar Azar, project Officer, and Carl Dutto, Chief of the Office of Water, Environment, and Agribusiness(WEA). Document review.
April 20	Meetings with Dr. Abdullatif Kamal, Director of The Technical Assistance and Services Office, Salah Juma' and Fuad Qushair, Advisors to The Technical Assistance and Services Office. Document review.
April 21	Interview candidates for local-hire evaluation team. Document review.
April 22	Jerash.
April 23	Meeting with Ed Loomis, Institutional Advisor to NCARTT and Dr. Kamal, Director of The Technical Assistance and Services Office. Document review.
April 24	Prepare draft outlines for impact assessment and final evaluation. Document review.
April 25	Kick-Off Meeting with representatives of NCARTT, the Technical Assistance and Services Office, the Ministry of Agriculture, National Agricultural Development project, evaluation team (including local counterparts), Ministry of Planning, USAID Jordan, Agricultural Marketing Organization (AMO), Agricultural Credit Corporation, University of Jordan Faculty of Agriculture, Jordan University of Science & Technology. Team Planning. Local professional team members begin work.
April 26	Team Meeting to discuss Impact Assessment and Team Schedule. Team Planning. Document Review.
April 27	Finalize Outline for final evaluation. Prepare team field visit schedule. Document review.
April 28	Visit regional agricultural research center (RASC) at Shoubak. Visit farmers in Shoubak area.
April 29	Petra.
April 30	Visit Rabba RASC and farmers in Rabba area.
May 1	Team Planning. Document Review. Full Team Meeting to discuss Outline for

	Final Evaluation and plans for upcoming field visits.
May 2	Meetings at NCARTT and the Ministry of Agriculture.
May 3	Visit Khaldieh RASC and Area Director and extension agents at the Ministry of Agriculture office in Zarqa.
May 4	Visit Deir Alla RASC and with farm leaders in Jordan Valley.
May 5	Early morning visit to Central Market. Visit Mushagar RASC and Jordan Cooperative Organization (JCO) agency in Mushagar. Tour of new NCARTT Building.
May 6	West Bank.
May 7	Meetings at NCARTT, the Ministry of Agriculture and other Government of Jordan organizations.
May 8	Review documents and field visit and interview notes. Full Team meeting to discuss report preparation responsibilities.
May 9	Visit Ramtha RASC, Jordan University of Science and Technology (JUST), Ministry of Agriculture Agency Director and extension agents in Ramtha, Maru substation.
May 10	Interviews. Report Preparation.
May 11	Meet with Carl Dutto and Munther Azar to discuss preliminary team findings and conclusions. Interviews. Report Preparation.
May 12	Interviews. Report Preparation
May 13	West Bank.
May 14	Report Preparation.
May 15	Report Preparation. Full team meeting to discuss findings, conclusion and key issues.
May 16	Report Preparation. Assemble draft materials for Impact Assessment and Final Evaluation and deliver to Carl Dutto.
May 17	Report Preparation.
May 18	De-briefings for USAID Jordan and Government of Jordan officials on evaluation team findings, conclusions and key issues.
May 19	Report Preparation.
May 20	Report Preparation.
May 21	Report Preparation.
May 22	Edit and Finalize Impact Assessment and Final Evaluation to leave with USAID Jordan before departing Amman.
May 23	Deliver final draft of Impact Assessment and Final Evaluation to Chief, WEA, USAID Jordan.
May 24	Murphrey, O'Donnell and Jackson depart Amman.
May 25–	USAID Jordan and Government of Jordan officials review final drafts June 2
of	
June 7	Impact Assessment and Final Evaluation and provide comments to Munther Azar who will be responsible for consolidating comments and forwarding them to Jackson.
June 1–6	Murphrey, Jackson, O'Donnell clean up draft documents, write missing portions, incorporate initial feedback.
June 7	USAID Jordan faxes comments by USAID staff and Government of Jordan officials to Jackson and O'Donnell.

June 10	Last day of Murphrey availability.
June 3–21	Murphrey, O'Donnell and Jackson edit, refine and include appropriate USAID and Government of Jordan comments and responses in impact assessment and final evaluation, coordinating by phone and fax.
June 22	Jackson Federal Expresses final draft of Impact Assessment, Final Evaluation, time sheets, vouchers etc. to TR&D. Jackson will be available for further work after June 15, if necessary. O'Donnell may be available, depending on resolution of pending scheduling questions. Murphrey will not be available after June 10.

13.4. List of persons contacted

NCARTT	*Position*
Dr. Mahmoud Duwayri	Director General
Mr. Nabil Katkhuda	Deputy Director General
Mr. Khalid Masannat	Assistant Director for Research
Mr. Khalid Masannat	Plant Protection
Dr. Mohammad Kamel	Animal Production
Dr. Rasmi Swaiti	Agr. Economics
Dr. Mohammad Ababneh	Rainfed Agri.
Mr. Ahmad Abu Ali	Training & Info.
Mr. Kamal Tadros	Range Plants
Mr. Ali Abu Zurayq	Chief Fruit Trees Branch
Dr. Samir Salti	Chief of Soil & Water Branches
Dr. Abdel Nabi Fardous	Irrigation Management
Dr. Amin Shams Eddin	Chief of Vegetable Branch
Ms. Sherin Abdul Razeq	Librarian
Dier Alla Station	
Mohammad Jalboush	Director of Dier Alla Station
Khalil Abu Ghannam	Ag. Engineer, Private Sector
Yousef Barakat	Ag. Engineer
Hasan Zahran	Ag. Engineer
Hasan Rooqa	Ag. Engineer
Hasan Barghothi	Ag. Engineer
Ahmad Sabha	Ag. Engineer
Jameel Hattar	College of Art
Saleh Klaib	College of Religion
Yousef Masood	High School
Amin Jabar	Bus. Admin.
Mushaqar Station	
Mr. Khalid Zakariya	Director of Mushaqar

Ramtha Station

Mr. Ali Gharaybeh	Director of Ramtha
Mr. Nasri M. Ya'acoub	Director Deputy, & Field Crops Research
Mr. Tawfiq Nserat	Animal Prod., Researcher
Mr. Mahmoud Ayyadi	Leguminous Forages, Researcher
Mr. Nazim Melkawi	Field Operations Supervisor
Dr. Munir Rosan	Soil Chemistry, U.S.A., Researcher
Mr. Louia El-Kara'an	Plant Protection, Researcher
Ms. Enas Gharaybeh	Eco. Soc. Economy, Researcher

Khaldieh Station

Mr. Jamal Hirzallah	Director of Khaldieh
Mr. Faldan Khresat	Researcher
Mr. Saleh Shdefat	Researcher
Mr. Mohammad Abu-Zant	Researcher
Mr. Esmate Karadche'	Researcher
Mr. Mohammed Khalid	Researcher
Ms. Manal Bqaa'een	Researcher

Rabba Station

Mr. Nedal Al-Majali	Director of Rabba
Miss Sa'afiya Ma'ali	Researcher
Miss Nofa Ammarin	Researcher
Mrs. Raghda Ammarin	Researcher
Mr. Husam Zrequat	Researcher
Mr. Jihad Ammarin	Researcher

Shoubak Station

Mr. Ismail Tuwaysi	Director of Shoubak
Mr. Khalaf Tarawneh	Large Apple Orchard "Supervisor"
Mr. Ali Khashman	Farmer (Apples)
Mr. Khalil Khashman	Farmer (Apples)
Mr. Yaseen Habahbeh	Farmer (Apples)

Maro Station

Fahid Al-Khatib	Dir., & Researcher, Crop Prod.
Musa Fayyad	Researcher, Plant Production
Yehya Shkhatreh	Asst. Researcher, Crop Prod.

Kraymeh (Jordan Valley)

Farmer Society for the Protection of Agriculture

Mr. Khalil Abu Ghannan	Plant Prod., Farmer, Leader
Mr. Yousef Baraket	Entomology, Farmer
Mr. Hasn Zahran	General Agri., Farmer
Mr. Hasan Barghooti	Soil & Irrigation, Farmer
Mr. Hasan Roka	Poultry Man, Farmer
Mr. Ahmad Taha	Plant Production, Farmer
Mr. Nidal Sa'efan	Plant Production, Farmer
Mr. Saleh Klaib	License of Islamic Laws, Farmer
Mr. Jamil Hattar	License of Literature, Farmer
Mr. Amin Jaber	Accounter, Farmer
Mr. Yousef Masoud	Farmer
Mr. Ahmad Sobhiya	Plant Protection (under training)

Technical Assistance and Services Office

Dr. Abdullatif Kamal	Chief
Mr. Salah Juma'	ADF Advisor
Mr. "Mohammad Adnan" Arafat	Training & Extension Specialist

National Agricultural Development project

Dr. Edward Loomis	Institutional Advisor
Mr. Fuad Qushair	Program Advisor

Ministry of Agriculture

Mr. Karim Nesheiwat	Head of Eval. & Monitoring
Dr. Waleed Abed Raboh	Policy & Economics
Mr. Lutfi Howaidi	Assistant Secretary General
Mr. Yahya Saket	Engineering Advisor
Mr. Jihad Abu Mushrif	Dir. of Highland project

Extension Information Directorate in the Ministry of Agriculture

Mr.Khaldun Es-Sobehi	Director
Mr. Salah El-Khatib	Chief Section, Ext., Inf., Training
Miss. Alia El-Khatib	Assistant Chief Section

Ministry of Planning

Mr. Mustafa A. Zahran	Director, projects Dept.
Mr. Radi Tarawneh	
Ms. Yanal Khasawneh	
Ms. Khaldah Ghazzawi	

Mr. Majed Zakariya	Data Bank Division

USAID

Dr. Carl Dutto	Director, WEA
Dr. Robert Hanson	Evaluation Officer
Mr. Munther Azar	project Officer

Ministry of Rural Affairs and the Environment

Mr. Saleh El-Share	Director
Kalaf Aloklan	Head, Nat. Protection Div.

MOW&I

Dr. Mohammed Beni Hani	Secretary General

AMO

Mr. Mohammad Al-Awamleh

ACC

Mr. Abdul-Razzak Khayyat

University of Jordan

Dr. Bassam Snobar	Dean, Faculty of Agriculture

JUST

Dr. Naji M. Abuirmeileh	Dean of Fac. of Agr.
Dr. Taher Rawajfeh	

NABAT

Khalil Abu Ghannam	Agr. Engineer, NABAT Agr. & Trading Co. Ltd.

JCO (IN MUSHAKAR)	Three staff members.

DIRECTORATE OF AGRICULTURE IN ZARQA

Mr. Mohammad Rshaid	Director Deputy
Mr. Mohammad Al-Ghowari	Head of Ext. Division

UNIVERSITY OF SCIENCES & TECHNOLOGY

Dr. Abu-Romeleh	Dean, Faculty of Agr.
Dr. Zaher Rawajfeh	Soil, Specialist, Professor

AMMAN WHOLESALE PRODUCE MARKET

Karim Haddin	Chairman, Exporters Association for Fresh Fruits & Vegetable–Amman
Richard J. Peters Sr.	Advisor Agr. Marketing project USAID SIGMA ONE
John S. Holtzman	Technical Dir., Abt Associates
William Levine	Agriculture & Natural Resources, Abt Associates Inc.

13.5. Documents reviewed

1 - Annual Report 1986–1987, NCARTT
2 - Annual Report 1987–1988, NCARTT
3 - Annual Report 1988–1989, NCARTT
4 - Annual Report 1989–1990, NCARTT
5 - Annual Report 1990–1991, NCARTT
6 - Annual Report 1991–1992, NCARTT
7 - Annual Report 1992–1993, NCARTT
8 - Research Strategy for Integrated Livestock Subsector, NCARTT
9 - Strategy and Medium-Term Plan for Low Rainfall, NCARTT 1194
10- Research Strategy for the Rainfed Agriculture Subsector, NCARTT 1994
11- Research Strategy for the Irrigated Agriculture Subsector, NCARTT 1994
12- Agricultural Research Strategy, Organization Structure, NCARTT 1994
13- National Agricultural Research Strategy, NCARTT Draft May 11, 1994
14- Dryland Resources Management project, Case Study, Final Report 1993
15- Jordan National Agricultural Development project, End of Tour Report, Sept. 1, 1989-Nov. 30, 1990, by W.A. Hargus.
16- Jordan National Agricultural Development project, End of Tour Report, Oct. 1989-Nov. 30, 1990, by Leroy Rogers.
17- Jordan National Agricultural Development project, End of Tour Report, Oct. 1, 1989–Nov. 30, 1990, by A.L. Kamal.
18- Jordan National Agricultural Development project, End of Tour Report, Dec. 19, 1989–Nov. 30, 1990, by H. Hepworth.
19- Progress Report on The Technical Assistance and Services Office's Activities Nov. 1, 1992–June 1993.
20- Semiannual Report for the Period of Dec. 1990–May 3, 1991 (Technical Assistance and Services Office)
21- Progress Report on The Technical Assistance and Services Office's Activities April 1,–Oct. 31, 1992
22- Al-Mashreq Annual Report, 1989–1990
23- Al-Mashreq Annual Report, 1990–1991

24- Al-Mashreq Annual Report, 1991–1992
25- Food Legume project, 1991–1992, Faculty of Agriculture, University of Jordan and NCARTT 26-Food Legume project, Final Report, Faculty of Agriculture, NCARTT 1993.
27- Annual Technical Plan, NCARTT, 1993–1994
28- Annual Technical Plan, NCARTT, 1992–1993
29- Annual Technical Plan, NCARTT, 1991–1992
30- Annual Technical Plan, NCARTT, 1988–1989
31- Supplement to Trainer Report, Jordanian Farming System Research and Extension Training Workshop, Aug. 5-24, 1989 Amman.
32- JNAGP Second Progress Report, 1991–1993 Design, Technologies for Production of Tomato Seedlings.
33- JNAGP, Farming System Research Extension, NCARTT 1987–1988.
34- Highland Agriculture Development project Paper 278-021.
35- Interim Evaluation Report on Jordanian National Agricultural Development project Amman–Nov. 1989.
36- project Agreement on the Highland Agricultural Development –July 31, 1985
37- Technical Assistance and Services Office, Guide for Design are Experimental Analysis, NCARTT 1993
38- Technical Assistance and Services Office, Guide, Technology of Protected Agriculture, NCARTT, 1994
39- JNADP, End-of-Tour Report for Oct. 1989–Sept. 1990, By K. (Dean) M. Batal, Veg. Specialist.
40- JNADP, End-of-Tour Report for Sept. 9, 1988–Aug. 23, 1990, by D.L. Galt, Socioeconomic Specialist
41- AID Loan No. 278-032 project No. 278-0264 project Agreement Between the Hashemite Kingdom of Jordan and The Jordan and The United States of America for Highland Agricultural Development, July 31, 1985
42- Agricultural Policy Analysis project, Phase II, Sponsored by USAID, Sept. 1993
43- Progress Report No. II on Tech. Spec. and Econ. Viability Studies on Green House Structure for Healthy Veg. Seedlings Production.
44- Fertilization Studies of Nitrogen and Phosphorus on Crops and Fruit Trees in Rainfed Regions 1991–1993
45- Final Report on Ext. Activities and Training in NCARTT, by Dr. Butler
46- Monthly Report No. 15 June, 1990 (National Agricultural Development project)
47- MANAR, The National Agricultural Development project, Monthly Report No. 15 June 1990
48- Quarterly Report Jan., Feb., March 1994 (JADP)
49- Progress Report on Training Activities, NCARTT Technical Assistance and Services Office April 20, 1992 - April 30, 1994, by M. A. Arafat
50- The National Agricultural Library and Information Center, A Consultancy Report, March 1994, by F. Mansour
51- Overview of NCARTT Library Activities 1993–1994, NCARTT Unpublished Report, by S. Abdel Razeq.

52- Annual Report, Aug. 1, 1990–June 31, 1991, NCARTT–July 1991 (Arabic)
53- The National Strategy for the Conservation of Environment, Ministry of Rural Affairs & the Environment, Amman 1991
54- Sources of Agricultural Environment Contamination in Jordan, Unpublished Report, Ministry of Rural Affairs & the Environment, Amman 1991
55- National Farm Data Handbook for Jordan, Ministry of Agriculture, ESCWA and Faculty of Agriculture, May 20, 1993
56- Economics and Agricultural Policy Dept., Data Bank Division, Agricultural Data 1981–1993, Amman
57- Water–Related Agricultural Management, Unpublished Report, Qasim Subhi, Ministry of Water and Irrigation, Amman 1992
58- Jordan Agricultural Sector Review: Synthesis, Agricultural Policy Analysis project, Phase II, Khaldi Nabil, Technical Report, No. 132 Volume VI, Amman, Sept. 1993.
59- AID project Evaluation Summary, Jan. 1990
60- NCARTT Paper (Loomis) Revised Sept. 22, 1993
61- Technical Transfer Train the Trainer, Lorna Butler, March 1988
62- Current Status & Future Perspectives of Collaboration between Institutions of Higher Agricultural Education & Agricultural Research Institution in Jordan
63- End of Tour Sept. 28–Nov. 1989, Norton
64- project Agreement Between Hashimite Kingdom of Jordan & the USA for Highland Agricultural Development project July 31, 1985
65- Policy Report: Common Farmer Problems in the Hashemite Kingdom of Jordan Oct. 30, 1989, D.L. Galt and A.F. Al Kadi
66- Socioeconomic & Operational Variables of Jordan, Highlands Custom Equipment Operations, Oct. 29, 1989
67- Wheat Subsidy Policies in the Hashemite Kingdom of Jordan, An Economic Analysis, August 1988.
68- The Wheat Baseline Data Survey Conducted in 1988
69- The Agriculture Sector in Jordan Figures & Facts 1993
70- National Farm Data Hand Book, Jordan May 1993

13.6. Detailed Outline for Final Evaluation of the National Agricultural Development project (National Agricultural Development project)

i. Table of Contents (DRJ)

ii. List of Acronyms (Lubna)

iii Acknowledgments (DRJ)

iv. Executive Summary (CJM/JOD/DRJ)

1. Introduction (DRJ)
(Discuss purpose of evaluation, timing, composition of team, methodology employed).

2. **Brief Project History (DRJ and JOD)**
(Describe when project started, project goal and purpose, what happened as project was implemented including major events such as the initial project Agreement obligating $12 million grant and $5 million loan, Pro Ag Amendment in April 1987 adding $2.7 million, the project Implementation Start-Up Workshop and changes in the log frame, the ProAg Amendment in June 1988 changing project focus from Highlands to National level, creation of separate Directorate of projects with responsibility for supervision of National Agricultural Development project, establishment of Steering Committee and NCARTT Board of Directors, establishment of the Higher Council for Science and Technology, mid-term evaluation, movement of NCARTT out of Directorate of projects and directly under the Ministry of Agriculture Secretary General, Pro Ag Amendment in May 1990 adding $1.7 million, the Gulf War, departure of Washington State University team, establishment of The Technical Assistance and Services Office in December 1990, personnel dislocations in 1991, establishment of Directorate of Extension and transfer of extension personnel out of NCARTT, project reassessment following Gulf War, ProAg Amendment in March 1993 adding $2.1 million to project, establishment of NCARTT Council, preparation of Policy Charter, work on National Agricultural Research Strategy. Discuss evaluation team intent to concentrate on events, accomplishments and problems since mid-term evaluation.)

3. **Project Inputs (Lead-in by JOD)**
(Discuss level of actual inputs as compared with inputs included in original log frame. Provide assessment of the effectiveness, timeliness and appropriateness of the inputs.

In addition to general discussion of subject, need to respond to task 3,B,1,a on pg. 4 of the Scope of work: "Examine the relationship between project inputs and outputs to determine whether inputs were provided in sufficient amounts and in a timely manner to obtain desired outputs."

3.1. **Technical Assistance (CJM and JOD)**
(In addition to general discussion of subject, need to address questions in Evaluation Element 7 on Pg. 7 of Scope of Work: "Technical assistance under this project has come from a wide range of sources including Consortium for International Development, Washington State University, and locally funded Technical Assistance and Services Office. Was recruitment of consultants for the project well-planned, were scopes of work appropriate, and were assignments relevant to project needs at the time?")

3.2. **Training (CJM)**

3.3. **Construction (JOD)**

3.4. **Commodities (CJM)**

3.5. **Agricultural Development Fund (DRJ)**

3.6. **Evaluation (DRJ)**

3.7. **Government of Jordan Personnel and Operational Costs (JOD)**
(In addition to general discussion of subject, need to respond to questions in Evaluation Element 5 on Pg. 6 of Scope of Work: "Has Government of Jordan budget support for this project been adequate to attain project objectives? Was the

Government of Jordan contribution realistic? What are recurrent cost implications for the Government of Jordan?")

3.8. Summary Financial Statement (DRJ)

4. Project Outputs (Lead-in by JOD)

(Discuss changes in outputs that have occurred over the course of the project, i.e., the revised log frame in January 1987 which was used as the basis for the interim evaluation, the changes following the Gulf War. Explain that we will be evaluating the outputs as presented in the original log frame because the mission has continued to use them throughout the project.

The discussion of each output should include what was envisioned in the project paper and what has happened under the project. Did the original concept of the output change? How? Why? Was the output achieved? Has it contributed to achievement of the project purpose? How? If not achieved, why not? If partially achieved, why?)

4.1. *Outputs in the Original Logical Framework*

4.4.1. Improved Institutional Coordination and Priority Analysis (JOD) (Should include discussion of original concept for Ag Development Council, SCRAD process, changes during project.)

4.1.2. Establishment of a National Center for Agricultural Research and Technology Transfer and four regional agricultural research centers (JOD). (Should include discussion of staffing, facilities, research program, technology transfer program.)

4.1.3. Development of Appropriate Demonstration Methodologies (JOD)

4.1.4. Improved Knowledge of Rangeland Management and Co-op Organization (JOD)

4.1.5. Increased Agricultural Production (DRJ)

4.2. Modifications Since the Gulf War (Lead in by JOD)

4.2.1. National Agricultural Research Strategy (JOD)

4.2.2. Agricultural Sector Review and Policy Implementation Plan (DRJ)

4.2.3. ISPAN Baseline Survey of Zarka Triangle (JOD)

4.2.4. Cooling Facility at Airport (CJM)

5. Progress toward Achievement of Project Purpose (JOD)

(Need to respond to task 3,B,1 on pg. 4 of the Scope of Work: "The evaluation team will 1) Determine if the project purpose has been achieved. and b) Study the relationship between project outputs and purpose to determine whether the outputs were accomplished and contributed to the achievement of the project purpose."

6. Relevance and Appropriateness of Project Design (JOD)

(In addition to general discussion of subject, need to respond to questions in section 3, B, 2 on pg. 5 of the Scope of Work: Assess the relevancy and appropriateness of project design. The evaluation team should: a) Review the project purpose to determine its continued relevance to Jordan's needs in light of changes in the past several years in agricultural technology, government policy, economic conditions and similar chains (sic). b) Examine the project design to determine if the planned inputs and outputs are appropriate for achieving the project purpose given any changes noted above. c) Assess the impact of the project to-date as well as the likely potential impact

in the long term particularly as a result of: the autonomous status which has been granted to NCARTT; the impact of returning participants; and the completion and equipping of NCARTT's facilities. Also need to respond to questions in Evaluation Element 2 on Pg. 6 of Scope of Work: "The project has a large institution-building component with heavy emphasis on construction (US$6.775 million loan) and commodities (US$6.854 million grant). Given the size of Jordan, the limited importance of agriculture, and other factors, was the design appropriate?

7. **Progress on Recommendations in Interim Evaluation (DRJ)**
(Need to respond to task in 3,B,1 on pg. 4 of the Scope of Work: "Special focus should be made (sic) on the actions and progress taken (sic) by the Government of Jordan as recommended in the Interim Evaluation which was conducted in November, 1989. These recommendations were mainly concerned with organizational, programmatic and operational areas which are detailed in Attachment III."

8. **Project management (CJM)**
(In addition to general discussion of subject, need to respond to question # 8 on Pg. 7 of Scope of Work: Has USAID or the implementing agency managed the project well? What improvements, if any, could have been made that would have improved management? Have Consortium for International Development, Washington State University, and later The Technical Assistance and Services Office, managed their components of the project well? What improvements, if any, could Consortium for International Development, Washington State University, or the Technical Assistance and Services Office have made to better and more effectively implement the project?

9. **Summary of Impact Assessment (DRJ)**

10. **Major Observations and Conclusions**
(In addition to general discussion of each subject, need to respond to task in B,3,1,c on pg. 5 of the Scope of Work: "Assess the effects of external and unanticipated actions and events on the overall implementation of the project.")

10.1. Increases in Agricultural Production (DRJ)

10.2. Project Design (JOD)

10.3 NCARTT's Current Stage of Development (JOD)

10.4. NCARTT's Lack of Status as an Autonomous Institution (DRJ)

10.5. Lack of Continuity in Project Direction (JOD)

10.6. Delays in Construction and Equipment Installation (DRJ)
(In addition to general discussion of subject, need to respond to questions in Evaluation Element 1 on Pg. 6 of Scope of Work: "To what extent did the delays in construction and laboratory equipment installation affect the progress of achieving project objectives; and how could these delays have been avoided?")

10.7. Interinstitutional Linkages (JOD)
(In addition to general discussion of subject, need to respond to questions in Evaluation Element 3 on pg. 6 of Scope of Work: "To what extent have the institutional relationships and links (i.e., structural arrangements) between NCARTT, the Steering Committee, NCARTT Council and the Ministry of Agriculture promoted

or impeded project implementation? Was project design realistic in addressing this issue? In particular, has the Steering Committee or the NCARTT Council played the role expected of them? If not, why? What should be the role, if any, of the Steering Committee and the role of the NCARTT Council? What progress has been made in establishing effective institutional relationships, and what are the prospects of these "newer" or proposed relationships for facilitating project implementation and achieving project objectives, especially after the issuance of NCARTT's Bylaw No. 42 issued June 19, 1993 in Jordan's Official Gazette?")

10.8. Agricultural Sector Analysis and Policy Formulation (DRJ)

(In addition to general discussion of subject, need to respond to specific question in Evaluation Element 2 on Pg. 6 of Scope of Work: "Have economic realities in the agriculture sector ground (sic) shifted?

10.9. Agricultural Research Strategy (JOD)

10.10. Agricultural Development Fund (DRJ)

10.11. Training (CJM/DRJ)

(In addition to general discussion of each subject, need to respond to questions in Evaluation Element 6 on pg. 7 of Scope of Work: "Training in the U.S. (both short- and long-term academic) has been a particular problem throughout the project in terms of identifying qualified personnel and getting Government of Jordan approval for those so identified. What are the implications of this problem? What can or should be done to improve the process?

