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CALAR II

Final Evaluation of the Cooperative Arid Lands Agricultural Research II Project

Prepared for
U S Agency for International Development
Bureau for Global Programs, Field Support, and Research
Center for Human Capacity Development, Office of Policy Programs

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Winrock International
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CALAR II PHOTO SUMMARY

COOPERATIVE ARID LANDS AGRICULTURAL RESEARCH II
(CALAR II)

Prepared for
U S Agency for International Development
Bureau for Global Programs, Field Support and Research
Center for Human Capacity Development, Office of Policy Programs

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COOPERATION BETWEEN THE UNITED STATES, ISRAEL, AND EGYPT

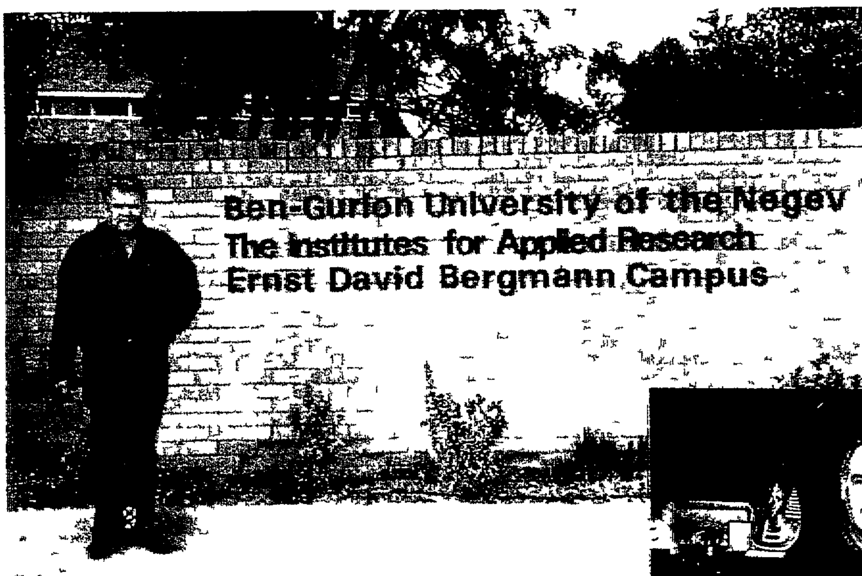
MIDDLE EAST REGIONAL COOPERATION (MERC)
United States Agency for International Development (USAID)
Cooperative Arid Lands Agricultural Research II (CALAR II)

The CALAR II project is a five-year, 6 3 million dollar project joining scientists of Israel, Egypt, and the United States in integrated research covering most aspects of protected agriculture The major purpose of the project is to promote peaceful cooperation between Egypt and Israel through multidisciplinary programs in which scientists of the three countries 1) develop protected agriculture to promote competitive export products and provide food for domestic consumption, 2) expand cooperative applied research efforts between Egypt and Israel, 3) improve the socioeconomic status of farmers in the participating nations, and 4) develop new lands and preserve the fragile ecosystems in those lands The first CALAR Project was initiated in 1982, and work has continued since that time

Protected Agriculture in arid countries is the primary research thrust of CALAR II in both Israel and Egypt

The development of protected agriculture receives high priority from the governments of both Egypt and Israel for similar reasons Both are arid countries where water for agriculture is limiting, and protected agriculture gives the highest return for unit of water applied

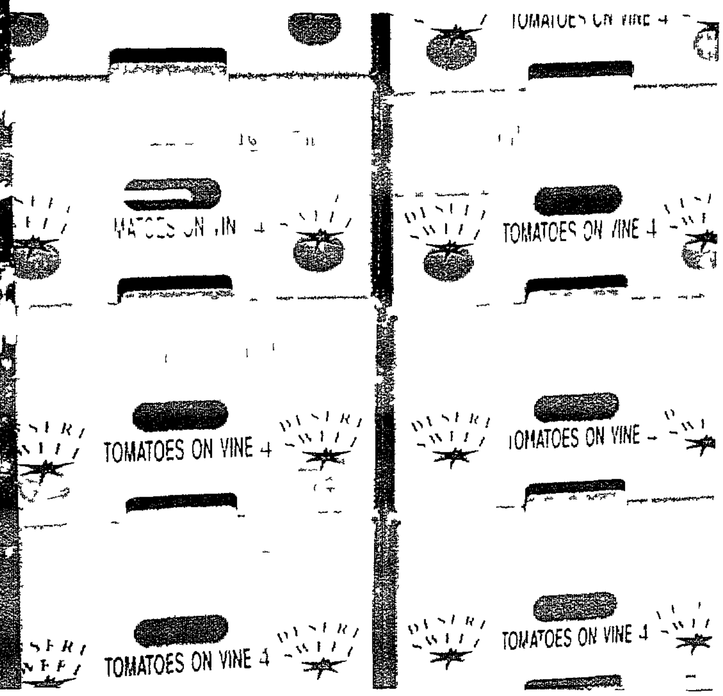
The project contractor is the San Diego State University Foundation under a cooperative grant from USAID The main sub grant cooperator in Egypt is the Agricultural Research Center of the Ministry of Agriculture and Land Reclamation, the Ben-Gurion University of the Negev is the Israeli cooperator The project receives management guidance from a six member Steering Committee (2 members each from Israel, Egypt, and the U S) Scientists carry out parallel research in each country and meet once each year at an annual workshop to compare results and plan future research



The Israeli Coordinator is Dr Dov Pasternak (above) of Ben Gurion University of the Negev The Israeli and Egyptian Coordinators have been instrumental to the success of the program

Right Dr Adel El Beltagy (left) is the Egyptian Coordinator and has the support of scientists such as Dr Mohammad S El Beltagy (right) and H E Dr Mahmoud Mahfouz

CALAR scientists have led the research which helped develop the "Desert Sweet" tomato which is produced under saline conditions Tomatoes grown under saline conditions are tastier than those grown with fresh water irrigation, although yields are slightly lower Salinity improves color and freshness without affecting exportable yield Market research has shown that these tomatoes sometimes bring up to 40% higher prices than ordinary tomatoes



Desert Sweet tomatoes bring premium prices in the European Market (above)

Left CALAR II scientists continually test new species of both ornamental shrubs and cut flowers for local and export markets

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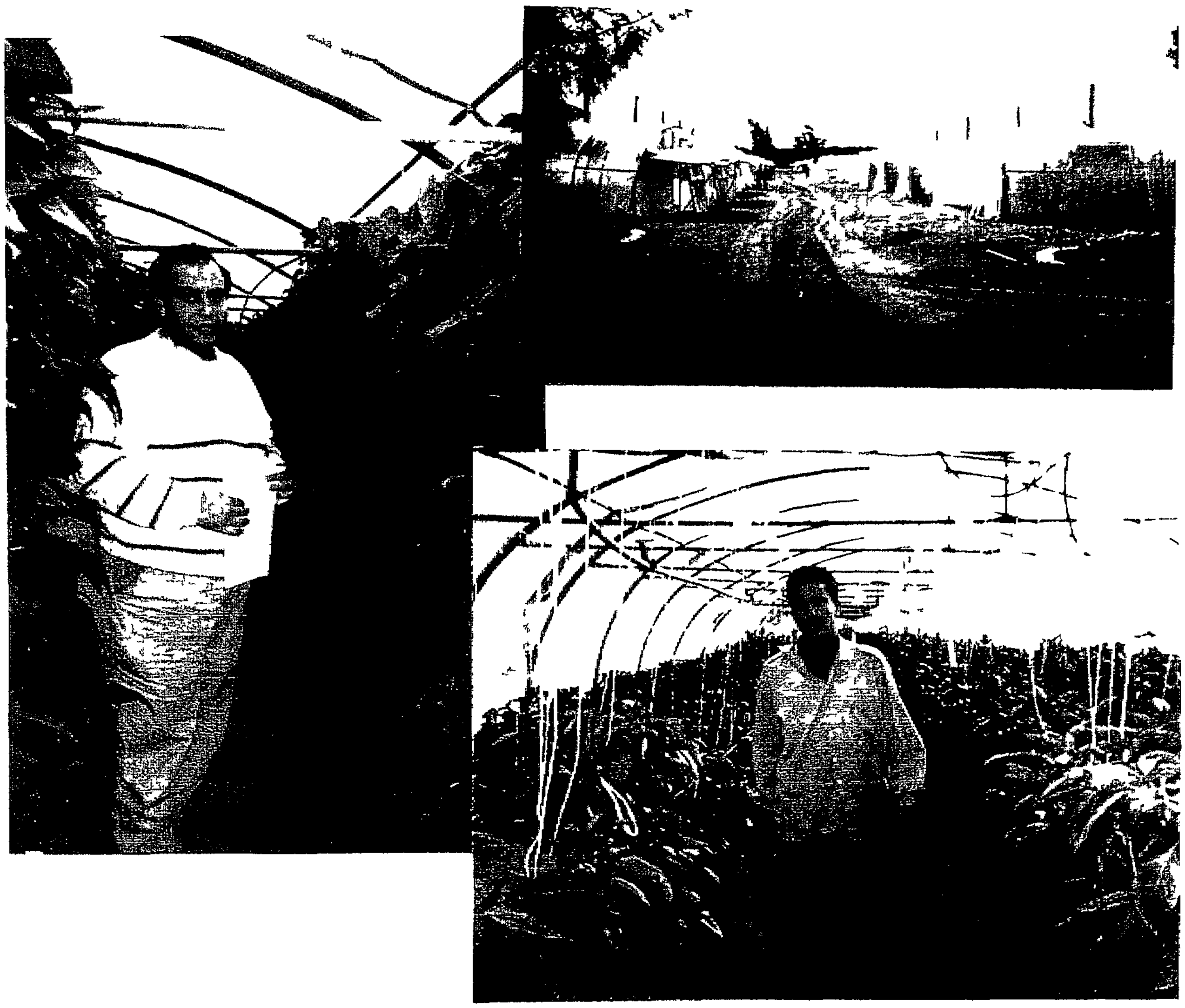
The El-Bouseilly research site, located on the Egyptian Mediterranean coast east of Alexandria, is suitable for out-of-season production of summer vegetables. The site has over 130 greenhouses, 70 of which are devoted to research of CALAR II scientists. After a thorough study of local practices CALAR II scientists have optimized methods for out-of-season production at El-Bouseilly. Drip irrigation, effective with both saline conditions and sand dune culture, was introduced. Genetic research has brought about effective changes of the Edkawy tomato cultivar.



Photos: CALAR II Research Site at El-Bouseilly provides valuable information to growers in the region

CALAR II funding has enabled scientists to properly equip their laboratories and to travel internationally for professional meetings and training Professional contacts have been made between scientists of the two countries that should provide linkages for future successful research Technological exchange has helped both Israel and Egypt (for example, both countries have provided the other with landscape plants) "Anna" apples and 'Galia' melons have been introduced from Israel to Egypt, and Israel has acquired materials and technologies from Egypt for production of oyster mushrooms The benefits of this cooperation will continue for years to come

Upper The CALAR II Project Coordinator, Dr Mohammad El Assal second from left discusses research with the CALAR II Egyptian Principal Investigator, Dr Ayman Abou-Hadid Lower left Scientist with equipment provided by CALAR II Lower right CALAR scientists at El-Bouseilly

Many innovations have evolved as a result of the CALAR II research The use of plastic sleeves filled with water to act as daytime solar collectors are being evaluated in Israel (upper left) Low tunnels are used in Egypt for off-season vegetables (lower photo Flowering ornamentals are an objective of the Israeli work (upper right)

The interaction of scientists has shown that cooperation between countries can contribute to the national priorities of both countries while building new friendships

CONTENTS

APPENDIXES

ACRONYMS

SOW	Scope of Work
USAID	United States Agency for International Development
MERC	Middle East Regional Cooperation Program
MOA	Ministry of Agriculture
MALR	Ministry of Agriculture and Land Reform (Egypt)
GARPAD	Agency for Land Reclamation Settlement (Egypt)
CALAR II	Cooperative And Land Agriculture Research II Project
SDSUF	San Diego State University Foundation
Feddan	A land measure used in Egypt, 4,200 square meters or about 1 04 acres
MASHAV	Israel Ministry of Foreign Affairs
Kibbutz	Communal settlement of Israel
Maryut II	USAID funded Integrated Agricultural Development Project, main site is the Maryut Agroindustrial Complex in the Western Desert of Egypt
Moshav	Israeli agricultural villages where each family lives in its own home and works its own plot of land

EXECUTIVE SUMMARY

THE PROJECT

The Cooperative Arid Lands Agricultural Research II (CALAR II) project is part of the five-year, $6 3 million, Middle East Regional Cooperation (MERC) program The project joins scientists of Israel, Egypt, and the U S in integrated research covering almost all aspects of protected agriculture The project's purpose is to promote peaceful cooperation between Egypt and Israel through multi-disciplinary programs in which scientists of the three countries, 1) develop protected agriculture to promote competitive export products, and provide food for domestic consumption, 2) expand cooperative applied research efforts between Egypt and Israel, 3) improve the socioeconomic status of farmers and growers in the participating nations, and 4) develop new lands and preserve the fragile ecosystems in those lands

The project contractor is the San Diego State University Foundation (SDSUF) under a cooperative grant with major sub-grants to the Ministry of Agriculture and Land Reclamation (Egypt) and to Ben-Gurion University of the Negev (Israel) under the joint Egypt-Israel Agricultural Committee

The report is a final evaluation of the project which was approved in March 1990, with a completion date of March 26, 1995

THE EVALUATION SCOPE

The scope of work calls for a team to evaluate three major areas of concern 1) management, 2) cooperation, and 3) technical progress toward meeting the stated subproject objectives on schedule The team consisted of an agronomist/research management specialist (team leader), a protected agriculture expert, and two participants of the American Association for the Advancement of Science Fellowship Program assigned to USAID

THE METHODOLOGY

The team carried out a review of program documents prior to leaving for the Middle East and interviewed representatives of USAID Winrock SDSUF and U S scientists involved with the project The team leader interviewed personnel of the SDSUF in their home office and interviewed U S scientists at The University of California, Davis Country coordinators were visited in Israel and Egypt, and visits were made to all major sites where research was being conducted (accompanied by CALAR II scientists) Israeli and Egyptian scientists gave reports of their research and many were interviewed by one or more team members Farms utilizing CALAR II technology were visited and interviewed about their utilization of the technology

THE SUMMARY CONCLUSIONS

Conclusions Regarding Technical Objectives

Technical objectives were met in areas of new crops introduction and genetic modification, agromanagement, environmental modification, and structure selection

There was minimal work on post-harvest technical objectives Lack of post-harvest work has not detracted from project success, however Both countries have qualified post-harvest physiologists in close contact with experts from other countries

Conclusions Regarding Project Management

The project contractor, SDSUF, has been an effective manager of the program Foundation representatives have taken a direct, 'hands-on' interest in the project, much more than required and expected of a project contractor

The country coordinators have been an effective team in carrying out and managing the project The Steering Committee has provided effective guidance for the project In future projects a smaller steering committee is recommended

The project has supported successful annual workshops which have enhanced cooperation and information transfer between scientists of the three countries The final presentations of scientists will be part of an International Society of Horticultural Science meeting held in Alexandria, Egypt in March, 1995 This meeting was organized by one of the Egyptian CALAR II scientists and will provide an international forum for project results

U S scientists have played a major role in helping the program succeed

Conclusions Regarding Cooperation Between Institutions and Countries

CALAR II has been successful in expanding the scientific partnership between Egypt Israel, and the U S Good sharing of information between scientists took place through country visits and the annual workshops

Research took place in parallel projects, structured according to country priorities, with minimal one-to-one collaboration between scientists The project design did not encourage or reward true collaboration, however, it did not discourage it, either Project management failed to "grow with the times" and move toward closer one-on-one associations between scientists Scientists interviewed indicated a desire to do collaborative research with identified counterparts from the other country

The momentum gained in bettering cooperation and understanding between Israeli and Egyptian scientists through CALAR II, should not be lost Follow-on activities to maintain the workshop contact and to develop collaborative research (through a system including peer review) should occur

Other Conclusions

Research sites in both countries will be maintained following CALAR II, however, research activity in Egypt will continue at a reduced level of activity

Contact between Egyptian and Israeli scientists, following project termination, will be minimal without follow-on support

USAID should be pleased with the success of the CALAR II project The project enhanced the expansion and implementation of protected agriculture in Egypt and Israel while enabling scientists of the two countries to cooperate in their scientific work

RECOMMENDATIONS

The SDSUF, subcontractors, all participating scientists and others who worked with the project should be commended for their contribution to a successful project

The country coordinators should plan follow-on activities which will maintain the momentum generated by CALAR II

Israel and Egypt should commit to a continuation of workshops to be held in Israel and in Egypt on an annual or biannual basis to maintain contact between scientists of the two countries and to update each other on research being conducted

Country coordinators should develop a proposal which would develop truly collaborative research between scientists of Egypt and Israel The proposal should encourage research publishable in a refereed journal and within a process which includes peer review of proposals and progress

