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# TRINATIONAL PROJECT ON PATTERNS OF TECHNOLOGY EXCHANGE AND COOPERATION IN AGRICULTURE (TATEC)

Project Number 398-0158-05 (298-0192)

## EVALUATION TEAM REPORT

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# I. INTRODUCTION

## A. The Trinational Project

The Trinational Agricultural Technology Exchange and Cooperation project, or TATEC, was initiated in 1984. Its purpose is to promote agricultural technology innovations in Egypt and Israel through joint activities of agricultural scientists in the two countries.

Funding of $2.5 million was provided for an initial three-year period, with provision for an evaluation to be conducted during the third year. The present report presents the results of the third year evaluation based on an evaluation team visit to Egypt and Israel in January, 1987.

## B. History

The Trinational project had a substantial period of genesis, with drafts of the proposal being reviewed by USDA and AID as early as 1981. A chronology of events leading up to initiation of the project is given in Table 1. The project was effective, with funds in the hands of the investigators on October 1, 1984.

Since the activation of the project, scientists from both sides have conducted research, visited their counterparts, exchanged materials, planned experiments jointly, shared results, and reported their activities semi-annually.

As approved, the project is designed for four years. USAID approved funding for the first three years, with the final year funds contingent upon

Table 1

Genesis of the Trinational "Ecosystems" Proposal
(TATEC Project)

Mar 1979 - Egypt & Israel sign peace treaty

Nov 1979 - USDA & Egyptian Ministry of Agriculture (MOA) sign Memorandum of Understanding that includes Regional Cooperation as an area of joint effort.

Mar 1980 - Egyptian and Israeli Ministries of Agriculture sign formal agreement to cooperate in research and other areas. Ministers exchange visits to each other's countries.

Feb 1981 - 1st draft of Ecosystems Proposal developed by Egyptian & Israeli proponents. USDA is asked to review it and help secure AID funding. Egyptians and Israelis revise and refine workplan in successive stages (May - technical narrative completed, informally submitted to AID by USDA; June - budget details developed; August - submitted formally to AID by USDA).

Jan 1982 - AID approves proposal in principle, subject to requested revisions (more specific description of technologies to be chosen and studied, shorter timeframe [e.g. 2-3 years, in lieu of 5 years], a more phased approach that clearly distinguishes between descriptive/planning studies and field trials/ demonstrations, detailed life-of-project budget, involving more scientific disciplines than agricultural economics, etc.)

Feb 1982 - Egyptian/Israeli/US meeting in Cairo, to revise proposal in accordance with AID comments; draft revisions informally submitted to AID through USDA.

May 1982 - Draft revised and refined by Egyptians & Israelis formally submitted to AID by USDA for comment.

Jun 1982 - AID comments focus on overall budget magnitude, desire for definable results to be specified a priori in the proposal, and U.S. role limited to administration/management and participation by individual scientists.

Trinational Agricultural Steering Committee, meeting in Washington for the first time, outlines several areas for research cooperation. Several are eventually included in the Ecosystems proposal (Feb '83 version).

Jun-Nov 1982 - Lebanon War delays coordination of latest Egyptian and

Israeli revisions to workplan, as well as planning for joint (Trinational) workshops in the Middle East on poultry/animal husbandry and intensification of cropland use.

Dec 1982 - Professor Pohoryles visits Egypt, to resume revision of Ecosystems proposal. Three distinct subjects are outlined (Intensification of Agricultural Production [emphasizing cropping systems & water use], Medicinal Uses of Desert Flora, and Solar Energy Uses in Agriculture). A reduced budget of about $1 million per year is agreed on.

Feb 1983 - Professor Pohoryles again visits Cairo, to refine and elaborate proposal's design. Five distinct subprojects are agreed on: Intensification of Field Crop Production, Economic Evaluation of Integrated Cropping and Water Use Systems, Medicinal Desert Flora, Solar Heating of Soils for Disease/Pest/Weed Control, and Evaluation of Technology Exchange Methods. Project duration reduced to 4 years.

Apr 1983 - Professor Yaron visits AID/Washington to assess their reaction to the current revisions and solicit USDA involvement in executing the redesigned project.

Jun 1983 - Professor Yaron visits Cairo to finalize proposal design; an additional subproject on Dairy Management Techniques is added. By July the requisite details (logistical framework, management plan, budget line-items for all 3 sides for all years of activity) are developed.

Aug 1983 - USDA submits to AID the finalized proposal, with authorizing signatures from both Egypt and Israel, last minute refinements of budgets, and other details in early September.

Oct 19[illegible] - Proposal under staff review at AID (including Project Review Committee)

Nov 1983 - AID's Near East Advisory Committee (NEAC) approves only the first year of the project, agrees to provide funding upon submission of a revised proposal for Year 1 that fully details what will be achieved by the project and submission of a detailed implementation plan. Other, more minor technical revisions are also requested.

Dec 1983 - USDA requests that Egyptian and Israeli proponents visit Washington, to discuss with AID the feasibility of complying with NEAC recommendations, length of AID funding commitment, etc. AID agrees to fund the first 3 years of the project, with an indepth evaluation in the 2nd or 3rd year to decide on AID support for further activity. Proponents must develop a detailed

implementation plan, by quarter, to outline the expected outcome and cost of each subproject activity.

Feb 1984 - Final proposal, with implementation plans, submitted by USDA to AID.

Mar-Apr 1984 - Implementation plan and revised proposal under review by Project Review Committee

Jul 1984 - AID Project Authorization signed

Jul 1984 - USDA-AID "PASA" signed

Sep 1984 - USDA grants to performing organizations in Egypt and Israel negotiated, with effective dates of October 1, 1984.

the present external evaluation being conducted during the third year.

C. Major Activities Under the Project

The approach of the project is to evaluate selected innovative technologies that are promising candidates for exchange between the two countries. Bilateral cooperative inter-disciplinary work is conducted as follows:

1. Experiments are conducted under controlled conditions at government installations as well as on farms.
2. Physical scientists from various disciplines work with economists to estimate feasibility.
3. Farm surveys are conducted and analyzed to find factors affecting adoption.
4. On farm experiments are planned to further test feasibility and identify barriers.
5. Recommendations are being formulated to foster introduction and accelerated adoption of agricultural technologies of benefit in the two countries.

The experiments involve both crops and livestock. One body of work is concerned with solarization, i.e. placing a covering of clear plastic over soil for several weeks prior to planting. A wide ranging series of solarization experiments, mainly for vegetable crops, is being conducted in Israel and Egypt.

Another body of work concerns wheat and maize. Different amounts and timing of water and fertilizer are being tried under various combinations of

surface, sprinkler and drip irrigation in the two countries.

The final work on crops concerns medicinal crops. Medicinal plants have been inventoried, and investigations of commercialization potentials have been initiated.

With regard to livestock, first, techniques for cooling of dairy cows are being investigated. Second, the use of milk substitutes in the feeding of calves is being investigated.

Economics work is central to the project. The participation by economists involves, in part, evaluation of the feasibility of the technologies. Considerable evaluation has been carried out and is in various stages of completion for the various technologies in the two countries.

Additional economics work is concerned with factors affecting adoption of technologies. Farm surveys have been conducted, and econometric analyses of the results have been carried out. Further investigation is being planned of factors affecting adoption, including on-farm experiments.

D. Timing

The project was conceived in three stages.

Stage I (1 year)

Stage I included selection of a limited number of technologies in Egypt, Israel and the United States deemed to be beneficial for exchange, adoption, and promotion. The study during this stage was based on:

-- Agro-technical studies regarding pre-selected technologies considered to have good adoption potential.

-- A review of additional technologies with potential for exchange.

-- A review of the economic and social factors relevant to the adaptation and diffusion of the above technologies.

Stage II (2 years)

Stage II activities are:

-- Continuation of field experiments and agro-technical studies commenced at Stage I, and modified or newly designed experiments in view of the knowledge gained during Stage I.

-- Farm testing of technologies selected for implementation.

-- Follow-up and analysis of the performance and the rate of diffusion of the technologies tested on farms, including physical and socio-economic aspects, within a comprehensive framework.

Four interdependent, but autonomous, simultaneously, executed sub-projects were begun:

1. The intensification of farm system production with emphasis on double cropping, water use, and dairy production.

2. Medicinal uses of desert flora.

3. Solar heating of soils for disease, pest, and weed control.

4. Evaluation of methods for technology exchange in agriculture.

These topics are among the high priority areas of research and technology exchange interest identified by the Egypt-Israel-U.S. Trinational Agricultural Steering Committee in June 1982.

End Products

In Stage III the following end products of the study are to be achieved:

1. A thorough evaluation of several agro-technologies and of their adaptability to selected Egyptian and Israeli farming systems.

2. Actual implementation of several technologies on commercial farms in Egypt (both large - and small - scale farms) and kibbutz and moshav farms in Israel.

3. Improved understanding regarding exchange, adoption, and diffusion of existing technologies, as well as development of new

technologies within a trilateral Egypt, Israel, and U.S. framework.

4. Recommendations for future promotion of exchange, adoption and diffusion of existing technologies and development of new technologies.

5. Increased interaction and understanding between Egyptian and Israeli agricultural scientists and administrators.

E. Project Management

The project is being administered by the U.S. Department of Agriculture, Office of International Cooperation and Development (USDA/OICD), which is responsible for coordinating and administering cooperative research. USDA/OICD disburses funds through subgrants or subcontracts with the Egyptian Ministry of Agriculture and Hebrew University to carry out the research. USDA/OICD obtains experts from the U.S. agricultural research-extension establishment as needed by the project.

USDA/OICD responsibilities include:

1. Appointment and compensation of the project advisor.

2. Securing specialized services from American agricultural scientists, who are suggested by the principal investigators.

3. Subcontracting with the Egyptian Ministry of Agriculture and the Hebrew University, for execution of the project scope of work.

4. Ensuring that project activities are carried out as truly cooperative regional projects.

5. Ensuring that technical and cooperative project objectives are met.

6. Preparation of periodic fiscal and progress reports to AID.

The overall study is coordinated by a Coordinating Committee. Initial members were:

From Egypt: (2 votes)

Dr. M. Goueli, Chairman, Department of Agricultural Economics.

Zagazig University.

Dr. Y.A. Mohieldin, Undersecretary, Ministry of Agriculture,

From Israel: (2 votes)

Professor S. Pohoryles, Ministry of Agriculture.

Professor D. Yaron, Hebrew University of Jerusalem, Faculty of Agriculture.

From U.S.A.: (2 votes)

Professor Robert Dorfman, Harvard University

Mr. David R. Kincaid, Acting Director, International Research Division, Office of International Cooperation and Development, U.S. Department of Agriculture.

Because of changes in duties, Dr. Goueli, Dr. Mohieldin and Mr. Kincaid have since been replaced. The Coordinating Committee has met twice to review progress, receive proposals for new or expanded activities, and provide ideas for areas of mutual interest. The next meeting of the Coordinating Committee is scheduled for February, 1987 in Egypt.

F. Sub-Projects

The objectives of the subprojects are:

1) The Intensification of Farm System Production with Emphasis on Double Cropping, Water Use and Dairy Production

a) Double Cropping System

1. Investigation of the efficiency of different cultural practices and varieties in double cropping of winter and summer crops.
2. Development of improved technologies for double cropping wheat and maize or sorghum in order to increase the production of these crops within the available areas of land.

3. Investigation of the efficiency of different cultural practices and varieties in double cropping wheat and maize or sorghum, or wheat and other suitable crops (e.g. forages).

4. Development of technologies for the double cropping of these crops.

b) Economic Evaluation of the Integrated Cropping and Water Use System

1. Agro-economic analysis of alternative on-farm water systems with emphasis on double cropping.

2. Analysis of factors promoting the adoption of advanced water use technologies.

c) Dairy Production

Improvement of the productivity and income-producing potential of dairy herds, as part of improving the efficiency of diversified commerical farm operations.

2) Medicinal Use of Desert Flora

Identification of plants that are traditionally used by the native inhabitants which, after intense horticultural, pharmacological and chemical studies, could serve as raw material for the production of biologically active compounds.

3) Solar Heating of Soils for Disease, Pest, and Weed Control

Further exploration of the feasibility of the use of solar heating in Egypt for the control of soilborne pests, with special emphasis on the agricultural regimes followed in Egypt (irrigation techniques, specific crops and soils, local pests, etc.) and in Israel, to further improve the

technique and adapt it to a wide range of conditions. Although the present research is carried out to benefit Egypt and Israel, there are potential advantages to many other countries with similar conditions.

4) Evaluation of the Methods for Technological Exchange in Agriculture

Stage I (one year)

a. Compile inventory of additional technologies that have promise over and above those mentioned in the preceeding sub-projects.

b. Select a few technologies in each country for implementation and full evaluation.

c. Select test areas and farms for the chosen technologies on the basis of a cursory review of the variety of agroclimatic and socio-economic conditions in the host country.

Stage II (2 years)

A thorough evaluation of the selected technologies and the conditions for their adoption and diffusion. The methodology of this stage involves:

a. Small-scale experiments, demonstration plots and other extension techniques on selected farms and/or nearby sites with respect to the selected technologies. Various extension methods will be tried and compared.

b. Follow-up and collection of data on the performance of the technologies implemented.

c. Analysis of the relative rapidity of diffusion of these technologies as related to the various techniques of introduction.

d. Study of the integration of the innovative technologies within the

farming systems (output, income, employment, capital requirements and the like) and the supporting system.

e. Overall cost benefit analysis of each of the technologies.

The end products of this part of the study will be:

a. Detailed report on the potential of each of the selected technologies, including the effects of the different background conditions observed.

b. Report on the agroclimatic and the socio-economic conditions that are pertinent to the implementation and success of technological introduction.

c. Background data and detailed plan for further stages of the project.

G. The Third Year Evaluation

The remainder of the present report presents the results of the evaluation of the TATEC project required during its third year. The report was prepared by an external evaluation team, based on visits to Egypt and Israel in January 1987. The team members were Dr. George Tolley (team leader), University of Chicago; Dr. John Moseman, recently retired from the Agricultural Research Service, USDA; and Dr. Mohammed Yousef, University of Nevada at Las Vegas.

H. Outline of This Evaluation Report

Following the introductory material which has been presented in Part I, Part II deals with the physical science work on crops. Included in Part II are sections on 1) soil solarization, 2) medicinal crops and 3) the cropping and water use component of the farm production intensification subproject.