10.12. National Agricultural Library and Information Center (CJM/DRJ)

11. Issues

Inasmuch as the final evaluation comes at the final stage of the project and considering the fact that there is limited time for the project to do much in terms of making necessary modifications or adjustments, the main focus of the evaluation should be on recommendations that will guide the Government of Jordan and provide it with a rational basis for making decisions on follow-up actions regarding policy, procedures and appropriate mechanisms that contribute to the sustainability of project outputs. These include but are not limited to, institutionalization, organization and management of NCARTT, its budget, incentives to attract and maintain qualified staff and their motivation. In this connection, a special effort needs to be made to study bylaw No. 42 issued June 19, 1993 which established NCARTT as an autonomous entity and its implications and determine the extent to which autonomy as envisioned in the bylaw meets NCARTT's needs. This section also needs to respond to task in 3,B,1,c: Identify constraints and make recommendation for overcoming these constraints e.g., institutional, organizational, resources (manpower, financial, physical) etc. Use issue, discussion, recommendation format.)

11.1. Identification, Development, Motivation and Retention of High Quality Personnel (JOD)

(In addition to general discussion of subject, need to respond to question in Evaluation Element 6 on pg. 7 of Scope of Work: What adjustments the evaluation team recommends to the existing Government of Jordan rules and regulations which would enable the attraction of personnel with potential to serve with NCARTT in the future?")

11.2. **Institutional Sustainability (DRJ)**
(In addition to general discussion of subject, Need to address questions in Evaluation Element 4 on pg. 6 of Scope of Work: "The project will terminate on September 30, 1994. What specific steps and actions need to be taken by the Government of Jordan to ensure sustainability of project outputs as may relate to budget allocation, institutionalization, organization and management, staff training and incentives, prioritization of research programs, authorities and powers of the NCARTT Council and Director of NCARTT.")

11.3. **Research Program Focus, Prioritization and Monitoring (JOD)**
(In addition to general discussion of subject, need to respond to specific question in Evaluation Element 2 on Pg. 6 of Scope of Work: Has appropriate research emphasis been given to market realities?")

11.4. **Technology Transfer (CJM/JOD)**

11.5. **Use of NCARTT/RASC Laboratories (DRJ)**

11.6. **Private-sector Participation (JOD)**

11.7. **New Directions for NCARTT (CJM/JOD)**
(In addition to general discussion of subject need to respond to specific question in Evaluation Element 2 on Pg. 6 of Scope of Work: "The project has a large institution-building component with heavy emphasis on construction (US$6.775 million loan) and commodities (US$6.854 million grant). What steps should be taken to ensure that this large investment is maximized?

12. **Lessons Learned and Unplanned Effects (CJM)**

13. **Annexes**

13.1. **Scope of Work for Impact Assessment, Final Evaluation (Lubna)**

13.2. **Bio-Sketch of Evaluation Team Members (Lubna)**

13.3. **Evaluation Team Schedule (Lubna)**

13.4. **List of Persons Contacted (Lubna)**

13.5. **List of Documents Reviewed (Lubna)**

13.6 **Detailed Outline for Final Evaluation (JOD)**

13.7. **Original Logical Framework Matrix (Lubna)**

13.8. **Project Implementation Letter (PILs) Chronology (DRJ)**

13.9. **Summary Financial Statements (DRJ)**

13.10. **Impact Assessment (DRJ)**

13.11. **Description of NCARTT Research Program (Dr. Awni Taimeh)**

13.12. **NCARTT Bylaws**

13.13. **National Agricultural Library and Information Center**

13.14. **Tables (Lubna)**

13.14.1. **Distribution of NCARTT personnel by location, specialization and educational level**

13.14.2. **Construction Start and Completion Dates and Cost in JD's for Project Physical Facilities**

13.14.3. **Comparison of Project Paper Dates with Actual Dates for Key Events**

13.7. Original Logical Framework Matrix

NARRATIVE SUMMARY	OBJECTIVE VERIFIABLE INDICATIONS	MEANS OF VERIFICATION	ASSUMPTIONS
GOAL: Increase fund production and total incomes in the highlands of Jordan	Increase highland production of cereals, pulses, tree crops, and livestock	Agriculture census Baseline Data Agricultural production Import and export reports Special reports	Continuous Government of Jordan commitment to the development of the highlands. Normal weather conditions
PURPOSE: Stimulate greater agricultural production through applied research, improved extension methodologies and various activities to enhance institutional capabilities	Strengthen the capabilities of the National Center of Agricultural Research and Technology Transfer to develop and diffuse agricultural technologies for cereals, pulses, tree crops and livestock so as to reach 75 percent of highland farmers	Project evaluation of NCARTT and RASC operations to include number of technologies promoted, on-farm demonstrations farmer adoptions rates and records of increased sales of agro-inputs and equipment	Productive technologies will continue to be developed in Jordan and elsewhere: Farmers and agro-enterprises will respond to profit opportunities associated with new technologies

OUTPUTS: · Improved institutional coordination and priority analysis · Establishment of a National Center for Agricultural Research and Technology Transfer (NCARTT) · Development of appropriate demonstration methodologies · Establishment of 4 Regional Agricultural Services Centers · Improved knowledge of rangeland management and co-op organization · Increased agricultural production	· Formation of Agricultural Development Council and a Secretariat; · Fully staffed and equipped (NCARTT); · On-Farm technology demonstrations; · Fully staffed and equipped regional agricultural research centers; · Rangeland set aside and managed by a co-op; · Higher yields in project area.	· Ministry of Agriculture reports · Approved action plans and budget allocations · USAID research center visits · USAID agriculture service center visits · Studies approved · Contract reports · Progress reports and evaluations	· Ministry of Agriculture retains qualified staff. · Budgetary allocations remain stable · Institutional re-organization of Ministry of Agriculture occurs · Investment environment for private sector remains favorable · Timing and quality of inputs provided according to specification

INPUTS: USAID · Technical Assistance · Training · Commodities and equipment · Evaluation · Agricultural Development Fund · Construction · Contingency and inflation Government of Jordan · Government of Jordan *Personnel and staff* support · Government of Jordan contributed land · Contribution to Agricultural Development Fund	(U.S. $000) · 312 p.m. of Tech. Asst. $ 4,445 · Training $ 753 · Equipment $ 6,704 · Evaluations completed $ 125 · Fund established $ 3,000 · Buildings completed $ 6,297 · $ 8,181 - Personnel $14,148 · Land titles transferred $ 1,000 · Development Fund $ 7,750	· AID records · Government of Jordan budget data · Progress and Financial reports · Project Audits	· Project authorized and project agreement signed · Conditions precedent met · Participants are named, qualified and processed on schedule · Budgets forthcoming as planned · Contractor selection, procurement and staffing proceeds on schedule

13.14.4. **List of Academic Training Participants funded by National Agricultural Development Project by field of study, location, dates of training, level of degree, and current status**

13.14.5. **Area Planted, Production, and Average Yields for Selected Crops**

13.14.6. **Costs of Production, Gross Margins per Dunum, and Gross Margins per Cubic Meter of Irrigation Water for Selected Crops**

13.14.7. **ACC and Technical Assistance and Services Office Administered ADF Projects**

13.14.8. **Seminars and In-Service Training Courses Offered by NCARTT**

13.8. Chronology of Project Amendments and Project Implementation Letters (PILS)

Amendments

Amendment 1: April 2, 1987-Increased grant funding from US$ 12 million to US$ 14.7 million, and loan funding from US$ 5 million to US$ 7 million.

Amendment 2: June 13, 1988-Name of project changed from Highland Agricultural Development Project to National Agricultural Development Project.

Amendment 3: May 21, 1990-Grant amount further increased to US$ 16.4 million.

Amendment 4: March 3, 1993- (1) Further increased grant amount to US$ 18.5 million (the US$ 2.1 million), (2) Changed project assistance completion date from September 30, 1994 to July 31, 1994 (which was subsequently allowed to be reversed by the Mission Director citing Handbook 3), (3) Stipulates procurement, source and origin, and reporting procedures.

Justification for this amendment includes the following activities:

A. Agricultural research and outreach activities to be implemented mainly through the ADF.

1) The need for a comprehensive strategy and medium term work plan for NCARTT to be conducted in collaboration with ICARDA and ISNAR.
2) Improved water conservation and harvesting practices to increase production of horticultural crops developed in the highlands.
3) A survey of range, vegetation and land use, and the initiation of a pilot range development project for livestock.
4) Development of improved production practices of sheep and goats in collaboration with ICARDA and Jordanian universities, and their dissemination.
5) Conduct a baseline survey of the irrigation service area (Zarqa Triangle), with assistance from ISPAN.
6) Continuation of 9-month practical training program with private-sector firms.

B. Technical Assistance, primarily through The Technical Assistance and Services Office, by short-term U.S. consultants in selected agricultural disciplines. Also Consortium for International Development contract close-out.
C. Short-term training in the U.S., postgraduate study at the University of Jordan and Jordan University of Science and Technology, and intensive English-language training.
D. Final Evaluation.
E. Procurement of field research equipment and other limited commodities.

Project Implementation Letters

PIL 1: December 19, 1985—Satisfaction of Conditions Precedent: (1) Creation of a projects department in the Ministry of Agriculture; (2) Appointment of an acting director of the projects department; (3) Creation of a steering committee to supervise the work of the projects department.

PIL 2: February 19, 1986—Clarification of Conditions Precedent concerning: (1) Assignment of adequate staff and financial resources by Government of Jordan to the project; (2) Legal establishment of ADF, adequate mechanisms and operating procedures, and contribution of US$ 6.8 million to the ADF; and (3) Loan for facility construction based on evidence of proper title to the land, adequate engineering and design and construction supervision, and construction contract documentation and supporting cost estimates.

PIL 3: February 9, 1986—Assignment of an Administrative Specialist from the University of Hawaii.

PIL 4: April 24, 1986—Corrects discrepancies between the project paper and the project agreement concerning construction elements. Adds design services and construction supervision.

PIL 5: May 18, 1986—Shifts funds from Commodities, and Contingencies and Inflation to Technical Assistance.

PIL 5A: July 17, 1986—Earmarks US$ 2.4 million for a long-term institutional contract with a Title XII university for technical assistance and training.

PIL 6: May 27, 1986—Allocates administrative support funds to the Administrative Specialist defined in PIL 3.

PIL 7: June 5, 1986—Transfers a two-year old Wang computer from Mission to NCARTT.

PIL 8: July 16, 1986—Extends deadline of the Condition Precedent requiring the establishment of a Steering Committee from July 31, 1986–to August 31, 1986.

PIL 9: August 20, 1986-Allows Government of Jordan personnel to assist in the selection of institutional contractor.

PIL 10: September 8, 1986—Authorizes funds for the construction of laboratory benches at the NCARTT research center in Baqa'.

PIL 11: August 26, 1986—Authorizes funds for Munther Azar, Ministry of Planning, to travel to the U.S. to take part in the selection of an institutional contractor.

PIL 12: September 28, 1986—Authorizes Consortium for International Development to assist in the design of five NCARTT research centers.

PIL 13: September 8, 1986—Extends the deadline of the Condition Precedent requiring the establishment of the ADF from August 31, 1986 to October 15, 1986.

PIL 14: September 7, 1986—Authorizes payment for computer maintenance.

PIL 15: September 15, 1986—Transmits copy of Chapter 3, Handbook 11 concerning rule governing local procurement.

PIL 16: October 20, 1986—Authorizes US$ 100,000 to be transferred from Contingencies line item to Evaluation line item to conduct a baseline survey for use in future evaluations of the project.

PIL 17: November 2, 1986—Relates back to PIL 12 and requests that civil engineers from the Ministry of Agriculture and MPW be provided to assist Consortium for International Development team in the design of NCARTT Research Centers.

PIL 18: February 8, 1987—Transmits Mission's initial contribution of US$ .4 million to the ADF and establishes future contribution procedures and guidelines.

PIL 18A: December 20, 1988—Requests conformance with ADF guidelines and procedures specified in PIL 18 in terms of documentation for approved ADF projects.

PIL 19: March 8, 1987—Transfers US$ 2.2 million from Inflation line item to Technical Assistance line item to cover underestimated cost of Consortium for International Development, Washington State University, institutional contract.

PIL 20: February 1, 1987—Amends PIL 10 to include US$ 1,500 for the construction of partitions to provide better office space for the Consortium for International Development, Washington State University, team.

PIL 21: February 15, 1987—Authorizes US$ 1,000 from the Contingency line item for the preparation and printing of a brochure explaining the goals and activities of the project.

PIL 22: February 12, 1987—Transmits format for Contract Agreement with a local engineering firm to build the research centers.

PIL 23: February 12, 1987—Authorizes transfer of US$ 15,000 from Contingency line item to Technical Assistance line item to contract for a feasibility study for management training of local NCARTT staff.

PIL 24: February 24, 1987—Requests permission from the Ministry of Agriculture project steering committee to use USAID centrally funded Communication for Technology Transfer in Agriculture project staff to conduct a feasibility study on the use of mass media at no cost to the project.

PIL 25: February 28, 1987—Requests transfer of US$ 7,000 from Contingency line item to "Other Costs" line item to allow Ministry of Agriculture personnel, including the Minister, to attend a conference on Agri-energy in Geneva, Switzerland.

PIL 26: June 2, 1987—Authorizes US$ 1,500 for the local purchase of office furniture for NCARTT.

PIL 27: June 29, 1987—Approves Terms of Reference and Sample Contract Agreement for construction of national headquarters and research centers.

PIL 28: July 7, 1987—Authorizes the hiring of two local social scientists for six

months to create a socioeconomic unit within NCARTT. Funds to come from "Other Costs" budget line item.

PIL 29: July 13, 1987—Authorizes an increase in the Contract Agreement for the construction of Research Centers in order to expand existing office space in building currently housing NCARTT.

PIL 30: July 8, 1987—Authorizes payment of per diem to Ministry of Agriculture field staff who participate in the project-funded Management Skills Training Program.

PIL 30A: January 4, 1988—Authorizes additional payments of per diem based on PIL 30.

PIL 31: July 26, 1987—Further specifies authorization in PIL 29.

PIL 32: August 23, 1987—Authorizes purchase of office equipment for NCARTT to be used by the Management Information System Unit.

PIL 32A: January 11, 1988—Authorizes purchase of additional office equipment for MIS unit.

PIL 33: October 5, 1987—Authorizes purchase of office equipment for NCARTT.

PIL 33A: January 11, 1988—Authorizes additional purchase of office equipment for NCARRT.

PIL 34: October 27, 1987—Revises project budget in accordance with Project Amendment 1.

PIL 35: January 4, 1988—Authorizes additional purchase of office equipment for NCARTT.

PIL 36: November 23, 1987—Amends Consortium for International Development, Washington State University, PIO/T to: (1) add Participant Training component to Technical Assistance component under Consortium for International Development, Washington State University, institutional contract and transfers US$ 497,000 from Inflation line item to Training line item; (2) transfer local procurement activities from Mission Controller's Office to Consortium for International Development, Washington State University, institutional contract; (3) transfer responsibility for the hiring of local experts from University of Hawaii contract to Consortium for International Development, Washington State University, contract, and transfer US$ 300,000 from Inflation line item and US$ 50,000 from Contingency line item to the Technical Assistance line item to do so; (4) transfer local short-term training responsibility from Mission to Consortium for International Development, Washington State University, contract, and transfer US$ 250,000 from the Inflation line item to the Technical Assistance line item to do so; and (5) transfer "Eliza" activities in viral detection from the Jordan Valley Agricultural Services Project to the Consortium for International Development, Washington State University, institutional contract, and transfer US$ 750,000 from the Contingency line item to the Technical Assistance line item to do so.

PIL 37: October 27, 1987—Authorizes contract with Manar Consulting Engineers for the design and construction supervision of research centers at $ 585,450.

PIL 38: October 21, 1987—Authorizes use of project funds for inland transportation of 25 project vehicles from Aqaba to Amman.

PIL 38A: December 30, 1987—Authorizes payment for inland transportation of 26 (sic) vehicles from Aqaba to Amman.

PIL 39: December 9, 1987—Transfers funds to pay for design and construction supervision contract as per PIL 37.

PIL 40: January 11, 1988—Requests the use of project funds to pay for 20 private-sector producers and exporters to travel to EEC markets prior to initiation of the Agricultural Marketing Development Project.

PIL 40A: October 24, 1988—"De-earmarks" US$ 29,900 from authorized amount in PIL 40.

PIL 41: January 11, 1988—Request to contract with a short-term Farming Systems expert in "response farming", using the Other Costs line item for US$ 8,500.

PIL 41A: November 21, 1988—Transfers US$ 2,000 from PIL 41 to the Training line item.

PIL 42: January 11, 1988—Request for use of US$ 10,500 from Evaluation line item to undertake baseline data collection for farming systems research on 300 wheat farmers.

PIL 42A: August 16, 1988—Increases the amount of PIL 42 by US$ 3,000.

PIL 43: January 13, 1988—Requests the use of US$ 8,000 to hire an expatriate technical advisor to give a presentation at a Policy Planning Workshop.

PIL 44: January 26, 1988—Transfers US$ 70,000 from the Inflation line item to the Other Costs line item to pay for agricultural marketing activities agreed to in PIL 40.

PIL 45: February 4, 1988—"De-earmarks" funds from various line items which were not fully expended in the first three years of the project.

PIL 46: February 16, 1988—Describes the warranty servicing procedures for 26 project vehicles.

PIL 46A: February 15, 1989—De-earmarks US$ 5,326 from PIL 46 and transfers the funds from the Commodities line item to the Training line item.

PIL 47: March 1, 1988—Authorizes the local procurement of some computer software and supplies. Denies local procurement of additional software citing 100 percent price differential of similar software available in the U.S.

PIL 48: February 14, 1988—Authorizes the procurement of rangeland equipment for US$ 4,600.

PIL 49: April 19, 1988—Authorizes the procurement of computer equipment for US$ 18,200.

PIL 49A: July 6, 1988—Increases the authorization in PIL 49 to US$ 23,200.

PIL 50: April 19, 1988—Requests authorization to hire short-term advisor to re-examine wheat subsidy program for US$ 30,459.

PIL 51: May 5, 1988—Authorizes the Ministry of Agriculture to prepare tender documents for the construction of a "meeting hall" on top of the current NCARTT building in Baqa'.

PIL 52: May 9, 1988—Authorizes US$ 5,250 to pay for printing costs of an "Organizational Statement of the Ministry of Agriculture."

PIL 52A: November 2, 1988—De-earmarks US$ 643 from PIL 52.

PIL 53: May 10, 1988—Grants Variation Order No. 1 increasing the floor area of the research centers by 4,600 sq. meters.

PIL 53A: April 13, 1989—Authorizes payment of JD 10,000 to cover variation Order No. 1 in PIL 53.

PIL 54: June 5, 1988—Authorizes local procurement of US$ 340,000 for equipment and supplies.

PIL 55: August 2, 1988—Authorizes trip by NCARTT Director to Consortium for International Development offices in Tucson, Arizona at a cost of US$ 2,900.

PIL 55A: November 2, 1988—Cancels PIL 55.

PIL 56: August 16, 1988—Authorizes US$ 1,700 for the preparation of a document entitled "Policies and Priorities draft working paper for ARTT."

PIL 57: August 23, 1988—Transmission of Information for Bidders (IFB) documents to the Ministry of Agriculture.

PIL 58: September 18, 1988—Requests that US$ 350,000 be transferred to the Consortium for International Development, Washington State University, contract to cover unforeseen expenses in the procurement, design and engineering activities for the five research facilities. US$ 100,000 to come from the Contingencies line item, US$ 200,000 from the Inflation line item, and US$ 35,000 from the Other Costs line item.

PIL 59: September 26, 1988—Requests authorization to use US$ 50,000 from the Training line item to send 27 Ministry of Agriculture staff to the University of Jordan for M.S. (15) and B.S. (12) degrees.

PIL 59A: March 28, 1989—Clarifies financial support to be provided in PIL 59.

PIL 60: September 27, 1988—Informs the Ministry of Agriculture that the Condition Precedent for "Disbursement for Facility Construction" have been met.

PIL 61: October 16, 1988—Authorizes the earmarking of US$ 42,013.44 for training in English and computer usage, as well as per diem for the Ministry of Agriculture NCARTT staff to attend workshops.

PIL 62: October 18, 1988—Gives approval to Addendum No. 1 to the IFB concerning construction of facilities.

PIL 63: October 20, 1988—Authorizes US$ 1,200 for a member of the University of Jordan Faculty of Agriculture to attend a beekeeping conference in Cairo.

PIL 64: November 17, 1988—Allocates US$ 100,000 for use in combating locusts.

PIL 64A: December 20, 1988—Increases amount in PIL 64 to US$ 200,000.

PIL 64B: February 15, 1989—Authorizes the disbursement of US$ 50,000 from the Locust Control Fund Account to pay for technical assistance and training.

PIL 65: January 26, 1989—Authorizes the hiring of an agricultural economist for the Ministry of Agriculture's Monitoring Unit for one year. At the end of one year, this person's salary would be continued by the Ministry of Agriculture.

PIL 66: December 13, 1988—De-earmarks US$ 100,000 earmarked in PIL 54 and authorizes the purchase of US$ 25,000 worth of protective suits for use in the anti-locust campaign.

PIL 67: January 23, 1989—Deletes Contingency and Inflation line items and transfers the US$ 2.272 million to the Land and Facility Construction line item due to price increases. Specifies amounts for Baqa' and the four regional agricultural research centers.

PIL 67A: March 22, 1989—Provides concurrence for the Ministry of Agriculture's selection of a construction firm for the Ramtha RASC, and authorizes up to US$ 520,656 for the contract.

PIL 67B: March 23, 1989—Provides concurrence in the selection of contractors for the

national headquarters and the remaining three regional agricultural research centers, and specifies financial limits for each contract.

PIL 67C: May 21, 1989—Repeats concurrence and amounts given in 67A.

PIL 67D: August 26, 1990—Increases committed funds for the Ramtha RASC by US$ 228,000 and reduces the allocations given to the Baqa' Headquarters and the three other regional agricultural research centers by the same total amount.

PIL 67E: October 12, 1992—Concurs with the termination of the contract noted in PIL 67A, and de-obligates US$ 250,000 from the loan agreement due to the Ministry of Agriculture's inability to disburse it by September 30, 1992.

PIL 68: December 22, 1988—Concurs with the Ministry of Agriculture selection of same contractors referred to in PIL 67B.

PIL 69: January 25, 1989—Approves addenda Nos. 6 and 7 to construction contracts cited in PILs 67A and 67B.

PIL 70: January 26, 1989—Authorizes purchase of a fax machine for NCARTT for US$ 1,500.

PIL 70A: February 16, 1989—Authorizes an additional US$ 1,000 for the purchase of the fax machine in PIL 70.

PIL 71: February 1, 1989—Authorizes an additional US$ 200,000 from the ADF for use in the Locust Control Program.

PIL 71A: February 5, 1989—Authorizes an additional US$ 50,000 from the ADF for use in the Locust Control Program.

PIL 71B: September 9, 1990—De-earmarks US$ 100,000 for use in the Locust Control Program since USAID Washington's Office of Foreign Disaster Assistance had already paid this amount.

PIL 72: May 24, 1989—Transfers US$ 37,000 from the Technical Assistance line item to the Evaluation line item to cover the cost of the Mid-term Evaluation (otal cost, US$ 53,500).

PIL 73: June 7, 1989—Transfers US$ 4,000 from the Technical Assistance line item to the Evaluation line item to cover the cost of an eminent Jordanian to participate in the Mid-term Evaluation.

PIL 74: July 19, 1989—Authorizes US$ 3,300 from the Other Costs line item for NCARTT Director to travel to Washington State University to meet prospective long-term technical assistance candidates and assist in their orientation.

PIL 75: June 1, 1989—Approves subcontract for electro-mechanical work at Baq'a Research Station.

PIL 76: September 5, 1989—Transfers US$ 50,000 from the Technical Assistance line item to the Commodities line item to cover a shortfall in a PIO/C for US$ 2.4 million for laboratory casework at the NCARRT Headquarters and the four research centers.

PIL 77: October 3, 1989—Transfers additional funds to cover cost of casework: (a) reduces PIO/C from US$ 2 million to US$ .5 million; (b) transfers US$ 100,000 from Technical Assistance line item to Commodities line item; (c) transfers US$ 150,000 from Locust Control Program in PIL 71 to Commodities line item; and (d) transfers US$ 400,000 in unearmarked funds to Commodities line item.

PIL 78: October 11, 1989—Authorizes three Variation Orders to the Baq'a NCARRT

construction contract; PVC doors, foam concrete, and solid slabs.

PIL 79: October 11, 1989—Earmarks US$ 4,000 from Technical Assistance line item to support a Soil Solarization Conference to be held at the University of Jordan.

PIL 79A: May 13, 1990—Increases the amount earmarked in PIL 79 by US$ 336.78.

PIL 80: October 22, 1989—De-earmarks US$ 3,018 from PIL 42 and increases PIL 73 by US$ 1,000 to cover additional costs of including a Jordanian professional on the Mid-term Evaluation Team.

PIL 81: November 2, 1989—Transfers US$ 148,009.90 (out of US$ 150,000) from PILs 64, 64A, and 64B to the ADF since the expected locust invasion did not occur.

PIL 82: December 26, 1989—Transfers US$ 5,000 from the Other Costs line item to the Commodities line item for laboratory casework in order to pay US$ 8,060 in shipping and demurrage charges which had not been paid by USAID Washington's Procurement Services Agent.

PIL 82A: March 1, 1990—Increases PIL 82 by US$ 670.

PIL 83: January 16, 1990—Approves Variation Order No. 7 which extends construction period for Baq'a building by three months.

PIL 84: January 16, 1990—Approves Variation Order No. 6 which increases the Ministry of Agriculture, Manar construction contract by JD 2,000.

PIL 85: January 16, 1990—Approves Variation Order No. 4 concerning the Ramtha RASC Construction Contract (no additional costs).

PIL 86: January 22, 1990—Approves Variation Order No. 4 which changes the piping to be used in the Baq'a Construction Contract from iron to plastic. Approves Variation Order No. 8 changing the paint to be used from emulsion to semi-gloss at a cost increase of JD 3,969.

PIL 87: January 23, 1990—Authorizes payment from Other Costs line item of JD 745 for posters and newsletters concerning the Desert Locust.

PIL 88: January 15, 1990—Approves a subcontract between Yousef Abu-Ayyash Contracting and Trading Company and the United Engineers Contracting Establishment concerning electro-mechanical work at Al-Rabba RASC.