MAIN LESSONS LEARNED

Initial project design, and subsequent project management, did not encourage or reward truly collaborative research, thus, none occurred

Future project design should be specific about the desired outputs to be generated

Reciprocity of expertise is important Whenever possible, future projects should have reciprocal exchanges of scientists/personnel from both countries

The support of the USAID Mission and the U S Embassy enhances the success of MERC projects When possible, MERC projects should complement USAID Mission priorities On-site monitoring by MERC personnel should help projects meet goals and objectives

In carrying out project evaluations, the role of the contractors should be clearly identified as that of a facilitator for the evaluation team

CALAR was first funded in FY 82 and has supported effective research in both Egypt and in Israel We found only one joint research publication since 1982 (between an Israeli and Egyptian scientist) which is not an enviable record for the amount of money, time and effort spent to bring cooperation between Egyptian and Israeli scientists

Future projects should carefully evaluate the amount of travel outside the target countries and the size and role of advisory groups (such as the Technical Committee and the Steering Committee)

Project activity among Egyptian and Israeli scientists must be an association among equals throughout the process of planning, implementation and dissemination of results Project funds should be devoted to the maximum extent possible to collaborative research in Egypt and Israel

PROJECT IDENTIFICATION DATA SHEET

Cooperative Arid Lands Agricultural Research
(CALAR II)

Project Number 398-0158 03

Life of Project Funding U S $6,300,000

Current Obligations U S $ $6,300,000

Project Activity Completion Dates 03/26/95

Objectives To promote peaceful cooperation between Egypt and Israel through multi-disciplinary programs in which scientists in Egypt, Israel, and the United States (1) develop protected agriculture to produce competitive export products and provide food for domestic consumption, (2) expand cooperative applied research efforts between Egypt and Israel, (3) improve the socioeconomic status of farmers and growers in the participating nations, and (4) develop new lands while preserving the fragile ecosystems in those lands

Project Description CALAR II is an integrated research program in which groups of scientists specializing in specific areas join forces to cover almost all aspects of protected agriculture The technical program is made up of five components agromanagement, new crops introduction, genetic modification, whole plant and post-harvest physiology, environmental modifications, and structure selection

AID Inputs Professional and technical resource specialists, project administration, research operations including equipment, supplies, and research facilities, and state-of-the-art technical information

Project Outputs A program implemented by Egyptian and Israeli cooperating institutions and researchers that results in new and on-going research and technology transfer in greenhouse covers, effects of soil and space heating, physiological studies related to fruit production quality of tomatoes, peppers, and eggplants in a protected environment breeding and selecting melons for winter production, and breeding greenhouse tomatoes with an emphasis on tolerance in tomato to yellow curled-leaf virus post-harvest studies, mainly on tomatoes and peppers and results of studies and reports on selected ornamental plants and fruits

Required Reports Annual, semi-annual and quarterly reports financial reports, budget analysis, final evaluation report, and final program report

Previous Evaluation Mid-term evaluation of March 1993

Involved Institutional Contractors USAID grant to San Diego State University Foundation with major sub-grants to the Ministry of Agriculture and Land Reclamation (Egypt), Ben-Gurion University of the Negev (Israel) under the joint Egypt-Israel Agricultural Committee, in cooperation with the San Diego State University Foundation

I. PROJECT BACKGROUND, PURPOSE, AND OBJECTIVES

A Background

Following the Camp David accords, a Congressional initiative took shape to support improvements in Egypt/Israel relations and, perhaps later, to include other Arab countries The Middle East Regional Cooperation Program (MERC) began in FY 79 and included $5 million in the Foreign Aid Bill for FY 81 The first Cooperative Arid Lands Agricultural Research (CALAR) Project was initiated in March 1982 as a regional program of the Near East Bureau of the Agency for International Development CALAR was approved at a level of $5 million for 5 years and continued over a period of 8 years

A project review in late 1988 indicated that the project had been successful in bringing about a working-level scientific cooperation between the two countries, as well as a successful degree of policy and administrative coordination between Egyptian, Israeli, and U S agencies and scientists Prevailing arid conditions in both countries mean that water is a major limiting factor in agricultural production To emphasize water conservation and the development of high value horticultural crops for domestic use and for export, protected agriculture was selected as the major emphasis for the CALAR II Project which was approved in March 1990 at a level of $6 3 million Research and development activities are carried out in Israel and in Egypt, with consultant and administrative functions the responsibility of the Project Contractor, the San Diego State University Foundation (SDSUF) The project had a mid-term evaluation in 1993, and the project completion date is March 26, 1995

MERC programs are based on the premise that people who work together in a collaborative manner are more likely to reach their common goals while developing a better knowledge and understanding of each other and of their respective cultures and heritage Participating country sectoral development programs, which bring together national expertise in a collaborative manner, are strengthened and enhanced by regional cooperation Successful regional cooperative programs can help attract additional financial resources (public and private) for common economic or social development programs

B Program Goals and Objectives

The overall goals of the CALAR II project are to foster cooperation among Egyptian, Israeli, and U S scientists, to strengthen institutional linkages among the cooperating countries, and to focus on problems of protected agriculture in arid lands, while concentrating on crops and technologies of significance to both Israel and Egypt The overall program objectives are

1 Development of protected agriculture as a means to produce competitive export products and to provide food for domestic consumption
2 Expansion of cooperative applied research efforts between Egypt and Israel
3 Improvement of the socioeconomic status of growers in the participating nations
4 Development of new productive lands in Egypt and the preservation of the fragile ecosystems in those lands

Six major research activities were initiated in Egypt and Israel to address the above objectives The activities were agromanagement, environmental modifications, structure selection, genetic modification, post-harvest aspects, and floriculture and new crops

II SCOPE OF WORK AND METHODOLOGY FOR EVALUATION

Purpose of the Evaluation CALAR II is scheduled to terminate in March 1995 The evaluation is to determine if sufficient progress has been made toward the expected objectives of the subprojects and whether the annual work plans were realistic and successfully implemented The management effectiveness of the Steering Committee, combined with input from the Annual Workshop (serving as a technical committee), is to be analyzed The evaluation will determine the extent to which the project has met the Congressional mandate for the MERC program of fostering cooperation and collaboration between Israel and Egypt Specific attention is to be given to determining the nature and extent of this cooperation and whether project activities are conducted in parallel or are truly collaborative

Literature Reviewed Prior to departing for Israel and Egypt, the team met at offices of Winrock International in Washington D C and reviewed appropriate documents provided by Winrock and USAID A listing of significant documents reviewed is summarized in Appendix C

Interviews with U S Implementors (including USAID) The team met with the USAID CALAR II Project Officer, other representatives of USAID, and Winrock personnel The team leader interviewed officers of the San Diego State University Foundation in their home offices and had personal, or phone interviews, with three U S Technical Committee members A listing of those interviewed, or reports given, is noted in Appendix B

Site visits In Israel visits were made to Volcani Center & Ministry of Agriculture at Bet-Dagan, Ben Gurion University of the Negev, The Institutes for Applied Research at Beer-Sheva, Ramat Negev Experimental Station (including Kibbutz Rivivim and one Moshav using CALAR II technology), and a farmer using CALAR II technology in the Arava Valley near the Jordan/Israel border, south of the Dead Sea

In Egypt, the team visted CALAR II sites at Ain Shams University, Shalakan, and El-Bousseily, the Agriculture Foreign Relations Office of the Ministry of Agriculture, and the Board office of the Agriculture Research Center of the Ministry of Agriculture

Interviews with Participants, Implementors, and Recipients, Including Presentations by Scientists Scientists in Israel and Egypt presented summary reports of their research, followed by team questions When possible (about 60% of the time), two members of the team interviewed scientists about the non-technical components of the project (collaboration, program success, interactions between scientists and general program reactions) Country Coordinators and Steering Committee members were interviewed as were others who had a significant role in the project The itinerary of the review team is in Appendix D

Evaluation Team The evaluation team consisted of the following

Dr Rodney J Fink an Agronomist/Agricultural Management Specialist/Team Leader

Dr Mary Peet, A Professor of Horticultural Science at North Carolina State University/Protected Agriculture expert

Dr JoAnne Garbe American Association for Advancement of Science Fellowship participant assigned to USAID, DVM & JD degrees

Dr David O Brien, American Association for Advancement of Science Fellowship participant assigned to USAID, Engineer/Science specialist

III. MEETING OF TECHNICAL SUB-PROJECT OBJECTIVES

A. Quality of Research

Overall the quality of the scientific research effort was very high and substantial progress was made toward the goals described in the original contract Scientific personnel, coordinators and project managers are to be complimented on the fine job they have done Several projects are profiled in depth in Appendix E and the progress toward sub-project objectives is also discussed in more detail in Appendix E An increased interest in biologically sensitive agriculture (reducing pesticide use and substituting organic fertilizers for chemical fertilizers) was evident Junior scientists were also involved to a commendable degree

B Sub-Project Objectives

Agromanagement Agromanagement was given a high priority, and it was probably the area receiving the greatest attention overall The type of agromanagement research differed considerably between the two countries, however

In Israel the highest agromanagement priority was improving quality of melons, tomatoes and peppers for export to Europe in the winter months For melons and tomatoes, quality was defined as a concentration of particular sugars in the fruit, and for peppers, as producing large attractive fruit The study of sugar accumulation in melons, one of those profiled in Appendix E was a particularly well-directed and effective program in terms of both basic and applied components Some immediately applicable agromanagement techniques to improve sugar concentrations (such as the use of low night temperatures to prolong the period of sugar accumulation) have already come out of this program The greater understanding of sucrose accumulation achieved will help breeders and biotechnologists to develop cultivars with enhanced ability to accumulate sugar in the fruit

In Egypt most of the agromanagement effort was devoted to improving production practices for the greenhouses The areas given particular attention were characterization and prediction of water vapor exchange in greenhouses development and optimization of alternatives to ground culture in greenhouses (hydroponics, aeroponics, sandponics and various artificial media blends), testing of compounds to relieve the effects of salt and cold stress on seedlings, and optimizing temperatures and nutrition (including the use of organic and foliar fertilizers in greenhouses) The water balance work is profiled in Appendix E

Greenhouse crops studied in Egypt included snap and Romano beans cucumbers melons, tomatoes, eggplant, oyster mushrooms, sweet and hot peppers, and marigold and thyme grown for aromatic oils Some work was also on-going on outdoor crops including tissue culture of asparagus and potato and methods to induce off-season production of artichoke and Jews mallow The work on oyster mushrooms is profiled in Appendix E as an example of research where production practices were developed for a new crop with considerable potential export and domestic markets (hotels) Other aspects of the oyster mushroom study were comparing production and economic aspects of using various types of compost (rice straw, cotton stalks, town refuse and legume wastes) In some cases, raw materials were blended to reduce costs with minimal loss of production Determination of consumer (tourist) preferences for mushroom type and methods to produce adequate supplies for producers were also included in the project A number of farmers and graduates are now producing oyster mushrooms using the technologies developed in this program In addition, several scientists and two kibbutz members from Israel have visited the Dokki (Egyptian) site to acquaint themselves with details of production practices This visit was arranged after Israeli scientists heard a workshop presentation and saw production on a site tour at the Third CALAR Workshop in Alexandria, March 1993

Environmental Modification Environmental modification research overlapped to a considerable extent with the agromanagement research and the structure selection research This is because temperature control in greenhouses is an integral part of agromanagement and also affects response to other cultural practices The focus of the environmental modification research in Israel, as with the agromanagement research, was to reduce problems in fruit quality Pepper flowers and fruit were found to be malformed under low night temperatures because low temperatures altered auxin transport and inhibited seed formation In Egypt, malformation of both bean pods and pepper fruit was also correlated with low night temperatures Research in Egypt on sprays or conditioning to reduce cold stress also represented a type of environmental modification research in that the economics of stress avoidance by heating could be compared with stress tolerance provided with various chemicals

Structure Selection Research on solar greenhouses in Israel is discussed in detail in Appendix E The basic concept is to store energy in water-filled plastic sleeves during the day and to release the stored energy at night as a source of heat The most recent innovation in the project is the development of a plant growing area separated from the energy collection area by retractable thermal screens The plant growing area can be vented during the day as necessary to cool the plants At night heat loss is reduced by a moveable thermal screen to retain heat The water sleeves in the energy collection area are suspended in tiers on a metal frame to reduce heat loss to the ground and to increase airflow around the sleeves Temperature sensors control the movement of both the thermal screen over the plants and the screen separating the two parts of the greenhouse The design is very interesting It would be useful to have information on capital and operating expenses compared with a conventionally heated greenhouse In Egypt, production in unheated plastic houses was compared with production in low plastic tunnels, large heated houses, and unheated houses with water-filled sleeves on the sides or between plants Another modification of the large greenhouses being studied in Egypt was to lay clear plastic on the soil to warm it and to place plants in low tunnels within the house The low tunnels are opened during the day to improve air circulation and reduce shading, as is also done when the tunnels are used outside

Genetic Modification Research in Israel included a study of cold tolerance in melons coupled with a breeding project to improve cold tolerance, and another project to breed tolerance to the yellow curled leaf virus into greenhouse tomatoes In Egypt, breeding projects supported included disease resistance in cucumber to powdery mildew and other foliar diseases, and virus and salinity tolerance in tomatoes In most cases, commercial lines have not yet resulted from CALAR-supported research This is not unexpected as cultivar development is a long-term commitment At some time however, it would be interesting to obtain information on the amount of seed of these lines sold worldwide

Floriculture and New Crops Research in Israel focused on cut flower and decorative branch crops for which Israel was felt to have a competitive edge in the export market to Europe For example Heliconias were collected, grown, and some production information developed during 1991-93 but research was finally dropped because the flower was too heavy to be economically air freighted to Europe Heliconia research is a good example of goals being continually refined in response to data developed and market conditions There was little or no research on standard cut flower crops such as roses and carnations The production practices for these crops were felt to be well understood, and Israel was felt to lack a competitive edge because of its high labor costs New crops were constantly being evaluated for their appearance, market appeal, and adaptation to outdoor or greenhouse conditions, including use of saline water in the case of ornamental shrubs and trees and the pitayas (a climbing cactus) For floriculture crops, the prime considerations were appearance, feasibility of air freighting, and ability to produce during a season when export prices are high Photoperiod modification for out-of-season flowering was emphasized to tie into high prices for export Other new crops were the kiwano (or melono), an exotic cucumber, and fruit of pitaya The pitaya work was a good example of new crop development and is profiled in Appendix E

In Egypt, the main new crops studied were artichokes, oyster mushrooms and thyme and marigold for aromatic oils The artichoke work focused on use of growth regulators (gibberellin) for earlier production The oyster mushroom work is profiled in Appendix E as a good example of development work with a new crop

Post-harvest Post-harvest topics were not addressed to any great extent in either country probably because project personnel felt that information and data is available from published material and would not be significantly affected by local conditions One of the American project scientists is a widely recognized post-harvest expert and could have accessed any necessary technical materials Post-harvest factors were, however considered in many of the agromanagement projects For example, soluble sugar concentration in tomatoes and melons is a post-harvest characteristic affected by such pre-harvest characteristics as use of saline water and pruning regime Also, tomato breeding projects included shelf life as a necessary quality attribute

Several studies were conducted in Egypt on post-harvest characteristics of tomatoes These studies described the ripening characteristics of various parts of the tomato fruit, concluding that ripening occurred from the inside out In another series of experiments, ripening characteristics of normal and ripening-inhibited tomato mutants were compared with and without the addition of EDTA (a chelator to the cations in the nutrient solution) Production of CO_2 (ACC) and ethylene was reduced in all the ripening inhibited lines Adding EDTA to the nutrient solution restored some of the ripening characteristics to the rin and nor lines The effect of temperature on ripening characteristics was also measured Respiration increased linearly up to 30C, while ethylene production was greatest at 20C Inhibition of ethylene synthesis at temperatures over 30C was attributed to a reduction in ACC synthesis

IV. COOPERATION BETWEEN INSTITUTIONS AND COUNTRIES

Background MERC programs have an overall objective of facilitating cooperation and collaboration (in this project between Egyptian and Israeli scientists) According to project coordinators, the project was structured so that research activities in both Egypt and Israel were conducted independently and in parallel due to the regional political situation at the time of CALAR II funding Although the proposal did not specifically call for one-on-one collaboration, it certainly did imply that cooperation leading to collaboration, was desired Scientists met annually during the project-sponsored workshops to discuss their work but otherwise worked independently of scientists outside their own country As the political situation changed there was no change in the program to accompany political changes The scientists interviewed generally were favorable to one-on-one collaboration but the same level of enthusiasm was not exhibited by the Project/Country Coordinators Likewise, neither the mid-term evaluation, peer reviews, nor USAID identified any mid-course adjustment calling for closer collaboration between scientists of the two countries

Participant Responses The evaluation team questioned participant scientists and administrators, both individually and in groups concerning the issue of collaboration and cooperation within the CALAR II Project The Israeli and Egyptian country coordinators (and the U S Project Coordinator) maintained that the CALAR II Project had met its collaboration/cooperation goal In discussions with the project scientists however it was clear that research was formulated and conducted independently Neither Israeli nor Egyptian scientists identified with a collaborating counterpart in the other country Proposals were developed and written independently and submitted to the respective country coordinator for approval and funding