Findings on the crop work are reported, and recommendations are given. Dr. John Moseman had major responsibility for Part II.

Part III concerns the physical science work on dairying. It deals specifically with the dairying component of the farm production intensification subproject. Findings on animal feeding and cooling experiments are presented, and recommendations for the dairy work are given. Dr. Mohammed Yousef was responsible for Part III.

Part IV concerns the economics work. The progress in economic evaluation of the technologies is reviewed, and the findings on factors affecting adoption are evaluated. Recommendations for the economics work are given. Dr. George Tolley had primary responsibility for Part IV.

Part V is concerned with the project as a whole, presenting comments on the log frame and making recommendations that apply across the board, with emphasis on international cooperation. All members of the evaluation team contributed importantly to Part V.

The Appendix lists references, project personnel and the activities of the evaluation team.

## II. CROPS

### A. Soil Solarization (Solar Heating) of Soils for Disease, Weed and Pest Control

#### 1. Background

This project has explored the feasibility of solar heating for the control of soilborne pests, seeking to improve the technique and adapt it to a wide range of conditions. The principal scientists have been:

Dr. Mokhtar Satour, Ministry of Agriculture of Egypt, Field Crops Institute

Dr. M. Fahmy Abdel Rahim, Ministry of Agriculture of Egypt, Field Crops Institute

Dr. Yaacov Katan, Hebrew University, Rehovot

Dr. Avi Grinstein, The Volcani Center, Israel

#### 2. Summary of Research Progress

In Egypt, solarization was conducted under furrow irrigation at several locations and with several crops. At Fayed-Ismailia the yield of onion bulbs from seedlings and from sets was increased over 250%. At Nefesha-300%. At Tamya-Fayoum the yield of broadbean was increased over 110% and onion bulb and seed were increased about 200% and over 300%, respectively. The disease, pink rot, of onion was completely controlled. Orobanche (broomrape), a plant parasite on broadbean, was completely controlled. Several other fungal pathogens, weeds, and nematodes were either completely killed or at least partially killed. The results confirm those reported by

Katan in Israel under drip and sprinkler irrigation. The killing may be due to thermal action and subsequently the increase of biological activity of certain beneficial microbes. They plan to conduct short-term experiments in 1986-87 on the same crops plus strawberry and potato and long-term experiments on corn, onion, and tomato. The three most significant results from the research in Egypt is that

1. with furrow irrigation there was complete control of Orobanche (broomrape)
2. decrease in salinity, and
3. the effect of solarization under furrow irrigation is similar to that under drip and sprinkler irrigation.

In Israel, four types of studies were conducted. Those studies were

1. increased growth response (IGR),
2. decreased salinity
3. pathogen disease and weed control by solarization and
4. the use of used polyethylene plastic for soil solarization.

The following are some of the results:

A) IGR-1 increased growth weight of plants grown in solarized soil was detected in 9 of the 11 soils tested.

B) Increased amounts of mineral nutrients were found in soils.

C) The number of fluorescent pseudomonas (PF), which are beneficial micro-organisms, was increased 2-100 fold in the rhizosphere and 50-1,000 in tissues of plants growing in solarized soils.

D) Decreased salinity by soil solarization. Soils samples

were collected at sites in Egypt (Fayed, Manayel and Tamya) and from the Gaza area. The tests showed that at certain soil levels there is a reduction in salinity in the solarized soils. There is a reduction in the concentration of $Na^+$, $Cl^-$ and an increase in $NO_3^-$. The almost complete elimination of evaporation in soils covered with plastic may partially explain the reduced salinity.

E) Pathogen, Disease, and Weed Control by Solarization. Solarization controlled the pathogens Verticillum, Fusarium, Rhizoctonia solani to considerable depths. Evidence is being accumulated to show that biological control contributes to the long-term effects observed in solarized soils. The combined effect of solarization and a nematicide are being studied in the Gaza area. The combined effect of solarization and certain herbicides to control Cyperus, a perennial weed, are being studied. The performance of a newly designed mulching machine is encouraging.

F) Use of Used Polyethylene Plastic for Soil Solarization. Studies showed that in the Gaza area, that old polyethylene plastic previously used for covering plastic houses was more effective than new plastic in Killing Meloidogyne (nematode), and Fusarium O. niveum and equally effective in killing Verticillium.

3. Information Transfer

A) Research Progress Reports. The scientists in both countries

prepared four research progress reports. The reports were as follows:

| | | |
|---|---|---|
| First Semi-Annual Report | - | Oct. 1, 1984 - March 31, 1985 |
| First Annual Report | - | Oct. 1, 1984 - Sept. 30, 1985 |
| Second Semi-Annual Report | - | Oct. 1, 1985 - March 30, 1986 |
| Second Annual Report | - | Oct. 1, 1985 - Sept. 30, 1986 |

B) Other Communications and Reports. The scientists in both countries have presented talks and lectures to farmers, scientific and other groups in their countries in which they have described their results from soil solarization. Professor Katan has prepared a leaflet entitled "Soil Solarization for the Control of Soilborne Diseases." The leaflet is written in Arabic for Arabic farmers in the Gaza Strip and on the West Bank. A joint paper between the scientists entitled "Soil Sterilization - A potential Method for Controlling White Rot and Other Soilborne Diseases in Onion" by El. Yamine, M. F. Abdel-Rahim, K. Y. Michael, A. Grinstein, and J. Katan was published for the Second International Workshop on Allium White Rot at Beltsville, Md., June 1983. Another joint paper is being prepared for publication. That paper is by M. F. Abdel-Rahim, M. M. Satour, K. Y. McKail, S. A. El-Eraki, A. Grinstein, Y. Chen, and Y. J. Katan and is entitled "Effectiveness of Soil Solarization in Furrow-Irrigated Egyptian Soils."

4. Plans for Future Work

According to a proposal for further work prepared by M. M. Satour and M. F. Abdel-Rahim in Egypt, future research would be conducted under three topics.

1) Research on Effectiveness of Solarization and Mechanisms Involved;

2) Improvements of Soil Solarization; and

3) Application of Solarization Under Farm Conditions.

It is anticipated that further work in Israel will continue present efforts with more emphasis on the application of soil sterilization under farm conditions.

5. Interaction Between Scientists in the Two Countries

The scientists on this project have been cooperating since 1981. They have a very close, friendly relationship. They have published a joint paper and have prepared another paper for publication. Many of their experiments are planned jointly and they frequently discuss their research by telephone. In February 1986-Y. Katan, A. Grinstein, and A. Dinar visited Egypt. In June and July 1986, M. F. Abdel-Rahim and M. M. Satour visited Israel. In January 1987, M. Abdel-Rahim and M. M. Satour are visiting for a week in Egypt.

6. Interactions with Economists and Other Scientists Within Countries

The scientists in both countries are cooperating with many other scientists, extension personnel, and farmers. Their lists of more than 10 scientists in each country with whom they have cooperated include nematologists, weed scientists, soil scientists, agronomists, and

individuals in other disciplines. In Egypt there has been interaction with the economists. The results of their research has been analyzed and discussed. In Israel the cooperation with the economists is very close. A joint paper entitled "An Economic Analysis of Soil Disinfection for Controlling Soilborne Diseases," has been prepared in which the potential benefits from solarization has been described. There has been some joint planning of experiments to make additional economical analysis possible.

7. Conclusions

A) A very close relationship and cooperation has been developed between the scientists involved in these two countries on this subproject. There are visits, frequent telephone calls, all experiments are planned jointly, and there have been joint publications. However, some cooperation had been established prior to the initiation of this subproject.

B) There has been cooperation between the scientists in this subproject and the economists on the project. There is a joint paper being submitted by the scientists in Israel.

C) The response of farmers in the two countries to information on experimental results is very different. Farmers in Israel are anxious to learn of the results and will immediately use the innovative procedures. Farmers in Egypt do not follow the experiments as closely and are less inclined to implement new procedures.

D) The significant findings related to solarization in Egypt have been the killing of Rhozobium, the reduction of salination, and the effectiveness of soil solarization with surface irrigation.

E) The effects of solarization on many pests, hosts, and pest-host interaction have been studied in Israel.

8. Recommendations

A) There is a very close relationship between the scientists in the two countries on this subproject. It is recommended that this relationship be continued and that joint activities of the scientists be used as an example of what can be accomplished by this type of project.

B) The relationship and cooperation between the scientists on this subproject and the economists in Israel is very close. It is recommended that an effort be made to improve the relationship and cooperation by the scientists on this project and the economists in Egypt.

C) The transfer of information regarding solarization must be managed differently in the two countries. It is recommended that the scientists cooperate closely with the Extension personnel and farmers in their countries in the dissemination of information on soil solarization.

B. Medicinal Uses of Desert Plants

1. Background

This project seeks to identify plants that are traditionally used by the native inhabitants which after intensive horticultural, pharmacological, and clinical studies could serve as raw material for the production of biologically active compounds.

The principal scientists are:

Kamal Awaad, Horticultural Institute, Ministry of Agricultural of Egypt

Dan Palevitch, Medicinal/Aromatic Crops, The Volcani Center, Israel

2. Summary of Research Progress

The initiation of this project was delayed in Egypt because of problems in acquiring a 4-wheel drive vehicle for collecting plants. The vehicle was shipped several months ago from the United States and should soon arrive. More research has been accomplished than reported in the research progress reports. Much of the information and data are in Arabic and has not been translated into English.

The following is a brief summary of the research progress in Egypt. In an extensive literature survey, over 250 plant species were identified which have been used for medicinal purposes. Thirty-four plant samples have been collected, which were identified by healers in 6-7 Bedouin groups. These were collected in cooperation with Ibrahim Abu Led-Fadell and Miss Badea

Hassan at the Sakahia Station near Alexandria. They have dried and ground the plant material so that it can be analyzed for active compounds. At the Baarage station near Cairo, and at Giza, five of the plants are being grown to obtain quantities of seed. Arrangements have been made for Shafi I. Balbaa at Cairo University to begin comparing chemical constituents of wild and cultivated desert plants in March 1987.

In Israel, the research on this subproject is part of a large program coordinated by Dan Palevitch on aromatic and medicinal plants. Palevitch is recognized as a leader in research in this area.

The following is a summary of research which has been conducted on this subproject in Israel. An ethnopharmacological survey was conducted to identify plants having medicinal qualities when grown under arid conditions. Twenty-three healers in different regions of Israel's arid zone were interviewed. The survey emphasized 34 main species used by local healers which showed a wide range of medicinal properties. The survey results were matched with information found in a computerized literature survey.

It was divided to conduct more intensive studies on plants with hypoglycemic (lowering blood sugar) properties because diabetes is an important disease worldwide and many hypoglycemic plants are known. The hypoglycemic action of 14 plants indigenous in Israel and probably in Egypt were determined. The most active plants were Atriplex spp. (saltbush) and Salvia spp. (sage). Detailed studies were conducted on Atriplex spp. since Atriplex plants prevent diabetes symptoms in sand rats (Psammoys obesus). In vivo studies with young rats were carried out, which indicated that the body weight of rats was less when fed plants with extracts from Atriplex

plants. Several species of Atriplex and lines of Salvia have been transplanted in sites in the arid zones of Israel. Clinical studies have been initiated with plants of Atriplex in a hospital in Haifa.

3. Information Transfer

A) Research Progress Reports. The principal investigators in each country have prepared four research progress reports. Those reports are as follows:

| | | |
|---|---|---|
| First Semi-annual Report | - | Oct. 1, 1984 - March 31, 1985 |
| First year Annual Report | - | Oct. 1, 1984 - Sept. 30, 1985 |
| Second Year Semi-annual Report | - | Oct. 1, 1985 - March 31, 1986 |
| Second Year Annual Report | - | Oct. 1, 1985 - Sept. 30, 1986 |

B) Other Reports. Dr. Awaad has data in his files on the characteristics of 250 plants grown in Egypt and adjacent areas, which have been used for medicinal purposes. He also has data on the Egyptian and Hebrew names and uses of the 34 plants they have collected with the aid of healers in Beduin groups. Those data are written in Arabic. It would be useful for them to be translated into English. Palevitch has published four research papers and a chapter in a book on the results from his research on this subproject. The following is a list of those publications:

1) Dafni, A., Yaniv, Z., and Palevitch, D. (1984) Ethnobotanical survey of medicinal plants in nothern Israel. J.

Ethnopharmacol 10 295-310.

2) Palevitch, D., Yaniv, Z., Dafni, A., and Friedman, J. (1986) Medicinal plants in Israel: An ethnobotanical survey. In: L.E. Craker and J.E. Simon (Eds.). Herbs, Spices and Medicinal plants. pp. 281-345. Oryx Press Phoenix, Arizona.

3) Perl, M. (1987) The biochemical basis of the gypoglycemic effect of some plant extracts. (Submitted for publication.

4) Perl, M. and Yaniv, Z. (1985) An *In vitro* study on the effect of *Momordica charantia* on glucose uptake and glucose metabolism in rats. Planta Medica 1985 12-16.

5) Friedman, J., Yaniv, Z., Dafni, A., and Palevitch, D. (1986) A preliminary classification of the healing potential of medicinal plants,based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. J. Ethnopharmacol 275-287.

4. Plans for Future Work

Dr. Awaad has retired and will not continue as the principal investigator on this subproject. A new prinicpal investigator for the subproject in Egypt is to be appointed. Palevitch tentatively is planning to visit Egypt when a new principal investigator has been appointed. They will then propose the research to be conducted under Phase II.

5. Interactions Between the Scientists in the Two Countries

Palevitch has visited Egypt twice and Awaad has visited Israel once. Palevitch will visit the new principal investigator in Egypt as soon as that individual has been appointed. The following are the times of the visit and what was accomplished:

| | | |
|---|---|---|
| December 1984 | - | Dokki Cairo, Discussion on the initiation of the scientific collaboration between the two centers. Study tour to Baarage Experimental Station. |
| June 1985 | - | Bet-Dagan, Israel. Discussion on the continuation of the project. Study tour to Newe Year Experimental Station - Research on Aromatic crops. |
| January 1986 | - | Dokki Cairo. Exchange of data on plant species and metrological data of the western desert (temperature minimum and maximum rains, sand and air movements). |
| February 1987 | - | Dokki Cairo. (Planned) to follow up the results, and to exchange plant material with mutual interest. Visiting Alexandria Experimental Station. |

6. Interaction Between Economists and Other Scientists Within Countries

A) Egypt. Insufficient information has been summarized for economists to analyze. Three scientists at other institutions have or will soon participate in the subproject. Those individuals are Ibrahim Abu L. Faddel and Badea Hassan at Sakahia Station near Alexandria, and Dr. S. I. Balban, Cairo University.