PIL 89: February 28, 1990—Approves Variation Orders 10, 11, 12, and 13 for construction of the Ramtha, Mushagar, Al-Rabba, and Shoubak RASCs for a change from poly-propylene pipes to iron pipes.

PIL 90: March 1, 1990—Authorizes changes in the drawings for electric water heaters which will be installed in the regional agricultural research centers.

PIL 91: March 6, 1990—Approves Variation Order No. 16 extending Baq'a Construction Contract by one month.

PIL 92: July 8, 1990—(In draft, not sent.) Letter requests that the Ministry of Agriculture expedite the approval of PIL 92 which, in turn, alters the ADF approval and disbursement policies.

PIL 92: January 9, 1991—Transfers US$ 91,884 allocated in PIL 106, plus JD 59,593.723 from the ACC to the Technical Assistance and Services Office Special Account.

PIL 93: June 18, 1990—Amends and revises Annex 1 to the project agreement as per the recommendations of the Mid-term Evaluation Report and the Audit Report

to more properly reflect the many changes to the original project documents dated July 31, 1985.

PIL 94: May 16, 1990—Lowers the amount of a contract with Hamilton Industries for laboratory equipment by US$ 21,615.

PIL 95: May 23, 1990—Earmarks $10,000 from the Other Costs line item for the new NCARRT Director to travel to the U.S. to visit Washington State University and participate in a management training course.

PIL 95A: June 21, 1990—Authorizes up to US$ 300,000 to Royal Jordanian Airlines to construct and equip a 60 metric ton cold storage unit at Amman Airport. Transfers the US$ 300,000 from the Technical Assistance line item to the ADF line item.

PIL 96: July 18, 1990—Authorizes a total of US$ 23,406 left over from PILs 32 and 49 to purchase seven fax machines for NCARTT.

PIL 97: July 18, 1990—De-earmarks remaining funds from PILs 33, 38, 59, 61, 66, 70, and 74 for a total of US$ 63,136.

PIL 98: July 31, 1990—Earmarks US$ 45,000 to pay the salaries of Dr. Sharaf as the Director of NCARTT and as the Director of the National Agricultural Development Project on behalf of the Ministry of Agriculture for a period of two years. To be charged to the Technical Assistance line item and not to the Consortium for International Development, Washington State University, contract.

PIL 98A: August 1, 1990—Authorizes payment of PIL 98 for up to two years.

PIL 98B: May 5, 1991—Calls attention to the fact the Dr. Sharaf has not met his contractual obligations in terms of quarterly reporting and interaction with USAID, nor has he provided progress toward making NCARTT a semi-autonomous agency.

PIL 98C: May 30, 1990—Approves a one year extension to Dr. Sharaf's contract and reminds the Ministry of Agriculture of his reporting responsibilities.

PIL 99: August 29, 1990—Informs the Ministry of Agriculture of recommendations made by the Regional Inspector General audit conducted in late 1989 and specifies the actions that the Mission has taken to comply with the recommendations.

PIL 100: August 28, 1990—Approves Variation Orders No. 17-20 extending the construction contracts for the four regional agricultural research centers by one month each.

PIL 101: September 16, 1990—Approves Variation Order No. 31 increasing the amount of the Shoubak RASC construction contract by JD 16,900.

PIL 102: September 3, 1990—Approves Variation Order No. 28 extending the Shoubak RASC construction contract by 14 days.

PIL 103: September 12, 1990—Approves Amendment No. 1 to Stage II for Construction Supervision with Manar Consulting Engineers by 12 months at a cost increase of JD 149,990.05. using funds available under PIL 39.

PIL 104: October 24, 1990—(Not Issued.)-Advises the Ministry of Agriculture of the termination of the Consortium for International Development contract, the termination of U.S.-hired staff, the termination of the Jordanian staff, and the

transfer of responsibility for trainees in the U.S. and at the University of Jordan to the Ministry of Agriculture and USAID.

PIL 104: April 22, 1991—Approves Variation Order No. 33 for an extension to the construction contract for the Mushaqar RASC by 60 days.

PIL 105: October 28, 1990—Approves Variation Order No. 32 which replaces rock wool by perlite concrete in the Shoubak RASC construction contract.

PIL 106: November 15, 1990—Establishes a Technical Assistance and Services Organization (Technical Assistance and Services Office), and a Special, interest-bearing Bank Account for the National Agricultural Development Project. Names Dr. Abdullatif Kamal as the chief of the Technical Assistance and Services Office, and the horticultural specialist for NCARTT responsible directly to the Minister of Agriculture under a contract between Dr. Kamal and the Higher Council for Science and Technology. Based on a 13-month budget, December 1, 1990–December 31, 1991, US$ 294,048 is obligated including US$ 146,019 for Technical Assistance (Technical Staff, Administrative and Secretarial Staff, and Office Supplies), US$ 15,314 for Equipment and Commodities, US$ 40,831 for Training, and US$ 91,884 for the ADF. Entire package contingent upon the negotiation of a MOU between USAID Jordan and Dr. Kamal (attached to PIL 106). Cites considerable cost savings due to the cancellation of the Consortium for International Development contract.

PIL 106A: March 17, 1992—Authorizes US$ 429,871 to The Technical Assistance and Services Office for the period January 1, 1992, to December 31, 1992, plus US$ 107,938 in unspent funds from the previous 13-month budget for a total of US$ 537,809.

PIL 106B: October 27, 1992—Authorizes an additional US$.100,228 for The Technical Assistance and Services Office (US$ 19,727 for Technical Assistance and US$ 80,501 for commodities), which is urgently needed.

PIL 106C: June 15, 1993—Authorizes an additional US$ 776,853 which is urgently needed for The Technical Assistance and Services Office for the period up until the project assistance completion date, September 30, 1994 (US$ 225,420 for Technical Assistance, US$ 200,463 for Commodities, US$ 100,970 for Training, and US$ 250,000 for the ADF).

PIL 107: November 29, 1990—Authorizes the transfer of US$ 400,000 from the Technical Assistance line item to the Training line item to continue the financial support for six Ph.D. students in the U.S., as well as for eight to ten additional students that the Ministry of Agriculture might nominate. Also transfers the responsibility for these students from Consortium for International Development to the USAID Office of International Training.

PIL 108: December 5, 1990—Approves the contract between Dr. Kamal and the Higher Council for Science and Technology to serve as Chief of The Technical Assistance and Services Office, and Chief Horticultural Expert at NCARRT.

PIL 109: December 17, 1990—Authorizes an extension to the project assistance completion date to September 30, 1994, to allow for: (1) technical assistance to be provided through project-funded locally hired consultants; (2) participant training in the U.S.; and (3) Agricultural Development Fund projects. It also states that all other NCARTT project activities, including facility construction

shall be completed by the current project assistance completion date of September 30, 1992. Attached memorandum justifies the extension on the grounds of: (1) the need for the institutionalization of The Technical Assistance and Services Office; (2) the need to continue financial support for the graduate students in the U.S.; and (3) the continuation of the ADF.

PIL 109A: March 3, 1992—Authorizes an extension of the project assistance completion date to September 30, 1994, for *all project activities.*

PIL 110: December 4, 1990—Approves Variation Order No. 33 for electric cable at the Ramtha RASC at a cost increase of JD 2,790.

PIL 111: December 11, 1990—Approves Amendment No. 3 to the contract between the Ministry of Agriculture and Hamilton Industries for laboratory equipment and installation. Amendment No. 3 alters Terms of Payment including documentation, destination, and conditions of payment.

PIL 112: January 9, 1991—Provides guidelines and procedures for the disbursement of ADF funds which were promised in PIL 106. Attachment provides more specific instructions.

PIL 113: February 19, 1991—Approves Amendment No. 2 to Stage II of the Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision. This amendment increases the value of the contract by JD 20,718 due to devaluation of the dinar.

PIL 114: March 22, 1991—Approves Variation Order No. 35 to the Baq'a NCARTT construction contract which increases the amount by JD 21,270 and extends the construction period by 35 days.

PIL 115: March 22, 1991—Approves subcontract between Al-Arab Construction Co. and Diran Contracting Co. for installation services of the electro-mechanical works at Baq'a NCARTT.

PIL 116: April 4, 1991—Approves Variation Order No. 34 which extends the period of the Ministry of Agriculture Toukan contract for the construction of the Shoubak RASC by 50 days.

PIL 117: April 4, 1991—Approves Variation Order No. 36 which extends the period of the Ministry of Agriculture, Samara & Yousef Contracting Company contract for the construction of the Ramtha RASC by 19 days.

PIL 118: April 22, 1991—Approves Variation Order No. 37 which authorizes the use of black steel class B pipe instead of seamless black steel pipe. This reduces the total amount of the Baq'a construction contract by JD 3,465.

PIL 119: June 9, 1991—Agrees to advance to the Ministry of Agriculture (for advance to the contractor, Manar Consulting Engineers) the cost of completing delayed construction items due to delays in the delivery of casework by the Hamilton Company for the Ramtha RASC.

PIL 120: July 11, 1991—Requests authorization from the Minister of Planning for the transfer of US$ 150,000 from the Technical Assistance line item to the Training line item to pay for increased costs associated with five candidates studying for Ph.D.s in the U.S.

PIL 121: August 4, 1991—Approves Amendment No. 3 to Stage II which increases construction supervision costs by JD 4,535.100 and extends the completion date from August 7, 1991, to September 7, 1991.

PIL 122: August 27, 1991—Approves Variation Order No. 3 Stage I (Design Component) at a cost of JD 5,000 for additional design services. Transfers the funds from Stage II (Construction Component).

PIL 123: September 4, 1991—Approves Amendment No. 4 to Stage II Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision which extends the completion date from September 7, 1991, to November 7, 1991.

PIL 124: November 3, 1991—Approves Ministry of Agriculture drafted documentation pertaining to the tendering for a new construction contract for the completion of the Baq'a NCARTT building, and grants permission to the Ministry of Agriculture to advertise for the submission of bids. Requires that the Ministry of Agriculture terminate its contract with Al-Arab Construction Company. Advises that the project assistance completion date for construction activities is September 30, 1992—and that all construction must be completed by that date.

PIL 125: November 6, 1991—Approves Amendment No. 5 to Stage II of the Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision which extends the completion date of Stage II from November 7, 1991, to January 7, 1992.

PIL 126: January 11, 1992—De-earmarks at total of US$ 45,784 from PILs 32, 35, 47, 48, 73, 40, 41, 56, and 98 which was committed but not spent. Amounts will be re-earmarked once new purposes are identified.

PIL 127: December 4, 1991—Approves Addendum No. 1 to Baqa's IFB which postpones the submission date for construction proposals to December 10, 1991.

PIL 128: December 5, 1991—Requests that the Ministry of Agriculture return the unutilized balance of Dr. Naim Sharaf's salaries to the USAID Amman Controller. (Funds obligated in PIL 98, amount of funds to be returned not specified.)

PIL 129: Missing.

PIL 130: January 5, 1992—Advises Minister of Planning of the need to change the project budget increasing the ADF and Training line items and decreasing the Technical Assistance line item.

PIL 131: January 7, 1992—Approves Amendment No. 6, Stage II to the Ministry of Agriculture Manar Consulting Engineers' contract for Construction Supervision which extends the completion date of Stage II from January 7, 1992, to March 7, 1992.

PIL 132: February 24, 1992—Approves Variation Order No. 4 of Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision (Stage II) which increases the construction supervision cost by JD 6,750.

PIL 133: March 2, 1992—Approves Amendment No. 7 to the Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision of Stage II which extends the completion date from March 7, 1992, to May 7, 1992.

PIL 134: May 5, 1992—Approves Amendment No. 8 to the Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision of Stage II which extends the completion date from May 7, 1992, to July 7, 1992.

PIL 135: May 27, 1992—Approves Addendum No. 1 to Baqa's IFB with the provision that a clause providing for "mobilization money" be deleted.

PIL 136: June 30, 1992—De-earmarks funds from PIL 18 (ACC/ADF for US$ 89,346) and PIL 95 (Cold Storage Facilities for US$ 300,000) for a total of US$ 389,346 to cover the cost of the Agricultural Sector Review and Implementation Plan. PIO/T, Scope of Work, Terms of Reference, and Budget attached.

PIL 137: July 12, 1992—Approves Amendment No. 9 to the Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision of Stage II which increases the construction supervision cost by JD 37,800, and extends the completion date from July 7, 1992, to September 7, 1993.

PIL 138: September 8, 1992—Earmarks US$ 160,000 for the local procurement of steel and cement, "to complete the construction of the NCARTT building at Baq'a and the renovation, rehabilitation, and remodeling of NCARTT's substations."

PIL 138A: October 8, 1992—De-earmarks US$ 29,022.09 from PIL 138 as it was not required.

PIL 139: September 15, 1992—Requests that the Ministry of Agriculture prepare a space utilization plan for the NCARTT building at Baq'a including the consolidation of other laboratories in the Amman and Baq'a area. Due date, March 31, 1993.
September 21, 1992—Letter to the Minister of Agriculture informing him that the final invoice from the Al-Arab Construction Company in the amount of JD 134,127.80 is denied on the grounds that liquidation damages (JD 240,667.38), concerning the construction contract are higher than the amount of the invoice. The letter also reminds the Minister that in spite of the fact that the Government of Jordan took a high-level decision not to collect liquidation damages, the bilateral agreement mandates USAID contracts with the Government of Jordan to be approved by the Mission and that approval to waive such charges was not given.

PIL 140: November 18, 1992—Concurs with the Ministry of Agriculture's selection of the Arab Business Corporation as the lowest bidder, at a cost of JD 1,726,888.542 for the completion of the Baq'a NCARTT building. Mission agrees to earmarks US$ 1,895,293 to this activity which is lower than the bid amount; Government of Jordan to make up the difference.

PIL 140A: January 21, 1993—Approves the Ministry of Agriculture's contract with the Arab Business Corporation for completion of the Baq'a NCARTT building.

PIL 141: July 25, 1993—Agrees that USAID will partially finance invoices three and four, and fully finance future invoices for completion of the Baq'a NCARTT up to US$ 1,895,293. Scheduled completion date; February 1994.

PIL 142: September 9, 1993—Approves Amendment No. 10 to the Ministry of Agriculture Manar Consulting Engineers' contract for construction supervision which extends the completion date of the contract by seven months from September 7, 1993, to April 7, 1994.

PIL 143: February 10, 1994—Earmarks US$ 120,000 for the construction of cold storage facilities at Queen Alia International Airport which will supplement US$ 230,000 already earmarked by the Agricultural Marketing Development Project.

PIL 144: February 10, 1994—Transfers US$ from the Contingency line item to the Technical Assistance line item. No purpose given.

PIL 145: April 6, 1994—Approves Amendment 11 to the Ministry of Agriculture Manar Consulting Engineers Contract for design and construction supervision of the Baq'a NCARTT by three months from April 7, 1994 to July 7, 1994.

13.9. Summary Financial Statements

Original Project Budget (US$'000)
Life of Project Total

	AID		Government	
	Grant	Loan	of Jordan	Total
Technical Assistance	4,445			4,445
Commodities	6,204		500	6,704
Training	753		59	812
Evaluation	125			125
Agricultural Development Fund	3,500		6,750	10,250
Land and Facility Construction		4,728	1,000	5,728
Government of Jordan (Personnel and Operations)			14,148	14,148
Contingency	1,953	1,336	2,321	5,610
Inflation	3,520	936	10,033	14,489
Totals	20,500	7,000	34,811	62,311

End of Project Budget (US$'000)
(as of May 23, 1994)

	AID		Government	
	Grant	Loan	of Jordan	Total
Technical Assistance	8,264			8,264
Commodities	6,854		3,550	10,404
Training	1,124		145	1,269
Evaluation	169			169
Agricultural Development Fund	1,961		1,500	3,461
Land and Facility Construction		6,150	1,545	7,695
Design Services		172		172
Construction Supervision		453		453
Government of Jordan Personnel and Operations			16,400	16,400
Other Costs	128			128
Contingency				
Inflation				
Totals	18,500	6,775	23,140	48,415

Source: Project paper and project staff.

13.10. Impact Assessment

13.10.1 Introduction

The following impact assessment of the National Agricultural Development Project (National Agricultural Development Project), initially entitled the Highlands Agricultural Development Project (HADP), was conducted between the months of April and June 1994 as part of the final evaluation of the project. The seven-person assessment and evaluation team was composed of three U.S.-based and four Jordan-based agricultural development experts with broad experience in both the technical as well as the administrative and managerial aspects of projects of this type and scope. (The methodology employed in conducting both this assessment and the final evaluation can be found in the evaluation report. Additionally, biographical sketches for the team members can be found in the annexes to the Evaluation Report.)

The National Agricultural Development Project is a US$ 48,415,000 (USAID $25,275,000; Government of Jordan $ 23,140,000), nine-year (July 1985-September 1994) bi-lateral project with the Ministry of Agriculture of the Government of Jordan (Government of Jordan). The project has been both large in financial terms and long in its implementation compared to similar projects of this type. The purpose of the project has been to stimulate greater agricultural production through applied research, improved technology transfer methodologies, and various strategic activities aimed at strengthening institutional capabilities in the agricultural sector. Project inputs directed at achieving this purpose have included long- and short-term technical assistance, degree and nondegree training both locally and in the United States, the construction and equipping of physical facilities, and the establishment of an Agricultural Development Fund (ADF) to finance various research activities and other "targets of opportunity" in the agricultural sector.

While the project purpose has remained the same over the nine-year life of the project, the means of achieving this purpose has changed substantially. In part these changes have been intentional due to changing conditions and needs in the agricultural sector of Jordan, and in part they have been due to conditions and events beyond the scope of the project's designers, its implementors, or the mission's project monitors to foresee or control. Of greatest importance to the assessment of the impact of this project is the latter category which, while not having negated the impact of many elements of the project, has severely slowed progress toward achievement of its purpose in addition to making the impact somewhat difficult to measure, at least quantitatively.

Central to this list of conditions and events are the Gulf War, the frequent turnover of key decision makers involved in the project—especially the Minister of Agriculture and the NCARTT Director General—and the Government of Jordan's often counterproductive rules, regulations, and procedures within which the project has been implemented. Qualified personnel related to the project, as well as the evaluation team, estimate that the project is approximately four to five years behind schedule in obtaining its optimal impact. Said differently, the project is currently at the stage of impact that it would have been in 1989 or 1990, had these conditions and events not occurred.

The Gulf War essentially brought the project to a halt during the years of 1990 and 1991. As a result, the second wave of technical assistance advisors was evacuated from

Jordan and was not able to return once peace was restored. This essentially truncated much of the work of the technical assistance team, which had been in progress since 1987. Additionally, relatively large amounts of construction activities were put on hold for the period of the war, and in some cases the logical sequencing of events (for example, the construction of laboratories, the installation of their equipment, and the technical assistance and training to operate them) was almost completely interrupted.

Over the nine years of the life of the project, the Minister of Agriculture was changed eleven times and the NCARTT Director General changed five times. This meant that policies and procedures that had been planned or agreed to by the people in these two key decision making positions were in an almost constant state of flux, with project staff having to orient new decision makers as to the goals of the project or gain their confidence on an almost continuous basis. In other cases, new decision makers arrived with different philosophies, strategies, or agendas, which put them at odds with those of the project. (The best example of this is one minister in 1991 who transferred 82 of NCARTT's best researchers to different positions and geographic locations while at the same time removing all extension activities from the NCARTT mandate. This meant that many of the ongoing research and technology transfer activities—many of which were funded by the ADF—came to a halt.)

Other conditions and events that have reduced the impact of the project, and that were beyond the control of project-related personnel, are Government of Jordan policies and procedures that run counter to maximizing the impact of the project. First and foremost of these has been the bureaucratic placement of NCARTT within the Ministry. In spite of a "condition precedent" in the project agreement tending toward autonomy, when NCARTT was created it was not given autonomous status from the Ministry of Agriculture but was placed under the project's Department of the Ministry. This resulted in the NCARTT Director General having direct responsibility for the implementation of many project activities but almost no authority with which to exercise this responsibility. It also meant that NCARTT was forced to function within strict bureaucratic regulations of the Ministry of Agriculture which are not conducive to proper, scientific agricultural research and technology transfer. Additionally, it meant that the incentives which qualified professionals require in order to conduct sound scientific research and technology transfer activities could not be provided. Indeed, progress toward achievement of this important aspect of the project did not occur until June 1993, when NCARTT was given "semiautonomous" status affording it some degree of independence and authority over its activities.

Lastly, it should be mentioned that in the early years of the project two baseline surveys were authorized in order to enable, "future evaluators to be better equipped to evaluate project activities." However, both of these surveys (one directed at 300 wheat farmers and the other directed at a general sample of farmers), could best be termed "socioagronomic" studies, which describe sociocultural and agrocultural indicators and opinions of a selected sample of rural households. Both surveys are devoid of quantitative economic data against which current macroeconomic data could be compared (i.e., production, land area, yields, income, etc.), and both would require the reinterviewing of the same farmers in order to judge the possible impact of the project. Neither the funds nor the time to do this were allocated to this current assessment and evaluation.

13.10.2. Impact of National Agricultural Development Project activities on NCARTT

13.10.2.1 Institutional Structure, Staffing, and Management

13.10.2.1.1 Institutional Structure

The National Agricultural Development Project played a key role in assisting the Ministry of Agriculture in establishing the National Center for Agricultural Research and Technology Transfer (NCARTT) within the Kingdom of Jordan. Currently NCARTT has a national center in Baq'a, six (6) regional agricultural research centers (RASCs), and six regional substations where research is being carried out and services are being provided to farmers. This national-level system forms an institutional framework to provide area specific, problem-solving adaptive research as well as laboratory and other services needed for agriculture in the various production areas of the country.

Until recently, NCARTT was organized along traditional commodity-based lines such as horticultural crops, field crops, and tree crops. However, as a result of the ADF-financed National Research Strategy and Medium Term Implementation Plan exercise, the Center is now organized according to a multidisciplinary systems approach, which includes the areas of irrigated agriculture; rainfed agriculture; low-rainfall agriculture; and integrated livestock. This systems approach should lead to a more efficient and effective research agenda and program of technology transfer to farmers.

13.10.2.1.2. Staffing

Over the course of the National Agricultural Development Project, NCARTT has grown from a staff level of 194 with 84 professionals in 1985 to a total staff of 513 with 132 professionals in 1994. The current staff is broken down as follows: 148 permanent staff (29%), 138 on indefinite contract (27%), 69 on fixed term contracts (13%), and 158 as daily workers (31%). According to their academic qualifications, 14 have PhD degrees (3%), 46 have M.Sc. degrees (9%), seven have high diplomas (between B.Sc. and M.Sc.) (1%), 62 have B.Sc. degrees (12%), and 104 have Diplomas or Certificates (20%); the remainder have lower academic qualifications (54%).

Table 2.1

NCARTT Staff by Academic Qualifications and Geographic Location

	Ph.D.	M.Sc.	B.Sc.	Other	TOTAL
NCARTT Baq'a	13	24	26	73	136
Deir Alla	1	6	10	98	115
Al-Rabba	—	5	13	66	84
Mushaqar	—	3	8	30	41
Khaldayya	—	2	3	27	32
Ramtha	—	6	5	63	74
Shoubak	—	3	4	24	31
Total	14	49	69	381	513

13.10.2.1.3. Management

While the organic structure of NCARTT is conducive to the management of a national research organization, major problems have existed and continue to exist that adversely impact management's effectiveness. As mentioned in Section 1, the ambiguity of NCARTT's status (first under the Directorate of Projects in the Ministry of Agriculture, then as a Directorate of its own under the Ministry of Agriculture, and now as a semiautonomous organization) while providing the director general with the responsibilities of a manager, the necessary authority, and incentives to carry out those responsibilities have never been granted. Additionally, the frequent changes in leadership of the Ministry of Agriculture and of NCARTT have not allowed necessary continuity in the leadership and management of the organization.

The project has attempted to improve this situation in two areas: first, through a dialogue with Government of Jordan policy makers, and second through a series of management training programs and study tours. In the area of policy dialogue, the project has attempted to stimulate changes in NCARTT's status through a variety of means. Among these were the creation of the Technical Assistance Service Organization and its flexible Agricultural Development Fund (ADF) which funded the preparation of an overall strategy and implementation plan for NCARTT calling for complete autonomy from the Ministry of Agriculture as well as appropriate incentives for the Center's long-term management. If complete autonomy is not feasible, then other means should be sought to achieve the necessary administrative flexibility to change rules and procedures, particularly salary levels, which are not conducive to the proper management of an agricultural research institution. Additionally, the project provided funding for a buy-in to USAID Washington's centrally funded Agricultural Policy Analysis Project (APAP), Phases II and III, which is assisting the Ministry of Agriculture in establishing an Agricultural Policy Charter and development strategies for its line institutions, including NCARTT. Furthermore, since the Gulf War the project has provided financial support for the hiring of two institutional development specialists to work at NCARTT, one Jordanian and one from the U.S.

As a result of these initiatives, NCARTT was first made an independent Directorate within the Ministry of Agriculture, and in July 1993 was granted semiautonomous status through Bylaw Number 42. Although semiautonomous status does not grant the NCARTT Director General complete authority in the management of the organization, it is seen as an important step in the movement toward complete autonomy, which would set the stage for improved salary levels and other incentives for improving staff performance.

The second area of project activity directed at strengthening NCARTT's management capability was a series of management training courses and study tours in Jordan, the United States and elsewhere. These activities, however, have proven to be of limited value due to the frequent turnover in middle and upper management, the restrictive rules and regulations of the Ministry of Agriculture, and the lack of any type of incentive structure for improved staff performance. It is hoped that achievement of autonomous status for NCARTT, as well as following through on the recommendations of the national strategy for agricultural research, will help to alleviate this situation.

13.10.2.2. Physical resources and infrastructure

The National Agricultural Development Project provided loan and grant financing to assist in the construction and equipping of facilities for NCARTT at Baq'a and at the regional agricultural research centers at Ramtha, Mushagar, Rabba, and Shoubak. These facilities include offices, laboratories, libraries, conference or training rooms and machinery shops. The equipment provided includes laboratory casework, vehicles, office equipment and farm machinery. The project has also provided some office equipment (computers), training and software to the Ministry of Agriculture's Personnel Department.

Additionally, the project has provided partial funding for a produce cooling chamber at the Amman International Airport. This has been done in conjunction with the Mission's Agricultural Marketing Project, which seeks to stimulate the export of fresh produce to regional and European markets.