Exchange and sharing of information between scientists occurred primarily at the annual workshop and other international scientific meetings This did not change during the project, even as the political situation improved and scientists themselves grew more at ease Travel between participant countries to see counterpart research sites did occur throughout the life of CALAR II, and it was felt to be valuable by all concerned Other interactions included exchange of ornamental and greenhouse vegetable cultivars, identification of plant materials, and comparison of cultivar performance

Many involved in CALAR II suggested that the scientific research priorities concerning protected agriculture in Israel and Egypt were significantly different so different, in fact, that direct collaboration on many research activities was not possible There was a sense from all scientists involved that conducting truly collaborative research between Israeli and Egyptian scientists would be an exciting prospect, however for that to occur, it would be necessary to identify, define, and focus on research issues common to both countries This reliance on research topics related to national self-interest was a stated hindrance to research collaboration Some scientists stated that national self-interests hindered the collaborative process, however there were sufficient research priorities in common that topics of common interest could have been identified Broadly defined objectives in CALAR II permitted very diverse projects to be identified in the two countries

Egyptian scientists especially emphasized the need for projects to be structured with an equal partnership between collaborating scientists They felt that projects involving a disproportionate transfer of information (for example, technology being provided only one way), fell short of project expectations Egyptian administrators indicated that in early stages of the project, Egyptian scientists collaborating with Israelis suffered negative impacts in the form of lessened opportunity for Gulf state employment This negative view of collaboration has apparently subsided as young scientists in the project did not share similar experiences Many junior scientists were brought into the CALAR II project and several institutions in each country were involved Thus, at this time, Israeli scientists could spend several months working on joint projects at Egyptian Institutions, and vice versa, resulting in closer collaboration

Involvement of Scientists: The participation of scientists has been very good It was especially pleasing to see the large number of young, enthusiastic scientists participating in the program Twenty-seven Israeli scientists have been involved in the CALAR II program and have participated in the workshops from 1990 through 1994 Forty-three Egyptian scientist have participated in workshops including 32 listed as presenters of work for evaluation Eighteen new Egyptian participants are scheduled to attend the March 1995 workshop in Alexandria Twenty-two U S scientists have also been involved in the program Three Palestinians participated in the annual workshop in California, May 1994

Visits of Scientists CALAR II has funded 4 trips of Israeli scientists to Egypt and 27 trips of Egyptian scientists to Israel In addition, 60 Egyptian participants and 4 Israelis have traveled to other sites, including a conference in Mexico City and a visit to laboratories in the United States by 6 Egyptians and 4 Israelis Travel (other than workshop travel) of scientists using CALAR II funding is listed in Appendix F The actual attendance at each of the annual CALAR II workshops is shown in the following table

Country Attendance at CALAR II Workshops

Country	USA 1991	Israel 1992	Egypt 1993	USA 1994	Egypt 1995*
Egypt	13	14	19	18	27
Israel	17	20	18	18	17
USA	7	4	10	8	6
Other				2**	

*Anticipated attendance for March 8 11 Meeting in Alexandria
**Palestine

Numbers of Co-authored Publications & Presentations No papers jointly authored by Egyptian and Israeli CALAR II scientists were discovered by the evaluation committee In CALAR I one publication was was co-authored by an Israeli and an Egyptian scientist CALAR II was neither structured nor managed to provide incentive for close one-on-one collaboration

Germplasm, Analysis, Techniques, Students, Faculty and Ideas Exchanged The project was successful in facilitating the transfer of germplasm new techniques, and ideas At the annual workshop and on scientific visits, there were free exchanges of ideas, techniques, and information We were not able, however to find any examples of scientific personnel exchanges for long-term collaboration only short-term training work

Sustainability of Collaboration and Research of the CALAR II Program Scientists and country administrators were asked whether the scientific relationships developed as a result of the CALAR II project would continue after project completion There was general agreement that continuation of these relationships was possible, but unlikely, because the scientists involved are working on different research problems There is, consequently, less incentive for direct scientist-to-scientist contact Lack of funding would also limit scientific interchange The Egyptians believe that the participation of U S scientists is vital for continuation of collaborative efforts with Israel U S counterparts act as both mediators and as networking facilitators, in addition to providing technical/scientific advice The Egyptians readily emphasized that the critical role of the U S extended well beyond that of a financial contributor to the success of the CALAR II project

Scientists and administrators from both countries indicated that research in protected agriculture would continue, but at a reduced level especially in Egypt Research sites will be maintained in both countries, however, their utilization for research will be substantially reduced in Egypt

Parallel Versus Collaborative Research: The research conducted in the project was parallel, topic-oriented research, conducted by scientists in each country to meet national priorities In interviews, both Egyptian and Israeli scientists indicated a desire to be involved in collaborative research with an Egyptian/Israeli counterpart and had a strong desire to become better acquainted with their neighboring country scientists CALAR II served to effectively promote cooperation between Egyptian Israeli, and U S scientists The relations among these scientists has reached the stage where true collaboration is now possible The momentum gained during CALAR II should be used to move cooperation and understanding between Israel and Egypt to a higher plateau

V. PROJECT MANAGEMENT

A Management by U S Institution

Administrative coordination between the United States, Egyptian, and Israeli agencies has been effective The San Diego University Foundation has a good working relationship with institutions in all three countries Communication between parties, equipment purchases, convening of meetings, and trouble shooting have been handled superbly by the SDSUF Arrangements for visits between cooperating countries, often difficult to arrange, have been managed well and without significant problems or embarrassing episodes Financial, quarterly, semi-annual, and annual reporting are up-to-date, however, country staff have been slow in submitting needed reports for use by SDSUF compilation and submission As a result, the annual and semi-annual reports were less informative than desired

Status of Required Reports· The annual and semi-annual reports submitted to USAID appear complete in reporting personnel change, travel, meetings and collaborative activities, procurement, and publication and intellectual property rights In terms of reporting progress in meeting technical goals and work plan objectives, the reports often lack substantive information Progress statements such as data from the previous season is being analyzed" or ' research is being conducted on a variety of crops are typical of reports reviewed Country coordinators do not consider technical reporting a high priority, and the U S project coordinator prepares reports without substantive data with which to work

Participant Peer Review of Project Work: The internal Peer Review called for in the project proposal was to be conducted jointly by the CALAR II Program Steering Committee and the Program Coordinators This review of projects was to be carried out to approve projects, but, other than action taken by County Coordinator, there is little evidence that this took place Country Coordinators reported dropping support for a few scientists for poor work or for work not meeting project reporting requirements The Annual Scientific Workshop, conducted with U S collaborators present, provided partial peer review input to the Steering Committee and Program Coordinators to the extent that questions were raised by scientists after hearing particular presentations The Steering Committee and Program Coordinators reviewed proposed annual scientific work plans and worked with each scientist (or the Country Coordinator) to develop an approved plan of work The evaluation team feels the review system used has not impeded program success but the quality of work in future projects could benefit from a more competitive and open peer review process

Fund Flow to Principal Investigators Scientists benefitted by the funding of the project for visits to Israel/Egypt, training/working in the U S with a scientist counterpart, travel to professional meetings, equipment upgrading, and support of individual research activities

<u>Egypt</u> Funding for direct research expenses is provided at the request of the scientist to the Principal Investigator, followed by approval of the Country Coordinator Support funding appears to be flowing to

scientists in a timely manner as appropriately needed--at least no complaints were voiced

Israel The Israel Country Coordinator is running a targeted, small grants research program with CALAR II funds Project members have access to funds and the Country Coordinator provides supervision and evaluation of each member's work The funding supports work within the targeted area (protected agriculture) with appropriate supervision and direction of expenditures to promote project goals Scientists are assigned a budget number in the accounting office of Ben Gurion University thus knowing their funding for the year Eleven scientists, other than the Country Coordinator, received life-of-program funding ranging from $17,600 to $142,279

B Role of the Steering Committee

The Steering Committee provides policy direction to the program The Egyptian and Israeli Steering Committee Members, along with the Country Coordinators, have maintained project stability The national stature and prominent positions of the Steering Committee members from Israel and Egypt have helped to resolve potential political problems and keep the project on track When problems occur they appear to have taken rapid action to solve them The Committee also plays an important role in maintaining program direction unless conditions warrant modification Future projects should consider whether such a large steering committee is needed, however The presence of Israeli and Egyptian committee members to provide country support is apparent but the presence of three Americans (a coordinator and two steering committee members) may not be necessary The Steering Committee meetings were in the U S , Europe, Israel, and Egypt The value of collaboration, wherever it may occur, is high In the future, if such large steering committees are necessary, it would seem appropriate that they evaluate activities and meet near the site of project activity

C Overseeing Activity of USAID Program Office

Unlike programs operated out of a Mission, USAID hasn t been able to provide on-site supervision MERC programs stand alone in the field however, they should have some overseeing activity by USAID to keep them on track and to direct mid-course adjustments in program when necessary In this project, the presence of on-site MERC project personnel might have enabled a "change in direction" to promote some true collaboration between Egyptian and Israeli scientists MERC projects could be monitored as follows

On-site Supervision from Washington, D C If project office personnel made regular inspection trips, the direction of each project could be monitored and changes in direction implemented more easily The presence of a project officer could help solve problems and facilitate changes in direction as needed

Supervision by USAID Country Mission or Embassy Personnel Because of the multi-country nature of MERC projects, supervision may be limited Embassy personnel are often not qualified for project supervision and USAID Mission personnel have full portfolios, often limiting their time for other activities When MERC projects are in line with Mission priorities, assistance is possible and should be encouraged Embassy and USAID Missions can provide useful assistance for evaluation teams by enabling the teams to be less reliant on the contractor In addition, their general monitoring of in-country progress is helpful for overall evaluation Embassy personnel interviewed displayed a strong interest in the programs and wanted to be more involved

MERC Project Officer/Representative Stationed in the Middle East This is a possible alternative but the added expense of placing a person in the field may not be cost-effective (depending on numbers and size of projects)

The on-site monitoring of MERC projects by USAID Washington would be a useful addition to MERC programs and would help insure that projects are meeting the overall program objectives The utilization of a contractor to provide technical and management assistance is a positive step, but does not eliminate the need for on-site monitoring by MERC

VI. ADDITIONAL FINDINGS AND CONCLUSIONS

A. Value of Internal Evaluations as a Management Tool

The Steering Committee has the major evaluative role in the program based on an evaluation of the presentations and input from scientists at the annual workshop U S scientists attending the annual meetings or participating in other professional activities, may provide input to the Steering Committee which subsequently provides guidance for review and management changes San Diego State University Foundation initiated a mid-term evaluation of the program in Feb and March of 1993 This evaluation provided a good review of scientific achievements and positive reinforcement to the Steering Committee The evaluation team feels the evaluation system used throughout the project has been effective and supportive of the program We must question the internal evaluation, however in that no mention was made concerning the need for one-on-one collaboration between scientists

B Contributions of U S Scientists Serving on SDSUF-MERC Project Committees

Eleven U S scientists serve on the three MERC Projects (CALAR II, MARYUT II MOROCCO) related to protected agriculture Egyptian scientists especially appreciated the opportunity to interact with American scientists and to work in American laboratories American scientists often serve as the "middle ground' in providing direction to projects and their role was contributive to project success

Three of the U S scientists serve on more than one project and two of them have made major contributions (beyond the annual meeting participation) The team feels that having committee members serve on more than one project may sometimes reduce the originality of projects but that liability is more than offset by savings in travel to the area, which is coordinated between projects, and by the opportunity for committee members' to incease their familiarity with the region

The U S scientists have all played a contributive role but reducing the numbers of U S scientists, while increasing the activity of those remaining may be desirable Many scientists attended the workshops but took little part in guiding the project Scientists who advise projects should be selected for their expertise, interest and willingness to provide continuous service

C Committee Structure for the Projects

The CALAR II Project has one committee, a Steering Committee, but makes use of the Annual Workshop to gain input for the annual work plans from scientists in attendance (We were told that scientists usually meet according to interest groups at the annual workshop to evaluate their work and suggest program direction to the Steering Committee, although this didn't happen at all workshops) The Steering Committee sets policy and maintains the continuity of the program When political considerations create operational problems, members of the Steering Committee have been available to resolve them promptly

One has to question the size of the Steering Committee when considering future programs Also, annual meetings of the committee were held not only in Egypt and Israel, but in the United States and France as well, with over 20 people usually attending each meeting Thus the cost-benefit ratio for such large groups, at such diverse sites must be considered If a Steering Committee is to make judgments on the future of a project, their meetings should be held at the project sites to observe the progress to date This is especially true of a project like CALAR II, which has no formal technical committee for guidance, although the scientists were collectively referred to as a Technical Committee Effectively, the Israeli and Egyptian Country Coordinators (with some input from their scientists) provided the direction for the project

D Utilization of the Generated Technology

In Israel, the team observed one private farmer, a Kibbutz, and a Moshav utilizing the technology of the project In Egypt, work of CALAR II can be published in technical bulletins made available to farmers through the MOA and the Extension Service Field days are held to pass the information to farmers near research sites (El-Bousseily, for example), and the word of mouth of "early adopters' serves to provide the information to receptive audiences

Farmer Access to Inputs In Israel, targeted farmers generally have access to the inputs needed for implementation of the information In Egypt, some farmers (such as the targeted resettlement groups) have access to inputs enabling them to implement the information provided The numbers of farmers utilizing "protected agriculture" are limited, but growing rapidly According to the CALAR II Principal Investigator the number of large plastic greenhouses has increased from 1 500 in 1987 to 15,000 in 19 2 and to 20,000 in 1994 Low tunnels covered about 500 feddans in 1987 and over 2,500 feddans in 1994 The anticipated increase is about 10% per year for the near future In the Nubaseed region however, some large structures were deserted The reason given by locals" was that profit could not be obtained from local markets or that management (generally salt problems) reduced profitability New structures also appeared in the region, so it is difficult to determine long-term profitability Some larger farmers hired CALAR II scientists as consultants and received valuable input in this way

Type of Farmers Benefitting from the Technology. Both affluent farmers and less-affluent farmers benefit from the technology Because protected agriculture requires a significant investment of capital and knowledge the more affluent or subsidized farmers are in a better position to utilize the technology Israeli farmers are eager to obtain new technology, and the government has provided partial grants and loans and other subsidies to enable new farmers to establish and maintain protected agriculture facilities In Egypt, the structures used are less elaborate and within the financial means of established farmers In the resettlement areas, government subsidies are available for the establishment of structures and irrigation systems CALAR II scientists do not pass information to the private sector without first obtaining approval for release of the information (such as a new variety or new procedure) from the Egyptian MOA The information is then published The literate farmer is in a better position to utilize the information Some scientists consult on their own time and transfer information in this way

E Evidence of Research Results Being Shared Between Countries

The sharing of results at annual meetings has been the major source of updates for scientists from both countries Numerous examples of genetic materials being transferred between countries exist Several examples of benefits (one country to the other) were found, including the following

- 'Williams banana introduced from Israel is being grown in Egypt
- Landscape plants have been exchanged between countries
- Almonds from the U S and other countries have been introduced from Israel to Egypt
- Plant materials and technologies for growing oyster mushrooms have been transferred from Egypt to Israel
- Numerous examples of genetic materials being transferred between countries exist
- Egypt has received mango varieties (U S varieties) from Israel
- 'Anna' apples and Galia' melons have been introduced from Israel to Egypt
- Methods of managing salinity have been exchanged between scientists
- Scientists from both countries reported benefits from the many exchanges of information at the annual meetings and on individual or group tours Both Israeli and Egyptian scientists reported information/materials gained from some of the American scientists involved
- Although difficult to quantify, the project created a strengthened respect between scientists of Egypt and Israel Early meetings were reported to be tense and provided little interchange on a personal level Now, scientists of both countries report closer relationships with "friends' from Israel or Egypt

F Status of Project Sites at Termination

The Israeli sites will not be affected by project termination Funding to Israeli scientists supplemented their on-going research, and this work will continue Other sources, such as BARD grants and programs of other countries provide continuing support to Israeli scientists CALAR II funds generally provided support for work already underway by Israeli scientists

Egyptian project sites will be maintained as production or service units, but there will be a reduced level of research activity The site at El-Bousseily is operated by a board composed of members from the MOA The site reportedly uses 60 of the 130 greenhouses and much of the field area for commercial production of vegetables They also sell produce from the 70 research greenhouses This generated enough funding to support the construction of an outreach center Salaries of support workers at the site are paid by the government In return for produce from greenhouses/land assigned to research, the site committee provides technicians, some inputs, and day-to-day care and management of experiments for CALAR II scientists Scientists utilize CALAR II funds for travel, additional technicians, research materials, and equipment The site will continue to operate as a government-managed commercial operation, but unless additional government or other funding is obtained, there will be a reduced level of research activity when MERC funding ends