B) Israel. Palevitch and Economist D. Yaron have discussed some problems in which the economists may become involved. Such problems are very complex and are difficult to study at the present time. The following are individuals who have participated in the project in Israel:

Stage I - Ethnopharmacology survey

Computerized literature survey

Prof. D. Palevitch - Project leader, Dept. of Medicinal and Spice Crops, ARO.

Prof. J. Friedman - Botanist and Ecologist, Department of Botany, University of Tel-Aviv.

Dr. A. Dafni - Botanist, Department of Evolution, University of Haifa.

Dr. Z. Yaniv - Assistant in the literature survey, Department of Medicinal and Spice Crops, ARO.

Mr. N. Krispil - Botanist, Expert in the use of plants by the Arab folklore.

Stage II - Horticultural Biochemical and Clinical Studies

Professor D. Palevitch - Project leader and

horticulturist.

Dr. M. Perl - Biochemist, Dept. of Medicinal and Spice Crops, ARO (MD).

Dr. Edi Karenielli - Rambam Medical Center, Haifa. Expert in Diabetic disease.

Dr. Daud (MD) - Rambam Medical Center, Haifa.

Dr. U. Ravid - Organic Chemist, Department of Medicinal and Spice Crops, ARO (Option).

7. Conclusions

A) There is more data and information available in Egypt than is evident in the reports. Many folders exist with data written in Arabic. An example is the data on medicinal uses, Latin and Arabic names of about 250 plant species which grow in Egypt and adjacent areas.

B) The lack of a 4-wheel drive vehicle to collect plants may have impeded their progress. The vehicle has been ordered and shipped from the United States several months ago and should soon arrive. However, through the cooperation of Ibrahim Abu El-Faddel and Badea Hassan at the Shahia Station, progress have been made in obtaining informaton from healers in 6-7 Bedouin groups.

C) There may be a lack of seed of some of their plant species in Egypt. For some plants growing at Barrage Station and at Giza the stands appeared thin and the plants lacked vigor.

D) The subproject in Israel is part of an ongoing established project.

Palevitch has written a book, participated in many interntional meetings, and published many recent papers. He also cooperates with many scientists at other institutions and in other disciplines.

E) The Establishment of Clinical Tests on Humans with Diabetes in the Haifa Hospital is unusual but an excellent method for obtaining needed data.

F) There has not been as much interaction between the scientists on ths project as on some other subprojects. The subproject was initiated late and there have been other problems in developing the subproject in Egypt. Both principal investigators indicated a desire to increase their cooperation. The appointment of a new principal investigator to replace Awaad, who has retired, may permit a greater exchange of information and plant material.

8. Recommendations

A) Kamal Awaad has retired and is working only part time. It is recommended that a new principal investigator who would work full-time on this subproject should be appointed in Egypt.

B) A considerable amount of information and data on this subproject in Egypt is written in Arabic. It is recommended that a botanist should be added to the subproject who could translate Arabic information and data so that it can be summarized and reported.

C) The lack of a 4-wheel drive vehicle and space for growing plants in the field were mentioned as constraints on this project in Egypt. Funds allotted to this subproject have not been spent. It is

recommended that if necessary unspent funds be used to rent a 4-wheel vehicle and space at the Barrage Station or at Giza for growing plants.

D) The purchase of equipment and furnishing a new chemical extraction laboratory was suggested in Egypt. A trained scientist would also be required to operate and manage such equipment. It is recommended that arrangements be made to have chemical extractions done in an already established laboratory.

E) Plants used for medicinal purposes have been identified and collected through healers in Bedouin groups. This is an excellent method for obtaining plants. It is recommended that contacts with Bedouin healers be continued and if possible be expanded.

F) Information and plant material should be exchanged between the subprojects in the two countries. It is recommended that as soon as possible after the new principal investigator has been appointed in Egypt, Palevitch arrange to meet that individual to discuss the continuation of the project.

G) Many plants with various medicinal uses have been identified, which grow in Israel and Egypt, through literature surveys and interviews with healers in Bedouin groups. The Latin, Arabic and Hebrew names, as well as the uses, have been obtained. It is recommended that information on medicinal plants be summarized and combined and possibly published as a joint paper between the scientists in the two countries.

C. The Intensification of Farm System Production: Cropping Systems and Water Use

1. Background

This activity investigates the efficiency of different cultural practices, and it seeks to improve wheat and maize production technologies and inverse water use efficiency. Principal scientists are:

Abdel Maabud Shafy, Field Crops Institute, Ministry of Agriculture of Egypt

Abou Serria, Y. Badawi, Soil and Water Institute, Ministry of Agriculture of Egypt

Moshe Pinthus, Hebrew University, Rehovot

Avishalom Marani, Hebrew University, Rehovot

2. Summary of Research Progress

Experiments have been conducted on wheat and maize in both countries. The research in Egypt has been at the Gemmeiza Agricultural Research Station and in Israel at the Lakhish Station. The following is a summary of the results from their research.

A) Egypt

1) Wheat

a) The maximum yield and water use efficiency was obtained from the treatment using chisel twice plus leveling and drilling. The lowest yield was from no tillage and without control.

b) Four applications of nitrogen fertilizer was better than three applications, and the sprinkler and drip methods of irrigation

were both superior in water use efficiency than surface irrigation.

c) The last period of irrigation was the most important in the soil water depletion study.

d) The 6-wheat cultivars studied differed in their response to water stress.

2) Maize

a) Under both surface and sprinkler irrigation, increased nitrogen applications increased grain yield, but the time of nitrogen application was not significant.

b) There were no differences in grain yield between surface, sprinkler, and drip irrigation when maize was grown under 50% water depletion, but leaf blight was more severe under sprinkler irrigation, and late wilt was more severe under drip irrigation.

c) There were no differences in grain yield under 25, 50, and 75% water depletion, but late wilt was more severe under 25% depletion.

B) Israel

1) Wheat

a) Grain yield of wheat following maize was significantly higher than following summer fallow.

b) Dense planting also increased grain yield of wheat.

c) The application of the growth regulator CCC increased grain yield in the absence of lodging.

2) Maize

a) Late planting (June 13) reduced grain yield compared to earlier planting (May 30).

b) There were no significant differences in grain yield with 6, 8, or 10 plant/meter of row, but there was a somewhat higher grain yield with 6 plants/meter.

c) The grain yield was significantly higher with 1 drip line for 2 plant rows as compared to 1 drip line for 1 plant row.

d) A late termination of irrigation (September 26) gave a significantly higher grain yield than an earlier termination (September 2).

3. Information Transfer

A) Research Progress Reports

The scientists in both countries have prepared the following research progress reports:

| | |
|---|---|
| First Semi-annual Report | - Oct. 1, 1984 - March 31, 1985 |
| First Annual Report | - Oct. 1, 1984 - Sept. 30, 1985 |
| Second Semi-annual Res. Prog. Rpt. | - Oct. 1, 1985 - March 31, 1986 |
| Second Annual Res. Prog. Rpt | - Oct. 1, 1985 - Sept. 30, 1986 |

B) Information to Farmers

In Egypt, there are two scientists and several technicians on this subproject who are located at the Gemmeiza Research Station. Those scientists and the principal investigators cooperate closely with the Extension personnel and farmers in the Gemmeiza area. Members of the

evaluation team met Ovadia (Abdullah) Kedar, the on-farm Israeli consultant, who is concerned with transferring farming technology from Israel to Egypt. He was clearly well liked and seemed to be effective. The proposed research in the new area (Nubaria area) may be on a farmer's field.

In Israel, the research is part of much other research being conducted on wheat and maize at Lakhish Station. Both scientists have been involved in research on maize and wheat for many years. They have contacts with farmers in Kibbutz and on Moshav farms.

4. Plans for Future Work

Suggestions for further work have been prepared by Abdel Shafi (Egypt) and M. Pinthus (Israel). The suggestions were discussed with the scientists in both countries. The following are comments on each of their suggested topics:

A) Conduct of research at two new sites It was suggested that the research in Egypt be expanded to include the new areas. This research may be conducted on farmer's fields. The climatic conditions at a commercial communal farm (Kibbutz) in the northern Negev are more comparable to conditions in Egypt than is Lakhish Station.

B) Additional Crop. The suggested crops appear satisfactory for double cropping and the types of agronomic research now being conducted. It would be well to discuss the additional crops with the economist and project coordinators in each country, who may wish to recommend that other high income crops be studied on the new lands and in the Negev.

C) Much of the proposed work contains present research with minor

variations. Discussions suggested the advisability of supervising the experiments carefully in farmers' fields.

5. Cooperation Between Scientists on the Subproject

A warm friendship and spirit of cooperation has been developed between the four principal scientists on this subproject. They call each other frequently on the telephone to discuss the progress and the planning of the research. The following are the meetings which they have had and plan to have:

A) January 1986 - A. M. Abdel-Shafy and M. J. Pinthus discussed research results and future plans and visited the Gemmeiza Research Station.

B) September 1986 - A. M. Abdel-Shafy and A. Y. Badawi visited A. Marani at Rehovot to discuss research on maize.

C) December 1986 - M. J. Pinthus visited A. M. Abdel-Shafy and A. Y. Badawi in Cairo. They discussed results of research on wheat and prepared the suggestions for Phase II (see attached).

D) A. M. Abdel-Shafy and A. Y. Badawi plan to visit Rehovot in late February or early March 1987 to observe the research on wheat and to discuss research plans.

E) The scientists in both countries suggested that they travel together to observe ongoing research related to this project in the United States. They definitely want to travel together as a research team.

6. Cooperation with Economists and Other Scientists

A) In Egypt, cooperation takes place with Dr. Samir, who works with Nabil Habeshey, in meetings nearly every month. The extent of communication is not clear. Agreement has been reached to study the use of sprinkler irrigation on wheat and drip irrigation on maize. Cooperation also takes place with the following scientists.

Dr. M. Kalifa - maize breeder

Dr. A. H. Ragab - soil scientist

Dr. F. F. El-Sayed - wheat breeder

Dr. M. M. El-Menoufi - wheat agronomist

Dr. M. El-Refaie - water specialist

Dr. M. Serf Diab - plant pathologist

Dr. A. H. Awaad - maize breeder

B) In Israel, the economists on the related subproject Economic Evaluation of Cropping Systems/Water Use are conducting several studies but not necessarily in cooperation with subproject. Scientists on this subproject cooperate and consult with scientists in other disciplines at Rehovot when problems in the research arise.

7. Conclusions

A) The objectives of the subproject are being fulfilled. Experiments have been completed to determine efficiency of different cultural practices and to increase wheat and maize production, and have measured water use efficiency with various irrigation methods.

B) Experiments are being conducted to improve maize production in both

countries. Problems in maize production are different in the two countries even though the countries are adjacent to each other. Irrigation water is free or at low cost and until recently plentiful in Egypt, but the water is expensive and very limited in Israel. In Egypt nitrogen fertilization is being studied with all three types of irrigation. In Israel planting dates, plant spacing, and rates and times of irrigation are being studied.

C) Experiments also are being conducted on farm production in both countries. The production problems for wheat are different in the two countries. In Egypt, tillage treatments, time of nitrogen application under the three types of irrigation, and effects of water depletions are being studied. In Israel effects of previous crops and planting rates are being studied.

D) An excellent relationship has been established between the scientists on this subproject in the two countries. The two scientists from Israel have visited Egypt twice and the two scientists from Egypt have visited Israel once and will visit again in late February. They also contact each other frequently by telephone.

E) Scientists on this subproject do not appear to be cooperating as closely as they might with economists. Only final yields and not input costs are considered in evaluating their results from various experiments. Communication is taking place with economists regarding future studies.

F) Regarding transferring the results from research, four research

progress reports have been prepared. There is cooperation with extension personnel and some farmers directly.

G) While some modifications may be needed in the selections of commodities to be studied in the future, the plans were prepared jointly between the scientists in the two countries and should aid the already very good interactions.

H) These are long-time experiments. Only one experiment can be conducted each year. Each experiment must be repeated at least for the second year. Therefore, two or three years are required for each experiment.

8. Recommendations

A) Cooperating scientists have been visiting the other countries at least twice each year. It is recommended that visits twice yearly or more frequently be continued.

B) Complimentary experiments have not been conducted even though the studies concern the production of maize and wheat in both countries. It is recommended that some complimentary wheat and maize experiments be conducted even though different factors affect production in the two countries.

C) The cooperating scientists in the two countries are cooperating with each other and with other scientists but so far not too extensively with project. Cooperation between plant scientists and economists should be mutually beneficial. It is recommended that the scientists on this subproject cooperate more closely with the

economists on the project.

D) The scientists have been preparing annual and semi-annual research progress reports and are cooperating with extension personnel and farmers. It is recommended that the research progress reports be expanded and that the close relationships with farmers and extension personnel be continued.

E) Considerable thought and effort have been devoted to plans for further work. Which crops are to be studied in the new areas (Nubaria area) and on commercial communal farms (Kibbutzim in the Northern Negev) may still need to be settled. It is recommended that economists and research coordinators in each country be consulted before finalizing plans for further work.

F) Several years are required to obtain information from field experiments. One year is required for each experiment. New experiments are planned for new sites in both countries. It is recommended that this subproject be funded at least for an additional three years.

## III. DAIRY

### A. Background

Although the trinational agricultural technology exchange and cooperation (TATEC) program was implemented in 1984, the death of Dr. M. Kheiraldin, Project Coordinator, and the illness of Dr. M. Hathout, the dairy production Principal Investigator, have delayed activities of this subproject. In December, 1984, Dr. Berman visited Egypt but a final implementation plan was not reached. In January, 1985, Dr.'s Berman and Kali visited Egypt and cooperative parallel research projects and experimental sites were selected. Between January, 1985 and 1986 there were no personal visits and the only interaction was through the semi-annual and annual reports. In January, 1986, Dr. Berman visited Cairo to attend the Coordinating Committee meeting and was able to see Dr. Hathout. In July, 1986, Dr.'s Hathout, El-Nouby and El-Keraby visited Israel to discuss their results and experimental plan in addition to visiting the experimental sites and other enterprises of animal production. During this visit, plans were made to implement the cooling system in Egypt. Further discussions of this plan and the possibility of developing a complete ration system in Egypt were made during a visit to Egypt in December, 1986 by Dr.'s Berman and Kali.