When completed, fully equipped, and staffed, the NCARTT headquarters at Baq'a, together with its six regional agricultural research centers (four of which were constructed with assistance from the project), will provide a national and regional infrastructure and technical capacity with the potential to raise the level of agriculture research and scientific technology transfer to a higher plane than in the past. Additionally, the NCARTT offices in Baq'a will house the country's National Agriculture Library and Information Center (NALIC).

13.10.2.3. Planning and development of NCARTT's research and technology transfer programs

The project's impact on the planning and development of NCARTT's Research and Technology Transfer Program has been mixed. There have been several changes in the approach used for the planning and development of NCARTT's capabilities over the course of the project. The project design called for the utilization of the Systematic Commodity and Resource Analysis and Development (SCRAD) approach to identify production constraints and establish research and development priorities. In 1987, the SCRAD approach was dropped

and replaced by Farming Systems Research and Extension methodology to involve farmers in identifying and prioritizing research and extension needs. The Washington State University Consortium for International Development Farming Systems advisor conducted a FSR/E Workshop for 43 participants in 1989 and then directed a survey of 279 farmers from all parts of the kingdom in 1990 to identify and prioritize farmers problems. NCARTT management was in the process of using the results of the farmer survey to design their research program when, in 1991, 82 of its employees were transferred to other positions in the Ministry. This effectively ended the attempt to apply FSR/E methodology to research and technology transfer planning. To date, NCARTT has not returned to this approach and relies instead on the long-standing traditional approach of using interaction between program leaders at headquarters and field researchers to plan its research program.

Over the past year, the project has had renewed and significant impact on NCARTT thinking about research planning and development through its funding of the elaboration of an Agricultural Research Strategy and Medium Term Implementation Plan. The strategy has set general guidelines for research planning which are being refined in the Medium-Term Implementation Plan. When completed, the strategy and plan should make a major contribution to NCARTT's approach to research planning and development.

The project had a positive impact on the planning and development of NCARTT's technology transfer program when a resident Washington State University Consortium for International Development extension advisor was working with NCARTT and the Ministry of Agriculture technology transfer staff in 1987–1989. The advisor worked on introducing methodologies and conducting on-the-job and formal training programs in technology transfer organization and procedure. Progress in this area was slowed when the extension advisor departed country and completely stopped when the responsibility for direction of extension agents was shifted from NCARTT to the Ministry of Agriculture in late 1992. The overall, lasting impact of the project on the planning and development of NCARTT technology transfer programs has therefore been slight.

13.10.2.4. NCARTT research and technology transfer capability and management

The project has had a major impact on NCARTT's research capability by providing funding for: (1) construction and equipping the headquarters building at Baq'a and the four regional agricultural research centers; (2) degree training for seven PhD's and 48 M.Sc.'s and short-term training for several hundred NCARTT and Ministry of Agriculture employees; (3) establishing the Agricultural Development Fund to promote collaborative research and to respond to high priority targets of opportunity; and (4) establishing the National Agricultural Library and Information Center. There are significant resources in place, but much remains to be done for NCARTT to realize its full potential such as (1) securing full autonomy or the flexibility to be able to offer competitive salaries; (2) establishing a systematic process to identify and prioritize research needs; and (3) reshuffling personnel and programs to develop a smaller, high quality staff capable of conducting and directing others in conducting specific high priority research and technology transfer activities.

The project has had some limited impact on those responsible for managing NCARTT's research and technology transfer programs, principally through their interaction with project-funded technical advisors and through short-term training courses. The improvements in

management have been less than hoped for because of the frequent turn-over of NCARTT directors and the lack of serious attention to tightening up research and technology transfer monitoring and supervision procedures within the organization.

13.10.2.5. Interinstitutional linkages and acquisition

The project has had significant impact on NCARTT's activities related to interinstitutional linkages and technology acquisition. The project's emphasis on promoting interinstitutional coordination took many forms, starting with the project design concept of establishing an Agricultural Development Council continuing through the NCARTT Steering Committee to the present NCARTT Council. The present arrangement, established under Bylaw No. 42, provides for the Minister of Agriculture to serve as chairman and the director general of NCARRT as the deputy chairman of the NCARTT Council, which also includes the secretary general of the Higher Council for Science and Technology and the secretary general of the Ministry of Agriculture as well as representatives from the Ministries of Planning and Water and Irrigation, the Faculties of Agriculture of the University of Jordan and JUST, and a scientist appointed by the Minister of Agriculture. The Council is supposed to meet at least monthly to discuss and coordinate activities in agricultural research and technology transfer.

The project has supported coordination between NCARTT, the Ministry of Agriculture, and the JCO in providing improved seed and related technologies to JCO members. The project funded preparation of the Agricultural Research Strategy and Medium Term Implementation Plan which served the very useful purpose of bringing researchers from NCARTT, the Ministry of Agriculture, the universities and the private sector together to consider ways to improve agricultural research focus, prioritization and implementation. These are significant achievements but fall short of establishing the kind of strong and continuous interinstitutional linkages needed to coordinate programs and optimize the use of existing resources. Most collaboration which takes place is informal and ad-hoc, based upon personal interests and relationships. There are many examples of this in collaborative efforts between and among NCARTT researchers and professors from the Faculties of Agriculture at University of Jordan and JUST. The ADF was especially useful in fostering this type of collaboration. The linkages between NCARTT and the Ministry of Agriculture extension program are weak although there is an ad-hoc committee working on improving research and extension linkages. There is also some collaboration at the regional agricultural research center Agency Directorate level, but once again based largely upon personal relationships.

The project has been more successful in promoting NCARTT linkages with, and technology acquisition from, regional and international organizations such as ICARDA, CIMMYT, ACSAD, FAO and UNDP. NCARTT has established good working relationships with all of these organizations and gets strong technical inputs and almost all of the germ plasm for its research program from ICARDA, CIMMYT and ACSAD.

Lastly, with the recent creation of the National Agricultural Library and Information Center, if properly staffed and funded, can only serve to strengthen the interinstitutional linkages which already exist and allow researcher accessibility to a worldwide network of agricultural data.

Through assistance from the project, NCARTT and the regional agricultural research centers now have an institutional structure and core staff which have the potential to involve

and assist farmers in the major production areas of the country and to reach out to national and international research and scientific organizations.

13.10.2.6. Resource mobilization and the potential for sustainability

NCARTT currently receives its financial resources from a core budget provided by the Ministry of Agriculture, the National Agricultural Development Project (a Technical Assistance and Services Office staff of six, the ADF, and two institutional advisors), and several other donors who support joint research activities including the GTZ, UNDP, FAO, ICARDA and ACSAD. At this time it is doubtful that the resources currently provided through the project will be fully replaced by either the Government of Jordan or other donors after the project assistance completion date.

In terms of the National Agricultural Development Project's impact on assisting NCARTT in the mobilization of additional resources and enhancing its organizational sustainability, two achievements can be mentioned. The first has been the emphasis that project staff including those working in The Technical Assistance and Services Office and the two current institutional advisors have placed on obtaining autonomous, or more flexible, status for NCARTT. While full autonomy has not as yet been achieved, the present semiautonomous status represents progress in the right direction making the Center a more likely target of opportunity for other donors be they local, regional, or international.

The second is the current work which is being done by project staff on the National Agricultural Research Strategy and the Medium-Term Plan for implementation of that strategy. This activity began with the use of project funds to assist the Ministry of Agriculture in the preparation of the Agricultural Sector Review which led to the development of the Agricultural Policy Charter, and now to the current work in progress concerning the national research strategy. The accomplishment of these key activities will no doubt give the Center greater visibility within both the public and private sectors of the country, as well as among the donor community thus enhancing organizational sustainability.

Following, Table 2.2 demonstrates the types of resource mobilization that NCARTT is currently capable of generating.

Table 2.2
Agricultural Research Projects Implemented by NCARTT in Cooperation with National and International Agricultural Organizations

Name of Project	Implementing Organization	Duration	Financial Support
Agricultural Development in Dry Land	NCARTT, JCO	1989–91	Government of Australia
Al Mashriq	NCARTT	1989–94	UNDP, Arab Fund for Agriculture and Social Development, ICARDA
Feed Production	NCARTT, JCO	1988–91	GTZ
Food Legume Improvement	NCARTT, FOA	1989 (renewed annually	renewed Project CIDA
Crop Rotations Project	NCARTT, FOA/UOJ, ICARDA	1987 renewed annually	ICARDA
Farming Systems Project	NCARTT	1987 renewed annually	ACSAD
Wheat Breeding Project	NCARTT	renewed annually	Government of Jordan
National Project for Agricultural Development	NCARTT, FOA/UOJ, FOS/JUST	1985–94	Government of Jordan, USAID

13.10.3. Impact of NCARTT on the agricultural sector

13.10.3.1. Changes in agricultural area, production, and productivity

The amount of agricultural land under production, both irrigated and rainfed, as well as the productivity and profitability of most crops have varied considerably over the life of the project. While some of these changes can be attributed to technological innovations, a majority of them have been due to changes in relative prices, government policies including support prices, the subsidized cost of inputs, especially water, and yearly changes in climatic variables. Table 3.1 demonstrates changes in land area, production, and productivity for selected crops grown under both irrigated and rainfed conditions.

Table 3.1
Changes in Land Area, Production, and Productivity for Selected Irrigated and Rainfed Crops 1980–1993*

Crop	Land Area 1000 Hectares		Production 1000 Metric Tons		Productivity Metric Tons/Hectare	
	1980–81	1992–93	1980–81	1992–93	1980–81	1992–93
Olives	23.81	75.94	18.9	49.2	.79	.65
Grapes	9.83	13.59	45.9	54.8	4.67	4.03
Apples	.72	4.54	3.0	24.9	4.17	5.49
Almonds	.50	1.07	1.1	2.1	2.20	1.96
Citrus	3.18	5.40	83.0	175.8	26.00	33.00
Bananas	.31	1.20	12.0	18.4	38.70	15.33
Tomato	14.26	14.93	341.4	621.2	24.00	42.00
Eggplant	3.86	2.05	99.3	70.4	26.00	34.00
Cucumber	4.28	1.18	106.2	100.6	25.00	85.00
Potato	.42	4.90	9.1	117.6	22.00	24.00
Onion	1.11	2.91	11.7	43.1	11.00	15.00
Garlic	.02	.62	.2	8.7	10.00	14.00
	1983–84	1992–93	1983–84	1992–93	1983–84	1992–93
Wheat						
Rainfed	43.00	66.38	25.0	37.4	.58	.56
Irrigated	1.99	6.41	3.0	37.4	1.51	5.84
Barley						
Rainfed	19.03	66.39	4.8	33.3	.25	.50
Irrigated	.76	2.73	.7	11.0	.92	4.03

Source: Data Bank, Ministry of Agriculture, Amman, Jordan.

* The yearly changes in these indicators on a crop by crop basis can be found in the Statistical Annex to the final evaluation report of this project.

As Table 3.1 demonstrates, there has been a measurable increase in land area and production, especially in the case of irrigated crops. Tree crops such as olives and apples have shown the most significant increases. It also shows that there has been a shift toward the more intensive cultivation of vegetable crops, most likely due to the mass acceptance of plastic or glass greenhouse technologies. While no statistical data exist to enable the impact assessment team to attribute these increases to NCARTT research and technology transfer, anecdotal evidence does exist that the Center's activities have been important in the cases of apples, olives, barley, onions, and garlic. Additionally, it is clear, also from anecdotal information, that NCARTT's research in the areas of biological control and disease resistant varieties has also had an impact on the reduction of losses in the case of both tomatoes and cucumbers.

13.10.3.2. Farmers and intended beneficiaries

13.10.3.2.1. Beneficiaries

The Social Soundness Analysis (SSA) to the project paper broadly identifies the target population as, "all persons engaged in rainfed agriculture in the Jordan highlands. This population is diverse including land owners, renters, landless laborers, herders, those with a long cultural history in agriculture and those without." By extension, in 1988 as the project's focus expanded from the highlands to include the entire country, one can assume that the target population also expanded to include essentially all farmers in the country—a rather ambitious, and probably unachievable, goal for any development project! The Logical Framework Matrix for the original HADP established that 75 percent of highland farmers will be reached through NCARTT's research and technology transfer activities. While the impact assessment team cannot ascertain a precise percentage of farmers reached by the project, it is quite clear that the target of 75 percent was not met by a substantial margin, if indeed it was ever achievable in the first place.

The SSA also goes on to state that, "Effects should be felt by both large and small producers as some technologies could be transferred to both without adaption." While this statement is generally true for some technologies and some crops, it was not true for others. For example, one of NCARTT's achievements has been in the identification of higher yielding barley varieties and the development of a technological package, including tractorization of the land. In reality, due to severe land fragmentation, especially in the highlands (which was to have been partially addressed by the project through a Pilot Land Aggregation Program, which was never implemented), farmers' plots are often too small and too disperse to be able to adopt some of the new technologies. On the other hand, NCARTT's research on disease resistance and biological control methods in certain vegetable crops can be considered to be parcel-size neutral.

Again referring to the SSA, "Women form an important target group for the project, given their active role in agricultural production." However, an attempt was made on each of the impact assessment team's field trips to identify women farmers, but without success. (Actually one woman entrepreneur was identified who produced flowers in the Jordan Valley with the use of expatriate Egyptian laborers.) Indeed, in several cases we were told that the absence of women farmers was not necessarily due to discrimination, but rather that in this conservative rural society a husband would be seen as not carrying out his obligations to wife and family if he allowed his wife to work in his fields.

This is not to say that the implementors of the project were remiss in not addressing gender issues, but rather that the issue of reaching women farmers was outside of their control. On the other hand, where the project and NCARTT were able to exercise control over gender issues, the results are much more positive. Of the current NCARTT professional staff, 25 percent are women and of the people who received, or are receiving, formal training or assistance in completing their thesis research under the project, 20 percent are women. Women also participated in many of the short-term training activities carried out under the project.

13.10.3.2.2. Income and profitability

Farmer income and profitability are other indicators that can determine which crops a farmer will choose to grow within the broad confines of land type, availability of water (the amount of rainfall or the availability of irrigation water), and decreasing government subsidies. Table 3.2 demonstrates the relative profitability of selected crops using high-level technologies. As was the case above concerning the impact of the project and NCARTT on national level production and yield statistics, it is impossible for the impact assessment team to measure impact as it relates to crop selection either within or between agro-ecological zones.

However, if we assume that the project and NCARTT have had an effect on the level of technology that farmers use, table 3.3 is useful in showing the relative gross margins for selected crops using low technologies versus high technologies. The table also demonstrates, however, that the availability of irrigation water is, by far, the most important determinant variable in regards to production, yield, and profitability.

13.10.3.2.3.- Employment

The creation of jobs and returns to labor inputs are other indicators often used to measure the benefits that accrue to farmers. As table 3.2 demonstrates, the returns per person-hour of labor are extremely variable depending on the crop in question. Irrigation and the growing of tree crops (even when the 4–8 year maturation period is considered) receive the highest returns. This has its greatest impact among Jordanian small farmers who supply the bulk of their own farm labor. However, in the case of Jordan, much of the agricultural labor is performed by Egyptian and Pakistani expatriate workers receiving the minimum wage. No doubt that some of their income remains in the country and thereby benefits the local economy. Nevertheless, anecdotal information indicates that a substantial portion of the income earned by these workers is repatriated back to their countries of origin.

13.10.3.3. Technology Transfer and Extension Services

NCARTT's impact on technology transfer in the agricultural sector has been limited. NCARTT was making some progress in improving its technology transfer programs in 1987–1989 with strong input from the Washington State University Consortium for International Development extension advisor. When the advisor left, the program slipped and then deteriorated further when the 82 NCARTT personnel were transferred out of NCARTT to other offices in the Ministry of Agriculture. There was also a serious lack of continuity in the Ministry of Agriculture and NCARTT leadership which contributed to a further weakening of NCARTT extension programs. In late 1992, the responsibility for supervision of field extension agents was moved from NCARTT to the Ministry of Agriculture when the Department of Extension was established in the Ministry. Since then, very little has happened in technology transfer because of the lack of interest, support and qualified personnel in NCARTT and uncertainty about how NCARTT and the Ministry of Agriculture should work together on technology transfer.

Table 3.2
Profitability of Selected Crops per Dunum
in Jordanian Dinars using High Level Technologies
(Gross Margins exclusive of Land Rent)

Crop	Zone (1)	Gross margins overall	Gross margins per cubic meter of water	Gross margins per person-hour of labor
Wheat; Irrigated	II	43.995	0.063	8.799
Rainfed	III	11.185	0.000	1.928
Rainfed	IV	15.940	0.000	3.542
Barley; Irrigated	I	31.300	0.210	17.389
Rainfed	II	6.400	0.000	1.600
Rainfed	III	10.525	0.000	1.815
Rainfed	IV	11.850	0.000	1.992
Cucumber; Irrigated	I	718.102	1.181	1.967
Irrigated	III	550.400	0.724	1.326
Onion; Irrigated	I	123.995	0.191	1.319
Tomatoes; Irrigated	I	115.850	0.185	0.898
Irrigated	II	120.620	0.241	0.632
Rainfed	IV	47.150	0.000	1.025
Eggplant; Irrigated	I	142.640	0.143	1.603
Irrigated	III	113.670	0.146	1.043
Potatoes; Irrigated	I	136.000	0.320	1.308
Irrigated	II	98.840	0.176	0.677
Olives;(2) Irrigated	II	136.640	0.455	3.105
Rainfed	II	28.280	0.000	0.832
Irrigated	III	97.310	0.324	1.836
Rainfed	III	58.950	0.000	1.371
Irrigated	IV	341.170	1.137	4.549
Rainfed	IV	60.950	0.000	1.417
Apples;(2) Irrigated	III	629.960	0.562	5.164
Irrigated	IV	834.960	0.746	6.844
Rainfed	IV	121.250	0.000	3.070
Grapes;(2) Irrigated	III	477.103	0.596	6.278
Rainfed	III	11.600	0.000	0.161
Irrigated	IV	543.963	0.680	5.551
Rainfed	IV	85.860	0.000	1.160
Bananas;(3) Irrigated	I	742.500	0.371	5.380
Oranges;(2) Irrigated	I	377.560	0.378	4.340
Mandarins;(2) Irrigated	I	179.460	0.179	1.795
Lemons;(2) Irrigated	I	281.930	0.282	3.241

Source: *National Farm Data Handbook*, Jordan, Ministry of Agriculture, ESCWA, FAO, 1993.
Notes: (1) Zone I; Jordan Valley, Irrigated.
Zone II; Less than 200mm annual rainfall.
Zone III; 200–300mm annual rainfall.
Zone IV; More than 350mm annual rainfall.
(2) At 8–20 year maturity.

Table 3.3
Relative Profitability of Selected Crops per Dunum
Based on the Type of Technology Utilized
(In Jordanian Dinars, Exclusive of Land Rent)

Crop		Zone (1)	Gross margin technology A(2)	Gross margin technology B(3)
Tomatoes;	Irrigated	I	70.700	95.250
Tomatoes;	Rainfed	IV		31.050
Eggplant;	Irrigated	I	118.250	90.137
Potatoes;	Irrigated	I	99.600	55.538
Onions;	Irrigated	I		91.095
Cucumbers;	Irrigated	I	572.102	
Squash;	Irrigated	III	76.370	
Squash;	Rainfed	IV		24.589
Olives;(4)	Irrigated	II	114.690	
Olives;	Rainfed	II		10.160
Olives;	Irrigated	III	72.030	37.500
Grapes;(4)	Irrigated	III	441.423	
Grapes;	Rainfed	III		-22.600
Apples:(4)	Irrigated	III	563.960	
Apples:	Rainfed	IV		100.600
Wheat;	Irrigated	II	41.495	
Wheat;	Rainfed	III		8.285
Barley;	Irrigated	I		30.670
Barley;	Rainfed	II		5.000
Barley;	Rainfed	III		7.625

Source: National Farm Data Handbook, Jordan, Ministry of Agriculture, ESCWA, FAO, 1993.

Notes: (1) Zone I; Jordan Valley, Irrigated.
Zone II; Less than 200mm annual rainfall.
Zone III; 200–300mm annual rainfall.
Zone IV; More than 350mm annual rainfall.
(2) Level A; nonconventional irrigation system (mainly drip), plastic house culture, intensive application of chemicals and fertilizers, and high yielding varieties.
(3) Level B; flood or surface irrigation, open fields, minimal application of chemicals and fertilizers, and use of traditional varieties.
(4) At 8–20 year maturity.

13.10.3.4. Impact on the Environment

13.10.3.4.1. Introduction

Water, soil, vegetation, and climate are basic agricultural environmental elements and are very necessary for human existence and growth. The agricultural land area of Jordan is

limited and is decreasing continuously because of increased land erosion, desertification, and the expansion of urban areas. (In 1980, 8 percent of Jordan's land area was estimated to be appropriate for agriculture. As of 1994, this figure has dropped to only 6 percent.)

In rural areas, land resources are being destroyed due to the cutting of trees and brush for firewood and the overgrazing of pasture lands, which lead to soil erosion and ultimately desertification. Additionally, the overpumping of groundwater either for agricultural or nonagricultural purposes leads to the deterioration of water quality, increased salinity, and depletion of water resources in the long run.

Without a doubt, water, its availability and quality, is and will always be the most critical environmental element to Jordan's agriculture—as well as the element that will be the most affected by environmentally unsound agricultural practices. For example, the Agricultural Sector Review states that in terms of horticultural crops, the increase in production from 404 thousand metric tons in 1980 to 699 thousand tons in 1991, caused the usage of irrigation water to rise, "at an annual rate of 8 percent, reaching a record level of 657 million cubic meters compared to 285 millions in 1980. Thus, a 75 percent increase in production was achieved at a cost of a 140 percent increase in water consumption."

13.10.3.4.2. Jordan's Ecological Zones

The Jordan Valley.—The Jordan Valley is subject to pollution from municipal waste water discharges, the inappropriate location of land fills, pesticides and other agro-chemicals, the increased salinity of irrigation water, and increased fertilizer usage due to declining soil fertility. Pollution from plastic wastes, either from black plastic mulch or greenhouse coverings is increasingly becoming a problem. Additionally, the fact that the King Abdulla Canal is uncovered and close to populated areas make it subject to pollution by wastes and chemicals.

The Highlands.—The Highlands areas with rainfall over 250mm per year are mainly cultivated with field crops, fruit trees, natural and planted forests, and natural grazing areas. Many indicators show that this area is affected by desertification because of receding plant cover and increasing erosion in agricultural areas. This is in addition to the increased salinity of the groundwater in irrigated areas due to overpumping, and by the residual effects of agricultural chemicals.

The Semidesert area (*Badia*).—These areas, with less than 200mm of annual rainfall, are even more fragile and are being degraded through increased grazing pressure.

13.10.3.4.3 Impact of NCARTT on the Environment

The impact of the NCARTT, and by extension the National Agricultural Development Project, on the environment has been in two areas: (1) through increases in agricultural production; and (2) through specific research, funded by NCARTT itself, by national and international organizations or by the ADF, on environmental issues or on agricultural issues which are "environmentally friendly."

Jordan's agricultural land area is both relatively scarce and fragile. It is therefore almost axiomatic to draw the conclusion that increases in agricultural production and productivity (some of which can be attributed to NCARTT), if not done through

environmentally sound technologies, have led to a further degradation of the environment. Nevertheless, several of the research and development projects funded through the ADF have been specifically directed at the identification and use of technologies that rely less on the use of agro-chemicals such as the breeding of disease resistant varieties (field and vegetable crops), insect traps using pheromones, the use of black plastic mulches to "solarize" the soil thereby killing soil-borne diseases, and the use of biological controls for several pests including the whitefly. Additionally, two research grants were awarded to study the ways in which sewer sludge could be treated for use as a soil additive. Thus, the project and NCARTT had a modest impact on environmental concerns. Much work needs to be done in this area, particularly on improved water management and conservation.

13.10.3.5. Laboratory Services

A major component of the project was financing the construction and equipping of laboratories for use in conjunction with NCARTT's research and service delivery activities. The Engineering Annex to the project paper contains specifications and site plans concerning these laboratories including the NCARTT headquarters facility at Baq'a and the four regional agricultural research centers (RASCs). The Baq'a laboratories were to have been in a one-story, 200 square meter building separate from the administrative headquarters. There were to have been ten laboratories including: crop protection (2), animals (2), pulses (1), cereals (1), forages (1), fruits and vines (1), a preparation lab., and a general use lab. Each of the four regional agricultural research centers were to have had two general service and repository laboratories. The construction of the NCARTT buildings and the regional agricultural research centers, including the 18 laboratories, was to have been loan-financed through the project. Equipping the laboratories was to have been done under the grant portion of the project. Staff to operate the laboratories was to have been provided by the Ministry of Agriculture with some of the technicians being trained under the project.

At this point, nine years later, the situation has changed significantly. Each of the four regional agricultural research centers has five completed and equipped laboratories, rather than the two planned for in the project paper. Many small items, as well as reagents and expendable supplies, are missing and NCARTT does not have the resources to purchase them. Furthermore, there is an almost complete lack of trained technicians and the research staff has never been taught how to calibrate, operate, or maintain the equipment. For the most part, these laboratories stand idle and no services are being provided.

At the time of the writing of this impact assessment (four months before the September 30, 1994, project assistance completion date), the headquarters building at Baq'a is yet to be completed and the number of laboratories has increased to 48, 12 on each of four floors, encompassing between 5,000 and 6,000 square meters. Additionally, no equipment other than the casework (laboratory benches and cabinets), has been installed. Rather, the equipment destined for these laboratories, which was ordered in 1988, and arrived in 1989, remains in the original shipping containers in which it arrived, its warranties and service contracts long since expired. Furthermore, NCARTT lacks the core budget to hire, let alone train, even a small fraction of the technicians would be required if all 48 laboratories at the National Headquarters were to be made operational.

Counting the various laboratories that NCARTT currently has in its headquarters building and at the six regional agricultural research centers (two which already existed, plus

the four built under the project), plus the new ones in the headquarters building under construction, yields a total of between 70 and 90 laboratories depending on the person questioned and the definition of laboratory utilized. This is far more than NCARTT needs at the present, or will need well into the next century. The impact assessment team made a concerted effort to find out how and why the situation changed so significantly since none of the change concerning the size of the buildings or the number of laboratories could be found in the project's documentation. Informed observers were also asked these questions and the answers ranged from the fact that the construction contracts were between the Ministry of Agriculture and the contractors (i.e., host-country contracts) to the devaluation of the dinar in 1988, which resulted in there being additional funds available for construction activities (the construction line item in the Budget was loan funded and denominated in U.S. dollars), to the Washington State University consultants who performed a needs assessment for laboratory requirements to a plan for NCARTT to become a regional Arab center on a par with ICARDA.