Scientists at the Ain Shams University site feel they have well-equipped laboratories as a result of CALAR II but they will soon experience the effects of reduced operational funding The Egyptian MOA is committed to maintaining the research, but acknowledges the expected reduced level of activity Scientists tend to gravitate toward outside donor funds, and CALAR II scientists will follow this pattern (some already have)

G Effect on the Environment

Many experiments of the CALAR II project target techniques, such as use of manure, which minimize use of pesticides and inorganic fertilizers These techniques, when implemented, will tend to minimize on- and off-site environmental impact On the negative side is the reality that expansion of "protected agriculture" will increase the amount of land converted from desert to intense cultivation thus causing environmental degradation of desert lands and reduce water quality Most water for irrigation comes from the Nile, and the reflow of irrigation water back to the Nile will lower water quality by adding salts pesticides, and nutrients to the flow Both countries have policies which will place desert lands in production so within this framework the CALAR II project has had a desirable effect on the environment Greater concern about these issues was voiced at this review than at the CALAR mid-term evaluation, so issues will hopefully be addressed at a higher level of government in both countries

H The Future of Protected Agriculture in the Middle East

The patterns of increase in protected agriculture in Israel and Egypt lead one to conclude that protected agriculture has a future in the area Both governments are committed to placing more land in intensive production Both Israel and Egypt show rapid increases (up to 10% per year), and there is no evidence that this trend will slacken Increased water-use efficiency in greenhouses is the major driving force for this type of agriculture The ability to increase profits by getting materials on the market earlier, or to find a European market window, also drives the expansion In addition, the intensification of production under protected cultivation allows profitable farming in smaller land areas than would be possible out-of-doors Soils unsuitable for conventional cultivation can be amended or crops grown on soil-less culture As more greenhouses are built, however, there will be a point where the declining profitability will place a limitation on the area being used

VII. SUMMARY OF CONCLUSIONS

A. Technical Objectives

1 Technical objectives were met in areas of new crops introduction and genetic modification agromanagement environmental modification, and structure selection Scientists deserve commendation for meeting these objectives

2 There was minimal post-harvest work toward meeting technical objectives Both countries have qualified scientists in post-harvest physiology in close contact with experts from other countries One U S Steering Committee member is an expert in the area and contributes to the needs of both Israel and Egypt Lack of post-harvest work has not detracted from project success, however in Egypt in particular, significant technology transfer and infrastructure capability would have to be added for the bulk of greenhouse produce to attain sufficient quality for the export market

3 In Israel, economic factors appear to have been a major factor is determining research priorities (see Technical Evaluation in Appendix E) In Egypt, scientific effort has been directed toward basic or descriptive research areas with less focus on particular windows of opportunity for Egyptian growers

B Project Management

1 The project contractor, SDSUF, has been an effective manager of the program They have utilized non-grant funding (such as the Fred J Hansen Institute for World Peace) for project support, especially for travel of personnel related to the project The SDSUF has taken a direct interest in the project, much beyond that required and expected of a project contractor

2 The contract with SDSUF called for cooperation between scientists of Israel and Egypt It implied that collaboration (one-on-one scientist interaction) would take place All parties, SDSUF, sub-contractors, Country and Project Coordinators, peer reviews, the internal evaluation, and USAID should have recognized that collaboration wasn't taking place and should have initiated steps to adjust the program In general, scientists are receptive to carrying out collaborative efforts The first CALAR Project was funded in 1982, but only one joint publication between an Israeli and an Egyptian scientist was found That is not an enviable record for the time money, and effort expended
3 The country coordinators have been an effective team in carrying out the work of the project
4 The project has supported useful annual workshops that have enhanced cooperation and information transfer between scientists of both countries
5 Those responsible (Steering Committee and others) for conducting the final annual workshop in conjunction with a meeting of the International Society of Horticultural Science (being held in Alexandria in March, 1995) are to be commended for taking advantage of this opportunity to showcase CALAR II work
6 U S scientists have played a vital role in helping the program succeed
7 The Steering Committee has been effective in directing project activity
8 The annual workshop provided a useful means of monitoring progress while fostering interaction between scientists The peer review process called for in the proposal (which the coordinators interpreted as not including any external peer review process) and carried out by the project, didn't appear to detract from project success Future research programs should have a competitive grants program involving a system of peer review
9 Personnel representing the contractor and subcontractors were uncertain of the role of Winrock International in the program Although not a problem for the evaluation team, USAID and Winrock International should clarify that role to all those involved in the project
10 A suggestion was made to the Evaluation Team that in future projects involving multiple countries an initial meeting should be held at the start of the project to provide guidelines to all individuals on their expected roles, required reports, accountability, etc

C Cooperation Between Institutions and Countries

1. CALAR II has been successful in expanding the scientific partnership between Egypt, Israel, and the United States Notable personal ties between scientists of Israel and Egypt have been developed, both administratively and, to a lesser extent, between scientists Participating members have a much better understanding of each other s culture and heritage and appreciation of the other's viewpoint
2. Research took place in parallel projects, structured according to country priorities, with minimal collaboration (one-to-one) between scientists
3. Scientists from both Israel and Egypt favor collaborating with their counterparts Administrative feeling is that success for such efforts is currently limited due to difficulties existing between the two countries, especially in Egypt
4. The project did not have a system in place which encouraged or rewarded true collaboration
5. Good sharing of information between scientists has occurred through visits the annual workshop and contacts at international meetings
6. The tri-national nature of the project contributed to project success
7. The momentum gained in bettering cooperation and understanding between Israel and Egypt through CALAR II should not be lost Follow-on efforts between the three participants should occur to perpetuate the enthusiasm and spirit of cooperation developed between these dedicated and motivated scientists CALAR efforts also supported the Maryut and Morocco projects In fact, it was often difficult to separate research efforts supported by the three projects

D Continuation of Project Work After Project Termination

1. Research sites in both countries will be sustained, however, research in Egypt may not continue at the same level of activity as currently exists in CALAR-supported areas
2. Contact between Israeli and Egyptian scientists, following project termination, will be minimal
3. Both country coordinators provided evidence of country commitment" in continuing the project work and cooperation
4. The project has helped develop a cadre of enthusiastic and capable scientists in both countries, which will continue to do meaningful research to meet national priorities

E Program Success in Meeting Program Objectives

1. USAID should be pleased with the success of the CALAR II Project The project promoted the expansion and implementation of protected agriculture in Egypt and Israel, while enabling Egyptian and Israeli scientists to cooperate in their scientific and personal endeavors
2. The SDSUF, subcontractors, and all participating scientists should be commended for their participation in a successful project

VIII. RECOMMENDATIONS FOR FOLLOW-ON ACTIVITIES

Country coordinators in Egypt and Israel should consider proposing a program to external donors, including USAID, that will perpetuate the momentum gained through the CALAR II Program

The proposed program should insure support for the annual workshop to continue to bring scientists of the two countries together in the future The proposal should include a commitment from both countries to provide financial and program support before requesting funding from USAID and other donor sources Future USAID-funded workshops should take place in Egypt and Israel, rather than in the U S , and should be structured to achieve maximum participation of Egyptian and Israeli scientists with minimal donor costs Travel to research and farmer sites would be especially valuable

In addition the proposal/plan to USAID and other donor sources should requestfunding for collaborative research between scientists of the two countries The plan should include

- Research that is truly collaborative and that brings scientists in contact with each other on a continuing, regular basis
- Research that has the possible outcome of publication of a jointly-authored article in a reviewed journal
- Research that utilizes a management system that would rely on existing management and personnel procedures, but with proposal selection based on an external peer review process in which both scientific quality and relevance are integral components

IX LESSONS LEARNED

A The success of future projects needs the support of the USAID Mission and/or the U S Embassy for maximum project impact Whenever possible MERC projects should complement country mission priorities

B Many donor agencies contribute to work in targeted countries Whenever possible, projects should coordinate with, and complement the work of, donor agencies, including other USAID projects

C When possible, the management of evaluations should be handled by an entity other than the contractor to avoid the potential for introducing bias or undue pressure on evaluators The USAID Mission and/or the U S Embassy, in cooperation with Winrock, should take a more active role in coordinating project evaluation Some phases of the evaluation should be done without the presence of contractor personnel because contractors can influence evaluators by controlling sites visited and personnel interviewed Team Leaders should have full flexibility to alter schedules as they deem appropriate

D Equality between countries is mandatory in managing cooperative projects Future projects, whenever possible, should have reciprocal exchanges of scientists and personnel from the countries involved

E On-site monitoring by MERC personnel would help to insure that projects meet MERC goals and objectives

F Design of bilateral research projects which have common goals and objectives results in better opportunities for collaborative activity

G In future projects the steering and technical committees should be smaller The numbers of meetings the committees hold outside the target countries should be minimal

APPENDIX A: Scope of Work

Project Evaluations For

Cooperative Arid Lands Agricultural Research Project
Maryut Integrated Agroindustrial Complex Project
Moroccan Cooperative Agricultural Development Project

Scope of Work

Context of these projects and evaluations

The goal of the MERC program is to promote peace between Israel and its Arab neighbors and to facilitate development that will improve the well being of the people

The premise of the MERC program is that people who work together in a truly collaborative manner to solve common problems or to develop shared opportunities substantially enhance their knowledge and understanding of each other, of their respective cultures and heritages, and their common goals and aspirations

A further premise of the MERC program is that participating country sectoral development programs are strengthened and enhanced by regional cooperation projects which bring together national experts and expertise in collaborative technological or scientific efforts focused on common economic or social development priorities A corollary is that if successful, regional cooperation projects can help attract additional financial resources, public and/or private, to common economic or social development programs

Projects supported by the MERC program, the results produced by those projects, and those participating in them are likely to become important examples and focal points for the development and spread of further mutual understanding to colleagues within participating institutions and nations, and to other entities within the region

Active, focused, and broadly based regional cooperation among the countries of the Middle East is, therefore, the fundamental goal of the MERC program Thus defined, regional cooperation is the principal goal of MERC projects and cooperation is an integral feature or characteristic of all stages of MERC project activities, from conceptualization and planning through implementation to completion

Section one Activities to be evaluated

Three projects will be evaluated by one team This unusual practice is justified by the following similarities among the three projects
1) All three projects are MERC initiatives, thus intended to promote regional cooperation between Israel and her Arab neighbors through specific project level collaborative activities
2) All three projects have the same US cooperator - San Diego State University Foundation, (SDSUF)
3) All have the same Israeli cooperator, Ben Gurion University, and the same principal investigators
4) Protected agriculture in an arid environment is a main component of each project
5) The goal of each project is to develop export quality horticultural products for the winter European market
For these reasons and to reduce the cost of evaluation, the three evaluations will be done at the same time by the same team

The three projects are
1) Cooperative Arid Lands Agricultural Research, (CALAR II)
2) Maryut Integrated Agroindustrial Complex, (Maryut II)
3) Moroccan Cooperative Agricultural Development , (Morocco)

Section two Purpose of Evaluations

This is the mid-term evaluation of the Maryut II and the Morocco projects, and the final evaluation of CALAR II The purpose of these evaluations is to determine whether or not significant progress is being made, compared to that expected, toward the stated objectives of the subprojects, and whether or not annual work plans were realistic and successfully implemented It is also important to analyze the Steering Committee/Technical Committee method of management, to determine to what extent the two committees reviewed work under way, revised the annual work plans relative to success of specific activities, and whether or not it is cost effective to support two committees Since there is a Congressional mandate for the MERC program to foster cooperation and collaboration between Israel and Egypt/Morocco, specific attention is to be given to determining the nature and extent of this cooperation, and whether project activities are conducted in parallel or are truly collaborative
The team is to comment on the extent to which the subprojects of the Maryut and Morocco projects are on track with original or approved plans to generate worthwhile technology, have the potential for generating technology by the end of the project, or would benefit from restructuring

Project One

The Cooperative Arid Lands Agricultural Research Project

Background of CALAR II

In 1980, the governments of Israel and Egypt expressed common interests in arid land agriculture and executed agreements to that affect The CALAR project was initiated in March, 1982 It was funded for 5 years at a level of $5,000,000 and was eventually extended, for a total of 8 years There were three main research activities

- The use of saline water to produce crops in arid environments,
- Improving the production of small ruminant animals (sheep and goats) in desert environments,
- Trials of plant species not native to the two countries, which might have promise as commercial or forage crops, or for production of industrial raw materials

The final evaluation of the first CALAR project in 1988, indicated that cooperation among the scientists of the two countries had been successful There was also established friendly policy and administrative coordination among the trinational entities In meetings to develop CALAR-II, the parties agreed to concentrate on protected agriculture and phase out the small ruminant activities

CALAR-II is funded under the Middle East Regional Cooperation Program The overall goals of the CALAR-II project are to foster cooperation among Egyptian, Israeli, and U S scientists, to strengthen institutional linkages among the cooperating countries, and to focus on problems of protected agriculture in arid lands, concentrating on crops and technologies of significance to Israel and its Arab neighbors

The overall objectives of this multi-disciplinary program are

1 Development of protected agriculture as a means to produce competitive export products, as well as for providing food for domestic consumption
2 Expanding cooperative applied research efforts between Egypt and Israel
3 Improvements of the socioeconomic status of farmers and growers in the participating nations
4 The development of new productive lands in Egypt and the preservation of the fragile ecosystems in those lands

Six major research activities were initiated in Egypt and Israel to address the above overall objectives The crops to be studied are those that are now in demand in the local and export markets and the crops that are now being grown in protected agriculture in the two countries In addition, the project will identify and study new crops with high potential and high profitability The titles of the subprojects to be evaluated and the objectives of these activities follow

1) Agromanagement

The objective is to conduct research on the following components of protected agriculture

a Conduct research on the use of artificial root-growth substrates relative to crops grown in protected environments,

b Study the optimal planting dates for each crop under conditions prevalent in the program,

c Research the optimal methods of intensive cultivation such as the manipulation of plant architecture and plant density as a means to increase yield of high quality melons,

d Study various combinations of irrigation and fertilizer application for optimal growth,

e Conduct research on reducing the reliance on chemicals for disease and pest control, and

f Utilize computer-aided techniques in gathering and assessing the data required by CALAR II researchers

2) Environmental modifications

The objective is to study various methods of heating, cooling, ventilating, shading, and using CO_2 enrichment to optimize crop production and quality in protected agriculture

Research is to

a Study the ways and combinations of ways that environmental variables (heating, cooling, ventilation, carbon-dioxide enrichment, and shading) can affect plant growth, and

b Study the use of unconventional heat sources for protected environments such as geothermal water, waste water from power plants and various water sleeves

3) Structure Selection

The design, construction material, and selection of optimal structures for selected crops at the most favorable cost will be studied

a Study the use of inexpensive solar greenhouses, film plastic, and flexible P V C sheets, and

b Conduct studies on various shading levels and its effect on heat levels in the greenhouses and on fruit quality

4) Genetic modification

The objective is to breed plants to be grown in protected environments with the following traits

a The development of salt and heat/cold tolerant cultivars,

b The improvement of the quality of selected vegetable, fruit, and ornamental species for the export market,

c The introduction of insect and disease tolerance, and

d The extension of shelf life and keeping quality

5) Post-harvest aspects

The objective is to study optimal harvest dates, cooling, methods to extend shelf life, packaging, controlled storage, and marketing and economic assessment Specifically, research will center on the following topics

a The optimal season for markets, both domestic and for export,

b The volume of the existing market and forecast of potential markets,

c An estimation of production costs, market price, and profitability of the various production systems,

d Studies of product handling to aid in extending shelf life, and

e Studies on harvest dates and relevant environmental control for storage and shipping

6) Floriculture and new crops

The objective is to develop new, high-value crops for the export market, using techniques that are suitable and cost-effective for farmers in Egypt and Israel Examples of studies to be conducted are

a Collection and domestication of arid plants with a high export value, and

b Studies of ornamental plants of known export value in both protected and open-field conditions

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Project Two

The Maryut Integrated Agroindustrial Complex Project, (Maryut II)

Background of Maryut II

The **Maryut I** project was initiated to develop technology useful to the agricultural graduates that were given land to farm in the newly settled western desert During this first phase, much of the physical structures at the Maryut site were constructed including the office, packing and grading sheds, irrigation systems and greenhouses Israel had found interesting differences in saline tolerance in cultivars of melon The Maryut II was approved to allow the project to refine the crop management recommendations, to finish the training and extension facilities at Maryut, to prepare extension material and to train extension workers, and to increase the nursery capability to supply farmers with planting material

Maryut II is funded by the Middle East Regional Cooperation Program The overall goals of the project are to promote the spirit of cooperation between Israeli and Egyptian scientists, to strengthen institutional linkages among the cooperating countries, to develop technologies, cultivars and methodologies for intensive agricultural production in Egypt's western desert, and to develop farm settlement models geared for the needs and capabilities of university graduates and farmers who will settle these lands In order to reach these goals, the project will assist in the development of the agro-industry in the newly reclaimed lands and will develop the Maryut site as a center for technology generation and dissemination and as a center for training and extension

The program in Egypt has six major topics, with one or more specific objectives under each topic, and the program in Israel has nine activities Research in these topics will be conducted in collaboration, in parallel, or addressed separately in Egypt and Israel Results are shared among all participants