### B. Research Needs and Individual Country Goals

Animal proteins provide a small portion of the total dairy caloric

intake of the Egyptian population as well as most other developing countries in the arid lands. This type of nutritional inadequacy is a consequence of the low productivity of livestock in these countries. In Egypt, a national priority is to increase milk production to reach the level of self-sufficiency in the near future. Dr.'s Hathout, El-Nouby and El-Keraby agreed that milk production in Egypt (at this time) is about 2.2 million tons, a level that is far below the minimum requirement of the population (estimated to be about 4 million ton). Therefore, intensive research work on dairy production in Egypt is necessary to help elicit the maximum possible return of the available livestock breeds. The TATEC program is an excellent opportunity for Egyptian and Israeli dairy experts to develop, together, strategies to bring about significant improvement in productivity levels of dairy cows.

In Israel, the question is not how to increase national total milk production but rather how to increase the dairy farmers income through eliciting the maximum efficiency of each individual animal. For example, to prevent the known decrease in milk production and conception rate (reproductive efficiency) during the summer time will probably provide today's production level from a smaller number of animals. This, consequently, can reduce the need for additional feeding of larger numbers of cows for same total milk output and thus provide higher economic return to the farmer.

C. Analysis of Subproject

The research teams of both countries have selected topics that are

appropriate for cooperation and suitable for the facilities available. For example, low dairy productivity in Egypt is due to various factors including poor nutrition and management as well as heat stress in summer. In Israel, heat stress contributes to a significant loss of milk production. Therefore, questions dealing with nutritional problems and heat stress are key elements for increasing milk production in both countries. The TATEC dairy project began with studies designed to: (1) examine the most obvious nutritional problems such as calf rearing, and utilization of non-conventional resources for feeding; (2) develop an efficient system for dairy recording to aid in any breeding selection program, and (3) reduce heat stress using a low-cost efficient system.

D. Research Activities

1. Research teams

The research team from Egypt included scientists from the Animal Production Research Institute, Ministry of Agriculture. The team is headed by Dr. M. Hathout (PI) and Dr.'s El-Nouby and El-Keraby. In Israel, the research team is composed of scientists from the Hebrew University (Department of Animal Science) and the Ministry of Agriculture. The team is headed by Dr.'s A. Berman and J. Kali.

2. Experimental work and important findings

2.1 Egypt

At the beginning of the project, the team conducted a literature survey and the experimental work started in April-May, 1985. The subjects were: (1) calf rearing systems; (2) feeding weaned calves on a complete ration

using non-conventional resources, (3) development of a modern recording system for the dairy herd, and (4) the effects of climate on milk yield. In less than two years, progress has been made toward the first two objectives and significant steps have been made for implementation of the last two objectives. The important findings included the following.

i) Calf rearing: Studies were conducted to examine the effectiveness of early weaning and the use of milk replacers on performance of Friesian calves. The data on growth rate (average daily gain) showed that the use of milk replacers yielded about equal performance to the traditional method of using whole milk. The use of milk replacers can save about 400 kg. fresh milk/calf, i.e., about 10% of the total milk yield/year per cow.

ii) Use of non-conventional feed resources: Food shortage for livestock is a primary factor in low productivity of the animal production sector. Traditional feed resources include clover or Berseem and rice straw plus concentrate mixture (unified feed) for winter and summer, respectively. However, because of the Egyptian agricultural strategy to increase wheat production, it is anticipated that the size of the land allowed for Berseem will be reduced significantly in future years. Therefore, the use of non-traditional feed resources - such as corn stover, molasses, urea and other available agricultural by-products - as an important part of livestock feeding is essential for development of animal production. Feeding trials using Friesian calves were conducted to compare animal performance on traditional and non-conventional rations. For winter feeding, a non-conventional ration composed of 50% Berseem, 25% chopped corn stover, 20% concentrate mixture and 5% molasses resulted in slightly better average

daily weight gain and feed efficiency. For summer feeding, a complete ration with non-conventional resources (35% chopped corn stover, 48.5% concentrate mixture, 15% molasses and 1.5% urea) resulted in higher growth rate.

It is apparent from the data that the use of unused feed resources in winter and summer is, at least, as beneficial to animal performance as the conventional feeding methods. Using such agro-industrial by-products as future animal feed in Egypt and in all arid regions is of enormous advantage for development of animal production. The economic evaluation of using non-conventional feeding methods should be addressed.

iii) Development and update of dairy recording systems: Improvement of available animals is a necessary step to increase animal production. One plan to achieve such improvement is to develop an efficient system for genetic breeding and selection. As a step toward this goal, the research team began to computerize their present system which is tedious, time consuming and inefficient. A desk computer was purchased and installed in Sakha Station. Only in 1986, the team began to plan a recording system to include production traits and external breed characteristics. Specifically, the recording system included data on reproductive efficiency, milk yield, body weight gain for dams and sires, and progeny tests for male and female offspring.

The Friesian herd on Sakha was initiated in 1961 and due to inbreeding problems, new blood - through importation of frozen semen and artificial insemination - was introduced in 1971. If the large body of data on the

Sakha station is computerized and analyzed statistically, the breeding selection program at the station can be improved significantly, since strain differences in adaptability can be scientifically assessed. Additionally, analysis of the data may provide a scientifically valid foundation for other breeding programs in Egypt.

iv) Milk yield and climatic factors: Although a large body of data on milk yield in various seasons of the year are available, little has been done to analyze these data. A preliminary analysis was made to compare milk yield of 5 lactation periods in summer and winter. The lactation curve had a higher duration of peak milk yield and the subsequent decline in milk yield was less steep in winter as compared to summer. The drop in milk yield during the summer season is due, mainly, to heat stress and nutritional factors (Berseem vs. concentrate and straw). To separate both factors, the team agreed to begin a study using the cooling system developed by Dr. A. Berman.

2.2 Israel

At the start of the project, the team reviewed the literature on effects of climate on fertility and milk production, cooling methods, and use of low quality feeds to weaned calves. The objectives of experimental work included:

i. to develop an effective and low cost cooling system in summer for dairy cows;

ii. to define the proper time and duration for cooling to increase milk production and reproductive efficiency;

iii. to develop ways in which low quality feeds could be use in feeding weaned calves.

i) Development of cooling systems: Levels of milk production are known to be closely related to levels of metabolic heat production. In other words, high dairy productivity can not be sustained unless heat is removed from the animal to its environment. Reduction of the intensity of heat stress by increasing heat loss from the animal can be achieved by relative cooling of the micro-environment. Available cooling methods include: shading, sprinkling, forced ventilation, and a combination of sprinkling and forced ventilation. Field experiments on development of low cost cooling methods have been initiated by Dr. Berman prior to funding of this project. With funds available from the TATEC project, Berman and his colleagues began to test and develop an automated wetting system involving water spraying for a few seconds (10-30) followed by forced ventilation for 15-45 minutes. Cooling by this technique is unlikely to be feasible but over concreted surfaces. Hence, its is limited to the feeding area and to the holding area adjacent to the milking parlor. Four experiments were conducted to determine: the duration of wetting and forced ventilation periods, the effects of density of cows in holding area during cooling and the influence of cooling on diurnal increases in body temperatures. Results showed that cooling the high producing Israeli-Friesian for 5 times a day for 30 minutes each time can prevent cows' overheating in hot weather.

In the second stage of the experimental work, the cooling method was tested in a field situation, i.e., a medium sized dairy farm of 200

lactating cows, for its effect on milk yield and reproductive performance. The selected farm for implementation was Kibbutz Na'an and cooling began from the day preceding expected estrus until day 8 post-insemination in summer and autumn. The data are in the final stage of analysis. Dr. Berman indicated that the potential benefits from cooling may reach 3 kg of milk/cow/day, i.e., the equivalent of about $150 per lactation season. On the other hand, extended cooling into fall caused increased incidences of mastitis and increased food intake without an increase in milk yield. It is suggested that cooling should not be used when the temperature is below 25°C.

ii) Feeding system for dairy calves using low quality feeds: The premise for this component of the project was to replace milk by relatively low cost and low quality feeds for young calves, thus saving the milk for human consumption and reducing the cost of their rearing. The main problem with such a feeding system is that its consumption by the calf is limited when offered in dry or paste forms. Therefore, the experimental protocol was devised to attempt to use such a feeding system in liquid form. The work was carried out on the experimental dairy herd of the Agricultural Research Organization at Bet Dagan. A control group of calves were fed a normal ration (milk plus freely available concentrate) and a treatment group was fed increasing amounts of concentrate in liquid form, i.e., they were fed in addition to the normal ration a complete concentrate: chopped roughage ratio for high producing dairy cows. It was assumed that a large intake of liquid concentrate instead of milk or milk replacer would provide economical

feeding system. The data were not conclusive and therefore the additional cost of the feed in liquid form was found to be economically unjustified.

E. Potential Application of Research Findings

Low productivity of livestock in arid lands is primarily related to environmental stress, low quality feed and inadequate nutrition and poor management. Israel has overcome most of these problems as shown by the high productivity of Israeli Friesian herds. The TATEC project provides a unique opportunity to examine two different systems of dairy production. The questions addressed by both research teams are of common interest to all those involved in development of arid lands. The results obtained on milk replacer, complete ration using agro-industrial waste and by-products, and the low cost cooling system indicate that these findings have potential for exchange and possible transfer to other nations in the region. Development of a system for complete rations using non-conventional resources and/or cooling for animals may provide a nucleus for the establishment of new industries with greater economic return for populations working in sectors other than farming. The potential contributions of the results outside the project has already been made. After the cooling was conducted in Israel, one farm with about 150 lactating heads began to implement a cooling system. It is expected that 4 additional farms will be adopting the cooling system. Such simple technology can be exchanged, without a great investment in personal training, with other nations of the arid lands.

F. Reports of Research Activities

The principal investigators in both countries submitted periodic

reports throughout the duration of the project. These reports were collected together, summarized, edited and bound by Mr. Mark Abbott. A list of reports on dairy production is shown in the following table.

| Report Number | Reporting Period | Remarks |
|---|---|---|
| 1 | October, 1984-April, 1985 | semi-annual |
| 2 | October, 1984-September, 1985 | annual report |
| | April, 1985-September, 1985 | |
| 3 | October, 1985-March 1986 | semi-annual |
| 4 | October, 1985-September, 1986 | |
| | April, 1986-September, 1986 | annual report |

Additionally, both teams have prepared part of their data for publication and/or presentation at scientific meetings.

(1) Publication by the Egyptian team:

Hathout, M. K., 1986. Feed resources for livestock in Egypt. Presented at the second Egyptian-British Conferences on Animal and Poultry Production. Bangore, UK. gust 26-28th (Proceedings, in press).

Mahmoud, A., M. K. Hathout, H. El-Nouby and F. Keraby. Utilization of non-conventional feed resources in feeding growing dairy calves (in preparation).

Koreit, E., M. K. Hathout, H. El-Nouby and F. El-Keraby. Use of milk replacer in rearing Friesian calves. (in preparation).

(2) Publications by the Israeli team:

Flamenbaum, I., D. Wolfenson and A. Berman, 1986. Cooling dairy cattle

by a combination of sprinkling and forced ventilation and its implementation in the shelter system. *Journal of Dairy Science*, 69: 1340.

Berman, A., I. Flamenbaum and D. Wolfenson. Climatic management for the reduction of Summer fall in milk production and conception rate. *Dairy Producers Journal* (Meshek Habakar VeHahalav, in Hebrew). (In preparation)

G. Exchange of Visits

The Egyptian and Israeli teams have had a total of five visits as shown in the following table. During these visits major strides were accomplished. Their relationship has moved from the stage of just getting to know each other with perhaps reservations of a psychological barrier to a stage of trust, respect and friendship. Future visits should turn out to be more productive.

| | Visitor(s) | Location | Accomplishments |
|---|---|---|---|
| December, 1984 | Dr. Berman | Cairo | Various aspects of the tentative implementation plan were discussed. Final plan was not reached. |
| January, 1985 | Dr. Berman<br>Dr. Kali | Cairo | Topics for the studies were defined and a plan was formulated. Experiments sites were visited, i.e., Mohalet Mossa Farm, Sakha Farm, El-Salhia farm (a private farm). |
| January, 1986 | Dr. Berman | Cairo | Attended the Coordination Team and met with Egyptian colleagues. |
| July, 1986 | Dr. Hathout<br>Dr. Keraby<br>Dr. El-Nouby | Rehovot | Visited the experimental sites including tours of the AI Center, Embryo Transfer Center, the kibbutz and moshav agricultural systems. Results were discussed. |
| December, 1986 | Dr. Berman<br>Dr. Kali | Cairo | Visited experimental sites and a privately owned farm in Nubaria. Berman discussed the implementation of the cooling system in Sakha and agreed to help in providing parts of the system. Also, he discusses the use of computer system in analysis of the breeding data. Kali discussed the possibility of setting up a food mixing system for the utilization of non-conventional feeds in Sakha. |

H. Joint Planning and Coordination

Joint planning and coordination was undertaken during the exchanged

visits. For example, during the early visits of Dr.'s Berman and Kali, to Cairo, both research teams agreed on selection of the appropriate topics to be investigated in each country. Also, during their visit in December, 1986, both teams planned, jointly, the experimental protocol for the study on the effects of cooling on milk yield and reproductive efficiency at Sakha. During the visit to Israel by Dr.'s. Hathout, El-Nouby and El-Keraby, both teams discussed implementation of the cooling system based on a visit to the experimental site in Israel.

I. Encountered Problems

The changing nature of the political situation in the region has affected the exchange of visits. This is evident from the lack of visits during certain periods. However, it is significant to note that in a short period of time (less than 2 years) and with a complicated framework for all of the subprojects, a good relationship has been established between the research teams of both countries. The psychological barrier among the involved scientists seems to have been eliminated and the personal friendship of members of both teams is an important achievement of this project.