Currently NCARTT does provide some laboratory services out of its present headquarters and at the regional agricultural research centers, including soil and water testing; fertilizer and animal feed quality testing, mostly for the Ministry of Agriculture; seed quality and germination tests, also for the Ministry of Agriculture; and, plant disease identification for farmers at the regional agricultural research centers.

13.10.3.6. Publications

NCARTT's publications have had some positive impact on the agricultural sector. NCARTT has issued 47 bulletins, some of which are quite good. NCARTT, through The Technical Assistance and Services Office, also issued a periodic newsletter, which was very well done and contained much useful information. The overall quality of the publications is good; they are technically accurate and for the most part relevant to farmers' problems. Most are illustrated with photos but do not have much in the way of simple diagrams to illustrate techniques or practices. The impact assessment team noted the availability of bulletins in the regional agricultural research centers but did not encounter any bulletins in visits with farmers. The team did not have time to check the bulletins with farmers to verify whether they were understandable and useful.

13.10.3.7. Training

It is most likely that the training component of the National Agricultural Development Project has had, and will continue to have, the most lasting impact on NCARTT and the agricultural sector. There is still, however, a great need to upgrade every category of employee including managers, administrators, technicians, researchers, and farm managers. Additionally, this upgrading will have to be done at all levels including degree training at the graduate and undergraduate levels, at the diploma level, seminars, workshops, and in-service training.

Under the project, ten students have completed, or will have completed by the end of the project, postgraduate work at U.S. universities; eight at the Ph.D. level and two at the M.Sc. level. Project training provided at the University of Jordan has resulted in seventeen completed M.Sc. degrees with six still in progress. Twelve students have received diploma-

level training at the University of Jordan as well. Of these trainees, 31 are currently employed at NCARTT or the Ministry of Agriculture. University of Jordan officials indicated that the university itself had benefited from this program in allowing it to develop stronger and larger graduate level programs.

Short-term training has had a resurgence since 1992, which has resulted in 48 courses of various types being given in approximately 24 months to 1,415 participants from both the public and private sectors (some participants have received multiple courses) for 403 course days.

An innovative type of on-the-job training was initiated with the use of ADF funding and managed through the Association of Agricultural Engineers (AEE). This program places newly graduated agricultural engineers with prospective employers for up to nine months. During this period the trainee learns valuable job skills while the employer gets a chance to evaluate potential employees and to custom train them. The ADF financing pays for 70 percent of the costs involved, principally the trainee's stipend, and the employer pays 30 percent. Four groups of 50 trainees each will benefit from the program. Two groups have already "graduated" and two are currently in progress. Of the first two groups of 100 trainees, 70 percent were offered positions with their host employer, many before completion of their training period.

Lastly, the National Agricultural Development Project has further assisted the in-country training process through the construction and equipping of excellent training facilities at the regional agricultural research centers and at the headquarters building in Baq'a, once it is completed.

13.10.4. Impact of National Agricultural Development Project Activities on the Ministry of Agriculture

The impact of the National Agricultural Development Project on the institutional capability, policy formulation, and effectiveness of the Ministry of Agriculture can be measured in two general areas: raising of the technical capabilities of its staff through short- and long-term training; and, in supporting the Ministry's efforts in policy analysis and planning. Over the life of the project, especially in its later years, 13 current Ministry of Agriculture staff members received degrees at the University of Jordan; 7 M.Sc. Degrees as Agricultural Engineers, and 6 High Diplomas in Agricultural Science. Additionally, a substantial number of Ministry of Agriculture staff received support to fund their thesis research as part of University of Jordan Masters degree program in Agricultural Engineering. Lastly, substantial numbers of Ministry of Agriculture personnel participated in a multitude of NCARTT provided short courses, workshops, and seminars on a variety of agricultural topics.

In the area of policy and planning analysis, the project has contributed in, at least, two ways toward assisting the Ministry of Agriculture and, by extension, NCARTT in the analysis and formulation of policies directed at the agricultural sector. The first was the use of project funds to purchase services from the USAID centrally managed Agricultural Policy Analysis Project (APAP, II), which for the first time in over 20 years allowed for a detailed and comprehensive analysis of the country's agricultural sector. This analysis also changed the traditional commodities-based approach of analyzing the sector to a systems approach considering irrigated agriculture, rainfed agriculture, low-rainfall zones, integrated livestock production, and forestry. The major output of this activity, a six-volume set of documents, has

already been used by the World Bank in the formulation of an upcoming Agricultural Sector Adjustment Loan and its companion Agricultural Sector Technical Assistance Project. No doubt other donors, in addition to the Ministry of Agriculture itself, will be able to use these documents in attracting and planning further projects that support the agricultural sector.

The second contribution of the project in the area of policy analysis and planning is using ADF funds to develop a national agricultural research strategy and a medium-term plan for its implementation. This process includes the Ministry of Agriculture, NCARTT, the University of Jordan, JUST, and the private sector. This research strategy and plan—when completed and formally accepted—will be important cornerstones for the Ministry of Agriculture, and the Government of Jordan in general, to use as they develop future policies and priorities concerning research in the agricultural sector.

13.10.5. Impact of ACC/ADF and Technical Assistance and Services Office/ADF Projects

The Scope of Work (SOW) for the impact assessment asked the team to comment on both phases of the Agricultural Development Fund: the first phase, when its management was with a Steering Committee within the projects Department of the Ministry of Agriculture and linked financially to the Agricultural Credit Corporation (ACC); and the second phase when The Technical Assistance and Services Office was created and the approval of projects to be financed under the fund passed to the NCARTT Council with assistance from the Technical Assistance and Services Office advisors. More specifically, the SOW asks the team to comment on the impact of the ADF on the development of NCARTT's agricultural research and technology transfer programs, as well as its impact on agricultural production and productivity.

As designed, the ADF was funded at just over US$ 10 million with two-thirds of the money coming from the Government of Jordan contribution and one-third coming from the project's grant funding. In its first phase, each individual project was to have been funded in these same proportions. The ACC's role was limited to that of a financial mechanism, and it had no part in the selection of the projects to be funded or their monitoring. This activity began in 1987 and ended in 1989. Of the 33 research projects and activities funded during that period, 28 had no NCARTT involvement. The vast majority of these projects and activities were not completed for a variety of reasons including the researchers going on study leave, the transferring of Ministry of Agriculture and NCARTT staff from one location to another, and a general lack of monitoring and supervision. Nevertheless, several of these projects and activities were successful and still continue, such as on-farm demonstrations of wheat and barley technologies; dryland and irrigated onion and garlic research; and, plant protection and biological control measures, which were published as extension bulletins for dissemination to farmers. A lack of leadership and monitoring of these activities appears to have been the missing ingredients in the implementation of the fund.

With the creation of the Technical Assistance Service Organization in late 1990, the concept of the fund was changed. TASO was given responsibility for the management of the fund, which was capitalized 100 percent through the project with no Government of Jordan contributions. Additionally, decision-making responsibility for the acceptance or rejection of proposals was given to the NCARTT Council. Of even greater importance was the expanded

flexibility given to the concept of the fund which stimulated innovative approaches to addressing the problems of the agricultural sector.

In addition to several projects that could be considered standard research activities (research on *capnodis* in stone fruits, research on baladi and shami goats, research on *Phyloxera*-resistant grape rootstock, etc.), other activities were added including a grant to develop the national agricultural research strategy for NCARTT; a program to provide on-the-job training with private-sector businesses for newly graduated agricultural engineers; a program to support M.Sc.-level agricultural thesis research at the University of Jordan and JUST, a program to support graduate level studies in the agricultural sciences at these same universities, and even a program to teach researchers how to write proper research proposals. An additional important element of the TASO/ADF activities was that the selection and approval process encouraged joint or collaborative research and other activities between people in the Ministry of Agriculture, NCARTT, the two Faculties of Agriculture, and others.

All in all, the ADF did not have the impact that it was assumed it would have in the original project design. Of the US$ 10 million originally allocated to it, only approximately US$ 2.556 million will have been spent by the project assistance completion date with approximately one half coming from the project grant and the Government of Jordan. In terms of measuring the impact of the ADF on either the development of NCARTT's research and technology programs or on agricultural production and productivity in general, no clear, quantitative information exists, although anecdotal information does show that some impact was achieved in the crops mentioned above.

Additionally, it is clear that the ADF, especially in its second phase, did have an impact on bringing agricultural researchers together and in forging collaborative ties between research organizations. Furthermore, the training (both short-term and long-term) activities carried out under the second phase of the fund were quite successful, although as is the case with any training program, the true impact of these activities will only be known over time. (See Table 13.14.7 in the Tables Annex to the final evaluation report on the National Agricultural Development Project for a listing of projects and activities financed by the ADF, both through the ACC and TASO.)

13.11. Description of NCARTT Research Program by Dr. Awni Taimeh, Soils Department, University of Jordan

NCARTT Technology Generation and Validation Program

NCARTT has been carrying out its research program and related activities through different departments or sections. These sections have included field crops, vegetable crops, horticulture, soil and irrigation, plant production, range and livestock, monitoring and evaluation, and genetic resources. NCARTT is in the process of shifting to a more systems-based approach that calls for different program areas, i.e., irrigated production, rainfed production, integrated livestock, range and natural resources management, water and irrigation management, and genetic resources. Since this transition is still in process, this report will deal with programs as presently structured.

Several research stations located within different ecological regions are utilized for field testing. These stations are 1-Irrigated areas- Deir Alla (regional agricultural research

center), Wadi Yabis, Karameh, Khalidia (regional agricultural research center), and Ghor Al Safi. 2-Rainfed Areas- Ramtha, Maru (regional agricultural research center), Mushaqar (regional agricultural research center), Rabba (regional agricultural research center), and Shoubak (regional agricultural research center), in addition to some stations were range studies are conducted.

NCARTT's main headquarters has central laboratories to support the above sections. Space and equipment are allocated to some laboratories at the regional agricultural research center level. Laboratory establishment is not yet completed.

Each research section conducts research activities at NCARTT's central laboratories, while the field research is carried out at several locations at the same time. Demonstrations are conducted at the research stations and on farmer's lands. Experiments are also conducted for specific purposes on private farms and orchards. The technical staff members responsible for conducting the research are distributed between NCARTT headquarters and the different regional agricultural research centers.

The kind and number of technical staff at the research stations does not match the research program carried out at the stations. This is largely due to the efforts of direct supervision by headquarters staff of all activities carried out at the stations. Research activities are planned at the NCARTT center with no, or very little, input from researchers located at the different stations. Input from farmers is not systematically pursued, if at all. Only one case was cited where farmers were asked about their immediate needs (at Mushaqar). This practice was not continued. Extension activities, which could serve as a channel through which research activities could be generated, have been transferred to the Ministry of Agriculture. It was clear that research activities are generated from the experience of researchers and their exposure to the needs within their areas or related to their background, field trips, or from media exposure of some isolated problems or from participation of researchers in special projects carried out in cooperation with local or international organizations.

Research activities are planned in advance by each section with research demonstrations, workshops, and training activities presented in one document. Activities of each section seemed to reflect the interest of that section. No joint activities between sections was observed. The listing of the experiments in the annual technical plans reflects segregated research topics and the absence of interaction between different sections. Consequently, research programs with integrated approaches are not one of the features of the NCARTT program. However, an integrated approach is being followed in special projects such as the food legume project, agricultural production in the arid or semiarid regions and areas suffering from desertification, etc. These projects are financed by international donors, and NCARTT is only one of the collaborators among other local institutions.

Field experiments are planned at the main headquarters, but executed in the field in cooperation with field officers. In many cases, appropriate numbers of technical staff are not found thus increasing the burden of supervision on some staff within the center. In other cases research is implemented by unqualified staff. Data are gathered by the main staff or staff positioned at the stations. The data are processed and kept at the center. Results are not channeled back to the station except in a few cases.

The technical staff consists of 13 Ph.Ds., 37 M.Scs., and 70 B.Scs. distributed between the main headquarters and the various centers and stations. The number for each discipline is not stable and changes frequently. Examination of the background of the higher degree holders (M.Sc., Ph.D.) reveals severe deficiencies in many important areas and in all aspects of

agricultural research. Except for M.Sc. degree holders, very few of the Ph.D.s are new graduates (The project had provided six Ph.D. scholarships to NCARTT). This was reflected in the inadequate coverage of very important and pressing issues facing the agricultural sector. Just to give an example, very few experiments are carried out in irrigation or soil salinity or on major crops such as citrus. Many pressing issues which need to be examined are yet to be addressed.

Data gathering is vital in research. The extent of data collection related to the whole sector or related to the needs of the experiments varied from one department to another. Specifically, research programs need two types of data. The first is the status of the problem being investigated. In the case of the soil and irrigation section, for example, the status of soils and their conditions and special problems in various areas is vital. This could be helpful in designing experiments that reflect the different conditions from one place to another. Another type of data that is needed are agroecological data, which are extremely helpful in explaining some abnormalities in measured responses. These two types of data are directly needed for any program. A third type of data helpful in assessing impacts are data on the area of land with a specific problem, economic data, land use data, etc. Unfortunately, the annual reports do not include such vital data, nor are they collected during the execution of any of the experiments. Few experimental reports give rainfall distribution. Few data were reported with some experiments, mainly plant protection. Otherwise yields, as the target of most of the experiments, were the only data measured in the field. A few exceptions might be found here or there, but a striking feature of the research program was the weakness of data collection.

With respect to field statistical layout, only one statistical design was used for all activities during the past years, that is the Randomized Complete Block Design (RCBD). This design is suitable for testing one factor. Except for a few experiments (supplemental irrigation, and one or two other experiments), the RCBD was the only design used. This clearly reflects the simple tests being conducted. While it is true that such design is good for evaluating varieties, in most cases, more than one factor are involved in agricultural trials. This has an important bearing on the value of the experiment as a tool for generation of technology transfer material. Proper design reduces time and cost when combining two or more factors. This means that a complete technological package involving more than one component will be hard to formulate. For example, one cannot recommend a rate of N-Fertilizer and P-Fertilizer for a farmer when all the results were obtained without measuring the NP interaction, because the interaction of the combined rates might be negative.

Technology validation and transfer is the objective of any research program in agriculture. Validation of experiments is carried out through repeating the same experiment for several years at several locations. Some experiments are also conducted at private farms. Several field demonstrations are carried out every year to introduce local farmers and communities to the results of some of the experiments validated on the stations. Some experiments are hard to validate during the next season or through demonstrations, especially if they are related to environmental conditions. Verified data are transferred to the farmers during field days where farmers are introduced to the new developments, or through special bulletins distributed by the stations, or by conducting field demonstration on farmers' fields.

While some obstacles faced by NCARTT are beyond the control of its researchers, such as farmer acceptance of recommendations due to conditions such as farm size, and economic and educational status of the farmers. With regards to obstacles within the control of the researchers, however, several problems can be cited:

1- Insufficient formulation of comprehensive programs with adequate interaction between various departments. Programs always have a final product. Scattered experiments always yield scattered results.

2- With respect to suitability of research, most of the research investigates single factors, while agriculture is a multi-component system. No integrated program was cited. As a consequence comprehensive technological packages were not formulated except in few cases (e.g., Al Mashreq Food legume project).

3- The majority of the research activities address problems but do not necessarily reflect priority issues. This could be one of the reasons for the negative attitude of farmers toward new packages.

4- Lack of follow-up and assessment of research impact.

5- Soil information as transfer tool which has been totally neglected. Usually results of field experiments are transferred to farmers with similar conditions. Soil is among the most important. It is true that the country is not covered with an appropriate soil map, but the stations should have a detailed soil map for their areas. Moreover, important conditions surrounding experiments, whether soil or climate, should be characterized each time the location is changed. When a technological package is transferred to farmers, ideal conditions for implementation can be stated so that the farmer is aware of possibilities.

6- Contacts with extension agent are minimal. Therefore, an important avenue for sensing real field problems is not active.

7- Coverage of the most important issue is very weak. Activities in the Jordan Valley with regard to soil and irrigation productivity almost do not exist. Transfer of technology in this area could be very effective because the cost of the farming is intensive and the farmers could be convinced easily to use any ideas that work. As a result, the private sector is very active in selling ideas to the farmers who are very responsive to all suggestions that might help them in business.

Regional research activities have been gaining momentum during the last few years. Examples are the NCARTT collaboration with the Faculty of Agriculture, University of Jordan, and ICARDA in projects such as Food Legume Project, Improvement of Agricultural Production in Areas Suffering from Desertification (financed by EC), cooperation with ACSAD on testing of varieties, farming systems, supplemental irrigation with regional countries (financed by UNDP), the Mashreq Project (farming systems on semiarid regions, with ICARDA and Syria and Iraq). These projects are well planned, executed, and monitored. Results are well documented and immediately reach the farmer communities. NCARTT should grasp the spirit of these projects and use the mechanism involved in planning, implementation, and evaluation on its own activities to ensure successful work.

The status of researchers is a big concern in the whole process at NCARTT. They are civil servants who work according to restrictive time frame and other obstructive regulations.

Research in the field waits for no regulation and obeys no holidays. The financial security of researchers plays a crucial role in reducing their efficiency and hinders them from future advancement. Until the researchers are free to go to the field anytime they feel necessary, and are recognized in a manner similar to other national institutions such as the university professionals, and feel no longer like mere 8-to-2 employees, it would not be fair to expect too much from them.

Reporting.—Results of the experiments are presented in annual reports. The reports cover the activities of all sections. They give brief descriptions of the objectives, justification of experiments, some information about the execution, location, number of years to be reported, and AOV for the statistical design. Except for plant protection and for a few other experiments, interpretation of data should be improved. Background and reporting of what has been achieved locally and internationally is inadequate and should also be improved.

Availability of technical information.—The center has the best agricultural library in Jordan. Plans are underway to make it a regional one. Several important scientific journals are available. With the rapid increase in areas of specialization, there is great need to improve the number and diversity of scientific materials received in the library, coupled with better library services. Assuming the necessity to help researchers allocate more time to his primary duty, technical service should help researchers to be aware of new materials. This was clear from the inadequate coverage of international literature in the technical reports.

Publications.—Annual reports, or reports for special projects, and extension bulletins are produced. However, the publication of results outside of NCARTT does not exit. Such activities would help the interaction of NCARTT researchers with local and international scientists, improve writing capability, force them to read the literature, and improve their technical proficiency.

Sustainability of resources.—Sustainability of resources was not emphasized when conducting research in various fields. This should be considered as a major deficiency in long-term planning activities. It is hoped that this deficiency will be corrected in the process of establishing the agricultural research strategy. However, this concept was also not adequately addressed in the strategy.

Exposure to literature.—In some cases, researchers present what others did in a specific area. However, a majority of the research documents did not have an adequate literature review. Among the most obvious patterns was the absence of any documentation of local literature, especially that of universities, which is usually referenced by international or regional scientists. A great deal of available information is not utilized.

A description of each of the program sections within NCARTT follows:

1. Soil and Irrigation Section

Technical staff as reported in 1993

Center Total 10

3 Ph.D.

7 B.Sc.

1.	Deir alla	M.Sc. 1
		B.Sc. 1
2	Ramtha	M.Sc. 2
		B.Sc. 1
3	Shoubak	M.Sc. 1
4	Rabba	M.Sc. 1
		B.Sc. 1
5	Mushaqar	M.Sc. 1
		B.Sc. 1
6	Khalidia	M.Sc. 1

Research Conditions

Rainfed Crops:-

- Experiments are conducted on a number of crops such as barley, wheat, summer tomato, watermelon, olives, grapes, and apples. All experiments were conducted under rainfed conditions. Occasionally other crops are investigated. Recently new crops such as lentils were introduced.

- Objectives:- There was one objective for all these experiments, that is the grain yield for field crops or fruit production for fruit trees. No other yield components were evaluated.

- Scope and Objectives: Different experiments using different levels of either nitrogen (N), or P (Phosphorus), or Micronutrients (Such as Zinc (Zn) or Manganese (Mn) or Iron (Fe) or Copper (Cu) on the yield of the above crops were carried out. No experiment was reported on the combination of any two nutrients.

- Statistical Design: Randomized complete block design (RCBD) was the only statistical design used throughout the studies. This design is suitable for measuring the effect of a single factor, which explains the absence of any combination of any two factors.

- Durations and time frame work: Most of the experiments were repeated for three or more years. Specific time frames for the work were not always given in advance.

- Locations: Experiments are conducted at more than two locations within the regional agricultural research center. Some experiments, especially fruit trees, were conducted at farmers' orchards in three locations: Irbid (North), Salt (Middle) and Karak (South). Some trials on Barley and wheat were conducted on private farms.

- Statistical analyses: Analyses of variance was completed. Due to simplicity of the experiments, and the fact that only one component (yield) was measured, only one AOV table including differences between single treatments was possible.

The experiment covered rainfed conditions only. Very few experiments under irrigated conditions were reported.

Comments and recommendation:

- Crops:- Crops covered by the activities are very important for the agricultural sector. Wheat, barley, tomato, apple, olive, and grapes are considered strategic commodities. However, very important crops are totally ignored such as citrus, banana, cucumber, onion, garlic, chickpeas and lentils, etc.

- Scope and objectives:- Its seemed obvious that one objective was targeted, that is the yield of the test crop. Different yield components such as the quality of the product were not tested. Quantity of plant residues in case of wheat and barley plays a significant role in the livestock economy and in the improvement of soil conditions. Furthermore, only the effect of the fertilization on yield was the subject of the research. Fertilization also plays a significant role in plant production. Nevertheless, a long list of research topics can be cited which are needed for improving productivity and also sustaining such productivity and should be given proper attention, i.e., soil erodability, moisture conservation, etc.

- The activities on fertilization were carried on single treatments; no combination of two fertilizers was tested. The interaction which measures the influence of one level of one factor on the other was never tested. This could have great impact on the transferability of the research results. To explain the results of this research, an extension bulletin on fertilization of wheat and barley was produced. The bulletin recommends the addition of N and P fertilizer combinations even though experiment with two levels of N and P-fertilizer in one experimental plot were ever conducted. This could cast a great deal of doubt on the value of this recommendation.

No recommendation concerning the use of micronutrients is passed on to farmers through bulletins.

- Though the section is called soil and irrigation, no work has been done in irrigation. Research of this type would have made significant contributions for several reasons:

1- Yield under irrigation is greatly improved.

2- Adoption by farmers is quicker due to certainty of yields.

3- Impact on the agricultural sector would be significantly felt.

4- A concerted effort should be undertaken to ensure the sustainable production of these vital resources. There is no contribution in this area. Works in areas such as crop water requirements, soil salinization, water quality, soil degradation, production function, etc., should be initiated. Recently, some work was begun on supplemental irrigation. No results are yet reported. Effort in this direction should be intensified.

Transferability of the results:-

Many experiments were carried out on private farms. To successfully transfer technology, a clear result must be obtained. In the case of experiments on soils better results are obtained with similar environmental conditions. The latter requirement is somewhat met by carrying out the same experiment at different locations. But as far as conditions of the sites, this was violated. To fulfil this requirement, soils at the experiment must be well characterized and classified. Then recommendations should produce good results on farms with same soil conditions. Since no soil map is available in the country, characterization of the experimental site must always accompany any experiment. Impact of recommendations can be assessed when such requirements are fulfilled.

- Statistical design: Factorial design should be utilized to asses the interaction of two factors. Several experimental conditions during the execution of experiments were never monitored such as agro-ecological characteristics, soil moisture, etc. Several activities conventionally carried out by soil and irrigation research should be initiated. The list of such activities is very long.

- Timeframe work:- Several activities seemed to be extended over a long period of time without proper justification. It is true that under rainfed conditions, due to rainfall variability, more than one year data are needed. Still, a well designed framework should be established for each activity. Conditions of the experiment should be analyzed, as time progresses variables being tested might be modified. End results will be more decisive.

2. Vegetables:

- Research activities:- Rainfed and Irrigated (Open and under plastic).

- Crops–Potatoes, beans, cucumber, tomato, pepper, melon, onion, garlic, okra, cauliflower, sweet-peas.

- Demonstrations: for new varieties such as sugar beets, carrots, etc.

- Treatments:- Most of the activities were centered on evaluating new varieties. Some other scattered activities were concerned with tests such as the effect of plastic mulches, methods of planting, depth of furrows, date of fertilizer applications, growth regulators, effects of clipping. Experiments are usually carried out at more than one location.

- Statistical layout: One statistical design was used (Randomized complete, Block design, RCBD). This indicates, that only single treatments are being tested. No interactions between two factors were tested.

- Objectives:- Yield was the target of the various treatments. The list of areas that should be covered with strong influence on production of vegetables is long. Except for varieties evaluations, other experiments seem to be scattered. In most cases, they will not yield any results which can be transferred to farmers. One case which can be cited with regards to transfer of technology which had measurable effect on farmers is the selection of onion and garlic varieties and recommendation of appropriate practices under rainfed conditions. The annual reports point toward the supremacy of some vegetable varieties but no follow-up was evident. Once the variety has been selected, fertilizer, management requirements and economical analyses must follow. Very little work had been carried out in this area.

- Reporting:- Except for brief description of the main objectives, treatment, name of varieties, and yield figures, substantive information concerning the conditions surrounding the experiments was not given. Agro-meteorological data prevailing during the experiments, disease, and data describing the plant status were also not given. Most important, no information was ever given on soil at the location of the experiments. This will be a limiting factor with regards to the credibility of transferring packages.

- Transferability of the results:- The following can be cited:

1- The factors being tested are segregated experiments and cannot compose a program.

2- Single treatment was always tested, consequently a package will never be produced. Climatic, management requirements of any targeted crops are not investigated. Instead simple factors such as spacing and date of planting are examined.

3- Conditions surrounding the experiments are not well characterized to recommend the implementation of results under similar conditions (example, soil climate, water requirement etc).

When these components were put together in a program it produced transferable packages such as the production of garlic and onion under rainfed conditions. Water requirements, crop production under stress, interactions between crop varieties, crop production under the increasing use of waste water, fruit quality, and exportability are not among the features of the activities carried out by this section. These areas should be among the future challenges to be targeted.

3. Range and Livestock Unit

This section is somewhat different in the nature of activities from other sections since activities are restricted to low-rainfall zones. But most important is the fact that activities are project driven. Among the projects undertaken by this section are:

1. Survey of range resources- Funded by ADF
2. Management of Range Reserves- Ministry of Agriculture
3. Direct Range Seeding- ADF
4. Character of Sheep Production in Jordan- ADF
   Includes subproject on sheep movement, crop residues, and sheep production.
5- Effect of range testing on a triplex recovery.
6- Effect of P-fertilizer on the quality and productivity of range stations-ADF
7- Mechanical seeding in bushes.