The topics in Egypt and the objectives of these topics are

A. Protected Agriculture

1 Various greenhouse structures and coverings will be tested, including glasshouses, plastic covers, and screen houses,

2 All aspects of crop management systems will be tested for selected crops, from land preparation to post harvest treatment, and recommendations for optimal production developed,and

3 Crops and cultivars of vegetables, fruits and ornamental will be tested in non-heated greenhouses, tunnels, under shade, and with saline water to develop quality produce for the local and export markets

B Open Field Intensive Crop Research

4 The objective includes extensive varietal testing of ornamentals, flowers, and vegetable crops such as asparagus,lettuce, sweet corn, and processing tomato

C Tree crops and Grape Research

5 Research will concentrate on developing and extending new varieties of deciduous tree crops that are compatible with warm winters and calcareous soils

D. Nursery

6 A nursery will be established near the main desert highway connecting Cairo and Alexandria to supply farmers with quality plant material that will be the basis of modern intensive agriculture in the Western Desert

E Post-harvest Handling

7 Research will deal with
- optimal harvest time,
- ripening stages,
- sorting and grading,
- preservation treatments to extend shelf life, and
- packing methods and testing of packing materials

F Training and Extension

8 The objective is to develop a center for training of extension workers and farmers and to design and distribute technical publications

The topics in Israel and the objectives are

A. Development of new cut flowers for winter marketing

1 Increase the flexibility in changing species and cultivars of cut flowers for export This will assist the horticultural industry in the Negev and Maryut

B Native annual plants for environmental gardening

2 The botanical and horticultural characteristics of Israeli annual flora will be studied to develop them for commercial use in Israel and the Maryut site The saving of irrigation water is the principal interest

C Development of woody plants as cut flowers

3 Studies include crop selection and ways to reduce the intensive culture, high level of expertise, and high costs generally associated with woody plants grown for cut flowers

D Eucalyptus for flowering and decorative branches

4 Research will address propagation, dwarfing, salt tolerance, reduced intensiveness, and open field plantings

E Control of tomato quality

5 This research will seek to establish correlation between growing conditions, physical and chemical parameters, and organoleptic guidelines

F Protected agriculture
6 Various greenhouse structures and covering will be tested to find ways to produce crops at the most desirable economic period for off season crops, and
7 Research will concentrate on optimization of management systems for melons and tomatoes for optimal fruit quality

G Open field intensive crop research
8 This research will center on flowers from seed, hardy woody ornamentals, and potatoes and melons grown on sandy soils with saline drip irrigation

H Tree crops and grape research
9 Research efforts will include the selection of salt tolerant cultivars that are compatible with warm winters and calcareous soils

I Post-harvest handling
10 Research will deal with fruit acidity, pH, starch content, shelf life, and economic evaluation of quality control

Project Three

The Moroccan Cooperative Agricultural Development Project, (Morocco)

Background for the Morocco project
This five year project runs from September 1992 to September 1997 The approved LOP funding is $4,939,000 This was the first MERC project between Israel and an Arab country other than Egypt and the first with a non-government cooperator, an agribusiness company called the Maghreb Agricultural Cooperative in Azemour, Morocco The project calls for an Israeli technical expert to be assigned to the project site in Morocco

The Moroccan Cooperative Agricultural Development Project, (Morocco), is funded under the Middle East Regional Cooperation Program The overall goals of the project are to foster cooperation between Israeli and Moroccan scientists, to strengthen institutional linkages among the cooperating institutions, and to increase the ability of Morocco's agriculture sector to meet internal demands for agribusiness projects and to increase agribusiness exports from both Israel and Morocco

The specific project objectives in Morocco are
1 To construct a speedling nursery with an initial capacity of one million seedlings a year of tomatoes, peppers, cucumbers, and melons for farmer use

Capacity will increase to five million seedlings/year by the PACD
2 A pot-plant nursery will be constructed to produce rooted seedlings and finished pot plants of ornamentals for both the local and export markets
3 To develop commercial micro-propagation capacity in Morocco of disease free material, mainly banana and carnation, for local growers who now import their planting stock
4 To develop optimum cultural practices for the production of open field grown ornamentals collected from Morocco, Israel, Australia, and California
5 To experiment and demonstrate all parameters of open fi l and greenhouse production of vegetables for the fresh market and processing industries
6 Extension staff of Hassan II Institute and the National Institute for Agricultural Research will be trained at the Azemour project site and they, in turn, will help train groups of farmers at the site

The specific project objectives in Israel are
1 To breed high quality, high yielding processing tomatoes for Morocco
2 To develop management procedures for onion production based on plant physiology and nutritional needs
3 To study the effects of environment and seed treatment on growth and germination of *Verticordias* for flowering branches and pot plants
4 To make extensive truffles collections in Morocco and to domesticate the truffles for commercial production
5 To conduct tissue culture (micro-propagation) studies on Eucalyptus and banana at Ben Gurion University and to train Moroccan technicians
6 An economic and marketing study will be conducted on the crops and products being studied under the project

Section Three Statement of Work

There are three major areas of concern in these evaluations 1) management, 2) cooperation, and 3) technical progress toward meeting the stated subproject objectives on schedule

The following components should be considered and addressed in the team's reports, as well as additional items based on the professional judgement of the team members The discussion of each component should be concise, identifying factors affecting implementation in the context of the project purpose and the logical framework Recommendations should be confined to significant factors that can be implemented and that will result in increased cooperation or in generating more useful technology for the target farmers Mid-term evaluations should address the need to consider which activities are potentially successful and should receive more resources in a reallocation of resources within the project, and which activities appear to have less potential for success and should receive less resources The economics of protected agriculture is dynamic and the profitability of many of the crops being researched may change during a five year period The team should assess whether or not the economic and marketing studies have been done and are relevant, and whether current and projected market prices remain favorable for the target commodities Also, comment on whether or not the marketing data are regularly updated in response to market changes

Management

Assess the project management and the design format of the three for the following

- Assess the U S institution in its back-up role in relation to coordination of work, fund flow, report submission, research monitoring, equipment purchasing, convening meetings, and communicating with all parties, including AID
- Are technical reports filed in a complete and timely manner? Do the annual and semi-annual reports contain hard data to verify progress?
- Can the participants at technical meetings and workshops openly discuss each others' research in a typical peer review fashion?
- Do funds flow to PIs as planned, and are financial reports submitted on schedule?
- When the MERC program was initiated, the Steering Committee was an essential management component because senior officials were needed to encourage and protect cooperating scientists Is this committee still necessary?

Cooperation

Strengthening institutional linkages among the cooperating institutions and countries is a major objective of each of the projects Quantify the amount and sustainability beyond the life of the project of the cooperation between Israeli and Egyptian/Moroccan scientists and technical and administrative personnel generated by this project by noting the following

- Number of scientists, others, and institutions of both countries involved in the project
- Number of scientists visiting counterparts' work sites
- Number of co-authored publications or presentations at international meetings
- Evidence of data, germplasm, analysis, students, and insights exchanged
- Distinguish between collaborative research between Israeli and Egyptian/Moroccan scientists on a single activity and that which is merely conducted in parallel

Specific progress toward subproject objectives
The subprojects of each project should be evaluated to determine whether they have accomplished what was planned by the technical committees and set as goals in the annual work plans A listing of research conducted and technology generated should be compiled Other accomplishments, such as training, equipment purchases, and technology transfer are to be noted and compared with planned progress The team members should comment on whether or not each of the subprojects will reach its intended objective by the PACD and what steps will be necessary to reach the objective
(Refer to appendix I for a list of specific questions for each of the subprojects to assist the team in their deliberations with the project scientists)

Section Four Methods and Procedures

The team will follow the format and guidelines established by USAID in the supplement to Chapter 12, AID Handbook 3, entitled
AID Program Design and Evaluation Methodology Report No 7

The team will use the following document review, data collection, and interview methods,
1) Attend briefing in AID/Wash and in U S Embassies in Cairo, Tel Aviv and Rabat
2) Review all relevant project and grant papers, progress reports and previous evaluation reports
3) Interview members of the trinational steering and technical committees, subproject principal investigators, and examine activity records, data analysis, and conclusions
4) Brief the project coordinator of each country of your findings and then brief AID/Wash before writing the final evaluation report

The schedule for the evaluation is attached

Section Five Evaluation Team Composition

The team will consist of three professionals with the following qualifications
1) A Protected Agriculture/Horticulture expert that will be able to analyze and assess the biological science aspects of the six major activities This expert should have a PhD in a botanical science and have a current position in research in protected agriculture It is not assumed that any individual will be an expert in all of the subprojects, but with the assistance of the other team member, should be able to ascertain progress attained and steps needed to correct progress delays Demonstrated

technical writing abilities are essential and previous evaluation experience is desirable

2) An Agriculturist or Sociologist to examine evidence of cooperation and collaboration between and among project participants, including scientists, managers and others, and the development of cooperative or interdependent institutional linkages among the institutions involved in the projects, and among sister national institutions, if any Evidence of linkage into international research networks should also be examined

3) An Agronomist/ Agricultural Research Management specialist/Team Leader This expert should have an advanced degree in Agronomy and experience in the crops and environment central to these projects He or she should be knowledgeable in research organization, system functions and research methodology in order to comment on research procedures in the projects and whether the management of these projects might profit from reorganization

Each team member should have adequate experience in their respective fields The only language requirement is English proficiency Prior work in Egypt, Israel or Morocco will be considered a strong plus A laptop computer will be provided to each team member and members are expected to be proficient in the use of word processing

Section Six Reporting Requirements

An evaluation report will be written for each project

The format of the evaluation reports will follow AID guidelines established in, The supplement of Chapter 12 of AID Handbook 3

The reports will include an executive summary, project data sheet, table of contents, findings, recommendations, and appropriate appendixes (evaluation scope of work, list of people contacted, bibliography) The body of the reports, exclusive of executive summary and appendixes, should not exceed 30 single spaced pages The evaluation team will formulate their findings and from these prepare a set of conclusions for each of the objectives of the subprojects as well as for management and cooperation For the mid-term evaluations, a set of recommendations will be prepared that will help ensure that the objectives of the project can be successfully concluded by the project PACD The final evaluation will concentrate on determining whether the project was successful in meeting its stated end of project objectives and what further activities might warrant consideration

The report will be written jointly by all members of the team under the coordination of the team leader, who will be responsible for briefing appropriate USAID, U S Embassy and host government officials The team leader is responsible for the timely submission of the final report

A draft of the recommendations to be included in the evaluation report is due prior to the team's departure from the Middle East countries and is to be discussed with the U S Embassy/USAID in each of the three countries The final report will be completed prior to the team leader's return home or at a reasonable later date negotiated with the contractor, but in no case later than 30 days after completion of the evaluation

Section Seven Funding

Financial support for the evaluation will be supplied by A I D

Appendix I Additional questions to be addressed

Management questions for the three projects

- How valuable has the internal evaluation been as a management tool? Were any worthwhile recommendations made and did the project steering committee act on any of them?

- The project has U S consultants serving on the project technical committee, some serve on more than one SDSUF-MERC project Does their input into the project result in positive, documented change? If so, please state

- Review the steering committee reports and analyze the benefit of the two committee (technical and steering) system Could the technical committee be restructured in such a way to serve both purposes?

Related to specific activities in the CALAR II project

a) Agromanagement

- What has been the growth response of tomato to saline irrigation?
- What is the role of Calcium and Cobalt in salt tolerance of melons?
- Is there any progress in reducing chilling injury to cucumbers?

b) Environmental modification

- Are there any specific recommendations on use of growth mediums, air temperatures, and relative humidities for the crops being studied?

c) Structure selection

- What are the results on the optimal use of shading materials, fans, and size of plastic houses, on crop production in the summer months? Do results so far justify continuing this work?

d) Genetic modification

- Quantify specific documented success in developing plant cultivars that are superior in salt, heat, or pest tolerance
Have any improved varieties been developed and commercially grown that were a result of this project?

e) Post-harvest aspects

- Report on any progress in the studies on cooling, shelf life, packing and controlled storage of any of the crops researched

f) Floriculture

- Have any new crops been offered to farmers for adaption and what was the market response?

Related to specific activities in the Morocco project

- The project has completed its third draft of an economic and marketing study Is the study being used to guide the project as claimed?
- Israel is breeding high yielding tomatoes for Morocco Name the promising cultivars and their potential yield
- Is the chart showing all activities and progress for Morocco prepared by UC Davis a useful tool for project management and evaluation?
- Why did it take half the project life to decide whether to build the micro-propagation unit at the project site? Did the technical and steering committee function properly to resolve this dispute?
- The technical committee has recommended that the onion research should be terminated by October 1994 and that another activity should be chosen to replace it How can this management decision be resolved without waiting for the annual committee meetings?

APPENDIX B: Contacts Made During Evaluation of CALAR II and Maryut II Projects

USAID Washington, D C

John Daly, Ken Prussner, Herb Blank, Pamela Mandel, Sheree Belamy, Charles Uphouse

Winrock International, Washington, D C

Floyd Williams, Edward Rice, Vicki Walker, Doug Clark John Pino

U S Project Members at San Diego State University Foundation

Mohamed El-Assal, Bonnie Stewart, Harry Albers, Frea Sladek Tim Hushen, Davene Gibson, David Moore

Other U S Project Members from U Cal Davis

Dr Michael Reid, Dr Adel Kader, and Richard Jones (by phone)

American Embassy, Israel

David Mulenex Science Advisor

Israel Project Members/Contacts

Dr Samuel Pohoryles, Dr Dov Pasternak, Dr Irena Rylski, Mr Ben Ami Bravdo Prof Y Fulman, Joel Schechter, Dr Yitzhak Abt, Yoseph Elkana, Uri Dron, and Israeli scientists (see evaluation schedule)

Egypt Project Members/Contacts

Dr Adel Beltagy, Mr Mohamed Dessouki, Dr Ayman Abou-Hadid, Dr Awad Hussein, Dr Mohamad Beltagy, H E Dr Mahmoud Mahfouz, Mr Itzhak Ayalon (former advisor to Maryut site), and Egyptian scientists (see evaluation schedule)

American Embassy, Egypt

John Davison Economic Officer Russel A La Mantia Jr Minister/Counselor for Economic Affairs and Edmund Hull DCM

USAID Mission, Cairo Egypt

David Delgado Director Office of Agriculture

Other Contacts Made

Egypt

Dr Hamıd El-As Doudı, Faculty of Agrıculture of Aın Shams, Unıversıty and Seedsman

Sabry Elsayed Abd Allah, Vıce Chaırman of NUBASEED Co

Hısham M Fahmy, Office of Foreıgn Relatıons, MALR

Tarek Hassan, Dokkı

Dr Karım Faraq, Unıv of Alexandrıa, College of Envıronmental Agrıculture at Damanhoun

Israel

Prov A Shımshony, Dırector, MOA, Veterınary Servıces and Anımal Health

Lechaım Naggan, Vıce-Presıdent and Dean for Research & Development, Ben Gurıon Unıversıty of the Negev

Davıd Wolf, Actıng Dırector, Ben Gurıon Unıversıty of the Negev, The Instıtutes for Applıed Research

APPENDIX C: References Consulted During Evaluation of CALAR II, Maryut Ii, and Morocco Projects

1 Integrated Agricultural Development Project Maryut Agroindustrial Complex in the Western Desert of Egypt Continuation and Expansion Submitted May 1990 & revised July 1990 Request submitted to the Bureau for Asia and Near East USAID

2 Final Evaluation Report The Cooperative Marine Technology Program for the Middle East Final Evaluation Report July 1993

3 Cooperative Arid Lands Agricultural Research Project Mid-term Evaluation Feb & March 1993

4 A I D Evaluation Handbook Supplement to Chapter 12 A I D Handbook 3 Project Assistance April 1989

5 Maryut Project Internal Evaluation Sept 1993 Dr R A Jones

6 Final External Evaluation Trinational NUBASEED Development Project Report Oct 1992

7 Draft MERC Program Guidelines for individuals interested in preparing unsolicited grant proposals to the MERC program December 1994

8 SDSUF Contractual Subgrant with the Egyptian Ministry of Agriculture for the MARYUT II project

9 MARYUT II Integrated Agricultural Development Program request for a revision to the Office of Procurement USAID Dec 15 1992

10 Documentation of GRANT Amendment of Contract by USAID

11 Amendment Number 1 Subgrant between SDSUF and the Egyptian Ministry of Agriculture of the Arab Republic of Egypt

12 Amendment Number 2 Subgrant between SDSUF and the Egyptian Ministry of Agriculture of the Arab Republic of Egypt

13 Amendment Number 3 between SDSUF and the Egyptian Ministry of Agriculture

14 Setting an Agenda for Cooperative Development in the Middle East Publication of the Center for Social Policy in the Middle East May 1986

15 Review of Middle East Regional Cooperation Program (Project No 398-0158 25) Feb 1991

16 Annual Technical Progress Report (Oct 1993 to Sept 1994) of Moroccan Cooperative Agricultural Development Project submitted to USAID (Bureau for the Near East) by the SDSUF