J. Conclusions and Recommendations

1. This subproject corresponds to a significant step towards agricultural and economic developments of both countries. Improvement of milk production is one of the most appropriate topics for regional cooperation. In Egypt and Israel there are particular capabilities, interests and needs in both countries which make the cooperative efforts

mutually useful.

2. The research teams from both countries have actively participated in planning and implementation of their research work. Through their visits and communications, they developed strong ties and better understanding of the dairy systems in both countries. This is a significant step for future regional cooperation on research areas of common interests.
3. The data on rearing calves and utilization of non-traditional feed resources are promising and may lead to a breakthrough in development of a simple technology for providing adequate and complete rations for farm animals.
4. Cooling high producing cows with a simple low cost method has been benificial and its success is indicated by its adoption in Israel by one farm while others are expected to use the system in the near future.
5. Continuation of this subproject for an additional period of time is highly recommended to help both research teams sustain their linkage by working together jointly in some cases on activities of mutual interests. Such extension and funds should be made without any time lapse to keep the momentum of present achievement going.
6. The budget of this subproject should be increased to allow for purchase of needed equipment as well as for the involvement of larger numbers of junior scientists and graduate students. Additional involvement of university individuals should be encouraged.
7. Experimental work should be expanded to other sites such as the new lands in Egypt. For example in Nubaria, the agricultural problems may be more similar in both countries than the present sites.

8. The planned on-farm testing of the complete ration and milk replacers using a few of the farms near Sakha is highly recommended.

9. Annual and semi-annual reports have not been consistent in quality, and in future, reports should follow the instructions provided by Mr. Mark Abbott in his memo dated May 19, 1986 to all PIs, Coordinating Committee and administrative coordinators.

10. In future publications, the authors should acknowledge the TATEC project.

11. Economic evaluation of the dairy subproject should be emphasized in future work. More interactions between economists and dairy scientists should be encouraged, especially in Egypt

12. An addition of a subproject on animal health would be desirable for overall improvement of animal production in arid lands.

# IV. ECONOMICS

## A. Background

The economics work has been conducted under the subproject on Evaluation of Methods for Technological Exchange in Agriculture. It has involved assessment of the economic feasibility of technologies studied in other parts of the project, as well as study of factors affecting adoption ranging from climate, to characteristics of farmers, to infrastructure support systems.

The Egyptian economic research have included Professor A. Basheer and several other economists from the Ministry of Agriculture. The economists from Israel included Professors Yaron and Poharyles, Dr. A. Dinar, along with several others. A list of personnel may be found in the appendix.

In the remainder of this part of the report, the major economics findings will be reviewed and cooperation will be documented. Then conclusions and recommendations on the economics work will be presented.

## B. Economic Evaluation of Cropping and Water Use Systems in Egypt

### 1. Sprinkler Irrigation

A limited survey on new lands (Tahrir province) has been conducted to evaluate sprinkler irrigation which is the common method adopted there. One of the objectives of the study is to identify and assess problems facing farmers who use sprinklers irrigation in this region. Twenty-one farmers were interviewed. The area formed by each ranged between 8 and 22 feddans.

The total area farmed was 262 feddans. Winter crops constituted about 53% of the cultivated area while summer crops represented 47% of the total cultivated area. Berseem and green peas were the two main crops in the winter, constituting 42% and 30% of the winter area respectively. Peanuts and watermellons are considered the two main crops in the summer season, with peanuts, comprising 84% of the cultivated area. The results were as follows:

a. A fallow area had been left which constituted 56% of the winter area and 62% of the summer area.

b. Average costs of sprinkler irrigation are estimated at LE 40 per Feddan (does not include fixed and maintenance costs)

c. Average net returns of farmers cultivating peanuts were negative, except for 2 farmers (about 10% of sample size). The two farmers had positive net returns because they used more water than the rest of the sample population. This was due to their location advantage since they were near pumping stations.

d. For berseem, the situation was better. Net returns were positive at the average level of the sample. Total variable costs were estimated at LE 138, while costs of irrigation constituted about 30% of the costs. The net return amounted to LE 60 per feddan.

e. Quantities of water used for irrigation varied greatly for each crop while the number of workers used in the irrigation operation ranged between 6-8 worker per feddan during the season.

f. The main problem facing the farmers was the fact that the sprinkler irrigation stations had stopped several times during the season and

this affected the quantities of water available to the farmer. Electricity failures were the primary reason for stoppages of the water pump stations. The result was, that a considerable part of th area was left fallow. Had these problems not existed, there would have been a major saving of water, compared with surface irrigation.

An advantage of sprinkler irrigation in the area studied, is that it saves on land levelling operations and its suitable for the sandy soil of the area.

2. Field Experiment Conducted on Maize

Research was conducted in Gimmeza on effects of irrigation methods on fertilizer productivity in maize production. Data was collected for 3 types of irrigation: surface; sprinkler; and drip. Economic analysis was carried out comparing the relative attractiveness of each method. This was done by conducting a cost-benefit study for all 3 types of irrigation (while varying the amount of fertilizer used). In addition, the Egyptian team estimated the production function of Maize for varying degrees of fertilization, using the different irrigation methods.

C. Economic Evaluation of the Cropping and Water Use Systems in Israel

1. Adoption of Drip Irrigation in Cotton: A Case Study of Kibbutz Cotton Growers in Israel

The study investigated the adoption of drip irrigation technology in cotton growing based on a sample of 38 kibbutz cotton growers out of 50

in the Rehovot and Lachish regions of Israel. Main empirical findings are:

1) Yield per hectare is, on the average, about 10% higher under drip (4,944kg) as compared to sprinkler (4,479kg). Yield per $1m^3$ of irrigation water is about 2.5% higher under drip (1.195kg) as compared to sprinkler (1.166kg). Thus drip irrigation in cotton is more efficent than sprinkler irrigation and has the potential of being more profitable.

2) S-shaped logistic curves are characteristic of diffusion paths. As expected, adopters began with a small cotton area irrigated by drip and steadily increased its proportion. However, the estimates suggest that the diffusion could reach a ceiling at only about half the total cotton area.

3) Cotton growers said that the most important reasons for adopting drip irrigation were:

   a. "drip irrigation is more efficient than sprinkler irrigation" (i.e. the yield per a given amount of irrigation water is higher under drip).

   b. "on my farm several plots are inclined and/or non-symmetric and irrigating them by sprinkler is technically complicated and involves water wastage".

   c. "Switching from sprinkler to drip will increase the flexibility of the overall irrigation system of the kibbutz".

   d. "drip enables the use of fertilizers in a more efficient

manner than with sprinkler".

4) Disadvantages of drip irrigation in comparison to sprinkler irrigation where said to be:

a. "the drip system does not allow for easy access of agricultural machinery"

b. "laying the equipment for drip irrigation exerts great pressure on the work schedule both at the beginning and the end of the growing season".

The project is now in the final stages of applying an econometric model aimed at estimating the effect of several explanatory variables on the adoption of drip irrigation in cotton on the farm level.

The explanatory variables which were found significant include: the (one year) lag of the ratio (gross annual profit under drip)/(gross annual profit under sprinkler); the percent of total cotton area in relation to the total field crops area; the annual increase in the total cotton area; and the lag of the cumulative area of drip irrigation cotton.

Given the profitability advantage of drip irrigation, one can ask why is it not adopted instantaneously by all cotton growers. The answer is that across the population of the kibbutz cotton growers, the magnitude of at least one of the following economic variables differs: profitability (its magnitude changes for different soils, topographics, climates, etc); the availability and quality of the existing irrigation equipment; labor constraints (especially at the beginning and the end. Almost all of the interviewees stated that one of the most important reasons which motivated

them to adopt drip is the existence of marginal soil plots. In other words, the percent of marginal land plots is expected to be a significant explanatory variable. Supplementary detailed data is now being collected with the aid of soil maps.

2. A Case Study of a Transition from a Traditional to a Modern Irrigation System

The objectives of this study are to: (1) evaluate the potential economic benefits derivable from the transition from a traditional to a modern irrigation system and (2) identify the socio-economic factors which promote or inhibit such a transition.

An area in an arrid region (Jordan Valley, south to Beisan Valley) was selected for empirical analysis. Data from 24 farms served by a regional irrgation system were obtained on the land area of the farms, the cropping system both past and present, input/output relationships with emphasis on irrigation, and data on the prices and technology were collected.

Transition processes considered are: (a) transition from surface irrigaton to drip irrigation; (b) incorporation of small operational water reservoirs at the farm level (ponding); and (c) a change in crop composition, namely a transition from traditional subsistence crops (mainly grain and some vegetables) to high valued crops - out of season vegetables - mainly for export markets. Conjunctive use of canal flow water with underground well water has been practiced under the traditional system; the practice is being continued under the modern system.

The system has been analysed with the aid of a simulation program. A

main finding is that the transition from a traditional surface irrigation system to a modern capital intensive irrigation system is justified only if accompanied by a shift from the traditional crop mix to high income cash crops. Operation costs per $1m^3$ were found to be 8.6 and 5.2 UScents respectively for pumping from the operational reservoirs and the wells. These costs appear to be relatively high and the question arises as to whether they could be reduced by improved engineering configurations. The modernized project along with the new crop mix yields a gross return of .72 UScents/$m^3$ and therefore it passes quite favorably the cost-benefit analyses performed.

The major crops which contribute to the outcome are out of season (i.e., winter) tomatoes (50 ton/ha, 40% of the total area), eggplants (60 ton/ha, 22% of the total area) and marrows (20 ton/ha, 15% of the total area) produced mainly for the export markets. The project is justified even if the gross returns/ha would have been reduced by half. Cementing of the secondary canals aimed at preventing water loss is justified both by the traditional as well as the modern crop mix and irrigation systems.

An English report summarizing the study is in preparation.

3. Comparative Analysis of the Integrated Cropping and Water Use System

The aim of the project is twofold: (a) to study the cost of various irrigation systems under a variety of situations with particular emphasis on the question of whether there is a reduction in cost over time in the capital intensive systems such as drip irrigation; (b) to study in detail

the costs and benefits of alternative systems under selected farm conditions including salinity.

Data was collected from the Israeli Department of Agriculture (530 observations) on investment costs for different irrigation technologies, i.e., drip, micro-sprinkler, micro-jets and sprinkler irrigation as applied to vegetables, cotton and orchards during the period 1972-1986. Different cost variables were constructed to be regressed against explanatory variables such as plot size, irrigation system layout, water quality, soil characteristics and time. Preliminary results support the hypothesis that irrigation investment costs are related to the particular site conditions. Cotton, avocado, banana, mellon and cucumber production were investigated. In general, it appears that new irrigation technologies are quite expensive and therefore will be economically justified for application in high income crops.

4. Adoption of New Irrigation Technologies in the Citrus Industry: Influence of Input Quality and Other Variables

Work on the adoption of modern irrigation technologies in citrus production commenced in October, 1985. Thus far, a survey of literature on irrigation technologies in citrus in Israel since 1920 has been completed. Data has been obtained for 180 citrus groves in 6 regions. Work has begun on an econometric model to explain the adoption of new irrigation technologies. Preliminary results show that soil characteristics, water quality and water scarcity influence adoption. Adoption also appears to vary by region and social organization, i.e., private, moshav and kibbutz.

5. Evaluation of Irrigation Systems with Emphasis on Uniformity of Water Application

A stochastic optimization model for irrigation of spatially variable soils under nonuniform water application conditions has been developed. The level of application nonuniformity is determined by the irrigation system, with drip irrigation exhibiting higher uniformity than sprinkler, which in turn is more uniform than any surface irrigation system. The stochastic characteristics of the model are based on the estimation of parameters which describe the statistical properties of the spatial variability of the relevant soil parameters.

The economic optimization procedure assumes a risk-averting decision maker whose aim is to select the optimum irrigation water quantity which maximizes the expected utility from his profit. High profit expectation is a positive argument of the objective function while high profit variance is a negative argument.

The analytical model has been used in the empirical analysis of irrigation systems. The economic evaluation of various irrigation systems is based on the differences among them with respect to application nonuniformity as well as to investment and operation costs for selected crops.

D. Evaluation of Technology Exchange--Egypt

The economic evaluation in Egypt, other than on cropping and water use already reviewed, has concentrated on solarization. A technical report gave agronomic data of the results of 1985-86 experiments including yields per

hectare estimated on the bases of the output of the experimental plots for the crops treated for the control of soil borne diseases. These crops were 1) onions at Nefesha-Ismailiya and at Tamiya-Fayoum research stations, 2) tomatoes at Nefesha and 3) broad beans at Tamiya. These experiments of 1985-86 represent the first crop year for soil solarization experiments under the Trinational Project.

1. Evaluation of Soil Solarization Experiment on Tomatoes at Nefesha-Ismaliya, 1985/86

The yield per hectare of tomato was very high for solarized soil reaching 54.1 tons, that is three and half times the yield of nonsolarized soil (15.8 tons/h). The former yielded more than the latter by 38.3 tons/h or 242%. The market value of such a high yield increase (LE/h 6900) at farm-gate prices was much higher than the solarization cost (LE/h 2540). Income above variable cost was LE/h 6048 for solarized soil, or almost three times that of non solarized soil which amounted to LE/h 2049. The yield increase needed to cover the cost of solarization of this experiment amounted to 14tons/h or 90% of the yield of nonsolarized soil. This was slightly more than one third of the realized yield increase.

The results show that soil solarization on tomatoes was highly profitable. This was partly because the tomato is a high value crop and also because the yield increase due to solarization was high. Similar evaluation results were recorded in two soil solarization experiments on tomatoes carried out at Fayed.

2. Evaluation of Soil Solarization Experiment on Broad Beans at the Tamiya-Fayoum Research Station, 1985/86

The yield of broad beans was 5.3 tons/h for solarized soil versus 4.8 tons/h for non-solarized soil. The yield increase due to solarization was half a ton (500 kg) per hectare, i.e., only 10%. Consequently, the increase in marketing value of that yield (LE/h 250) was much less than the solarization cost (LE/h 2020). Consequently income above variable cost was very low for solarized soil (LE/h 146) compared with that of non-solarized soil (LE/h 1975). The yield increase needed to cover solarization cost of this experiment was about 5.3 tons/h or 11 times the realized yield increase. This also meant that doubling the realized yield of solarized soil, or increasing the yield of non-solarized soil by 120%, was required.