Most of these projects are still continuing.

- Reporting: A good amount of information is presented in the reports. Some of the activities are reported on separately.

- Scope: The section deals with a significant part of the agricultural sector. Unfortunately, neither the technical staff nor the facility is enough to cover the different jobs required in this sector. Several studies indicated that substantial improvement is feasible in the area of range and livestock sector.

Such needs must be met if the strategy developed for low-rainfall zones is to be implemented since all the activities identified in the sector strategy deal mainly with range and livestock related activities.

New technology in the area of geographic information systems should be utilized in this important area. Range improvement or degradation is one of the indices used to evaluate the advance of desertification and should be considered in future plans.

Estimation of carrying capacity coupled with proper environmental conditions (soil, climate, etc.) has not received proper coverage yet. Integration of field estimates with

soil map (Available through the National Soil Survey Program) through the use of GIS will provide proper tools for identifying constraints facing range management. Such work will help to produce useable and useful results.

- Staff: Substantial staff increases and a major expansion in facilities are required to allow this section to meet the great demands of research in this important sector.

4- Genetic Resource Unit:

This unit was recently established with one specialist. The unit conducts its work in close cooperation with the range and livestock section. Among the activities carried out by this unit are the survey of annual legumes, geographic distribution of annual medicago species, genetic properties in various regions in Jordan, survey of barley and wheat genetic resources in Jordan, collection and evaluation of genetic material such as wheat, barley, medicago, and medics. Multiplication was also conducted. Ecological factors and geographical distribution were studied, documented, and properly analyzed.

This unit cooperates with the range and livestock section and assists in identification of range plants and their distribution. Reports produced by this unit are of good quality. It should consider more the use of maps to document the locations of the genetic materials. Interpretation of soil, environmental data with relation to identified species should also be emphasized in their reporting.

The output of such a unit could be helpful in orienting research and the development of new varieties. Appropriate facilities and proper technical staff should be provided to widen and intensify the scope of this unit.

5- Monitoring and Evaluation Unit

This unit was recently established. Among projects evaluated by this unit were:

1- The feasibility of apple production in the Shoubak region. The analyses indicated the profitability of apple production and that the profitability depends on government policy, which should continue to limit the importation of this crop.

2- Evaluation of performance of wheat demonstrations. The wheat demonstration project is a major project within NCARTT. The plan was to conduct 105 demonstrations, but only 91 were implemented. The analyses indicated the presence of positive trends with regard the use of chemical fertilizers and herbicides. As a result of introducing modern technology, the yield of wheat increased by 73 percent over the national average.

3- Technical and economical feasibility for the production of sugar from sugar beet. Objectives was to produce 100,000 tons of sugar from:

(a) Use of waste water to irrigate 84000 dunum, 23000 dunums in North JV, and 30,000 dunums in the highlands.

(b) Irrigation of 100,000 dunums, of which 50,000 dunums in JV and 50,000 dunums in the highland.

The analyses indicated the economic feasibility of the first alternative. The study failed to realize that sending waste water to JV is a political decision. Technical data was not provided, the environmental consequences of using only the waste water was not considered. Furthermore, farmers' attitudes toward such new projects were not examined.

6- Field crops:

- Scope: Activities carried out by this section included evaluation of national and regional durum and bread wheat varieties and national, regional barley varieties. Evaluation of yield was performed through micro and macro-plots. Observations of both wheat and barley lines to select promising varieties is also carried at NCARTT, ACSAD and Arabic countries are the sources of the varieties. The selection of promising varieties of the highest yield is the final result of all experiments.

Experiments are carried out under rainfed and irrigated conditions and at several locations. Varieties adaptable to various ecological zones are tested. Very few experiments are carried out to test the drought or diseases tolerance of the crops.

- Experiments execution:- Experiments are conducted using the RCBD design. This suggests that single factors (usually grain yield) is measured. Other yield components are hardly reported. Interactions between varieties, different levels of fertilizers, or water addition were not tested. Other factors such as moisture stress, ecological requirements, and disease tolerance should be emphasized.

- Reporting and data collection:- Collected data are mainly centered around yield figures. Other data of agronomic value and important for explaining crop behavior or failure needs to be systematically collected. Genetic yield is best expressed when other factors are maximized. Agroecological data, most important for crop response are not documented. Date of planting for example should be coupled with rainfall distribution. No data regarding the growing season, for example, to justify recommendations concerning planting dates should serve as a background.

Several areas that could enhance the genetic expression can be recommended. This section seemed to have one major job, that is testing for the identification of new varieties. Other programs have no clear features. Nevertheless, the existing job can be characterized as testing of new varieties for their adaptability to local climate since other factors are not investigated on acceptable scale.

- Transferability of technology:- This section is considered blessed when compared to other sections. This is due to the presence of clear technological information adopted by various governmental departments mainly in wheat, barley, chick-pea, and lentil. The section concentrates its activities on the selection of wheat and barley. However, the massive work carried out by this section did not show success to match this effort. Among reasons for this are the lack of follow up on further screening of varieties and the lack of effort directed toward investigating conditions that maximize the genetic potential of the promising varieties.

Very often, experiments end with recommendations concerning the supremacy of some varieties. No clear or systematic efforts had been demonstrated to follow such recommendations. Most important soil conditions and land use recommendations should be incorporated in the program for field crops.

7- Horticulture:

- Scope: Activities of this section include comparison of the yield of different varieties such as peach, olive, apple, grapes, pistachio.

The objectives were primarily to monitor performance, development of the varieties, testing of roots stocks, fruit quality, and adaptability to local conditions. Most of the studies require long-term monitoring. Some work was carried out on proper soil mixture for seedlings.

The research was centered around monitoring plant growth, yield, and yield quality. Other relevant soil and agro-ecological data were not collected. Major work is directed toward the improvement of the yield of olive tree as the number one fruit tree in Jordan. Its adaptability to the local conditions is well known and accepted by farmers. No work was reported concerning important fruit trees such as citrus or banana.

Data collection and statistical design:- RCBD design was employed in all experiments. This reflect the narrow scope of the experiments conducted. Agro-ecological and soil data are lacking and should be incorporated.

- Transferability of technology:- Mechanisms for transferring results were not obvious. Varieties produced at Ministry of Agriculture nurseries and private sectors seemed to have the highest impact on farmers.

Special projects

Al-Mashreq Project:

Forty-four staff member (M.Sc., B.Sc., Ph.D.) from NCARTT and regional agricultural research centers participated in the activities of the project. This is a regional project financed by UNDP, Arab Fund for Agriculture and Social Development and ICARDA. NCARTT is the implementing organization in Jordan. The overall project is coordinated by ICARDA. The project duration is from 1989 to 1994. The main objectives of the project are to transfer technology to farmers through

1- The introduction of feed legumes to crop rotation.
2- Improvement and increased interest in planting barley in suitable areas.
3- Support of livestock production through improvement and providing feeds.
4- Introduction of improved varieties of barley and feed legumes to farmers' fields.
5- Improvement of livestock sector through breeding and nutrition.

The project plans include a wide range of activities such as demonstrations on complete packages in various areas on barley, vetches, evaluation of rotation legume, forage, barley at various locations, range studies, livestock studies such as the use of PMSG hormone on birth increase, use of vitamins, tests of different feed composition, livestock integration with rotation system, evaluation of farmers attitude, training activities which covers local technical staff as well as farmers, field days and workshops.

The project is well executed and monitored. Continuous contact with the farmers are implemented at various locations. Workshops are held to explain and introduce the package to farmers. Names of farmers participating in the project activities are filed. This should make it easy to evaluate the impact of the project. Some of the recommended packages and participating farmers were also recorded.

Impact on farmers was indicated by an increase in the number of farmers who are implementing some of the packages recommended by the project. The percentage of farmers implementing project packages varied from one zone to another and depended on the kind of package. The evaluation also indicated that implementation of packages by farmers increases every year. The acceptability of recommended packages also increased every year. The degree of acceptance varied from one geographic location to another. The results of the evaluation indicated the tendency of farmers to accept new technology. However, some farmers preferred some components over others.

The project report is very well written and proper documentation is available. The results demonstrate that integrated projects oriented to meet the real needs of farmers have a better chance of success in reaching their objectives. It also proves beyond any doubt that joint activities can be very productive. Annual reports cover various activities executed by the project. Interpretation is provided in tables and figures.

Special Project:

- Food legume Improvement project (FLID)
- Duration 1980–92
- Crops section
- Financed by IDRC
- NCARTT joined the project in 1988–92

The objectives of the project were to investigate the different aspects which could contribute to the improvement of yield of lentils and chickpeas and to recommend to farmers the cultural practices that will improve their yields.

Research activities on cultural practices were developed during two phases during 1980–88. The third phase was conducted in cooperation with NCARTT and JCO.

The main objectives of the third phase (1988–92) were to demonstrate to farmers in rainfed areas the optimum production practices for growing food legumes and the advantage of new technologies. About 21 researchers from NCARTT participated in this project.

Activities covered in this phase included farmer managed demonstrations (full package demonstration, minimum input), or farm research studies (harvest, mechanization, weed control, *sitona* and *Bructias* control).

The evaluation conducted through this phase indicated the following: A high percentage of farmers used all or part of the project technology package on use of cultivars and fertilizers recommended by the project, which resulted in significant yield increases. This project underscores the importance of executing joint research activities, proper linkage establishment, and the fact that farmers are willing to adopt a technology package when it is sound and addresses their immediate needs.

Special Project:-

-Improvement of Agricultural Productivity in Arid to Semiarid Zones of Jordan. The executing agency is the Faculty of Agriculture, University of Jordan, in close cooperation with NCARTT, and is financed by the European Community. The objective of the project is to contribute to the improved use and protection of the Bedia, land receiving 100–200 mm rainfall per annum.

The project aims to define criteria for the planning and development of Jordan's arid land based on the results of trials, survey, and predictive data to be trained through

1- Modeling of natural resources
2- Rationalizing of water harvesting and transfer
3- Elaboration of appropriate methods of supplementary irrigation
4- Investigation of soil-climate-plant relationships, soil fertility and soil structure improvement
5- Design of balanced and adequate cropping and grazing systems
6- Introduction of most valuable range plants and forage crops
7- Application of results through carrying appropriate demonstration
8- The finding of the project to be used as a suitable base for a national center for the development of arid zone in Jordan.

The project's duration is from 1994 to 1998. Technical assistance will be provided through European institutions and ICARDA, together with scientists from the Faculty of Agriculture at the University of Jordan and NCARTT.

13.12. Bylaw 42

Translation

Resolution No. 129

The Cabinet of Ministers has taken a resolution approving the (Bylaw for the National Center for Agricultural Research and Technology Transfer) in its following form: BYLAW NO. (42) for 1993 for the

National Center for Agricultural Research and
Technology Transfer Issued in Accordance with
Article (120) of the Constitution

Article 1- This Bylaw shall be called (The National Center for Agricultural Research and Technology Transfer Bylaw for the year 1993) and shall become effective from the date it is published in the Official Gazette.

Article 2- The following words and expressions, wherever mentioned in this By-Law, shall have the meanings assigned to them below unless the context indicates otherwise:

The Ministry : Ministry of Agriculture

The Minister : Minister of Agriculture

The Higher Council : The Higher Council for Science and Technology

The Center : The National Center for Agricultural Research and Technology Transfer

The Council : The Council of the Center

The Chairman : The Chairman of the Council

The Director General : The Director General of the Center

Article 3–The Center shall be considered one of the specialized centers for scientific research and technology and be attached to the Minister. Its principal center shall be in Baqa' (Ain El-Basha). The Council, upon the recommendation of the Director General, may open branches for the Center in the Kingdom, wherever the need necessitates.

Article 4–The Center aims at employing the results of agricultural research developed locally or adopted from other sources for purposes of increasing agricultural production in both the plant and livestock areas, improving it, enhancing its effectiveness, conserving the agricultural natural resources and their optimum utilization, serving the purpose of agricultural development and maintaining the ecological balance.

Article 5–The Center shall perform the following functions:

A- Preparing scientific agricultural research plans and programs that serve the purposes of agricultural development and fulfill the agricultural policy objectives, and coordinating agricultural research and technology transfer activities.

B- Developing or adapting agricultural technology appropriate for local conditions whether in relation to plant or livestock production and its transfer and dissemination to farmers to facilitate agricultural work and achieve optimum utilization of agricultural production resources.

C- Publishing adopted or adapted or developed agricultural technologies and their dissemination to agricultural extension agents and farmers, following up on their adoption by farmers in cooperation with concerned organizations and supplying the agricultural extension organizations with proven technical information.

D- Enhancing skills of agricultural specialists, extensionists and technicians working in the agriculture sector and holding specialized training courses, conferences and workshops.

E- Conducting economic studies on farm production systems and agricultural projects, and rectifying the effect of the various social, political, economic and financial factors bearing on the overall agricultural operation.

E- Cooperating with local, Arab, regional and international institutions for the implementation of agricultural research and technology transfer programs and offering consultancy and technical services in the field of agriculture.

Article 6–

A- There shall be established in the Center a Council called (The Council of the National Agricultural and Technology Transfer) consisting of:

The Minister. Chairman

The Director General. Deputy Chairman

Secretary General of the Higher Council. Member

Representative from the Ministry of Planning named by the Minister of Planning. Member

A member of the teaching faculty of professor status from each of the Faculties of Agriculture at the official Universities named by the University President. Member

An individual with experience and specialization in the field of scientific research appointed by the Minister for a period of two years extendable for one time. Member

B- The Chairman may invite any person with experience and specialization to attend any of the meetings of the Council to take his opinion in matters on the agenda without him having the right to vote.

C- The Cabinet of Ministers shall fix rewards of the Council members.

Article 7–The Council shall assume the following duties and authorities:

A- Approving agricultural research strategies and plans and prioritizing them according to the general agricultural policy.

B- Recommending approval of agreements and contracts with parties outside the Kingdom.

C- Approving policies governing the work of the Center and its annual plans and programs.

D- Preparing instructions necessary for the implementation of the provisions of this Bylaw including financial and administrative matters and submitting them to the Minister for approval and issuance.

E- Preparing draft annual budget special for the center and submitting it to the Minister for incorporation within the Ministry's Annual Budget.

F- Any other matters which are part of the duties of the Center which the Chairman or the Director General sees fit to include on the Council's agenda.

Article 8–

A- The Council shall meet at least once monthly or whenever the need arises at the invitation of the Chairman or his Deputy in his absence. Any meeting held by the Council shall be legal if attended by two thirds of the members including the Chairman or his Deputy in his absence. Decisions shall be by unanimous or majority votes of those attending. Should there be a tie, the official presiding over the meeting will break such a tie by casting his vote.

B- The Director General shall appoint a Secretary for the Council from employees of the Center who shall prepare for meetings of the Council, record minutes, organizing and maintain records and transactions pertinent to the Council as well as carry out any duties and other tasks entrusted to him by the Director General.

Article 9 -

A- The Director General shall be appointed, his salary and other financial rights fixed and services terminated or relieved from by decision of the Cabinet of Ministers upon the recommendation of the Minister provided that the decision is ratified by Royal Decree.

B- Whoever is appointed Director General for the Center must hold a Ph.D. or M.Sc. degree in agricultural science or in one scientific specialization related to the Center's activity in

addition to practical experience in the field of scientific research of a minimum of ten years in the case of the Ph.D. holder and fifteen years in the case of M.Sc. holder.

C- The Director General shall be linked to the Minister who may re-delegate all or part of his authorities to the Director General in relation to managing the affairs of the Center.

Article 10 -

The Director General shall assume the authorities and responsibilities delineated by this Bylaw and the instructions issued in accordance with it including the following:

A- Supervision work progress at the Center and following up on its activities.

B- Managing the Center's financial, administrative and technical affairs.

C- Preparation of the Annual and Regular Reports covering the Centers work and submitting them to the Council.

D- Execution of, and following up on, the Council's decisions.

E- Contracting with researchers from outside the Center to carry out specific work within the limits of the allocations made in the Council's budget for this purpose.

F- Carrying out any other duties or tasks entrusted to him by the Council.

Article 11 -

A- There shall be established in the Center the required specialized scientific councils, Directorates and Divisions to manage its administrative, financial and legal affairs as well as handle matters related to follow-up, studies, research and planning in accordance with instructions issued for this purpose.

B- The specialized scientific committees shall consist of individuals from the researchers category and the transfer technology category. Members of these committees may be appointed under contract by decision of the Prime Minister based on the Minister's recommendation. They will be subject to the conditions outline in their service contracts.

Article 12–

The Center may, by decision of the Director General, request the assistance of experts and specialized individuals with financial rewards paid to them for their services by Cabinet of Ministers decision based upon the Minister's recommendation.

Article 13 -

The Center's financial resources shall consist of the following:

A- The allocations made for the Center in the Ministry's budget of the General Government Budget.

B- Whatever the Higher Council allocates in its Annual Budget for the Center.

C- Whatever the Cabinet of Minister allocates for the Center from the Fund for the Encouragement of Tobacco Planting.

D- Revenues from services, consultancies and research rendered by the Center.

E- Assistance, gifts, donations and wills made to the Center provided the Cabinet of Minister's approval is obtained if these were from outside the Kingdom

F- Funds which are allocated to agricultural research in the Kingdom from bilateral or multilateral assistance.

Article 14–

The Minister may, upon recommendation of the Council, issue instructions necessary for the execution of the provisions of this Bylaw including the delineation of authorities, and duties of scientific councils, Directorate and Divisions as well as those related to administrative and financial affairs of employees and hirees in the Center.

June 19, 1993 Translated by Fuad Qushair, National Agricultural Development Project

13.13. National Agricultural Library and Information Center (NALIC)

13.13.1. General background

Although the NCARTT Library has not been given proper attention in terms of funds and staff, there has been a build-up of its collection over time. In 1986, the library was moved from the Directorate of Agriculture and Extension (DARE) and established in NCARTT. In 1993, there was a fresh start with the appointment of new staff members and plans for the development of the library into a National Agricultural Library and Information Center (NALIC) were formulated.

13.13.2 Present situation

Collection:

The present collection of the library consists of the following:

a. About 30,000 printed material (books, references...) most of which are old and in the English language.
b. 340 periodical titles.

c. Unique collection of research reports on various aspects of agriculture in Jordan.
d. A collection of documents (reports, projects, technical pamphlets); and,
e. A small collection of maps and A/V material.

In general, the collection covers the following fields: General Agriculture, Agricultural policies and planning, Agro-food development, Nutrition, Animal production and health, Plant production and protection, Forestry, Land and water development, Rural economic and social development, and Training and extension.

13.13.3. Staff

At present there are 7 staff members including one library specialist, two librarians, an assistant librarian, a translator (cataloguer), a clerk and a typist. In addition to the staff at the NCARTT library two librarians were recently appointed for the Rabba and Mushaqar regional agricultural research centers. The librarian reports directly to the NCARTT Director General.

13.13.4. Cataloguing

The library uses the Dewey Decimal Classification System in classifying books. The Anglo-American Cataloguing rules 2, and the International Standard Bibliographic Description are used in descriptive cataloguing. The library has recently adopted Agrovoc, which was developed by the Faculty of Agriculture, a practical and computer oriented tool for agricultural library material.

Lack of English-language and technical skills render the present card catalogue of the library unusable. Efforts are being taken to correct the situation. The library has initiated an automation process using the CDS/ISIS package.

13.13.5. Tools and equipment

In addition to the tools referred to above, there exists an IBM PC with a printer used for data entry and for using CD-ROM databases when available. Also, there are bilingual typewriters and photo-copying machines.

13.13.6. Services

The library offers the following services to NCARTT researchers, Ministry of Agriculture staff and to students from University of Jordan: book loans, photo-copying services, answering reference queries and computer search using the database on CD-ROM (Agricola). On the average, the number of daily users of the library services is 10.

13.13.7. Major problems and constraints

At present a number of problems and constraints facing the library limit its services to researchers, decision makers, planners, and other users, such as

- A lack of qualified staff
- Most of the library collection is not catalogued or classified or indexed.
- Deficiencies in the present collection: small number, incomplete scientific periodical collections especially for the period 1989–93.
- Inefficient control of periodical holdings.
- Limited and weak users' services.
- Lack of coordination between sources of information.
- High cost of providing information.

13.13.8. Development plan for NCARTT Library

Being an integral part of NCARTT designated as the National Agricultural Library and Information Center with the mandate for coordinating agricultural research and technology transfers in Jordan, the NALIC has a major role within the agricultural sector. The main features of the NALIC development plans are summarized as follows:

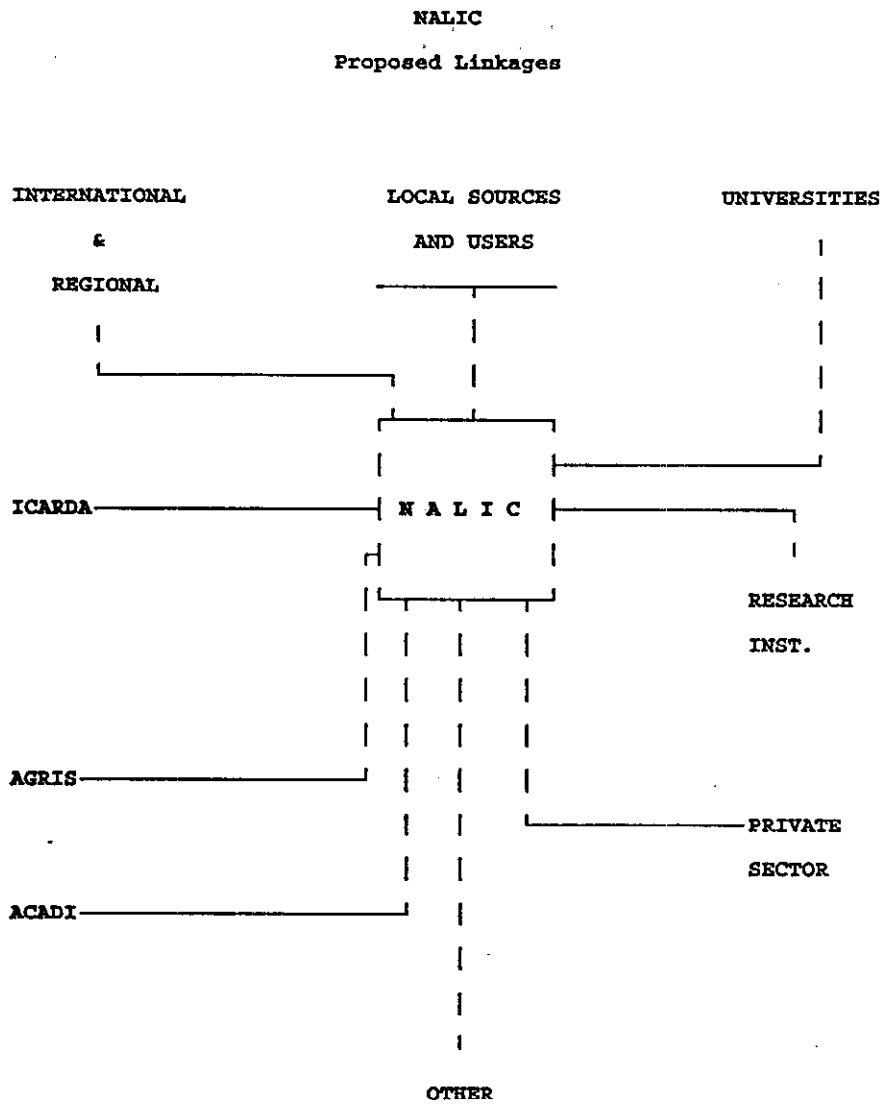
Mandate and objectives

It is proposed that NALIC should have the mandate for collecting, preparing, analyzing, providing and conveying to users all information that is related to agricultural activities. It should develop the mechanism to share, diffuse and utilize agricultural information. As a national institution other objectives are

- To be the repository of all agricultural literature including theses, reports, etc.
- To maintain close contacts with other national, regional and international sources of information (both hard copy and electronically.
- To coordinate agricultural information activities on the national level.
- To promote local and regional cooperation.
- To represent Jordan at organizations and conferences dealing with agricultural information, especially FAO, GRIS, etc.

NALIC linkages

As a National Information Center, NALIC has to make linkages with national as well as international agricultural information sources such as the Jordanian Libraries at University of Jordan and JUST, Jordan's National Information System (NIS) and other useful sources. On the international level NALIC is in the process of developing linkages with the two main agricultural information systems, AGRIS and CARIS and others such as ICARDA and ACADI, the USDA National Agricultural Library selected U.S., and other information or data sources.



NALIC organization structure

To assist in achievement of its objectives, a library committee is proposed. This committee would be chaired by the NCARTT Director General and be responsible for the long-range planning, policy making and funding. The NALIC staff would be responsible for the execution of these plans and for performing the various operations of the NALIC. Figure 2 shows the proposed organizational structure of NALIC. In the initial phase 12 staff members, this includes 6 well-qualified professional staff members to head the proposed sections.

Required finance

Upgrading of NCARTT library to the status of NALIC requires additional financial resources over and above present allocations. A financial plan has been prepared covering the period 1995–1999.

Estimated Budget for NALIC in JD 1995–1999

	1995	1996	1997	1998	1999
- Staff (1)					
Professional	12,600	12,900	13,200	13,500	13,800
Sub Professional		4,920	7,450	10,080	10,270
Supportive	6,600	6,720	6,900	7,080	7,260
- Collection (2)					
Books, INFO/DATA	80,000	80,000	90,000	100,000	100,000
Journals	21,000	42,000	63,000	74,000	85,000
Binding	1,500	1,200	1,400	1,800	2,200
Other Material	2,000	2,200	2,500	2,800	3,000
- Equipment (3)					
Production Unit	9,000	-	3,000	-	-
Microform Unit	100,000	-	-	-	-
Other (4)	5,000	-	-	5,000	-
- Supplies	6,500	6,500	7,000	7,700	8,500
- Travel	2,000	2,500	3,000	3,600	4,200
- Part-time Work (5)	16,000	-	-	-	-

1. Five professional and five others in the first year with annual increase in the subprofessional and supportive categories.
2. Books: 4,000 volumes in the first year (at JD20. per vol.) to be repeated, more or less.
   Journals: 61 titles in the first year (current paid JD21.00) to be increased to 100 titles in 1996, 160 in 1997, 220 in 1998, and 250 in 1999.
3. Allocations after the first year are for replacement and additions.
4. Photocopying machine.
5. Should be in (Salaries), but this sum is intended for clearing the backlog.