17 Cooperative Arid Lands Agriculture Research Program II (CALAR II) A Program in Protected Agriculture Sponsored by the Joint Agricultural Committee Egypt-Israel Submitted by SDSUF to USAID Bureau for Near East (Abridged version)

18 Small Farm Handbook Small Farm Center Univ of Calif Division of Agriculture and Natural Resources Oct 1994

19 Small-Scale Postharvest Handling Practices A manual for Horticultural Crops L Kitinoja & Adel A Kader Dept of Pomology Univ of Calif at Davis Jan 1994

20 Maryut II Workplans for 1994/95 Revised at the Maryut II Technical Meeting held in Cairo June 1994

21 Maryut Newsletter Spring-Summer 1994

22 Progress Report on the Achievements of Different Activities in Maryut Project April 1994

23 Report Schedule of Maryut II for Israel

24 CALAR II Fourth Annual Scientific Workshop Schedule and list of participants San Diego California May 2-6 1994

25 The Second CALAR II Workshop Book of Abstracts Beer-Sheva Israel March 13-20 1992

26 CALAR II Third Scientific Workshop Book of Abstracts Alexandria Egypt March 8-11 1993

27 Abstracts of the CALAR II Fourth Annual Scientific Workshop San Diego California May 2 6 1994
28 Cooperative Arid Lands Agriculture Research Program II Newsletter for Winter/Spring 1994
29 Cooperative Arid Lands Agriculture Research Program II Newsletter for Fall 1994
30 Cooperative Arid Lands Agriculture Research Program II Newsletter for Summer 1992
31 Cooperative Arid Lands Agriculture Research Program II Newsletter for Winter 1991
32 CALAR II Annual Technical Report Sept 30 1993 March 31 1994 Submitted by SDSUF
33 Communique from USAID promulgating Grant # HNE 0158-G-00 2075-00 to SDSUF (including estimated budget) Aug 28 1992
34 Required Revised Economic Analysis for Maryut II Integrated Agroindustrial Complex in the Western Desert of Egypt SDSUF December 1993
35 MOROCCO REPORT Newsletter of the Moroccan Cooperative Agricultural Development Project SDSUF Spring 1993
36 Morocco Report Newsletter Fall 1993
37 Morocco Report Newsletter Fall 1993
38 AMARIS Morocco Project Newsletter Fall 1994
39 Integrated Agricultural Development Project Maryut Agroindustrial Complex in the Western Desert of Egypt External Evaluation April 14-18 1990
40 Grant authorization to SDSUF for the CALAR II Program June 1990
41 Agricultural Development in the Middle East in A Regional Context Middle-East Peace Negotiations Multilateral Wroking Group on Reg Econ Development Final Report August 1994
42 San Diego State University Foundation Annual Report (Five Decades) 1992-93
43 Researh abstracts of Scientists at Volcani Institute Institutes for Applied Research of Ben Gurion University & the Rehmat Negaav Station
44 Micro Propogation of Ornamental Eucalyptus Training Work of Fatima Agid Annual report Aug 1993 July 1994 David Mills Shivta Wenakart & Fatima Agdid Submitted to AID/MERC by the Institute of Agriculture & Applied Biology
45 Irrigation with Brackish Water under Desert Conditions VIII Further Studies on Onion (Allium cepa L) Production with Brackish Water Y De Malach S Mendlinger I Borovic & N Abd El Salam Jan 1989
46 Human Resources of Agricultural Research in Egypt Arab Republic of Egypt Ministry of Agriculture and Land Reclamation Agriculture Research Center Information and Documentation Center Dec 1994

APPENDIX D: CALAR/MARYUT II Evaluation Schedule

Mon , Dec 12	Dr Fink Travels to Washington D C for meeting with Winrock, Int , evaluation team and USAID
Tue , Dec 13	Team meeting in Washington, D C
Wed , Dec 14	Team meeting in Washington, D C
Sun , Dec 18	Dr Rodney Fink, Leader of the evaluation team, travels to San Diego
Mon , Dec 19	Dr Fink visits SDSU Foundation In the evening, Dr Fink, Dr Mohamed El-Assal and Dr Bonnie Stewart Travel to UC Davis
Tue , Dec 20	Drs Fink, El-Assal and Stewart meet with Drs Adel Kader and Mike Reid at UC Davis Drs El-Assal and Stewart return to San Diego in the evening
Wed, Jan 4	Evaluation team members Drs Rodney Fink, Mary Peet, Jody Garbe and David O'Brien depart the U S for Tel Aviv, arriving Jan 5, 1995
Thu , Jan 5	Team arrives in Tel Aviv at 7 00 p m & proceeds by taxi to the Moriah Plaza Hotel155 Hayarkon Street
Thu , Jan 5	7 00 p m Business dinner at the Moriah Plaza with the Israeli CALAR/Maryut/Morocco Steering Committee Members Drs Samuel Pohoryles, Itzhak Abt, Irit Rylski, Lechaim Naggan, Joel Schechter, Itzhak Peretz and Dov Pasternak
Fri , Jan 6	9 00 a m Meet with scientists and TechnicalCommittee Member of Morocco project
Sat , Jan 7	Meet with Protected Agriculture Farmer in Arava Valley (growing melons in solar greenhouse)
Sun , Jan 8	9 00 a m visit Volcani Institute and project sites CALAR and Morocco sites until 4 00 p m Travel to Beer-Sheva in the evening Overnight at the Desert Inn Hotel, P O Box 246, Beer Sheva, 84 102
Mon , Jan 9	9 00 a m to 4 00 p m Visits Ben Gurion University/Institute for Applied Research Meet members of the CALAR/Morocco Projects Business lunch with Professor Lachaim Naggan, Vice President, BGU, and Mr Moshe Amir, Accounting Dept , BGU
Tue , Jan 10	9 00 a m to 5 00 p m Visits the Ramat Negev Experimental Station Meet scientists of the Maryut Project Presentations by Maryut Scientists and site visitations Return to Tel Aviv in p m Overnight at Moriah Plaza Hotel
Wed , Jan 11	Team meets with David Mulenix, Science Attache at the U S Embassy Write reports P M Meeting with Pohoryles and Israeli Committee Memebers
Thu , Jan 12	Write reports Fink & O'Brien travel with Mr David Mulenex, Science Attaché at the U S Embassy to the Veterinary Institute near Volcani to meet

	with Arnon Shimshony and others of the Institute about a MERC program and their plans for an extension Dr Peet visits with individual scientists at Volcani Institute and Hebrew University Late in the day, travel to Cairo via El Al flight 443 departing 8 00 p m arriving in Cairo at 9 20 p m proceed by taxi to the Cairo Nile Hilton Tahrir Square, Cairo, Egypt
Fri , Jan 13	Meet at 7 00 p m with CALAR II and Maryut II Egyptian Steering Committee Members Dr Adel El-Beltagy, Mr Mohamed Dessouki, H E Dr Mahmoud Mahfouz
Sat , Jan 14	Meet at Dokki at 9 30 a m with the Egyptian CALAR II scientists until 5 00 p m Presentations by 30 students and scientists
Sun , Jan 15	8 00 a m - 9 00 a m Meet with Mr David Delgado, USAID Mission in Cairo, and with Mr John Davison & Russell LaMantia, US Embassy in Cairo Meet at Dokki at 10 30 a m with Maryut II Scientists Presentations by the scientist
Mon , Jan 16	7 45 a m - 9 00 a m Meet with representatives of Mr David Delgado (absent), USAID Mission in Cairo, and Mr John Davison, Political Attaché, US Embassy in Cairo, and Mr Russel LaManta Visit CALAR II lab and sites at the College of Agriculture, Ain Shams University, Shubra El-Khaima Visit CALAR II site at Shalakan
Tue , Jan 17	Depart Nile Hilton Hotel at 7 30 a m travel to the Maryut II R&D site on the Cairo - Alexandria desert road Visit site until 4 30 p m , then proceed to Alexandria Overnight at the Helnan Palestine Hotel, Montazah Plaza Alexandria, Egypt
Wed , Jan 18	Depart Helnan Palestine Hotel at 9 30 a m to visit CALAR II sites at El-Bousseily Return to the Palestine Hotel at end of day
Thu , Jan 19	Check out of the Palestine Hotel early in the morning Team Leader, accompanied by an Alexandria Private Sector Seedsman, visits the NUBASEED Project site and rejoins team at MARYUT site Visit farmers in the MARYUT area, Bustan and Bustan Extension and along Cairo Desert Road benefitting benefiting from the Maryut R&D unit Check into the Nile Hilton Hotel (see above)
Fri , Jan 20	Write CALAR II and Maryut II reports
Sat , Jan 21	Free day
Sun , Jan 22	Write CALAR II and Maryut II reports Meet with David Delgado(USAID) at 1 00 P M
Jan 23	Write CALAR II and Maryut II reports
Tue , Jan 24	Meet with Mr David Delgado, AID Mission and Mr John Davison, US Embassy, for an exit interview
Wed , Jan 25	Team travels to Morocco via Gulf Air 81, Departing Cairo 2 00 p m Arriving Casablanca 5 40 p m , travel to Sheraton Hotel

Evaluation Committee - MERC Programs

Timetable for visitation at the Volcani Center
8/1/95

9 00 - 09 30	Meet Prof Y Fulman - Chef Scientist, Ministry of Agriculture
09 30 - 10 00	Effect of root restriction, nutrition and hormonal balance on quality of tomato fruit - Drs Asher Bartal and Eitan Pressman
10 00 - 10 30	Genetical, biochemical and environmental factors determining fruit quality in melons - Dr Arthur Schaeffer
10 30 - 11 00	Effect of environment on fruit quality of pepper - Dr Beni Aloni
11 00 - 11 30	1) Breeding of high quality open field tomatoes 2) Control of plant size in "Speedling" nurseries Drs Moshe Bar and Eitan Pressman
11 30 - 12 00	Breeding of greenhouse tomatoes for tolerance to the Yellow Curled Leaf virus - Dr Meir Pilowsky
12 00 - 12 30	Collaboration with the extension service Mr Omar Zeidan
12 30 - 13 30	Lunch
14 00	Depart to Beer - Sheva
15 00 - 16 30	Visit "Sde Teiman" plot - introduction of open field ornamentals

Evaluation Committee - MERC Programs
Timetable for Meetings at the Institutes for Applied Research
Ben - Gurion University
January 9, 1995

08 30 - 09 00	Meet Director - Prof David Wolf
09 00 - 11 30	Visit research sites at IAR
11 30 - 12 00	Research on melon breeding for winter season - Sam Mendlinger
12 00 - 12 30	Research on Flowers - Dr Ruth Shillo
12 30 - 13 30	Lunch with Prof David Wolf and Mr Moshe Amir (Director - Research Contracts)
13 30 - 14 00	Solar greenhouse - Drs Dov Pasternak Eli Korin, Uri Drori
14 00 - 14 30	Pitaya - a new fruit for greenhouses Research on Argan Dr Avinoan Nerd
14 30 - 15 00	Research on the Moroccan Truffle - Drs Varda Zur and Nurit Bejerano
15 00 - 15 30	Tissue culture propagation of Eucalyptus - Dr David Mills
15 00 - 16 00	Verticordia - a new species for decorative branches - Mr Y Ben Dov

Evaluation Committee - MERC Programs

Visitation to Ramat Negev 10/1/95

8 15	Leave hotel
9 00 - 9 30	Description of Ramat Negev R&D , Y Moscovic
9 30 - 10 00	Description of Ramat Negev Station, Y De Malach
10 00 - 11 30	Meet Maryut Technical Committee and Scientists
11 30 - 12 45	Visit Farm
13 00 - 14 15	Lunch & tour at Kibbutz Revivim
15 00 - 16 30	Visit Moshav Kadesh Bunnea Application of CALAR technology in saline irrigation of melons
16 30	Return to Tel Aviv

Egypt CALAR II Scientific Team
Preesentations to Team

Ayman Abou-Hadid Principal Investigator
- Introductory notes for Egypt

1 Dr Saleh Mohamadein — Plant diversity and breeding (Dokki)

- Productivity of snap Beans and egg plant under cover

2 Dr Hosny Khalifa — Infrastructure (Dokki)

- Development of protected Cultivation in Egypt

3 Dr Mohamed Edres — Tissue culture (Ain Shams)

- Ethylene inivienent in vitro regeneration of asparagus
- Propagation of potato using tisse culture technic

4 Dr Samir O El-Abd — Physiology (Ain Shams)

- Ethylene production from tomato and cucumber plants under saline condition
- Seed germination of tomato and cucumber in salinzed condition and prevention of its effect

5 Dr Mahmoud Hafes Mahmoud — Agromangement **(Dokki)**

- Studies on the use of some local materials for growing cucumber in closed recirculated hydroponic system Comparative studies on different cucumber growing media under protected cultivation in Egypt

6 Dr El-Sayed Abo-Fotouh Omar — Physiology (Ain Shams)

- Studies on the effect of salinity on the growth yield and soil and oil composition of thyme plants
- Yield and Chemical Composition of Both Sweet and hot Pepper Under Greenhouse house conditions
- Effect of water regime on the growth flower yield and volatile oil content of marigold (Tagetes Patula)

7 Dr Sayed M Singer — Climate Modification (Ain Shams)

- Amelioration of Chilling injury in cucumber seedings by short-term cold Acclimation
- Increased chilling tolerance by using some mineral nutrient for cucumber seedings

8 Dr Ahmed M Eissa Soil and Water (Ain Shams)

- Iron Zinc and Phosphorus relationship in nutritional of tomato seedling grown on sandy soil
- Tomato growth in calcareous soils in relation to forms and levels of some marco-and micro nutrients

9 Dr Abo El-Fotouh AbdAlla Breeding (Dokki)

- Tomato breeding for protected cultivation activities
- Effect of interaction between NaCl levels and root-zone temperature on growth and seed production of cucumber plant
- The influence of Root-Zone temperature and NaCI levels in the nutrient solution on seed germination and early growth of cucumber seedlings

10 Dr Usama A El-Behairy Hydroponics (Dokki)

- The effect of the source of pH-adjustment acids on uptake and transport of the ions for cucumber plants grown in NFT
- Effect of different Zenc concentrations in the nutrient solution on uptake and translocation on marco and micro nutrients on cucumber grown in NFT

11 Eng Samir R Salman Agromangement (Ain Shams)

- Using of commercial fertilizer in nutrient film techniques (NFT)
- Plastic house micro climate condition as affected by low tunnel and plastic mulch

12 Eng Mohamed Z El-Shenawy Water and Climate (Ain Shams)

- Preliminary studies on the use of aeroponics for vegetable crops under local conditions
- Lettuce plant grown in aeroponics or hydroponics and its relation to water consumption

13 Eng Sami Abdel-Gawad Gafaar Agromangement (Bossialy)

- The effect of shading and GA3 application on earliness and fruit quality of artichoke
- Studies on the production of off season Jews mallow in Egypt

14 Eng Mohamed Saleh Agromangement (Bousseily)

- Studies on the improvement of fruit quality of French beans (<u>Phaesolus vulgaris L</u>) grown under plastic houses

15 Wael El-Tohamy Climate Modification (Ain Shams)

- Effect of mineral nutrients and mefluidide treatments on pepper seedings tolerance to chilling stress

16 Dr Gad El-Rub (Dokki)

Research by Other Scientists/Projects and Location of Work

- Dr Hamed El-Saied (Shalakan)

- Dr Abdel-Mohsen Khalil (Bousseily)
- Dr Tarek El-Ragal (Bousseily)
- Eng Amany N Karas Climate and Water (Ain Shams)

  Influence of water-stress levels on growth and development of bean (Phaseolus vulgaris) plants

- Eng Shabaan D Abdel-Aziz Agromangement (Bousseily)

- Dr Saleh Youssif (Bousseily)
- Dr Badawy Abdel-Reheam (Bousseily)

- Dr Abd El-Salam Mohamed Youssif (Bousseily)

- Eng Abdel-Aziz Sheta (Bousseily)

- Eng Ahmad Abd-Alla Abd-El-Samad (Shalakan)

- Eng Maged El-Nemer (Shalakan)

- Eng Mohamed Ibrahim (Shalakan)

- Eng Mohamed Abo-El-Soud (Shalakan)

- Eng Mohamed - Mawgoud R Abdel Marwgoud Water and Climate (Abroad)
- Evaluation of some shading materials under Egyptian condition

- Dr Saeid Zakaria Post Harvest (Bousseily)

- Eng Mahmoud A Medany Climate Modification (Abroad)

- The effect of decomposed organic materials on soil water content of some vegetables Cucumber grafting for avoiding soilborne diseases in plastic houses

Presentations by Egyptian Maryut Technical Committee Members
Meetings with Maryut Staff

Jan 15, 1995

1 Dr Awad Hussein (Maryut Project Director in Egypt and expert in post harvest)
2 Dr Shafik El-Gindy (Ornamentals)
3 Dr Abdel Aziz Sheta (Soils expert)
4 Dr Sayed M Singer (Climate Modification)
5 Dr Samir El-Abd (Vegetables)
6 Dr Mahmod Hafez (Vegetables)
7 Dr Hamdy El-Doweing (Vegetables)
8 Dr Asem Shaltant (Fruit trees)
9 Dr Ahmed Salem (Fruit trees)
10 Dr Abdel Ghany El-Gindy (Irrigation Management)
11 Introduction of staff workers of the MARYUT II Project

APPENDIX E: Meeting of Technical Stated Sub-project Objectives.