Soil solarization on broad beans lead to a large loss. This is partly because broad beans are not a high value crop (it gave receipts and income above variable cost per hectare of solarized soil which were much less than those given by one hectare of solarized soil of tomatoes, which are a high value crop) and also because the yield increase per hectare due to solarization was small (only 10%). Similar evaluation results were recorded in the previous soil solarization experiments on broad beans carried out at the Giza Research Station in 1981/82 and 1983/84.

3. Evaluation of Soil Solarization Experiments on Onions Carried Out by the Egypt Pathologest Team in 1985/1986 at Fayoum and Ismailiya Research Stations:

At Fayed-Ismailiya, five soil solarization experiments were carried out

on onion bulbs. Three of these experiments produced onion bulbs from planting onion seedlings, while the other two experiments produced onion bulbs from planting onion sits. The average yield per hectare based on the results of the first three experiments was 17.5 tons on solarized soil compared with 6.9 tons on non-solarized soil, the former being two and half times the latter. Based on the results of the other two experiments, the average yield per hectare was 7.8 tons on solarized soil and 2.8 tons on non-solarized soil. At Tamiya-Fayoum, five experiments of soil solarization were carried out to produce onion bulbs from planting onion seedlings, and one experiment was carried out to produce onion seeds from planting onion sits. Here, the average yield per hectare of onion bulbs was 7.1 tons for solarized soil compared with 2.7 ton on non-solarized soil, with the former exceeding the latter by 4.4 ton/h or 165%. For onion seeds the average yield per hectare was 725 kg/h on solarized soil compared with 228 kg/h on non-solarized soil, the former exceeding the latter by 497 kg/h or 218%.

While the experiments on onion bulbs produced on onion seedlings had a positive average income above variable costs (LE/h 217), but less than that of non-solarized soil (LE/h 353), solarized soil incured heavy losses in all the other experiments and had income below variable costs of LL/h 1048, 2384 and 625 respectively. The reason is that onions in the areas chosen for the experiments (Ismailiya and Fayoum Governorates) are not a high value crop. Yields are low: onions are produced for local consumption; and the farm-gate price is relatively low. On the other hand onions are high value crop only in Upper Egypt, especially in the Sohag Governorate where the average yield is high, the crop is produced for export and has a relatively high farm-gate

price.

Therefore, the Egyptian-Ministry of Agriculture and Land Reclamation recommends that the Egypt pathology team concentrate the solarization experiments on onion in the Sohag Governorate because the control of onion soil-borne diseases in that area promises a high rate of return on solarization costs.

E. Evaluation of Technology Exchange--Israel

The economic work in Israel, other than on cropping and water use reviewed above, consists of several interrelated projects aimed at evaluating methods for technology exchange in agriculture.

1. Elements of Israeli Agricultural Technology Exchange Experience

An evaluation has been undertaken of Israeli experience in agricultural technology exchange with developing countries with a strong emphasis on arid and semi-arid areas. The methodological objective of this part is to draw lessons for future Israel-Egypt exchange. The evaluation is focussed on an integrated approach, including, economic, social, extension and research aspects. The first stage, consisting of a description of relevant projects and selection for further analysis has been completed.

The impact of technology exchange is being empirically evaluated through several case studies:

(a) Abou Massoud Integrated Agricultural Complex in Egypt's Western Desert. The first stage of this study has been completed and includes five chapters: Conceptual Framework, Description of the Projects, Agricultural Programs, Evaluation of the Performance and Development Strategy

Conclusions.

(b) Israeli-Egyptian direct cooperation and a technology exchange on a Delta farm.

(c) The third case study was undertaken by the Albert Einstein Foundation with Israeli knowhow and technology and is located in the new lands.

The case studies are different in their ecological significance. In Israel, the potential of the large stock of medicinal plants in Egypt is being studied for prospective adoption. Another subject with high potential for adoption in Israel is in the field of the various double and multi-cropping techniques.

## 2. Analysis of Factors Promoting or Inhibiting the Diffusion of Agricultural Innovation

### 2.1. A Study of Diffusion of Agricultural Innovation Based on Farm Level Survey Data

To analyze factors which promote or inhibit the adoption of agricultural innovations, a questionnaire has been designed and tested consisting of 5 parts:

1. economic data with reference to 2 years
2. demographic data
3. attitude towards, and introduction of, innovations
4. supporting systems: description and attitudes
5. extension: description and attitudes.

Two samples of family farms in two regions have been selected for

analyses, with 50 farms in each region. Collection of the data is nearly complete. The analysis will be in two parts:

1. A descriptive study aimed at highlighting the information collected in narrative qualitative terms, and
2. A econometric study aimed at identifying the factors which promote or inhibit the adoption of innovation.

2.2. Analysis of Census Data at the Farm Level

Additional data has been sampled from the Israeli Central Statistics Bureau tape for the 1981 rural census; adding two villages in the Hadera area and three villages in the Nazareth area.

3. Economic Evaluation of Technologies for Exchange:

3.1. Soil Disinfestation For Controlling Soil-borne Diseases

Economic evaluation of soil disinfestation by solarization has been based on 15 field experiments covering tomatoes, onions, eggplants, watermelons, cotton, peanuts and garlic. Budgets were constructed for each combination of crop, application method (broad/strip - long term/on year) and region.

The study compared between three methods for controlling plant diseases by soil disinfestation.

The yield was classified using two grades:

grade A: export quality

grade B: inferior quality.

## ECONOMIC EVALUATION OF SOIL FUMIGATION AND SOLARIZATION

| | Garlic, Gilat Station 1980 | | | | Onion, Yotvata 1977/78 | | Onion, Gefen 1977/78 | | Peanut, Kaffar-Kassem 1977/78 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Solarized | Untreated | Ethylene Dibromide | Methyl Bromide | Solarized | Untreated | Solarized | Untreated | Solarized | Untreated |
| Yield: | | | | | | | | | | |
| Grade A T/ha | 7.14 | 0 | 2.2 | | 57.3 | 25.4 | 28.2 | 15.5 | 4.92 | 2 |
| Grade B T/ha | 16.1 | 0 | 5.9 | 11.5 | | | 14 | 10.9 | 1.46 | 1.9 |
| Price: | | | | | | | | | | |
| Grade A $/ha | 1000 | | 1000 | | 270 | 270 | 270 | 270 | 830 | 830 |
| Grade B $/ha | 400 | | 400 | 400 | | | 140 | 140 | 350 | 350 |
| Receipts: $ | 13580 | 0 | 4560 | 4600 | 15471 | 6858 | 9574 | 5711 | 4594.6 | 2325 |
| Variable Cost Until Harvest | 3440 | 3440 | 3440 | 3440 | 3870 | 3870 | 4150 | 4150 | 2540 | 2540 |
| Harvest Costs | 2567 | | 1168 | 1482 | 4963 | 3436 | 4357 | 2725 | 335 | 335 |
| Cost of Treatment | 1200 | | 250 | 2100 | 744 | | 744 | | 1200 | |
| Income Above Variable Costs | 6373 | -3440 | -298 | -2422 | 5894 | -448 | 323 | -1164 | 519.6 | -550 |

| | Peanut, Bet Dagan 1982 | | | | Cotton, Bet She'an 1978 | | Cotton 1979 | | Melon, Yotvata 1982 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Untreated | Metham 900 l/ha | Solarized | Metham 400 l/ha Solarized | Untreated | Solarized | Untreated | Solarized | Untreated | M.B. | Solarized |
| Yield: | | | | | | | | | | | |
| Grade A T/ha | .43 | .92 | 2.32 | 4.04 | 2.46 | 4.16 | 1.31 | 2.88 | 27.5 | 40.5 | 27.6 |
| Grade B T/ha | 4.75 | 4.31 | 2.5 | 1.75 | | | | | | | |
| Price: | | | | | | | | | | | |
| Grade A $/ha | 830 | 830 | 830 | 830 | 800 | 800 | 800 | 800 | 390 | 390 | 390 |
| Grade B $/ha | 350 | 350 | 350 | 350 | | | | | | | |
| Receipts: $ | 2019.4 | 2272.1 | 2800.6 | 3965.7 | 1968 | 3328 | 1048 | 2304 | 10725 | 15756 | 10764 |
| Variable Cost until Harvest | 2685 | 2685 | 2685 | 2685 | 2040 | 2040 | 2040 | 2040 | 4950 | 4950 | 4950 |
| Harvest Costs | 335 | 335 | 335 | 335 | 360 | 360 | 360 | 360 | 1705 | 2505 | 1712 |
| Cost of Treatment | | 744 | 1200 | 1544 | | 1200 | | | | 2200 | 1200 |
| Income Above Variable Costs | -1000.6 | -1491.9 | -1419.4 | -598.3 | -432 | -272 | -1352 | -96 | 4070 | 6101 | 2902 |

As is shown in the accompanying table, in all the experiments (with the exception of melons), the value of the yield of the untreated plots did not cover the variable costs. In general, solarization tended to raise income above variable costs, by more than the other disinfestation methods. The increase in yield in these cases proved to be quite substantial, with solarization treatment significantly increasing the ratio of grade A to grade B in the yield. The economic analyzes lead to the conclusion that the study should be extended to include aspects such as rotations and other long run considerations at the farm level and not only at a plot or crop level.

Another conclusion is that low income crops can cover the cost of solarization only under specific conditions.

During the June-July, 1986 trinational (Egypt-Israel-USA) meeting, the solar heating technology was discussed in a joint session of plant pathologists and agricultural economists. The results of the discussion lead to an ad hoc conclusion that application of this technology in both Israel and Egypt should be properly monitored with priority given to high income crops and farm types with suitable crop rotations. As a result of these discussions, the Israeli team is undertaking steps towards a study of the diffusion of this technology in Israel.

### 3.2. Cooling Systems for Increased Dairy Production

Alternative cooling methods for cows being studied are: shading, sprinkling and forced ventilation. Preliminary analyses of costs has been carried out indicating that the potential benefits from the application of these methods may reach 3 kg of milk/cow/day equivalent to the total

seasonal value of $150 (150 days × 3kg/day × 30cent/kg). Additional benefits not quantified at this stage relate to increased fertility. The above results, while preliminary, indicate that this technology has economic potential and probable potential for exchange.

3.3. Double Cropping

Double cropping technologies evaluated include: wheat with silage crops, 2 grain crops in a row, winter silage crops and peanuts, wheat with cotton, etc. Cost-benefit analyses were performed for selected double cropping combinations at the field level and some at the farm level as well.

The results of these analyses indicate the optimal combinations of double cropping under selected conditions. This technology has the potential of substituting for cotton which now faces a world crisis due to over production. Double and multiple cropping technologies practiced in Egypt were reviewed, and their potential for adoption in Israel is being evaluated.

4. The Supporting System

A description and analysis of the supporting infrastructure of Israeli agriculture is being prepared covering credit, research and extension, agro-industrial enterprises, input supply and marketing organization. As a companion study, a field survey of the infrastructure system of family farm villages is being conducted. The study is part of a large sample of private family farms asked to fill in a questionaire on supporting services in agriculture as well as to express their attitude concerning marketing, credit and other facility requirements.

5. Agricultural Development on Arab Farms in Israel

A draft report entitled "Development in the Agriculture of the Arab Sector in Israel" has been prepared, and the final version is now in preparation.

F. Cooperation

Mutual Visits

| | | |
|---|---|---|
| December 1985 | - | Professor S. Pohoryles in Egypt |
| January 1986 | - | Professor D. Yaron, Professor E. Bresler, Dr. E. Feinerman, Dr. A. Szeskin, Dr. A. Dinar in Egypt |
| March 1986 | - | Dr. A. Dinar and Professor J. Kahan in Egypt |
| June/July 1986 | - | Dr. Y. Mohieldin, Dr. A. Rahin, Dr. M. Sahour, and Dr. Besheer in Israel |
| September 1986 | - | Dr. Abdel Maboud Abdel-Shafy and Dr. About Serria Y. Badawi in Israel |

During these visits the progress of the various subjects of the project were reviewed, information was exchanged and plans for cooperative work on mutually earmarked subjects were discussed.

Additional trips and contacts have taken place contributing to the international cooperation.

G. Conclusions and Recommendations

1) The central role played by economic analysis in much of the project has been one of the project's major strengths. The cooperation between

economists and physical scientists exemplifies approaches that are often lacking but generally needed wherever agricultural research on new technologies is carried out.

The progress in the economic analysis has been conditioned in part by progress in research on the various technologies. Economics has had to wait in some instances for results from the physical scientists to become available. In some cases where results have been available, extremely high calibre analysis of feasibility has been carried out. The analysis of the economic feasibility of solarization is particularly outstanding and could serve as a model of good analysis for projects everywhere.

At the same time, there is variation in the extent to which economic feasibility studies have been carried out. Partial and preliminary feasibility analyses have been done in some cases, and in a few cases no economic feasibility analysis at all has been done. While this variation is due in part to the lack of physical data, the result in some cases appears to be due to a need for a greater coordination between economists and agricultural scientists.

Meanwhile, the analysis of factors affecting rate of adoption--beyond sheer economic feasibility--has proceeded as rapidly as could be expected given that farm adoption remains at the end of the chain after development of technology and establishment of economic feasibility. The research has already brought out a number of factors affecting adoption that need to be taken into account, and it will continued to do so increasingly, if the proposed on-farm experiments go forward throwing light on economic, social an institutional factors promoting or inhibiting adoption.

Several of the recommendations concerning the economics work have to do with improving the economic evaluation process as influenced by coordination with physical scientists, which is already excellent in some areas. While the need for improvement of efficiency or coordination between subprojects was mentioned several times to the team, the view was also expressed that the greatest need for coordination and integration is not among the subprojects, but between the agricultural economists and agricultural scientists within each subproject.

It would be desirable to extend the approach of the best of the economic feasibility analysis throughout the other subprojects. Economic evaluation should be a two-way street providing for feedback between scientists and economists at all stages.

2) The choice of experiments and statistical designs should most desirably reviewed with the economists in the planning stages before final decisions are made about them. Agreement should be reached ahead of time on data to be collected. The data should be given to the economists as soon as it is obtained, in time to correct deficiencies if necessary.

To be able to make realistic assessments, economists should go on field trips with scientists or extension people frequently. Scientists should have an opportunity to critique preliminary economic evaluations and make suggestions for changes.