13.14 Tables

13.14.1. NCARTT Staffing. Distribution of NCARTT Personnel by Location, Specialization, and Educational Level

Location/program NCARTT	Position	Specialty	B.Sc.		M.Sc		Ph.D		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
Mahmoud Duwayri	D.G.	P. Brd.					1973	USA	24	2
Nabil Katkhuda	Deputy D.G.	Field Crops			1974	AUB			30	9
* Mona Saba	D.G. Office	Soil & Irrig.	1987	UOJ						5
I. Plant Prot. Branch										
Khalid Masannat	D.G. Tech. Aff., and Chief of Branch	Pathologist			1973	AUB			27	9
Sami Batarseh	Researcher	Virologist			1985	UOJ				9
* Rubi Asad	Res. Asst.	Virologist			1984	UOJ				1
* Ebtihal Abu-A'obaid	Res. Asst.	Virologist			1987	UOJ				1
* Abeer Abu Sherbeh	Researcher	Virologist			1989	UOJ				3
* Salam Al-Zahabi	Researcher	Herbology			1991	UOJ**				3
Faisal Nemir	Researcher	Virologist			1993	UOJ				1
Mo'tasem Obeidat	Researcher	Herbology			1983	UOJ**				1

D.G. = Director General
H.D. = High Diploma after B.Sc - UOJ.
Ch. Pl. Prot. = Chief of Plant Protection Branch
Alex. U. = Alexandria University
D.G. Tech. Aff. = D.G. Technical Assistant
• = Female
Pl. Brd. = Plant Breeding
**** NADP Participant**

Location/program NCARTT:	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
II. Insects Cont. Branch:										
Abdel-Kader Kasim	Chief of Brn.	Entomologist			1973	Alex. U.			13	9
Salem Qubailat	Researcher	Entomologist					1989	USSR		6
* Raeda Al-Awamleh	Researcher	Nematologist			1988	UOJ				6
* Muna Trayqhem	Researcher	Entomologist			1989	H.D.**				6
Marwan Abdulwali	Researcher	Entomologist			1993	UOJ**			8	2

D.G. = Director General **Alex. U. = Alexandria University** **Pl. Brd. = Plant Breeding**
H.D. = High Diploma after B.Sc - UOJ. **D.G. Tech. Aff. = D.G. Technical Assistant**
Ch. Pl. Prot. = Cheif of Plant Protection Branch *** = Female** **** Participant**

Location/program	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
III. Vegetable Branch:										
Amin Shams-Eddin	Veg. Chief Branch	Vegetables					1982	USSR	19	9
Muein Qaryouti	Researcher	Plant Production			1992	UOJ**				3
* Mariem Al-Majali	Researcher	Plant Production			1994	UOJ**				6
IV. Agri-Research Program for Rainfed Regions:										
Mohammad Ababneh	Director	Forage Crops					1991	Australia	15	9
Fadel M. Ismaeal	Researcher	Plant Breeding			1991	UOJ				2
Nidal Na'neesh	Researcher	Legumes			1988	UOJ				2
Hussain Meqdadi	Researcher	Field Crops			1990	UOJ				1
* Maha Syouf	Researcher	Plant Production (Genetic Research)			1988	UOJ				6
* Sa'edda Arabeyat	Research Assistant	Field Crops	1987	UOJ						6
• Enas Al-Hmoud	Research Assistant	Plant Protection	1989	UOJ						1
• Sobheya Say'efan	Research Assistant	Genetic Researcher Collection	1987	UOJ						1
• Siham Al-Louzi	Research Assistant	Plant Production	1985	UOJ						9
Majid Al-Zoa'bi	Researcher	Field Crops			1984 S	UOJ**			20	9

Veg. Ch. Br. = Vegetables Chief Branch
** NADP Participant
* = Female
S = Still Studying
X = Studying Ph.D. in the USA.

Location/program NCARTT:	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
V. Agri-Research Program for Animal Production:										
Mohammad Kamel	Director	Animal Nutrition					1980	Turkey	28	3
Mohammad Amasha	Researcher	Animal Production					1985	Yugo.		1
• Naderah Al-Jawhari	Research Assistant	Animal Production	1986	UOJ						1
VI. Horticulture Branch (Fruit Trees):										
Ali Abu Zurayk	Branch Cheif	Hort. Fruit Trees			1980	AUB			20	9
• Amal G. El-Hmoud	Researcher	Hort. Fruit Trees			1993	UOJ				6
VII. Range & Natural Resources Research Programs:										
Kamal Tadros	Director	Range					1987	USA		8
VIII. Water & Irrigation Management Research Program:										
Abdelnabi Fardous	Director	Soil & Irrigation					1993	USA	20	1
Mohammad Dabbas	Res./Irrigation	Soil & Irrigation					1991	Bulgaria	11	4
Munir Al-Rusan	Res./Soils	Soil Chemistry					1993	USA	13	1
Wa'el Al-Sharief	Res./Irrigation	Soil & Irrigation			1980	UOJ			19	1
Mohammad Al-Jamal	Research Assistant	Soil & Irrigation	1985	UOJ						1
Kamal Al-Faweir							1993			

Yugo. = Yugoslavia * = Female Br. Chief = Branch Chief Hort. = Horticulturist
(Fr. Tr.) = Fruit Trees Res/.Irrigation = Researcher on Irrigation Res./Soil = Researcher on Soils
** NADP Participant

Location/program NCARTT:	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years-govt.	Years-NCARTT
			Date	Place	Date	Place	Date	Place		
IX. Irrigated Agricultural Research Programs:										
Samir Salti	Act. Dir. Soil. Fert. Res.	Soil Fertility					1980	USSR	20	9
Rimon Qubrosi	Researcher	Soil Fertility			1990	USA**			19	3
Talal Al-Ashhab	Researcher	Soil & Irrigation	1974	Egypt					19	9
Amin Al-A'kour	Research Assistant	Soil & Irrigation	1984	Iraq						6
* Safa' Mazahreh	Research Assistant	Soil & Irrigation	1986	UOJ						5
Ahmad Bolad	Resercher	Soil & Water Ana.					1983	Turkey	19	9
X. Agri-Economics Research Program:										
Rasmi Swaiti	Director	Economist					1982	Turkey		3
Khalid Al-Zubaidi	Researcher	Economist			1990	UOJ				1
* Oruba Al-Kayed	Research Assistant	Agro-Economy	1984	UOJ						6
* Eman Khresat	Research Assistant	Agro-Economy	1987	UOJ						6
XI. Technology Transfer & Training Reserch Program:										
Ahmad Abu Ali	Director	Agro. Ext. & Info.			1978	Alex.U.			26	2
** Jamal Ershedat	Ph.D. Student at present	Agro. Extension								
Hussain Abu Rubaiha	Gen. Comm.	Agro. Extension	1988	H.D.						6

Act. Dir. = Acting Director Agro. Ext. = Agricultural Extension Soil Fert. Res. = Soil Fertility Researcher H.D. = High Diploma in UOJ Alex. U. = Alexandria University Agro. Eco. = Agricultural Economy Agro. Ext. & Info. = Agricultural Extension & Info. S.W. Ana. = Soil & Water Analysis Gen. Comm. = General Communication ** = Went into a scholarship to get Ph.D. in Agro. Ext. in the USA.

Location/program Jordan Valley: Deir Alla	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
Mohammad Abu Jalboush	Director	Plant Protection			1981	UOJ			20	9
Waleed Qawasmeh	Researcher	Soil					1982	Bulgaria		3
Adnan El-Yasin	Researcher	Barley Breeding			1992	UOJ				2
* Mona Masha'al	Researcher	Entomologist	1990	UOJ						4
Saeed Zureqi	Researcher	Irrigation			1978	UOJ				2
Akram Tahbasim	Researcher	Plant Protection	1981	UOJ					15	9
Hani Ghnaim	Researcher	Fruit Trees			1993	UOJ**			12	9
Abdulla Madi	Researcher	Entomologist			1988	UOJ				6
* Eman Hadidi	Research Assistant	Vegetables	1988	UOJ						1
Darwish Mustafa	Research Assistant	Plant Protection	1979	UOJ					15	9
Usam-Eddin Nijim	Research Assistant	Vegetables	1979	UOJ					15	9
Samir Darwesheh	Research Assistant	Economist	1985	UOJ						6
Adel Al-Shoubaki	Research Assistant	Soil & Irrigation	1985	UOJ						5
Basil Obeidat	Research Assistant	Entomology	1988	UOJ						1
Yehya Al-Sutari	Research Assistant	Plant Production	1985	UOJ						5

* = Female St. Sup. = Station Supervisor H.D. = High Diploma, one year after B.Sc from UOJ ** NADP Participant

Location/program Jordan Valley: Wadi El-Yabis	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years-govt.	Years-NCARTT
			Date	Place	Date	Place	Date	Place		
Mohammad Al-Qaderi	Station Superint.	Vegetables	1987	H.D					24	9
Al-Karameh										
Mustafa Al-Edwan	Station Superint.	Vegetables	1985	UOJ						5
Mushaqar:										
Khalid Zakariya	Director	Field Crops	1967	Alex. U.					26	
Mazen El-Rajabi	Researcher	Soil & Irrigation			1987	UOJ			14	9
Zeyad Shorat	Researcher	Pathologist			1987	UOJ				6
Akef Al-Qusous	Researcher	Field Crops			1989	UOJ				5
Husam Halaseh	Station Supervisor	Field Crops	1975	DU					20	9
Mahmoud Ali	Research Assistant	Soil	1982	En.Sh.						5
* Ekhlas Abu-Naser	Research Assistant	General	1985	UOJ						
Jehad Karadsheh	Research Assistant	Animal Production	1974	Iraq					19	
* Jakleen Halaseh	Research Assistant	Plant Protection	1984	H.D.-DU						
Mahmoud N. Al-Hwayan	Research Assistant	Fruit Trees	1986	UOJ						
Adnan Rabab'a	Research Assistant	Field Crops	1986	UOJ						
* Basma Al-Abbadi	Research Assistant	Vegetables	1985	UOJ						
* Sana' Tukan	Research Assistant	Field Crops	1986	UOJ						

H.D. = High Diploma, i.e., one year over High School DU = Damascus University St. Sup. = Station Superintendent
En.Sh. = Ein Shams University, Egypt Alex. U. = Alexandria University
* = Female

Location/program Al-Khaldieh:	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
Jamal Herzalla	Director	General	1967	Egypt					26	9
Saleh Shdayfat	Assistant Director	Field Crops			1992	UOJ **			14	9
Ismat Karadsheh	Researcher	Irrigation			1990	UOJ				1
Mohammad Abu-Zant	Research Assistant	General	1980	DU						5
* **Manal Bqaeen**	Research Assistant	Plant Production	1990	UOJ						5
Shoubak Center:										
Ismael Tuwaysi	Director	Fruit Trees	1986	DU						6
Adel El-A'bed	Researcher	Pathologist			1991	UOJ				1
Khalid El-Absi	Researcher	Fruit Trees			1993	UOJ				1
As'ad El-Khadir	Researcher	Soil & Irrigation			1990	UOJ				1
Mohammad Bedoor	Researcher	General Agricul.	1978	Cairo						1
Abdelrahim Bawalize	Research Assistant	Field Crops.	1994 S	UOJ**						4
Ibrahim Rawashdeh	Research Assistant	Field Crops	1991	Iraq						3

Gen. Agri. = General Agriculture
DU = Demascus University * = Female ** = NADP Participant S = Still Studying

Location/program Al-Ramtha:	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
I. Ramtha Station:										
Ali Gharaybeh	Director	Barley Crop			1989	UOJ			16	9
Faisal Al-Rjoub	Ph.D. Scholarship	Barley Crop			1983	UOJ**			16	9
Faisal Tawfeeq Awaddah	Ph.D. Scholarship	Sheeps			1976	Iraq				9
Nasri Yacoub	Acting Director/ Researcher	Fruit Trees	1989	H.D.					12	9
Nazem Mousa	Station Superint.	Field Crops	1969	Egypt					23	9
Qasem Mamdouh	M.P. Coordinator	Plant Production							20	9
Mahmoud Alayyadi	Researcher	Field Crops	1975						18	9
Hassan Khulqi	Tobaco Researcher	Plant Production	1979	Ankara, Turkey					21	9
Loay El-Qara'an	Research Assistant	Plant Protection	1988	UOJ						2
Tawfeq Inserat	Research Assistant	Animal Production	1985	UOJ						2
* Soha Abu El-Einnain	Research Assistant	Plant Production	1983	Cairo University						2
* Enas Gharaybeh	Research Assistant	Agro-Economics	1988	UOJ						6
Naser El-Sharif	Research Assistant	Mach.								2
Yousef Al-Omari	Research Assistant	Plant production	1975	Yugo.					20	9
Na'eem Mazahreh	Researcher	Soil & Irrigation			1993	UOJ				1
Fathi Mahmoud	Research Assistant	Soil & Irrigation	1977	USSR					18	9

Ph.D. Scho. = Ph.D. Scholorship at present St. Sup. = Station Superintendent M.P. = Maahreq Project.
H.D. = High Diploma from UOJ, one year after B.Sc.
* = Female Mach. = Agricultural Machinary; Yugo. = Yugoslavia
** = NADP Participant S = Still Studying

Location/program Ramtha Center (continued):	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCART T
			Date	Place	Date	Place	Date	Place		
II. Maro Station:										
Fahid Al-Khatib	Station Superint.	Grains Breeding	1973	Youg.	1975	H.D. Mexico			20	9
Tayseer Latayfeh	Research Assistant	Plant Production	1975	Youg.					20	9
Jawdat Tawalbeh	Research Assistant	Soil & Irrigation	1978	Egypt					18	9
Yehya Shakhatreh	Research Assistant	Recl. Sci.	1986	Youg.						6
III. Khanasreh Station:										
Mohammad Ershedat	Station Superint.	Animal Production	1986	Syria						3

H.D. = High Diploma St. Sup. = Station Superintendant Recl. Sci. = Reclamation Science
Yugo. = Yugoslavia

Location/program Al-Rabba Center	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Place	Date	Place		
I. Al-Rabba Station:										
Nedal Al-Majali	Director	Legumes			1993	UOJ				9
• Safieh Al-Ma'ali	Researcher	Plant Breeding			1990	UOJ**				9
Nofal Al-Omari	Researcher	Pathologist			1988	UOJ				5
Jihad Haddadin	Researcher	Entomologist			1991	UOJ				1
Jamil Sarayreh	Research Assistant	Animal Production	1983	UOJ						7
Esam Masa'adeh	Research Assistant	Soil & Irrigation	1986	UOJ						7
Husam Zurayqat	Research Assistant	Fruit Trees	1985	UOJ						5
• Afaf Madadha	Research Assistant	Plant Production	1988	UOJ						5
• Raghed Amarien	Research Assistant	Plant Production	1987	UOJ						5
• A'Ohood Horani	Research Assistant	Plant Production	1987	UOJ						5
• Diana Masa'adeh	Research Assistant	Plant Protection	1991	UOJ						2
Haytham Al-Adaylch	Research Assistant	Soil & Irrigation	1991	Iraq						2
• Maisah Haddadin	Research Assistant	Plant Production	1989	UOJ						1
II. Al-Ghowair Station:										
• Sabah Al-Majali	Station Superint.	Economist	1983	UOJ						7

• = Female St. Sup. = Station Superintendent ** = NADP Participant

Location/program Al-Rabba Center	Position	Specialty	B.Sc.		M.Sc.		Ph.D.		Years in govt.	Years at NCARTT
			Date	Place	Date	Plac e	Date	Place		
II. Ghor Al-Safi Station:										
Ahmad Madadha	Station Superint.	Plant Protection	1984	UOJ						7
Unes Tarawneh	Research Assistant	Plant Protection	1987	UOJ						3
Atif Mahadien	Researcher	Vegetables			1993	UOJ **				9

* = Female St. Sup. = Station Superintendent ** = NADP Particpant

13.14.2 Construction started, Expected Completion Dates in Interim Evaluation, Actual Completion date, and of Physical Facilities and cost of each in JD.

Location of Facilities	Construction Implemenation Dates*			Cost in US$
	Starting	Expected Completion	Actual completion date	
NCARTT main building (Baqa)	March, 89	February, 91	July 15, 94	3,385,714 **
Ramtha RASC	April, 89	October, 90	September, 90	652,418
Mushagar RASC	March, 89	September, 90	March, 91	622,321
Rabba Rasc	April, 89	October, 90	April, 91	880,208
Shobak RASC	April, 89	October, 90	August, 91	901,979
	Total construction cost			6,442640
	Plus cost of design and supervision			584,825
	Grand Total			7,027,465

*Expected date of completion of construction as envisaged in the PP: NCARTT main building, October 1987, RAS facilities, October 1988.
** Includes JD 200,000 contribution from the GOJ.

Source: USAID/Jordan NADP Project Paper (278-0264) and documents of the construction contracts of NADP.

13.14.3 Comparison of Target Dates in Project Paper and Actual Dates

Comparison of target dates in project paper implementation Plan and actual dates for key project activities (1985-1994)

	Activity	Target Date	Actual Date	Comment
1	Grand Agreement Signed	6/85	7/31/85	One month late.
2	Initial CP's Met*	7/85	12/19/85	5 months late.
3	Engineering/Architect Contract signed	12/85	10/27/87	23 months late.
4	Engineering/Architect Work completed	12/86	8/8/88	20 months late.
5	T.A. Institutional Contract Signed	1/86	1/1/87	12 months late.
6	Technical Assistance Begins	4/86	4/1/87	12 months late.
7	Commodity contract issued	7/86		
8	Second phase/replacement take place	FY 90	Not Done	
9	Facility Construction completed:			
	NCARTT Building	1988	7/94	Six years late.
	Ramtha RASC	1988	9/90	Two years late.
	Mushagar RASC	1988	3/91	Two and a Half years late.
	Rabba RASC	1988	4/91	
	Shobak RASC	1989	8/91	
10	Agricultural Development Fund Starts	1987	1987	

13.14.4 List of NADP Academic Training Participants Funded by NADP, by Field of Study , Location, Dates of Training, Level of Degree, and Current Status

Name	Degree	Field of study	University	Began	Completion date	Current employment
A. US ACADEMIC TRAINING						
1. Abdel Nabi Fardous	Ph.D.	Soils	Washington State University	June 1989	June 1993 C	NCARTT, Dir. Water Prog.
2. Majid Fandi Al-Zoubi	Ph.D.	Agronomy/Seed Prod. & Tech.	Washington State University & Manhatten - Kansas University	June 1989	September 1994 S	NCARTT, still in training
3. Faisal Al-Rjoub	Ph.D.	Agronomy	Washington State University	June 1990	June 1994 S	Ramtha, still in training
4. Munir Moh'd Al-Rusan	Ph.D.	Soils	Washington State University	June 1990	June 1994 S	NCARTT, Soil Fert. Res.
5. Motassem O'Beidat	Adv. M.Sc.	Weed Science Control	North Dakkota State University	March 1990	August 1993 S	NCARTT, Weed Control Spec.
6. Rimon Qubrosi	M.Sc.	Soils	Washington State University	January 1988	December 1990 C	NCARTT, Soil Fert. Res.
7. Jamal Al-Rusheida	M.Sc.&Ph.D	Extension Education	Missouri/Columbia University	January 1990	June 1992 S	NCARTT, still in training
8. Faisal Tawfiq Awwadah	Ph.D.	Animal Production	Washington State University	December 1993	December 1997 S	will complete under another
9. Moh'd Na'el Zubi	Ph.D.	Plant Protection	University of Illinoise	December 1993	December 1997 S	USAID funded Project
B. LOCAL UOJ/FOA ACADEMIC:						
1. Mohammad Rahahleh	M.Sc.	Agricultural Economics	University of Jordan	September 1987	March 1989 C	MOA, Public Relations
2. Adnan Abdel Nour	M.Sc.	Plant production	University of Jordan	September 1987	February 1993 C	MOA, Head of Vegetables
*3. Amal El-Hmoud	M.Sc.	Plant Production	University of Jordan	September 1988	October 1993 C	NCARTT, Researcher
4. Jamil Y. Ja'afreh	M.Sc.	Plant Protection	University of Jordan	September 1988	August 1991 C	Ghor Safi, Director
*5. Safieh Ma'ali	M.Sc.	Plant Production	University of Jordan	September 1988	August 1991 C	RABBA RASC, Researcher

Name		Degree	Field of study	University	Began	Completion date	Current employment
*6.	Mariam Al-Majali	M.Sc.	Plant Production	University of Jordan	September 1988	February 1994 C	NCARTT, Researcher
7.	Atif Mahadeen	M.Sc.	Plant Production	University of Jordan	September 1988	October 1993 C	Ghor Safi, Researcher
*8.	Amneh K. Issa	M.Sc.	Agricultural Economics	University of Jordan	September 1988	March 1993 C	MOA, Proj. Directorates
9.	Salah Nabilsi	M.Sc.	Animal Production	University of Jordan	September 1988	August 1992 C	Jarash, Director
10.	Saleh Shdayfat	M.Sc.	Plant Production	University of Jordan	September 1988	October 1992 C	Khaldieh RASC, Researcher
11.	Marwan Abdel Wali	M.Sc.	Plant Protection	University of Jordan	September 1989	June 1993 C	NCARTT, Researcher
12.	Malik Mahadien	M.Sc.	Agricultural Economics	University of Jordan	September 1989	August 1992 C	MOA, Policy Directorate
13.	Moh'd Rabah Katibeh	M.Sc.	Plant Protection	University of Jordan	September 1989	October 1993 C	MOA, Plant Protection Dir.
14.	Hani Dawood Ramadan	M.Sc.	Plant Production	University of Jordan	September 1989	October 1993 C	Deir Alla RASC, Researcher
15.	Fawaz Awad Abu Salem	M.Sc.	Plant Production	University of Jordan	September 1989	June 1993 S	still in training
16.	Muien Qaryouti	M.Sc.	Plant Production	University of Jordan	June 1990	December 1992 C	NCARTT, Researcher
17.	Hussain Saleh	M.Sc.	Plant Production	University of Jordan	June 1990	February 1993 C	MOA, Plant Protection Dir.
18.	Ahmad Nouri Shadaydeh	M.Sc.	Plant Protection	University of Jordan	June 1990	December 1993 S	still in training
19.	Kamal Al-Fawaier	M.Sc.	Plant Production	University of Jordan	January 1991	October 1993 C	MOA, Plant Prod. Direct.
*20.	Salam Ayoub	M.Sc.	Plant Production	University of Jordan	August 1992	August 1994 S	still in training
21.	Abdel Rahim Bawaliz	M.Sc.	Plant Production	University of Jordan	August 1992	August 1994 S	still in training
22.	Mohammad Abu Radaha	M.Sc.	Plant Production	University of Jordan	August 1992	August 1994 S	still in training
23.	Mohammad Al-Jamal	M.Sc.	Extension	University of Jordan	Augsut 1990	Stoped by MOA	NCARTT, Researcher
24.	Yahya Al-Sutari	M.Sc.	Plant Production	University of Jordan	August 1990	Stoped by MOA	Deir Alla RASC, Researcher

Name		Degree	Field of study	University	Began	Completion date	Current employment
25.	Moh'd Faris Soub	M.Sc.	Sheep Production	University of Jordan	August 1990	Dropped	Karak Directorate, Res.
26.	Bader Al-Saydeh	M.Sc.	Animal Production	University of Jordan	August 1990	Dropped	MOA
27.	Mahmoud Kan'an	M.Sc.	Plant Protection	University of Jordan	September 1989	Dropped	MOA, Ext. Amman
28.	Abdullah Batayneh	M.Sc.	Plant Protection	University of Jordan	September 1989	Dropped	MOA, Extension
29.	Naser Masarweh	M.Sc.	Plant Production	University of Jordan	September 1988	Dropped/broken leg.	Karak Directorate, Res.
*30.	Wafa Sahawneh	M.Sc.	Plant Production	University of Jordan	September 1988	Dropped/Medical Reason	Irbid Directorate, Res.
*31.	Samar Hadi	Diploma	Plant Production	University of Jordan	September 1987	August 1988 C	Private Sector
32.	Hashem Shakatreh	Diploma	Plant Production	University of Jordan	September 1988	August 1990 C	Ma'an Directorate, Res.
33.	Mohannad Yacoub	Diploma	General Agriculture	University of Jordan	September 1988	August 1990 C	MOA, Plant Production
34.	Zuhair Al-Rashdan	Diploma	Ag. Ext. & Economics	University of Jordan	September 1989	December 1990 C	MOA, Amman
35.	Kamal Al-Fawaier	Diploma	Plant Production	University of Jordan	September 1989	December 1990 C	MOA, Plant Prod. Direct.
36.	Issa Al-Jalamdeh	Diploma	Animal Production	University of Jordan	September 1988	June 1990 C	Karak Directorate, Res.
37.	Muien Qaryouti	Diploma	Plant Production	University of Jordan	September 1988	June 1990 C	NCARTT, Researcher
*38.	Abeer Abu Hassan	Diploma	Plant Protection	University of Jordan	September 1988	June 1992 C	NCARTT, Plant Protection
*39.	Muna Salem Trayghim	Diploma	Plant Protection	University of Jordan	September 1988	December 1989 C	MOA, Plant Production
40.	Hussain M. Saleh	Diploma	Field Crops	University of Jordan	September 1988	June 1990 C	MOA, Plant Production
41.	Abdelrahim B. Al-Ali	Diploma	Field Crops	University of Jordan	September 1988	August 1989 C	MOA Baqoura Station
*42.	Fatima Hwaidi	Diploma	Library Science	University of Jordan	September 1992	December 1993 C	NCARTT Library

Name		Degree	Field of study	University	Began	Completion date	Current employment
43.	Ziad Al-Rabadi	Diploma	Plant Production	University of Jordan	September 1989	Dropped	MOA Extension
44.	Mazin Dmour	Diploma	Plant Production	University of Jordan	September 1989	Dropped 2/90	Karak Directorate, Res.
45.	Hussain Burjaq	Diploma	Plant Production	University of Jordan	September 1989	Dropped 2/90	MOA Amman Direct.
*46.	Ghada Al-Naber	M.Sc.	Plant Production	University of Jordan	September 1993	June 1995 S	MOA, Public Relations

C = Completed S = Still Studying * = Female

13.14.5 Area Planted, Production, and Average Yields

Wheat and Barley: Area, Production and Yield in Jordan
1984 - 1993 (Rainfed) 1984 -1993 (Irrigated)

Year	Wheat (rainfed)			Barley (rainfed)		
	Area (000) dunum	Production (000) ton	Yield kg/dun	Area (000) dunum	Production (000) ton	Yield kg/dun
1984	430.0	25.0	58.1	190.3	4.8	25.2
1985	943.6	62.8	66.6	399.2	19.7	49.3
1986	506.5	40.3	79.5	181.9	14.5	79.7
1987	1245.4	109.3	87.8	600.6	41.0	68.3
1988	1182.7	137.0	115.8	663.6	50.0	78.9
1989	812.1	61.1	75.2	421.4	25.0	59.3
1990	634.2	59.7	94.1	328.1	26.0	79.2
1991	443.2	33.8	76.3	200.1	15.8	79.0
1992	809.0	98.0	121.1	811.0	92.0	113.4
1993	663.8	37.4	56.3	663.9	33.3	50.2
	Irrigated			Irrigated		
	Area (000) dunum	Production (000) ton	Yield kg/dun	Area (000) dunum	Production (000) ton	Yield kg/dun
1984	19.9	3.0	150.8	7.6	0.7	92.1
1985	18.9	2.2	116.4	12.0	1.0	83.3
1986	9.4	1.3	138.3	13.9	3.1	223.1
1987	25.8	7.1	275.2	12.2	3.4	278.7
1988	57.2	25.7	449.3	17.0	3.2	188.2
1989	84.8	24.8	292.5	20.4	3.7	181.4
1990	58.3	29.0	497.4	16.3	10.4	638.0
1991	63.2	24.0	379.7	25.6	11.0	429.7
1992	50.0	24.0	480.0	26.0	11.0	423.1
1993	64.1	37.4	583.5	27.3	11.0	402.9

Source: Economic and Agricultural Policy Dept., MOA, Amman.