Report Prepared by Dr Mary Peet

Several projects are profiled in detail to indicate the rate of progress toward meeting technical objectives during the period 1992-1995 Material included in this section was taken from the Second, Third and Fourth CALAR Workshop Abstracts (1992-1994), handouts provided to the Evaluation Team and in some cases, on verbal information from the talks, tours and other formal and informal meetings with the scientific staff In some cases, information from the CALAR mid-term evaluation and the 1993 Workshop at Alexandria Egypt was included for purposes of comparison although only one of the Evaluation Team Members (M Peet) participated in this Evaluation and Workshop

I Agromanagement

Goal Research interests will center upon irrigation water and timing, optimal fertilizer needs type of fertilizer and quantity the use of artificial root-growth substrates optimal planting season for each crop, methods of intensive cultivation, diseases and pest control and the use of computer-aided techniques for optimal water and fertilizer application These multi-disciplinary topics will be studied to develop the appropriate agromanagement techniques for optimum production of program crops '

A Israel

Overview

In Israel at the time of this review, agromanagement research efforts are largely focused in the area of improving quality in peppers and melons to make them more competitive in the European market The domestic market in Israel is felt to be adequately or even oversupplied, and any potential for expansion lies in the export market to Europe This is a highly competitive market, however, and the market window for Israeli crops is in the winter, when European greenhouses are at an economic and quality disadvantage because of the cold and poor light Thus the areas stressed in agromanagement research in Israel are improving sugar content in melons and tomatoes, reducing defects in pepper, and improving retting in melons The work described below was conducted at the Volcani Research Institute in Bet Dagan CALAR scientists in Israel often also had funds from Maryut and Morocco projects as well as BARD and other grants I consider that overall, Israeli scientists have made rapid progress on the projects described below in both practical and scientific terms but it is important to note that non-CALAR sources of funding also contribute to the success of these projects

Melons

The goal is to develop agrotechniques to ensure high yields of high quality melons Winter-grown, non-trained melon plants yield approximately 4-6 tons per dunam Feb -March, with an early and late wave of fruit production The early wave is most profitable in terms of market price so in 1992, the problem was approached in terms of increasing early yield at the expense of late yield, if necessary They found that a lea' rea of approximately 0 25m2 (10 leaves or 0 75 m long plant) was required t, produce a high quality melon fruit during the early season To compensate for fewer fruit per plant, plant density could be increased by planting double rows of 10-leaf plants at a higher in-row density (HDDR method) Use of saline irrigation water was also investigated in melons to increase soluble solids The melon architecture and saline irrigation project was not specifically addressed in any of the later workshop papers or the evaluation abstracts, but my understanding from the verbal presentations was that the HDDR system and saline irrigation are being used commercially, both in greenhouses and outdoors, to increase soluble solids The system has been modified by letting the plants grow beyond 10 leaves to produce another fruit, as this does not depress yield or quality of the first fruit Melon architecture research in Israel is also reported in the Maryut Technical Report

The issue of sugar accumulation in melons is not specifically addressed in the 1992 workshop abstract- but was reported on at the 1993 and 1994 workshops and the 1995 evaluation The rationale for research on sugar accumulation is that understanding the biochemistry will allow genetic manipulation through classical breeding or biotechnology In Israel, melons grown during the fall and winter months for export are frequently low in total soluble sugars At least 9% TSS is required for a US#1 grade and in the typical fall-winter commercial crop, 10% of commercial melons may fall below this level In 1993, they reported that the way to increase sugar content in melons was to increase the melon's ability to accumulate sucrose At the 1994 workshop they reported that sucrose accumulation was limited by activity of the sucrose hydrolyzing enzyme, acid invertase When this enzyme was active no sucrose accumulated in the fruit Genetic variability in sucrose accumulation was correlated with how long the fruit remained on the vine after acid invertase activity shut off

Acid invertase is not the only important enzyme required for signficant sucrose accumulation to take place however Melons that accumulate sucrose are also characterized by a sugar accumulating metabolism" which includes the following enzymes alkaline invertase, sucrose synthase and sucrose phosphate synthase Although these enzymes must be present in order for significant sucrose accumulation to occur, there is no correlation between the level of activity of these enzymes and the amount of sucrose accumulated Thus, they concluded that breeding for higher levels of sucrose accumulating metabolism" enzymes would not be worthwhile Current efforts focus on understanding the molecular basis of control of the loss of invertase activity They have correlated this loss with lack of synthesis of the invertase protein in mature fruit of sugar accumulating melons, rather than inhibition of enzyme activity

Part of this project also included a study of the effect of low night temperatures on sucrose accumulation in melons Low night temperatures (12C) extend the period of fruit development significantly compared to 18C, resulting in additional sucrose accumulation by the fruit The hypothesis currently being tested is that low night temperatures during ripening extend the period of low acid invertase activity and sucrose accumulating metabolism

Summary and Conclusions The main thrust of this project is basic research on the biochemistry of sucrose accumulation in melons This objective is clearly justified on the basis of market needs, and basic studies have been conducted in tandem with the applied studies on low night temperature and plant spacing and architecture effects It seems to me a good example of basic and applied studies complementing each other, with the application to farmers in Israel clearly being considered in the design of both the basic and applied research Overall, this project impressed me as an outstanding example of a well-directed and effective research program

Tomatoes

The objective of this project as reported in the 1992 CALAR Workshop, was to determine whether the relatively restricted rooting area available to tomatoes in protected cultivation limits water and nutrient uptake, thereby limiting yield and fruit quality The question was initially approached by physically pruning root volumes to 30 or 60% of controls at various nutrient concentrations and fruit loads Reducing root volume by 60% decreased yields and plant biomass Root pruning also reduced fruit size, but increased fruit quality in terms of lowering the incidence of blotchy ripening The low N treatment (1 5 mM N vs 9 mM N) reduced vegetative dry weight, but not yield The effect of N concentration was the same at both root volumes and the effect of root volume was the same at both N concentrations Pruning to 4 fruit per cluster reduced yield 45% but increased fruit size and fruit quality in terms of lowering incidence of blotchy ripening

Other factors measured in this study were nitrogen uptake and transpiration (per plant and per unit root) and nitrogen content in plant parts Roots in pruned plants were more efficient per unit root volume in terms of both N uptake and transpiration, but not enough to compensate for the reduced root volume N content in the leaves was not significantly affected, however, so the authors believed that the reduction in growth from root pruning was not a direct result of reduced N uptake

The next phase of this study (reported in the 1993 Workshop) was to compare the results of physical restriction of intact root systems (0 4 and 1 0 l bags) with the root pruning treatment applied in the previous study Another factor, root zone temperature was added to this study to test the hypothesis that heating roots would increase water and nutrient uptake, compensating for the smaller root volume The relation of the various root treatments to fruit starch and sugar content was also measured The results were generally similar to the root pruning treatments shoot weight fruit yield and fruit size were reduced but fruit quality was increased in terms of less blossom-end rot Soluble solids (not measured in the 1992 study) were also increased As with the previous study higher nitrogen concentration increased shoot weight, but not yield Higher nitrogen concentration increased blossom-end rot, although in the previous study there was no effect High root zone temperature compensated for low air temperature in terms of fruit yield but did not affect fruit quality

As in the previous study, tissue N content was not affected by root manipulation but was increased by the higher N concentration As also seen in the root pruning study, total plant N uptake and transpiration were reduced by root restriction Starch and reducing sugar concentration in the plant increased from the lower to the upper leaves in all treatments The authors interpret this data as indicating that carbohydrates do not limit growth in root-restricted plants

In 1994, K/Ca ratios were added to the treatments imposed on root-restricted plants Increasing the K concentration from 2 5 to 10 mmol/l increased blossom-end rot (BER) while increasing the Ca concentration from 3 to 7 mmol/l decreased blossom-end rot Since BER is caused by low fruit Ca concentrations, these results are not unexpected The following findings from the two previous studies were confirmed decreasing root size decreased shoot weight fruit yield and average fruit size, and higher nutrient concentration did not compensate for decreased root size Root restriction improved fruit quality in terms of soluble solids and decreased blossom-end rot Tissue starch and soluble sugars increased in leaves throughout development even though root development stopped 120-130 days after transplanting when the plants had 5-6 trusses and 2-3 inflorescences These results suggested that the simultaneous reduction in the fruit weight of the upper trusses and the reduction in the root growth rate did not result from lack of sugars caused by a competition between fruits and root for carbohydrates

<u>Summary and Conclusions</u> The original purpose of the root volume work was to see if the root restriction imposed in protected cultivation reduced fruit yield and quality Yield was reduced in all the studies, but quality was generally improved in terms of reduced blossom-end rot and increased

soluble solids The reason for the yield reduction does not appear to be limiting N K or Ca concentration or competition for carbohydrates, since shoot concentrations of substances measured were generally not affected by root restriction Thus the mechanism of yield reduction is not clear The authors suggest that a hormonal factor originating in the fruit clusters is transported to the roots where it inhibits growth They have not succeeded, however, in identifying cultural treatments which would overcome the effects of restricted root volumes on yield The relevance of this work to protected cultivation in Israel is unclear in any case, as most of the production we saw was in the ground, rather than aeroponic (as in their experimental system) or nutrient film technique (where root volumes are also restricted) In soil systems, although plant density is high, there is no physical restriction on root growth The work is nevertheless very interesting in terms of increasing our understanding of root-shoot interactions and the control of fruit soluble solids and blossom-end rot

B Egypt

Overview

In Egypt over 30 Ph D level scientists plus numerous junior-level scientific staff and graduate students participate in the CALAR program It is thus much more difficult to describe an overall goal or focus in the agromanagement program In general however, the agromanagement program can be divided into several different areas of specialization, with numerous sub-areas The areas are characterization and prediction of water vapor exchange in greenhouses, development and optimization of alternatives to ground culture in greenhouses (hydroponics, aeroponics, sandponics and artificial media), testing of compounds to relieve the effects on seedlings of salt and cold stress optimizing temperatures and nutrition (including the use of organic and foliar fertilizers in greenhouses), utilization of water-filled plastic sleeves plastic mulch and low plastic tunnels in greenhouses This work by Egyptian scientists adresses many of the sub-project objectives listed in the original proposal

Greenhouse crops studied included snap and Romano beans, cucumbers melons, tomatoes, eggplants, oyster mushrooms, sweet and hot peppers and marigold and thyme grown for aromatic oils Some work was also on-going on outdoor crops including tissue culture of asparagus and potato and methods to induce off-season production of artichoke and Jews mallow

In some of the work such as greenhouse production of snapbean, Romano bean and large blocky peppers, the objective was clearly to fine-tune production practices or overcome production problems (such as irregular podfill in beans grown at low temperatures) so that the crop would be of export quality In most of the work, however, as with production of the smaller, narrower green pepper used for stuffing in Egypt, the domestic market would be a more likely target, and research addresses production rather than quality improvement Reducing production inputs was also addressed in several projects In the oyster mushroom work, growth on rice/legume composts blends was compared with growth on the more expensive and less available legume residues Growers were advised to install nighttime heating to 15C rather than 18C at night to improve podfill in as cost effective way as possible

Rather than describing all the work, two agromanagement projects are profiled as indicative of overall progress in agromanagement research in Egypt These are the irrigation modeling project and the oyster mushroom project (See the New Crops Section) These projects were chosen because they each represent a "systems" approach to an agromanagement problem and thus are somewhat self-contained

Irrigation management and modeling

The overall aim of this project was to document and optimize the water requirements of greenhouse crops currently grown in Egypt The main reason that protected cultivation is attractive to countries in arid regions is that water-use efficiency is higher for greenhouse crops There are several reasons for high water use efficiency First, in greenhouses the humidity is higher so there is less water loss from soil evaporation and from plant transpiration Second, yields per unit area are higher in greenhouse-grown plants because growing conditions are better and because there are more plants per unit area (greater intensity of production)

Water consumption of greenhouse and outdoor-grown crops was compared as part of this project Both indoor and outdoor environmental variables were monitored to determine the most efficient method for determining crop water requirements for greenhouse-grown plants The effects on water consumption of cultural practices such as heating, cooling, ventilation and covering the soil with plastic mulch were also studied

Investigators began by measuring potential evapotranspiration and plant water consumption in greenhouses for different regions in Egypt Although solar energy data is used to calculate potential evapotranspiration in the open field in most published work, it was felt that in arid land greenhouses, other prediction methods should also be tested Therefore several methods of predicting potential evapotranspiration were compared They concluded that the use of class A pan evaporators to calculate potential evapotranspiration was most suitable for greenhouses in arid regions Piche evaporators could also be used as a rough guide to estimate Et using a correction factor

In the published work on greenhouse-grown crops (again mostly from humid or temperate areas), evapotranspiration was also found to be closely linked to radiation because of low wind and high humidity in protected cultivation To relate temperate zone experiences to arid land greenhouses, evaporation from class A pan evaporators in plastic houses was correlated with radiation, relative humidity and inside and outside temperatures for time periods representing a wide range of evaporative demands Crops studied were peppers and carnations As expected, daily pan evaporation rates were correlated with radiation, relative humidity and temperature The investigators suggested that pan evaporation could be estimated in arid regions by measuring relative humidity

They also determined the relationship between class A pan evaporation and water vapor pressure deficit under plastic house conditions They found a higher correlation (r=0 80) between evaporation in the greenhouse and solar radiation outside the house than solar radiation inside the house (r=0 60) This was attributed to the complications of absorption and reflection from the plants and plastic in measurements made inside the house Vapor pressure deficit was the factor most highly correlated with pan evaporation inside the house (r=0 88) A formula was developed to predict pan evaporation inside the house based on a 3-day average of vapor pressure deficit (PAN=0 135*VPD3+0 261)

Summary and Conclusions This work appears to be well done and has resulted in numerous publications in the Egyptian Journal of Horticultural Science a journal with referees both inside and outside Egypt Although farmers using unheated greenhouses would have limited ability to utilize these technologies, the group is preparing charts which list water requirements for particular crops in particular areas planted in particular seasons Farmers utilizing these charts should be able to optimize plant growth without over-watering

II Environmental Modification

Goal Heating cooling, ventilation carbon-dioxide enrichment and shading the study of ways and the combination of ways that the natural influencers in protected structures can affect crop production is of utmost importance to our program The uses of unconventional heat, such as geothermal water and waste water from power plants as well as other energy-saving methods for environmental control and modifications, will be studied

A Israel

Peppers

Peppers are an important crop for export in Israel The European market demands a large fruit with excellent appearance and eating quality The physiological disorders of peppers studied were low-temperature related fruit malformation, fruit cracking, color spots and flower abscission

Environmental and cultural factors considered in evaluating the causes of these disorders included temperature, irrigation regime, nutrition, and shading

The following conclusions were reached Fruit malformation If flowers are exposed to temperatures below 18C before they reach anthesis, the fruit developing from that flower is likely to be malformed Cultivars with reduced sensitivity to fruit malformation were more sensitive to flower abscission Fruit cracking Cultivar pericarp thickness was correlated with sensitivity to cracking Night irrigation and large fluctuations between day and night temperatures increased cracking In some, but not all situations, increasing K concentrations increased fruit cracking Overall, it was suggested that cracking is due to large fluctuations in turgor pressure in pericarp cells Color spots Cultivars differed in sensitivity High nitrogen and shading increased the incidence of color spots Fruit nitrogen content was not correlated with varietal sensitivity to color spots, but the spots themselves had higher calcium levels than nearby green tissue These areas were found to contain crystals, presumably of calcium oxalate Localized variation in tissue pH are thought to contribute to crystal formation Flower abscission Cultivars that abscise fruit during periods of low light and/or high temperature were found to have less ability to accumulate starch in their ovaries during the day Shading reduced starch accumulation in the ovaries of both cultivars, but the reduction was greater in the more sensitive cultivar Cultivars did not differ in starch utilization during the night or starch accumulation in sink leaves Removing leaves reduced ovule starch and increased flower abscission The results suggest that starch accumulation in the ovules during the day is insufficient to maintain tissue respiration during the dark period especially at high night temperatures These flowers fall off under unfavorable conditions Efforts are currently underway to investigate enzymes controlling starch accumulation in the pepper flower ovules

B Egypt

See agromanagement pepper studies on effects of low temperatures

Summary and Conclusions These studies on pepper make a great contribution to our understanding of fruit disorders in general and pepper disorders in particular This information should be very useful to the growers and offers a clear conceptual framework for further studies in both peppers and other crops The research approach was focused combining hypothesis-testing and empirical approaches as appropriate to the problem Rapid progress was shown in the 5 years of the CALAR project