3) To foster closer collaboration, it would be desirable for the Egyptian-Israeli economic evaluation team to prepare a two-part Economic Evaluation Guideline Document of 10 to 15 pages for joint use by the scientists and economists.

Guidelines I in the Document would tell how to estimate profitability per hectare. Data needs should be stressed.

Guidelines II would tell how to estimate total number of hectares to which a new technology might be applied. Instructions would be given for developing ranges and discussing upside and downside potentials. Total number of farmers affected and total net income effects should be estimated.

The Guidelines would be used to make a plan of work for economic evaluation for each subproject, to be agreed upon by the scientists and economists responsible for each area.

4) It is recommended that the joint Egyptian-Israeli team responsible for economic evaluation meet as a group every three months, alternating between countries. The meetings would be devoted to systematically taking stock of the work on economic evaluation in each subject (irrigation, solarization, dairy and medicinal crops). A score sheet would be prepared indicating progress and problems, to be updated at each meeting.

5) While it is premature to do detailed economic work on medicinal crops brief background paper could be prepared on the economic promise of selected medicinal crops as they can be seen at the present time. For example, given the price at which drugs to combat Type II diabetes sell at the present time, what farm gate price can be expected for Atriplex spp.? What might the cost of production be? Can a range be put on the total area in each country on which the crop would ultimately be grown?

6) It would be desirable to prepare a paper on how the economic evaluation of technologies is affected by agricultural pricing and subsidy policies and by foreign currency considerations. The paper would consider

how the profitability to the farmer differs from the profitability to the nation. The paper would make use of, rather than repeat, work being done by others. General orders of magnitude--drawing on literature and estimates from the World Bank and elsewhere--would be considered to see which subproject technologies deserve more, and which less, promotion from the point of view of the national economic interest of each nation.

# V. THE OVERALL PROJECT

## A. Summary Assessment of Accomplishments

The previous parts of this report have dealt with details of the individual subprojects. The purpose now is to deal with the project as a whole, considering what the subprojects add up to and taking up issues that cut across the subprojects.

### 1. Contributions to Program Goals

The logical framework table (or "log frame") of the project is given in Table 3 and provides an outline for discussing accomplishments.

The first row of the table, as indicated by the left hand block entitled Narrative Summary, refers to the broad agency or program goal to which this project contributes. In this case, the broad goal is to promote cooperation between Egypt and Israel and accelerate agricultural development in the two countries.

Reading across the row, the objective indicator of success for this goal is listed as the rate of diffusion on technologies and their demonstration effect. Measures of increased cooperation between the two countries might also be listed here to indicate the importance of the project to peace initiatives.

The means of verification, listed in this row as quantitative evaluation of changes in growth rates and incomes, appears appropriate to the agricultural development goal. Eventually estimates and actual measures of project effects on growth rates and incomes could be obtained with effort. Some

Table 3

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: Patterns of Technology Exchange--Egypt and Israel

| Narrative Summary | Obj. Verifiable Indicators | Means of Verification | Important Assumptions |
|---|---|---|---|
| Program or Sector Goal: The broader objective to which this project contributes: To promote agricultural cooperation between Israel and Egypt and to accelerate agricultural development in both countries. | Measures of Goal Achievement: Rate of diffusion of the selected technologies and the capability of their demonstration effect. | Quantitative evaluation of changes in growth rate and income in selected areas. | Assumptions for achieving goal targets: Adaptability of agricultural advanced technologies in the same ecosystem. |
| Project Purposes: Introduction of innovative agricultural technologies suitable to the ecological and socio-economic patterns. | Conditions that will indicate purpose has been achieved: End of project status: Diffusion of selected technologies in chosen areas and transformation of the related supporting system. | Positive results of agricultural experiments and adequate benefit-cost ratio or internal rate of return. | Assumptions for achieving purpose: Introduction of new technologies depends on adjustment of organizational and socio-economic patterns. |
| Outputs: Selection of appropriate technologies and identification of adequate projects and supporting systems. | Magnitude of Outputs: Modification of agricultural production patterns in order to increase yields and income through improved technology and diversification of production. | Increase of yields and income in comparison to existing traditional patterns of production. | Assumptions for achieving Outputs: The transition process to new technologies should be gradual and integrated with extension and research functions. |
| Inputs: Small scale experiments and demonstration pilot projects in selected sites and regions. | Implementation Target (Type and Quantity): Selection of technologies for implementation in different ecological areas. | Implementation of the selected technologies in different regions and the number of farmers involved in the implementation process. | Assumptions for providing inputs: There exists a significant difference between the technological potential of the Delta and the new lands. This requires a different methodology and technological approach in the promotion of innovative technologies. |

limited effort to obtain measures along these lines could be useful, though full blown estimation could be a major research task in itself. It is in any case too early to obtain such measures for the present project.

Means of verification for the cooperation goal could be listed including meetings, promotion of face to face contacts and lasting research relationships. All of these have been highly positive and are documented in Parts II, III nand IV of this evaluation report. Spin-offs to other areas, resulting from the demonstration of international cooperation, could be listed as one of the most important contributions of the project. While these spin-offs are perhaps the most difficult to quantify, the clear existence of constructive cooperation, and the warmth and depth of personal relationships between researchers in Egypt and Israel, are indicative of the great success of the project in promoting cooperation.

The assumptions for achieving goal targets, listed as the last entry in the row on program goals, have been verified. In all of the subproject areas, the advanced technologies have been shown to have promise warranting further investigation in both Egypt and Israel. The assumption could be listed that it is possible to promote cooperation through joint agricultural research and technology diffusion efforts, an assumption that has been quite dramatically verified by this project.

2. Project Purpose

The specific project purpose is listed in the Narrative Summary entry in the second row of Table 3 as the introduction of

innovative agricultural technologies suitable to the ecological and socio-economic patterns, which the evaluation team finds is in fact the purpose to which the project efforts are directed. Positive results of experiments, listed as the first means of verifying diffusion of technologies and transformation of support systems, have been achieved for all the major crop and dairying activities, as dealt with in detail in earlier parts of this report. The second means of verification, benefit-cost or feasibility analysis, has been achieved most effectively for solarization with variable results in other areas. As more experimental results become available and as cooperation between agricultural scientists and economists is increased in the subprojects, additional feasibility analyses should be forthcoming.

Initial verification has been obtained for the assumption, listed as the last entry in the second row, that introduction of new technologies depends on adjustments of organizational and socio-economic patterns. Organizational and socio-variables have been found to be significant in the analyses of adoption using farm survey data, undertaken in the economics subproject. The results will be important in designing efforts to promote adoption.

3. Outputs

As indicated in the Narrative Summary entry in the third row of Table 3, the first project output is selection of appropriate technologies, which the evaluation team finds has been achieved. The second output is identification of adequate projects and

supporting systems. Progress on this second output has been made in the preliminary on-farm applications, in the plans for extended on-farm experiments and in the general evaluative work on credit and infrastructure. The second output will become more important as the project continues.

With regard to indicators of project outputs, there is considerable evidence of the modification of agricultural production patterns to increase yields and income. Examples, provided by farms visited by the evaluation team, include the use of solarization in growing cucumbers near Ismailia in Egypt, the use of solarization in the growing of flowers by a lady farmer at an Israeli cooperative village, and the use of mechanized cooling techniques for dairy cows at a kibbutz.

The verification of outputs through measurement of effects on yields and income is, by necessity, not very advanced at this point. The project is at any early stage in terms of farm adoption. While there will be greater results by the end of the project, the ultimate effects of the project will probably occur a considerable time after it ends, in view of the fact that technology diffusion is a process that takes years.

The assumption listed in the last entry of the third row, that the transition process should be integrated and gradual, is verified by the preliminary results on this project indicating the sensitivity of adoption to individual farm conditions. A strong feature of this project is the care taken not to move to adoption recommendations too early, in contrast to some experiences elsewhere in the world of prematurely pushing adoption of technologies leading to unanticipated plant disease

losses.

One of the greatest strengths of the project is the comprehensive view of the transition process leading to inclusion of experiments, priority evaluation of technologies, on-farm testing and demonstration, and overall assessment of factors affecting adoption leading to effective adoption programs.

4. Inputs

Inputs specified in the Narrative Summary entry in the final row of Table 3 are small scale experiments and demonstrations at selected sites. This approach to inputs is indicated by the location of sites being studied, including Delta and new land sites in Egypt and several sites in Israel. As work proceeds with on-farm experiments, the number of farmers involved will increase.

The assumption shown in the final entry of the row on inputs, that there is a difference between potentials of different areas, has been verified in many of the experiments. One example is the indication of greater potentials for solarization for high value crops such as tomatoes in Upper Egypt than in some other areas of the country.

B. International Exchange

The exchange of knowledge, personal contacts and travel between Egypt and Israel have clearly been strong features of the project and are documented in the analysis of the crop, dairying and economics work earlier in this report.

The evaluation team feels that international exchange could now be further broadened through 1) travel to international conferences, 2) guest talks at the time of visits to Israel or Egypt and 3) extended stays of scientists in each other's countries to deepen cooperative research on a personal basis.

The issue of participation from Egyptian universities arose several times in the meetings of the evaluation team with project personnel. It was unanimously felt that such participation would be desirable, but there was some question as to whether it is possible in view of the fact that the funds in Egypt go to the Ministry of Agriculture.

A check of project documentation indicates that it would in fact be possible under the terms of the project for the Ministry to secure participation from people at Egyptian universities. The possibility is indicated by Section II.2 on page 2 of the March 24, 1980 Memorandum of Understanding.

The role of the Participating Scientists drawn from the United States was discussed with project personnel in both Egypt and Israel. There was agreement that useful consultative services from them should be promoted and that climatic similarities between Egypt, Israel and the western United States in particular make collaboration fruitful. The evaluation team did not reach resolution on the specifics regarding Participating Scientists and believes that the project Coordinating Committee should take up the matter.

C. Reporting

The major project reports to this time consist of individual papers written by project personnel plus semi-annual and annual reports.

It would appear useful to give more attention to reporting. The guidelines to improve uniformity prepared by Mark Abbott of OICD, if followed, will greatly contribute to the reporting.

Possibilities for wider outreach include: first, a newsletter of interest to the general public, of which a draft version exists; second, a publishable annual report of interest to professional researchers; and third, a final project report in the form of a book, which would be of interest to decision-makers and other persons with policy concerns.

The second and third possibilities appear particularly to warrant more consideration.

D. Administration and Budget

The quality of administrative support provided by OICD received universally favorable comment.

The major budgetary concerns encountered by the evaluation team had to do with underspending on some of the subproject categories in Egypt and an expressed desire there for more flexibility in re-allocating funds. Requests for re-allocations of more than 10 percent can be made, but there was a feeling that even though requests for re-allocations are likely to be approved, the necessity to obtain approval and the delay could be an impediment.

The funding and associated coordination problems appear

likely to be dealt with by Dr. Khader, who is taking a very active role in the project. Dr. Khader has recently replaced Dr. Mohieldin in a lead position in Egypt in view of Dr. Mohieldin's retirement.

E. Women in Development

Among women participating in the project, special mention should be made of the key role of Mrs. Attiat, who is responsible for arrangements and has other administrative duties in the work in Egypt.

In addition to the lady farmer participating in on-farm solarization in Israel as already mentioned, several women are involved in the solarization work. These include two plant protectiontist extension workers and six technicians or students.

In the work on cropping systems and water use, several women graduate students and laboratory technicians assist part time in both countries.

In the subproject on medicinal plants, Miss Badea Hassan, a plant taxonomist, has been involved with healers in Egypt in identifying plants to be collected.

In the economics subproject, one of the investigators is a women, Hillary Voet. Women graduate students include Hannah Savir, Sara Ben-Ami, Iris Magal, Ruth Peled, Haia Avidor and others.

F. Overall Project Recommendations

Many detailed recommendations concerning crops, dairying and economics have been made in Parts II, III and IV of this report,

where they have been underlined for emphasis. The following recommendations concern the project as a whole.

The first overall recommendation concerns extension of the project:

Overall Recommendation No. 1

The project has been impressively successful. It is enthusiastically recommended that the project be extended. Much of the work is still in gestation and should not be cut off in a short period of time. Thus providing an extension for a multi-year period is extremely important. If increased funding is feasible, it would be desirable to make plans for expanded activities.

The next four recommendations pertain to international exchange and participation:

Overall Recommendation No. 2

Conferences, colloquia and talks by visitors from Egypt in Israel, and Israel in Egypt, should be arranged in order to widen the number of people exposed to international cooperation.

Overall Recommendation No. 3

Scientists have indicated that they would like to visit other countries and to present their research results at international meetings. This is an excellent method for informational transfer. It is recommended that provisions be made for increased international travel of the project researchers from Egypt and Israel, with the criterion of attendance being to make a presentation which if possible should be joint.

Overall Recommendation No. 4

Interaction between the research teams has reached a stage of greater depth. Further joint work with active participation of both teams should be encouraged. Longer visits are desirable, with more work in the field or laboratory rather than in the office. Visits by the staff actively involved in the

research, e.g. junior scientists and graduate students, should be encouraged.

Overall Recommendation No. 5

The Coordinating Committee should issue a statement on the desirability and feasibility of participation of University faculty in Egypt, and active steps should be taken to secure the participation.

Four of the recommendations concern reports and publications:

Overall Recommendation No. 6

To achieve greater uniformity in the quality of the semi-annual and annual progress reports, the Coordinating Committee should take steps to ensure that the guidelines for these reports developed by Mark Abbott are followed.

Overall Recommendation No. 7

Consideration should be given to publishing an Annual Bulletin (in distinction to a Newsletter) that shows the outcomes and results of each of the subprojects in one publication. It would be prepared for the Coordinating Committee before its annual meeting. This bulletin could be used as evidence of scientific progress and sound regional cooperation and might possibly be more effective than a newsletter aimed at a popular audience.

Overall Recommendation No. 8

The publication of papers jointly authored by Egyptians and Israelis should be encouraged.

Overall Recommendation No. 9

Work should be started immediately toward a unified final report on the project, to be published as a book. The book should be aimed at decision-makers. It should stress lessons learned in a) international cooperation, b) inter-disciplinary cooperation and c) a comprehensive view of technology improvement.