Tomato (Irrigated and Rainfed)
Eggplant, Cucumber (Irrigated)
Area, Production and Yield in Jordan
1980/1981 - 1992/1993

Year	Tomato (Irrigated & Rainfed)			Eggplant (Irrigated)			Cucumber (Irrigated)		
	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/ Dun
1980/ 81	142.6	341.4	2.4	38.6	99.3	2.6	42.8	106.2	2.5
1981/ 82	156.5	375.4	2.4	64.3	110.0	1.7	32.0	87.5	2.7
1982/ 83	172.1	408.2	2.4	56.1	93.9	1.7	40.9	108.2	2.6
1983/ 84	155.7	354.6	2.3	28.1	73.7	2.6	34.4	99.1	2.9
1984/ 85	137.1	392.3	2.9	27.2	76.3	2.8	64.8	124.7	1.9
1985/ 86	96.4	305.9	3.2	23.8	80.0	3.4	21.6	92.7	4.3
1986/ 87	78.2	268.4	3.4	16.1	48.9	3.0	24.4	110.7	4.5
1987/ 88	74.1	290.8	3.9	10.7	34.9	3.3	11.0	80.0	7.3
1988/ 89	73.5	331.3	4.5	13.7	35.1	2.6	11.8	87.4	7.4
1989/ 90	94.4	446.2	4.7	13.6	35.9	2.6	10.3	92.1	8.9
1990/ 91	126.2	329.1	2.6	17.5	40.6	2.3	12.2	102.6	8.4
1991/ 92	152.2	706.0	4.6	28.9	58.7	2.0	20.9	116.8	5.6
1992/ 93	149.3	621.2	4.2	20.5	70.4	3.4	11.8	100.6	8.5

Source: Economic and A gricultural Policy Dept., MOA, Amman.

Onion, Garlic (Irrigated and Rainfed)
Potato (Irrigated)
Area, Production and Yield in Jordan
1980/1981 - 1992/1993

Year	Potato (Irrigated)			Onion (Irrigated and Rainfed)			Garlic (Irrigated and Rainfed)		
	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/ Dun
1980/ 81	4.2	9.1	2.2	11.1	11.7	1.1	0.2	0.2	1.00
1981/ 82	7.5	11.5	1.5	15.1	30.2	2.0	4.0	0.2	0.05
1982/ 83	7.8	25.7	3.3	17.5	24.6	1.4	1.0	0.3	0.30
1983/ 84	12.6	26.6	2.1	11.3	8.9	0.8	1.6	1.2	0.75
1984/ 85	15.5	26.3	1.7	12.9	13.7	1.1	1.1	0.7	0.64
1985/ 86	15.6	38.5	2.5	17.7	21.4	1.2	1.9	1.0	0.53
1986/ 87	21.4	48.2	2.3	12.5	18.1	1.4	2.2	1.0	0.45
1987/ 88	25.1	51.7	2.1	32.8	44.5	1.4	3.9	2.2	0.56
1988/ 89	17.6	40.1	2.3	22.5	27.4	1.2	1.4	1.0	0.71
1989/ 90	29.0	64.0	2.2	19.6	25.5	1.3	1.3	0.8	0.62
1990/ 91	38.4	76.7	2.0	29.6	37.2	1.3	4.5	3.4	0.76
1991/ 92	36.3	81.9	2.3	32.1	45.9	1.4	6.9	7.3	1.06
1992/ 93	49.0	117.6	2.4	29.1	43.1	1.5	6.2	8.7	1.40

Source: Economic and Agricultural Policy Dept., MOA, Amman.

Olives, Grapes, Apples, (Irrigated and Rainfed)
Area, Production and Yield in Jordan
1980/1981 - 1992/1993

Year	Olives (Irrigated & Rainfed)			Grapes (Irrigated & Rainfed)			Apples (Irrigated & Rainfed)		
	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/ Dun
1980/ 81	238.1	18.9	79.4	98.3	45.9	467.0	7.2	3.0	416.7
1981/ 82	244.5	43.1	176.3	106.2	46.5	437.9	8.5	4.2	494.1
1982/ 83	249.8	25.2	100.9	108.9	51.9	476.6	8.7	4.5	517.2
1983/ 84	255.1	38.5	151.0	111.6	41.5	371.9	9.1	4.2	461.5
1984/ 85	285.1	22.7	79.6	115.5	50.3	435.5	9.3	2.9	311.8
1985/ 86	351.1	45.7	130.2	125.2	57.9	462.5	10.6	2.5	235.8
1986/ 87	371.8	24.1	64.9	131.0	55.6	424.4	11.5	2.0	174.0
1987/ 88	406.0	78.8	194.1	133.9	69.4	518.3	12.4	4.8	387.1
1988/ 89	595.8	15.0	25.2	132.4	78.9	596.0	22.4	5.1	227.7
1989/ 90	622.8	72.4	116.2	133.4	65.5	491.0	27.0	11.9	440.1
1990/ 91	678.7	31.3	46.1	133.0	75.4	567.0	30.0	11.8	393.3
1991/ 92	728.2	85.1	116.9	126.2	63.6	504.0	40.0	24.6	615.0
1992/ 93	759.4	49.2	64.8	135.9	54.8	403.2	45.4	24.9	548.5

Source: Economic and Agricultural Policy Dept., MOA, Amman.

Almonds (Irrigated and Rainfed)
Citrus, Banana (Irrigated)
Area, Production and Yield in Jordan
1980/1981 - 1992/1993

Year	Almonds (Irrigated & Rainfed)			Citrus (Irrigated)			Banana (Irrigated)		
	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/Dun	Area (000) dunum	Prodction (000) Ton	Yield Ton/ Dun
1980/ 81	5.0	1.1	220.0	31.8	83.0	2.6	3.1	12.0	3.9
1981/ 82	5.1	1.3	255.0	38.5	86.5	2.2	4.6	13.0	2.8
1982/ 83	5.5	1.5	272.7	38.8	117.6	3.0	5.3	18.9	3.6
1983/ 84	5.6	1.6	285.7	39.3	95.1	2.4	5.6	17.1	3.1
1984/ 85	6.0	1.8	300.0	49.2	116.0	2.4	10.3	30.7	3.0
1985/ 86	6.6	1.0	151.5	50.4	115.7	2.3	8.4	27.8	3.1
1986/ 87	6.4	2.0	312.5	52.0	125.8	2.4	10.3	44.5	4.3
1987/ 88	6.9	1.3	188.4	53.0	141.9	2.7	8.6	30.9	3.6
1988/ 89	9.6	1.2	125.0	53.9	124.7	2.3	11.0	17.1	1.6
1989/ 90	9.6	1.1	114.6	54.2	119.0	2.2	11.7	19.1	1.6
1990/ 91	10.4	1.7	163.5	54.6	154.0	2.8	11.7	20.5	1.8
1991/ 92	10.8	2.1	194.4	53.3	127.0	2.4	12.0	18.3	1.5
1992/ 93	10.7	2.1	196.3	54.0	175.8	3.3	12.0	18.4	1.5

Source: Economic and Agricultural Policy Dept., MOA, Amman.

13.14.6 Costs of Production, Gross Margins per Dunum, and Gross Margins per Cubic Meter of Irrigation Water

Wheat *Profitability* According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No. I	Item/JD	Wheat			
		Technology Level A (3)		Technology Level B (4)	
		Summer Plant	Winter Plant	Summer plant	Winter Plant
II. Irrigated	Total Gross Output Total Variable Costs (2) Gross Margin Gross Margin/M^3 Water Gross Margin/hr.labor		78.000 34.005 ***43.995*** 0.063 8.799		
III. Rainfed	Total Gross Output Total Variable Costs *Gross Margin* Gross Margin/M^3 Water Gross Margin/hr.labor				20.475 9.290 11.185 0.000 1.928
IV. Rainfed	Total Gross Output Total Variable Costs Gross Margin Gross Margin/M^3 Water Gross Margin/hr.labor				23.400 7.460 15.940 0.000 3.542

Source: National Farm Data Handbook, MOA, Amman, 1993.

Notes: (1) Zone I Jordan Valley - Irrigated
Zone II Less Than 200 mm annual rainfall
Zone III 200 mm - 300 mm annual rainfall
Zone IV More than 350 mm annual rainfall

(2) Land rent on Opportunity Cost of land excluded.

(3) Technology Level A: Non conventional irrigated system (mainly drip), Plastic-culture, intensive application of chemicals and fertilizers. High Yielding Varieties.

(4) Technology Level B: Flood or surface irrigation, open fields, minimal application of chemicals and fertilizers and use of traditional varieties.

Barley Profitability According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Barley			
		Technology Level A		Technology Level B	
		Summer Plant	Winter Plant	Summer plant	Winter Plant
I. Irrigated	Total Gross Output				40.000
	Total Variable Costs				8.700
	Gross Margin				31.300
	Gross Margin/M^3 Water				0.210
	Gross Margin/hr.labor				17.389
II. Rainfed	Total Gross Output				10.400
	Total Variable Costs				4.000
	Gross Margin				6.400
	Gross Margin/M^3 Water				0.000
	Gross Margin/hr.labor				1.600
III. Rainfed	Total Gross Output				19.200
	Total Variable Costs				8.675
	Gross Margin				10.525
	Gross Margin/M^3 Water				0.000
	Gross Margin/hr.labor				1.815
IV. Rainfed	Total Gross Output				21.600
	Total Variable Costs				9.650
	Gross Margin				11.850
	Gross Margin/M^3 Water				0.000
	Gross Margin/hr.labor				1.992

Cucumber and Onion Profitability According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Cucumber (green house)			
		Technology Level A		Technology Level B	
		Summer Plant	Winter Plant	Summer plant	Winter Plant
I. Irrigated	Total Gross Output Total Variable Costs Gross Margin Gross Margin/M^3 Water Gross Margin/hr.labor		1384.750 666.648 718.102 1.181 1.967		
III.	Total Gross Output Total Variable Costs Gross Margin Gross Margin/M^3 Water Gross Margin/hr.labor	1260.000 709.560 550.400 0.724 1.326			
			Onion		
I. Irrigated	Total Gross Output Total Variable Costs Gross Margin Gross Margin/M^3 Water Gross Margin/hr.labor			184.000 60.005 123.995 0.191 1.319	

Tomatoes Profitability According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Tomatoes			
		Technology Level A		Technology Level B	
		Summer Plant	Winter Plant	Summer plant	Winter Plant
I. Irrigated	Total Gross Output	279.000	30.070	207.900	
	Total Variable Costs	163.150	169.232	94.450	
	Gross Margin	115.850	-139.162	113.450	
	Gross Margin/M^3 Water	0.185	- 0.311	0.162	
	Gross Margin/hr.labor	0.898	- 1.265	2.182	
II. Irrigated	Total Gross Output	303.720			
	Total Variable Costs	183.100			
	Gross Margin	120.620			
	Gross Margin/M^3 Water	0.241			
	Gross Margin/hr.labor	0.632			
IV. Rainfed	Total Gross Output			80.750	
	Total Variable Costs			33.600	
	Gross Margin			47.150	
	Gross Margin/M^3 Water			0.000	
	Gross Margin/hr.labor			1.025	

Eggplant and potatoes Profitability According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Eggplant			
		Technology Level A		Technology Level B	
		Summer Plant	Winter Plant	Summer plant	Winter Plant
I. Irrigated	Total Gross Output	268.840	269.700		182.187
	Total Variable Costs	126.200	116.800		66.150
	Gross Margin	142.640	152.900		116.037
	Gross Margin/M^3 Water	0.143	0.245		0.145
	Gross Margin/hr.labor	1.603	1.544		1.568
III. Irrigated	Total Gross Output	279.000		190.650	
	Total Variable Costs	165.330		122.030	
	Gross Margin	113.670		68.620	
	Gross Margin/M^3 Water	0.146		0.118	
	Gross Margin/hr.labor	1.043		0.624	
			Potatoes		
I. Irrigated	Total Gross Output	332.000		221.008	
	Total Variable Costs	196.000		140.270	
	Gross Margin	136.000		80.738	
	Gross Margin/M^3 Water	0.320		0.204	
	Gross Margin/hr.labor	1.308		1.121	
II. Irrigated	Total Gross Output	349.600			
	Total Variable Costs	250.760			
	Gross Margin	98.840			
	Gross Margin/M^3 Water	0.176			
	Gross Margin/hr.labor	0.677			

Citrus and Bananas Profitability According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Oranges			Mandarines			Lemons			Bananas	
		Technology Level A			Technology Level A			Technology Level A			Technology Level A	
		1-3 Years	4-7 Years	8-20 Years	1-3 Years	4-7 Years	8-20 Years	1-3 Years	4-7 Years	8-20 Years	Established	2-5 Years
I. Irrigated	Total Gross Output	0.00	294.00	490.00	0.00	183.00	305.00	0.00	237.00	395.00	0.00	875.00
	Total Variable Costs	138.58	83.64	112.44	112.70	102.42	125.54	107.08	80.91	113.07	153.87	132.500
	Gross Margin	-138.58	210.38	377.56	-112.70	80.58	179.46	-107.08	156.09	281.93	-153.87	742.500
	Gross Margin/M^3 Water	- 0.185	0.263	0.378	- 0.188	0.101	0.179	- 0.143	0.195	0.282	- 0.103	0.371
	Gross Margin/hr.labor	- 2.520	3.187	4.340	- 1.281	1.119	1.795	- 2.380	2.787	3.241	- 1.061	5.380

Olive Profitability According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Olives					
		Technology Level A			Technology Level B		
		1-3 Yrs.	4-7 Yrs.	8-20 Yrs.	1-3 Yrs.	4-7 Yrs.	8-20 Yrs.
II. Rainfed	Total Gross Output				0.000	36.00	72.00
	Total Variable Costs				18.460	25.16	43.72
	Gross Margin				-18.460	10.84	28.28
	Gross Margin/M^3 Water				0.000	0.00	00.00
	Gross Margin/hr.labor				- 2.367	0.638	0.832
II. Irrigated	Total Gross Output	0.00	57.600	216.000			
	Total Variable Costs	37.579	50.765	79.360			
	Gross Margin	-37.579	8.835	136.640			
	Gross Margin/M^3 Water	- 0.188	0.027	0.455			
	Gross Margin/hr.labor	- 4.270	0.316	3.105			
III. Irrigated	Total Gross Output	0.000	72.00	180.00			
	Total Variable Costs	37.579	51.865	82.89			
	Gross Margin	-37.579	20.135	97.31			
	Gross Margin/M^3 Water	- 0.188	0.081	0.324			
	Gross Margin/hr.labor	- 4.270	0.774	1.836			
III. Rainfed	Total Gross Output				0.00	36.00	90.00
	Total Variable Costs				20.46	16.16	31.05
	Gross Margin				- 20.46	19.84	58.95
	Gross Margin/M^3 Water				0.00	0.00	0.00
	Gross Margin/hr.labor				- 2.623	1.167	1.371
IV. Irrigated	Total Gross Output	0.00	72.00	432.00			
	Total Variable Costs	37.579	52.985	90.83			
	Gross Margin	-37.579	19.015	341.17			
	Gross Margin/M^3 Water	- 0.188	0.076	1.137			
	Gross Margin/hr.labor	- 4.270	0.689	4.549			
IV. Rainfed	Total Gross Output				0.00	36.00	108.0
	Total Variable Costs				18.46	25.16	47.05
	Gross Margin				-18.46	10.84	60.95
	Gross Margin/M^3 Water				0.00	0.00	0.00
	Gross Margin/hr.labor				- 2.376	0.638	1.417

Grapes Profitability According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Grapes					
		Technology Level A			Technology Level B		
		1-3 Yrs.	4-7 Yrs.	8-20 Yrs.	1-3 Yrs.	4-7 Yrs.	8-20 Yrs.
III. Irrigated	Total Gross Output	0.00	375.00	600.00			
	Total Variable Costs	70.063	80.795	122.897			
	Gross Margin	-70.063	294.205	477.103			
	Gross Margin/M^3 Water	- 0.234	0.588	0.596			
	Gross Margin/hr.labor	- 2.737	6.341	6.278			
III. Rainfed	Total Gross Output				0.00	52.50	75.0
	Total Variable Costs				44.82	42.50	63.4
	Gross Margin				-44.82	10.00	11.6
	Gross Margin/M^3 Water				0.00	0.00	0.0
	Gross Margin/hr.labor				- 1.751	0.216	0.161
IV. Irrigated	Total Gross Output	0.00	450.00	675.00			
	Total Variable Costs	70.063	88.715	131.037			
	Gross Margin	-70.063	363.85	543.963			
	Gross Margin/M^3 Water	- 0.234	0.727	0.680			
	Gross Margin/hr.labor	- 2.737	5.822	5.551			
IV. Rainfed	Total Gross Output				0.00	90.00	150.00
	Total Variable Costs				44.82	45.83	64.14
	Gross Margin				- 44.82	44.17	85.86
	Gross Margin/M^3 Water				0.00	0.00	0.00
	Gross Margin/hr.labor				- 1.751	0.797	1.160

Apples Profitability* According to Agro-Ecological Zone and Technology Level per dunum, in Jordan

Agro-ecological Zone No.	Item/JD	Apples					
		Technology Level A **			Technology Level B ***		
		1-3 Yrs.	4-7 Yrs.	8-20 Yrs.	1-3 Yrs.	4-7 Yrs.	8-20 Yrs.
III. Irrigated	Total Gross Output	0.00	615.00	820.00			
	Total Variable Costs		135.26	190.04			
	Gross Margin	122.83	479.74	629.96			
	Gross Margin/M^3 Water	-	0.571	0.562			
	Gross Margin/hr.labor	122.83	7.055	5.164			
		- 0.585					
		- 3.149					
IV. Irrigated	Total Gross Output	0.00	615.00	1025.0			
	Total Variable Costs		135.26				
	Gross Margin	122.83	479.74	190.04			
	Gross Margin/M^3 Water	-	0.571				
	Gross Margin/hr.labor	122.83	7.055	834.96			
		- 0.585		0.746			
		- 3.149		6.844			
IV. Rainfed	Total Gross Output				0.00	123.00	164.00
	Total Variable Costs				48.55	30.00	42.75
	Gross Margin				-48.55	93.00	121.25
	Gross Margin/M^3 Water				0.00	0.00	0.00
	Gross Margin/hr.labor				- 3.884	3.321	3.070

Source: National Farm Data Handook, MOA, Amman, 1993.

* Land rent is excluded.

** Technology Level A: Non conventional irrigation system (mainly drip), Plastic-culture, intensive application of chemicals and fertilizers. High yielding varieties.

*** Technology Level B: Flood or surface irrigation, open fields, minimal use of traditional varieties.

13.14.7 ACC and TASO Administered Agricultural Development Fund Projects

ACC/ADF Projects

Project	Project cost
1- Cereals Demonstration & Extension JD	33,250.000
2- The Production of Barley as Forage	49,520.000
3- Breeding for Resistance of the most ecomonmically important virusus affecting Cucurbita and Cucurbita SP.	25,500.000
4- Grape Vine Viruses	28,900.000
5- The use of MACRO and MICRO-Nutrient Fertilizers Under Arid Land to Increase its Productivity	71,600.000
6- Increasing Onion Production	7,600.000
7- Farm Management Development	14,000.000
8- On Farm Demonstration of Onion Seed Production Technology in Jordan	17,900.000
9- Development and Testing of Equipment for Direct Seeding of Range and Shrubs	2,705.000
10Design & Construction a Combination Chisel Plow/Grain Drill	2,400.000
11Resource Inventory of Range Reserves	23,644.000
12Characterization of Sheep Production in Jordan	11,790.000
13Breeding of Wheat for Jordan	122,000.000
14Comparison of Several Methods of Treatment of Domestic Sewage Sludge to Improve its Usage in Agriculture	5,600.000
15The Development of Tech. & Ext. Bulletins. Dynanics of C. Capitata in Jordan Valley by Using Pheromone Traps and Chemical Control	10,000.000
16The Role of Pheromone Taps and Some Chemicals in Controlling Olive Fruit, Dacus Oleae	7,040.000
17Evaluation of Poultry Litter as a Ration Component for Feeding Sheep	15,600.000
18Bitterness of Olive Oil	1,970.000
19Demonstration on Soil Solarization for Control of Soil Pests	2,600.000
20Advanced Payment on the Project Account	
21Mediterranean Sea Fly resistance	11,371.000
22Improved Sheep Production in Jordan	59,274.000
23Isolation & Indentification of Stone & Pome Fruit Tree Viruses in Mother Plants at MOA Stations	13,100.000
24Agricultural Statistical Charts	55,440.000
25Vegetable Seed Production Project	50,000.000
26Production of Diseases-Free Vegetable Seedling VIA Tissue Culture	79,400.000
27Economic Efficiency of Input for Citrus Prod. in the Jordan Valley	4,000.000
28Economic and Technical Factors Affecting Broiler Production in Amman, Zarqa and B	4,300.000
29Whole Wheat Improvement	9,100.000
30MSc Training of Students at the University of Jordan	27,430.000
31Microtus Gubther	1,000.000
32Comparison of Several Methods of Treatment of Domestic Sewage Sludge to Improve its Usage in Agriculture	27,500.000
33Citrus Viral Diseases in Jordan Valley Survey, Indexing & Certification	23,866.000

Total* JD 819,400.000

* At the current exchange rate of JD .69 = US$ this equals US$ 1,187,536.23. Nevertheless, the actual dollar figure would be higher given that some of the projects began prior to the 1989 devaluation.

TASO/ADF Projects

Project	Project cost
Vegetable Nursery (P-I) US$	3,700.00
Vegetable Nursery (P-II)	2,500.00
Newly Graduated Eng. (P-I)	10,000.00
Newly Graduated Eng. (P-II)	11,000.00
MSc Research Thesis Sup.	70,000.00
Capnodis Project (Almond Trees)	21,000.00
NCARTT Strategy	154,175.00
Genetic Resources	6,300.00
Baladi & Shami Goat	12,000.00
Onion & Garlic Project	4,000.00
Technical Report Writing	5,000.00
MSc. Training at *UOJ*	4,800.00
Biological Control	1,200.00
Range Plants Projects	5,600.00
Grapes (Phyloxera)	8,500.00

Total US$ 834,175.00**

13.14.8. Seminars and In-Service Training Courses Offered by NCARTT
MAY 1992 TO APRIL 1994

No.	Subject	Attendance	No. Attended	Location	Duration
1.	Seminars				
1.1	Integrated Pest Management of the Whitefly & Tomato Yellow Leaf Curl Virus Disease (TYLCVD)	Extension Agents, Researchers and others	100, of whom 65 Extension Agents & researchers	Baq'a	May 5, 1992
1.2	Integrated Pest Management of the Whitefly & TYLCVD	Extension Agents, Researchers and others	90, of whom 70 Extension Agents & researchers	Irbid Directorate	May 23, 1992
1.3	Integrated Pest Management of the Whitefly & TYLCVD	Extension Agents, Researchers and others	70, of whom 55 Extension Agents & researchers	Rabba RASC	May 27, 1992
1.4	Integrated Pest Management of the Whitefly & TYLCVD	Vegetable seedling Producers, The Agricultural Jordan Valley Union, Responsible at MOA, RASCs & Agricultural Directorates.	57, of whom 31 Vegetable Seedling Producers, 1 from the Agriculture Jordan Valley Union, 25 from the MOA, RASCs & the Agriculture Directorates	NCARTT/Baqa	June 1, 1992
2.	In-Service Training Courses				

No.	Subject	Attendance	No. Attended	Location	Duration
2.1	Propagation of Healthy Vegetable Seedlings under Plastic Houses	Extension Agents, Agriculture Technicians (Private Sector)	71 19	Repeated at four Locations -Karameh research station -Khaldieh RASC -Ghor Al-Safi Research Station -NCARTT/Baqa	Sept. 5-9, 1992 Sep.19-23 92 Oct.3-7, 92 Oct.17-21,92
2.2	Agricultural Experimental Design and Analysis		11	NCARTT/Baqa	March 29 - April 11, 1993
2.3	Seed Testing Techniques & Seed Health Testing		11	NCARTT/Baqa	May 3-10, 1993
2.4	Orchard Establishment, Fruit Tree Training and its Pest Control		33	NCARTT/Baqa	May 15-20, 1993 and Jan. 22-24, 1994
2.5	Management and Improvement of Rangeland in Jordan		10 4	NCARTT/Baqa	July 24-29, 1993
2.6	Technology & communication	Researchers & Extension Agents	14 2	CCTST* and TTAC**	September 25-29, 1993
2.7	Protected Cultivation Techniques	Extension Agents, and Researchers	17 6	NCARTT/Baqa, Deir Alla RASC and Karameh Research Station	Dec. 18-30, 1993
2.8	Scientific Writing in English	Researchers	16	CCTSS*	Jan. 15-26, 1994
2.9	Soil, Water and Plant Tissue Analysis	Researchers	8	NCARTT/Baqa	Feb. 16-17, Feb. 19 - March 3 and April 16-28, 1994
2.10	Pesticides and its Safe Use	Agric. Engineers of the MOA, Agriculture Market Organization, and Research of NCARTT	10 3 3	NCARTT/Baqa	Feb. 28 and March 7, 1994