One of the recommendations is about budgetary procedures:

Overall Recommendation No. 10

Steps should be taken by the Coordinating Committee to ensure that there is flexibility in use of funds within the overall purposes of the project. The resolution of the problem will need to take account of budgetary and bureaucratic procedures in each affected country.

One of the recommendations refers to the need to proceed to the on-farm phases of technology exchange:

Overall Recommendation No. 11

As a next major step in the project, proposals should be formulated and funded for a number of on-farm experiments investigating the adoption of the new technologies in practice, to be followed by planning for extension activities and programs of improvement for support systems.

The final recommendation is on future work and possible expansion:

Overall Recommendation No. 12

It is recommended that a new project activity be added that systematically identifies further possibilities for technology exchange. The most promising would be selected for funding.

The following areas could be considered.

--Greenhouses

--New crops

--Water use efficiency and value

--Labor availability and labor costs

--Salinity and water logging

--Animal and poultry virus diseases

--Processing, packaging and marketing

# APPENDIX

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"Scheme for Selecting Irrigation Technology at a Farm Level"

"Conceptual Structure"

# TAIEC PROJECT PERSONNEL

TRINATIONAL (EGYPT-ISRAEL-U.S.) AGRICULTURAL TECHNOLOGY EXCHANGE AND COOPERATION
(T.A.T.E.C.)

"Patterns of Agricultural Technology Exchange and Cooperation in a Similar Ecosystem: the Case of Egypt and Israel"

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# ACTIVITIES OF THE EVALUATION TEAM

## Activities Of The Evaluation Team

The members of the evaluation team (Drs. George Tolley, John Moseman and Mohammed Yousef) commenced activities with briefings in Washington, D.C. on January 8 and 9. Tolley and Yousef proceeded to Rehovot on January 9 where they stayed until January 13. On January 13 they travelled to Cairo and were joined by Moseman. The team travelled to Rehovot on January 19. They remained there through January 23.

Messrs Kincaid and Ressiguie were with the team ex officio, Kincaid from January 13 to 22 and Ressiguie from January 15 to 23.

The efforts of the team members in Israel and Egypt were devoted to meetings with project participants, field trips, formulation of findings and drafting of the evaluation report. The accompanying itineraries and meeting schedules gives details.

A final meeting was held at Rehovot on January 23, at which preliminary findings were presented and discussed with personnel from Israel and those who came from Egypt that day for the meeting.

# P R O G R A M

## T.A.T.E.C. EVALUATION TEAM

8 January 1987 - 24 January 1987

Washington, D.C.

8 Jan. 87 - Thursday

0900 h - Assess logistical needs (travel changes, per diem payments, etc.); review administrative items.

SITE: USDA/OICD International Research Division (IRD) 2121 K St. NW, room 378 (from the State Plaza Hotel, walk north on 21st St. to K, cross K, and turn left on K).

1000 h - Overview of Project and Evaluation Team Duties - with Robert Ressegule, AID Project Officer and Mark Abbott, USDA/OICD Project Director.

1100 h - Courtesy Call on Howard Marks, USDA/OICD Associate Administrator and Kenneth Swanberg, USDA/OICD/IRD Director.

- rm 310, 2121 K St.

1130-1315 - FREE TIME

1315 h - Move to State Dept. Bldg., between 21st, 23rd, C and D Sts. NW (across Virginia Ave. from the State Plaza Hotel). Proceed into the building, providing the following information:

name of your appointment: Robert Ressegule
Office Symbol: AID/ANE/TR/ARD
Room No.: 4440 NS
phone: 647-7061

Mr. Ressegule or someone from his office will come to the visitors desk and escort you to the following meetings:

1330 h - Courtesy Call on AID Officials in Mr. Ressegule's chain-of-command, Shirper, Purvis,

1400 h - Rm 3320A - meeting with AID Regional Cooperation Program officials (the funding office for this project), Gerald Kamens and Ann Gooch. Also in attendance: Jane Stanley, AID/Project Development Office.

Also in attendance: Jane Stanley, AID Project Development Office; David Kincaid, USDA/Agricultural Research Service; Robert Dorfman, Harvard University. The latter two are the U.S. members on the TATEC Project Coordinating Committee.

1500 h - Meeting with AID/Evaluation Office officials, Maureen Norton and Sharon Ranoliel.

evening - Free Time. Available for consultation at your hotel is Prof. Dorfman, who will be staying there.

9 Jan. 87 - Friday

8:30 a.m. Meet in lobby.

0900-1045 - Free Time. As necessary, David Kincaid may be available for consultation. Please arrange this with him personally.

1100 h - 2121 K St., Rm 360 - courtesy call on James L. Walker, USDA/OICD Assistant Administrator for International Research & Development. Check: Money in travel budget for help in Cairo. Get forms for travel reimbursement.

10 Jan 87 - Saturday

1300 h - (Israeli time) - Drs. Tolley and Yousef arrive TLV. Program for 11 and 12 Jan to be provided by Israeli hosts at Hebrew University (per arrangements between Prof. Dan Yaron and Dr. Tolley).

NOTE: main contact in Israel is Dan Yaron; phone (08) 481-227 (office)
(08) 475-604 (home)
(Hotel: tentatively Hotel Margoa, Rehovot).

12 Jan 87 - Monday

- Dr. Moseman and Mr. Kincaid arrive CAI, having departed Washington on Sunday, 11 Jan.

CAIRO, Egypt

12 Jan 87 - Monday OR
13 Jan 87 - Tuesday Hotel: GEZIRA SHERATON, phone 341-1333, -1336)

- depending on air service between TLV and CAI, Drs. Tolley and Yousef arrive CAI. Program with Egyptian hosts to begin the day following their expected late-night arrival. Events expected during stay of all four visitors:

First Day - Meeting with all Egyptian Principal Investigators (Foreign Relations Bldg., Min. of Agr. - Nadi El Seid St., Dokki - Cairo)

Intervening - Field Site Visits; consultations with individual PIs and, as needed, administrative staff.

Last Day (on/about 19 Jan 87 - Monday) - final meeting with all PIs.

MAIN CONTACT in Cairo for assistance: Mrs. Atiat El-Menshawy, Admin. Asst.
Foreign Relations Dept., MOA
phone 712-937 or 704-833

15 Jan 87 - Robert Ressegule, AID/Washington arrives CAI, to accompany Evaluation Team. He expects to remain with the team thru 25 Jan, when he returns to Washington from TLV.

REHOVOT, Israel Hotel: tentatively Hotel Margoa, Rehovot)

20 Jan 87 - Tuesday

Begin program of visit, to be provided by Prof. Yaron.

20-24 January

Anticipated events: Field Site Visits, individual discussions with Israeli PIs, and a debriefing/wrap-up session with senior Israeli and Egyptian scientists and officials. Several (4-6) Egyptians are expected to arrive from Cairo for this last event.

22 Jan 87 - David Kincaid departs Israel, on other [illegible]ness.

# ITINERARY

## PROFESSOR G. S. TOLLEY AND PROFESSOR M. K. YOUSEF

## JANUARY 10-13, 1987

| | | |
|---|---|---|
| Saturday, 1/10 - | 1 P.M. | Arrival and transportation to Grand Beach Hotel, Tel-Aviv |
| Sunday, 1/11 - | 1-2 P.M. | Lunch at Faculty of Agriculture (with Prof. Katan, Yaron, Berman and Dr. Barak) |
| | 2:15-3 P.M. | Dean I. Shets, Dr. A. Barak |
| | 3-5 P.M. | Israeli Team Coordinators - Prof. Pohoryles and Prof. Yaron |
| Monday, 1/12 - | 9-11 A.M. | Diary Production Team<br>Prof. Berman, Dr. Kali and colleagues |
| | 11-1 A.M. | Medicinal Plants Team, Dr. Palevitch and colleagues |
| | 1-2 P.M. | Lunch with Professors Palevitch, Berman, Katan, Marani and Pinthus |
| | 2-3 P.M. | Solarization Team, Prof. Katan, Dr. Grinstein and colleagues |
| | 3-5 P.M. | Economics of Water Use Team, Professors Yaron, Pohoryles, Bresler, Dr. Dinar and colleagues |
| Tuesday, 1/13 - | 9-10:30 A.M. | Field Crops Team, Professors Marani, Pinthus and colleagues |
| | 10:30-12:30 A.M. | Field trip to dairy production experiments (Beth Dagan, Naan) |
| | 12:30-1:30 P.M. | Lunch with Professors Katan and Berman |
| | 1:30-3:30 P.M. | Field trip to site of solarization, on farm experiment (Kfar Warburg) |
| | 3:30 P.M. | Departure to Hotel and later on to Egypt |

Note: - All meetings with the subprojects' teams will be held in meeting room #8.
- All lunches in the cafeteria, the small room.

## Group Meetings in Egypt

January 14-18, 1987

Jan 14 - Wednesday

Meeting at Dr. Hassan Khedr, the project coordinator, attended by

- Dr. Abd El Mawla Besheer
  P.I. of Evaluation of Technology Exchange
- Dr. Kamal Awad, P.I. of Medicinal Uses of Desert Flora
- Dr. Mohamed F. Abd El Rahim, P.I. of Solar heating subproject
- Dr. Moktar Satour, S.I. of Solar Heating
- Dr. Mostafa Hathout, P.I. of Dairy Production
- Dr. Nabil Habashy, P.I. of Econ. Eval. of Cropping System and Water Use
- Dr. Abdel Manboud Abdel Shafy, P.I. of Cropping System and Water Use
- Dr. Yousef Abo Srea Badawi, Researcher of Cropping System and Water Use
- Dr. Samir Darwish, Asst. Researcher of Econ. Eval. of Cropping System of Water Use

Jan. 15 - Thursday

- visit Barraga, Mr. Kincaid with Dr. Awad
- visit Gymyza with Abd El Maaboud

Jan. 17-18 visit to Ismaelia and Sakhal in delta

Discussion with Minister Wali, 1/16/87

G. Tolley, J. Moseman, M. Yousef, D. Kincaid, R. Ressequie, Ms. Atiat, Mr. Mammoud, and H. Khedr

1. Mentioned a problem which arose when there was supposed to be a meeting recently at San Diego. Was not clear as to what the meeting was going to concern nor what the problem was that prevented the meeting from taking place.

2. He indicated that he is looking forward to the day when Jordan will participate in the Regional Cooperation project. (I don't know if this hope was related to the aborted meeting mentioned above or not.)

3. The recent initiation of a plastic project or factory in Alexandria will help in the expansion of the solarization of soils project.

4. In conjunction with #2 above, he stated that the idea and activities surrounding the regional cooperation project are right or appropriate for the long term future of the region.

5. There have been in the past 2-300 Egyptian scientists who have visited Israel for short working visits. He is hopeful that these will continue and that the duration will become increasingly longer.

6. In terms of exchange, there are currently apples and banana's being produced and consumed in Egypt that have their seed origins in Israel. This is well known by the consuming public and in fact, they are known as Israeli fruits (the point being that this fact is not being hidden like in some other countries).

7. Egypt is looking for ways to improve and increase ag production, but bio-tech, while very interesting, is probably too expensive for Egypt to pursue at this time.

8. Expressed satisfaction with the planning and design of the various research projects to date:

   a. would like more research activities and more scientists involved in the project;

   b. additional budgets and more time needed to accomplish planned and potential activities;

   c. would like to move into extension activities and possibly include under this project;

   d. would like to see more meetings and conferences funded under the project to promote more involvement of scientists;

   e. conferences could be held in other countries (e.g., Spain), and include scientists from other countries in the region or from Europe, or wherever.

9. Mentioned that the overall aim of the government is to eventually move out of ag and have the private sector become more involved. This will be a slow process and not one that will be rushed into.

10. Extension is an important activity, even with limited budgets (in the Regional Cooperation program), because there is a need to have a wide range of activities. Do not want to put all their eggs in one basket. This would also allow more scientists to become involved.

11. By receiving technology from Israel, Egypt is in effect obtaining tech from California for many crops and practices, which have been developed under Mediterranean-like conditions.

12. There are some possibilities for cooperation in the area of marketing and processing. He was referring mainly to the possibilities of trade and suggested that it be looked into in the context of trade between Egypt, Israel and Jordan.

13. Cautioned against the loose exchange of plants and seeds because of the possible spread of diseases and pests. Said that the scientists on both sides were well aware of the dangers and were taking precautions to prevent problems.

14. Felt that the attitude of Egyptian scientists toward cooperation with Israeli scientists was favorable and probably getting better and that future prospects for continued cooperation were good.

# ITINERARY

## PROJECT EVALUATING TEAM

## JANUARY 20 - 23, 1987

## REHOVOT

Tuesday, January 20

10:00 - 10:45 General Meeting - Meeting room 8

10:45 - 17:00 Private work and discussions as arranged

(Dr. Moseman please see attached schedule)

Wednesday, January 21

9:00 - 17:00 Private work and discussions as arranged

Thursday, January 22

8:00 - 18:00 Trip to Jordan Valley irrigation project

Friday, January 23

9:00 - 12:00 General Meeting - Meeting room 8
Summary of session

Notes: 1) Lunch will be served in the small room of the Faculty cafeteria on Tuesday, Wednesday, and Thursday (tentative) from 13:00 - 14:00 upon arrival. Please inform Vicki if you and when you will be eating in the cafeteria.

2) Headquarters: Dr. Moseman - Dept. of Plant Pathology and Microbiology with Prof. Y. Katan

Prof. Tolley, Mr. Kincaid, and Mr. Resseguie - Dept. of Agricultural Economics with Prof. D. Yaron

Prof. Yousef - Dept. of Animal Sciences with Prof. A. Berman

ITINERARY

PROFESSOR MOSEMAN

JANUARY 20 - 23, 1987

REHOVOT

Tuesday, January 20

| | |
|---|---|
| 10:00 - 10:45 | General Meeting - Meeting Room 8 |
| 10:45 - 13:00 | Medicinal Plants Team - Prof. D. Palevitch |
| 14:00 On | Prof. Y. Katan |

Wednesday, January 21

| | |
|---|---|
| 9:00 - 11:00 | Profs. A. Marani and M. Pinthus |
| 11:00 - 12:00 | Prof. R. Kenneth |
| 12:00 - 13:00 | Lunch |
| 13:00 - 15:00 | Short trip to solarization site with Prof. Katan |

January 22 - 23 please refer to general itinerary