III Structure Selection

Goal Structure design, as well as materials for the construction of such structures are of interest In addition to glasshouses, a number of other structure types may be utilized to produce protected crops The design and selection of optimal structures for each selected crop in its regional setting, plus structures that provide the most favorable natural influencers at the most favorable cost will also be studied

A Israel

The main ongoing research activity has been the development of a solar greenhouse for out-of-season melon production Project personnel have also been active in advising growers on the use of screening to exclude whiteflies and the use of low plastic tunnels

In 1992 Workshop Reports, the solar greenhouse design consisted of plastic sleeves filled with water to act as solar collectors during the day, a plastic curtain covering the interior of the greenhouse and CO_2 enrichment to improve plant growth and to allow the houses to remain closed longer during the day CO_2 enrichment increases photosynthesis especially at high temperatures and in closed greenhouses Closure is necessary to allow temperatures inside the houses to rise sufficiently to heat the water in the plastic sleeves In the 91/92 season, the combination of water sleeves and screens raised night temperatures 5C during clear, cold nights and reduced day temperature maxima by 3C CO_2 enrichment to 1000 ppm doubled melon yields in this season

In 1993 Workshop Reports the system was improved by making the thermal screen moveable so it could be pulled over the plants at night to prevent heat loss Water sleeves were also moved to the outside of the greenhouse so they would not be shaded by the plants and to make it easier to work the plants Based on the 90/91 and 91/92 seasons 65 kg water/m2 ground area in a 4m wide tunnel and an arc-shaped thermal screen were necessary to provide sufficient night heating Air temperatures on a clear night following a clear day, were 6-7C above those outdoors Following cloudy days the improvement in night temperature was only 5C Over the 120 day growing season of the melon crop, this represented an estimated energy savings of 4 2-7 5 tons of oil CO_2 enrichment in this growing season, which was much brighter decreased total yield, although netting (and thus exportable fruit) was increased It is not clear why total yields were reduced

Research in 93-94 focused on adding an earlier and later planting date (Sept and Jan compared to November in the previous studies) The Sept and Jan plantings represented double cropping in the same greenhouse Yields were 3 2, 3 5 and 5 6 kg/m^2 for the 3 planting dates, respectively Other factors in this study included comparison of 2 vs 1 plants per pot and 4m x 11m structures with 9m x 18m structures Each treatment began yielding approximately 80 days after planting Fruit could thus be harvested over almost all of the December to May period of high fruit prices

A 500 m^2 solar greenhouse similar to the research structure was used in the Arava Valley in the winter of 1994 Compared with non-heated melons, the percentage of exportable fruits was markedly increased Performance of this full-size tunnel was found to be adequately predicted by the smaller research units at the Desert Research Institute

This design has since been modified to separate the greenhouse into a plant growing center and an energy center The plant growing area has a moveable thermal screen which can be ventilated during the day to cool the plants and an energy center for the plastic sleeves that can be heated to high temperatures during the day without over-heating the plants This system also allowed heat dissipation from the sleeves to the plant center to be delayed until the crop section needs heating, usually about midnight When temperatures in the plant center fall below the programmed level a moveable screen with reflective surfaces is lowered and heat moves from the plastic sleeves either by natural ventilation (current design) or by forced ventilation CO_2 enrichment could only be used in this system during the periods of the day when the crop section was not being ventilated, as is also true in a conventional greenhouse

In the 93/94 version of the energy center, an area of 2 5 x 1 m on the side of the house was allocated to the water sleeves In the current version (94/95) the diameter of the plastic sleeves has been reduced to 0 12 m and the sleeves are placed on special platforms which rise above the ground like bleachers This arrangement reduces the 30% conductive heat losses to the ground and increass surface heat transfer per unit volume of heat storage water more than threefold Energy centers are also present on both sides of the greenhouse

Summary and Conclusions This is a very interesting project and represents a clear progression over time in the sophistication of structural design and function Engineering and plant factors have been well integrated as have market demand factors The final design model (94/95) is very sophisticated Special structures are necessary to hold the sleeves automated and motorized screens separate the plant growing and energy centers of the house and moveable thermal screens and ventilation are provided for the plant growing center It would be interesting to compare the capital and operating costs of this system with a conventional house with propane gas or other heating system at current and future predicted energy prices

B Egypt

Work on the agromanagement irrigation modelling project is also relevant here Water-filled plastic sleeves were being used in a few of the El Bousseilly greenhouses but no specific data were reported on their performance Work was also underway on the use of plastic mulch and low plastic tunnels in greenhouses and in the field Again, however, specific data on performance were not presented

IV Genetic modification

Goal Experiments with genetic modification in selected crops will be undertaken so as to optimize these crops for protected production within the framework of the Program

A Israel

Melons

The most favorable period for melon export to Europe in terms of prices is Dec -April During this period, however, low temperatures limit growth in unheated plastic houses which is felt to be the most economical production system Minimum temperatures are about 6C, compared to 13C in heated houses The objective of the cold-tolerance breeder program is to develop a melon that would perform well at low night temperatures The methodology includes attempting to identify selection traits for classical breeding and a method described as an ideotype approach In the ideotype approach, lines were selected under low temperatures for traits such as rapid vegetative growth few female flowers good pollen viability good fruit size and appearance and lack of yellow leaves The first two years of work on the program concentrated on testing selection criteria and classifying genotypes for cold tolerance Hybrids were produced between two tolerant cultivars or one tolerant and one sensitive cultivar In years 3 and 4, other selection traits were investigated and crosses tested for growth rates, biomass production female flower production, leaf color and chlorophyll, pollen viability fruit set fruit size and appearance yield, and fruit quality Hybrids produced in the program were reported to have a faster growth rate and fewer female flowers Percentage fruit set and fruit number per plant were the same however Hybrids and parental lines did not differ in leaf color and chlorophyll or fruit quality Of the selection traits originally used percentage fruit set and mean fruit weight per plant were better than the others in distinguishing between cold sensitive and cold tolerant lines and should serve as good selection criteria for breeding cold tolerance in melons

Summary and Conclusion The ideas and ideotype breeding approach presented were very interesting and potentially valuable in breeding for stress tolerance in all crops Cold-tolerant hybrids are being grown in the early model solar greenhouse described in the Structure Selection Section of this Appendix, indicating good integration between CALAR projects As with most breeding projects development of commercial cultivars is an unrealistic goal for a 5-year project No quantitative data were given as to performance of the current hybrids relative to industry standards, but in qualitative terms progress was indicated by the investigators

Tomato

Indeterminate greenhouse tomato lines tolerant to the tomato yellow curled leaf virus are being developed as part of this project and are now being improved in terms of incorporating larger fruit size and higher soluble solids Field lines (determinates) are already available from previous work and are being used as sources of resistance Lines developed are not resistant to the virus, however They must be protected from infection until transplanted When infected they produce less than uninfected controls, but more than those lacking tolerance Experimental F1 lines of this cultivar will be available in spring 1996 We were told that over 200 kg of seed of the tolerant field crop was sold in Egypt last year

Summary and Conclusion Tolerance to this virus is very important in open field cultivation in both Israel and Egypt Most greenhouses are protected with netting and sealed entry areas to keep out whiteflies but even so virus resistance was felt to be important for greenhouse as well as field plants The open field material with resistance is apparently widely grown in Israel, but it was not clear how well it was doing in Egypt It is not included on the Ministry of Agriculture list of registered cultivars at this time To be registered requires at least 3 years of testing It was suggested by Egyptian scientists that it does not confer sufficient tolerance to the strain of the virus found in Egypt Although this is an internal policy matter in Egypt, the lack of cultivars sold elsewhere on the open market in Egypt was seen by the team as a serious limitation to agricultural progress and a potential source of conflict between the two countries Certainly it also encourages seed smuggling and loss of control of seed quality by the seed distributor It would be useful to have statistics on the use of these virus tolerant lines based on seed sales in Israel, Egypt, and Morocco

B Egypt

There is an active breeding program for disease resistance in cucumbers, but no data were provided on lines released or resistance relative to commercial lines

V Post-Harvest Aspects

Goal Program studies regarding post-harvest aspects will include but not be limited to optimal harvest date effects of post-harvest cooling investigation of different methods to extend shelf life packaging methods environmental control for storage, and marketing and economic assessment

A Israel

The Israeli work in this area was mainly focused on using various pre-harvest treatments (agromanagement) to increase soluble solids an important quality factor for the European market This work has been discussed in the Agromanagement section

B Egypt

Post-harvest

Post-harvest studies in Egypt concentrated on the ripening characteristics of tomatoes These studies were reported in 1992, but do not appear in the 1993 or 1994 workshops No material was presented on these topics at the evaluation so it may not be a currently active research area Endogenous ethylene levels were compared in different tissues in the tomato fruit By sampling for ethylene within 15 minutes of excision the effect of wound ethylene could be avoided At the mature green stage, ethylene production was similar in all tissues At the breaker stage, however, the inner tissue of the tomato (columella) produced the most ethylene, followed by the blossom end tissue followed by the pericarp and stem At the red-ripe stage, ethylene production was highest in the outer pericarp tissue probably because this tissue was entering the climateric after the other tissues These data suggest that ripening occurs from the inside of the fruit to the outside

In another study of post-harvest characteristics of tomatoes, various ripening indices were compared in a normally ripening line and 3 ripening-inhibited lines nor, rin, and NR Fruit from the nor and rin lines showed no evidence of the physiological changes associated with ripening except for a slight rise in an ethylene precursor ACC, in 'overripe" nor fruit and a slight rise in ethylene in mature nor and rin fruit NR fruit showed a climateric ripening pattern more characteristic of normal ripening, but at rates only half as great ACC levels were much higher and ethylene slightly higher than in the normally ripening tomato, however,

EDTA was added to the nutrient solution as a chelator of cations to determine its effect on ripening patterns in mature and normally ripening tomatoes Effects were minimal in the NR and normally ripening tomatoes, although ethylene production in the NR line was reduced by 30% Adding EDTA to the nor and rin lines, however induced an almost-normal color change and the rin line began to soften and produce CO_2, ACC and ethylene The authors felt that this effect demonstrated a link between the chelation of divalent cations such as calcium and the induction of the climacteric ripening pattern in tomatoes

In a third study of the post-harvest characteristics of tomatoes, the effect of high temperatures on ethylene biosynthesis was examined Increasing temperature for 15 to 30 linearly increased fruit CO_2 production, but ethylene production was greatest at 20C The inhibition of ethylene synthesis at temperatures over 30 was attributed to a reduction in ACC synthesis At 35C both ACC synthesis and conversion to C2H4 were inhibited

Summary and Conclusions The work is interesting and appears to be well done Although not directly applied to post-harvest problems of farmers, it builds a base of expertise to solve applied problems that arive and to utilize existing post-harvest technology

VI Floriculture and New Crops

Goal 'To develop new, high value commercial crops for the export market using new techniques and new methods that are cost-effective and suitable for farmers in the region

A Israel

Climbing cactus (pitaya)

Pitaya is grown in Nicaragua, Colombia and Vietnam, but in the Negev outdoor light was too high and temperatures too low for good growth and fruitset during the desired market window Research at the Desert Research Institute has concentrated on the best way to grow pitayas in greenhouses Shadings of 30,60 and 90% were compared and the least shading found to lead to the most growth CO_2 enrichment to 1000 ppm was found to increase net carbon exchange by 30%, mostly in the late afternoons, night, and early morning The use of CO_2 enrichment with this crop was particularly interesting because most greenhouse-grown crops only respond to CO_2 enrichment applied during the day Pitaya is a CAM plant and can be CO_2 enriched at night At night the greenhouse is closed to retain heat and CO_2 could easily be added In a mild winter climate, such as Israel greenhouses must be vented during the day to reduce temperatures thus ar CO_2 added to the crop is lost to the outside Thirty percent increases in photosynthesis suggest that yield increases might occur with nightly CO_2 enrichment Whether many Israeli growers would find it economical to apply night enrichment is another question, but the prospect is potentially attractive, because if the enrichment were part of the heating system both the heat and CO_2 generated would be valuable, unlike daytime CO_2 enrichment when the extra heat is undesirable The effects of enrichment on yield were not reported however and would obviously factor in any decisions on enrichment

The pollination requirements (self vs cross-pollination) were also investigated Some, but not all species were found to require cross-pollination Bee pollination was partially effective, but fruitset and fruit weight were lower than in hand-pollinated treatments Currently producers use hand-pollination because of the high value of the fruit, but ways of improving the efficiency of bee pollination are being studied Variety trials and collection of new materials are also continuing

Summary and conclusions Since there is considerable competition in the European market from open-field grown fruit from Columbia, it is unclear how long the greenhouse-grown fruits will be competitive The investigators, however report that more than 10 ha of pitaya have already been planted in Israel under either nethouse or greenhouse conditions, indicating that for the present the crop has economic potential Research on improving fruit color and size may also provide a competitive edge on field-grown material Market windows may also be explored

Eucalyptus and other ornamentals for use as decorative branches

This program is looking specifically for eucalyptus and other species with the following characteristics decorative when cut, can tolerate saline water, branches relatively light so they can be air-freighted, and good post-harvest characteristics Plants viewed by the team were very attractive and seemed to have good commercial potential In the trials at Ramat Negev, plants were placed in blocks with 4 levels of salinity Of the eight tree and eight shrub species tested all did well under saline treatments except for 2 species in which none of the plants did well including control Export trials are currently underway to determine feed-back information on how these branches are received in the European market

Cut flowers

Research is underway on new crops for the cut flower industry Protocols for producing such standard greenhouse flower crops as roses and carnations are considered to be already available In any case, it is not clear how long Israel can be competitive in standard crops relative to countries with low labor costs Currently, the main 2 crops receiving attention are the wax flower (Chamaelaucium uncinatum) and the butterfly flower (Asclepias tuberosum) Researchers have concentrated on altering the natural photoperiods to bring the crop on the market during the period of peak prices in Europe Heliconia cultivars were also selected and growing environments optimized for production Although progress was made in this area, the Israeli personnel involved in the project felt the flowering stalks were not light enough to be air-freighted economically to Europe Presumably successful cultivars could be grown for the local and hotel trade, however

Other species of flowers recently included in this research include Metalesia, Callicarpa and Ixora Studies of bulb forcing were also underway with Nerine baudenii, Hippeastrum, Orntogalum dabium and Pondopialla

Summary and Conclusions Continually testing new species of both ornamental shrubs and cut flowers and refining production techniques should allow Israeli growers to keep exporting cut flowers and ornamentals even though their labor costs are high The extension infrastructure and grower expertise are in place to allow technologies developed to move into the industry Both the ornamentals and cut flower research seems in-tune with the needs of the industry and well-designed in terms of improving production practices and saline water utilization

B Egypt

Oyster mushrooms

This study was conducted at the Dokki Protected Cultivation Center, ARC, Cairo but crops were also grown in greenhouses at El Bousseilly Mushroom cultivation offers farmers an opportunity to grow a high-value crop on small acreage using agricultural wastes There are 30 million tons of agricultural wastes produced annually in Egypt, some of which can be used as a compost for mushroom production Town refuse is also being investigated as a potential compost We were told that 3 farmers and 600 graduates are currently producing oyster mushrooms The overall goals of the project are to test various compost blends for mushroom yield, compare various production systems for cost and efficiecy, produce the type of Pleurotus preferred by tourists, and produce sufficient Pleurotus spawn for further propogation In the experiment reported at the 1993 Workshop, residue combinations were soaked overnight in water at ambient temperatures For the last 2h, temperatures were raised to 80-85C Residues were then placed in black plastic bags holding 3 kg each and placed in greenhouses to incubate at 25C (+ or - 2C) at 75% relative humidity When mycelial development was sufficient, the plastic was removed from around the residues and relative humidity raised to 85% The highest yield 1 990 2 g, fresh mushrooms/kg dry substrate, was found on the 50% rice straw/50% legume residue blend Other recommendations for growth of Pleurotus are pH 5-7 and 65%-80% substrate moisture content Substrates can vary but Pleurotus requires materials containing cellulose, sugars proteins, and lipids for growth

Summary and Conclusions These studies seem to have been well done and interesting Several Israeli scientists and 2 kibbutz members visited with the scientist involved to learn more about the production practices for potential production on the kibbutz in Israel

VII General Summary

Several studies were conducted in Egypt on post harvest characteristics of tomatoes These studies described the ripening characteristics of various parts of the tomato fruit, concluding that ripening occurred from the inside out In another series of experiments, ripening characteristics of normal and ripening-inhibited tomato mutants were compared, with and without the addition of a cationic chelator (EDTA) nutrient solution Production of CO_2, ACC and ethylene was reduced in all the ripening inhibited lines Adding EDTA to the nutrient solution restored some of the ripening characteristics to the rin and nor lines The effect of temperature on ripening characteristics was also measured Respiration increased linearly up to 30C, while ethylene production was greatest at 20C Inhibition of ethylene synthesis at temperatures over 30C was attributed to a reduction in ACC synthesis

APPENDIX F: CALAR Travel Summaries

CALAR II Travel Summaries, April 1990-December 1994
Egyptian and Israeli (Excludes Workshops)

Year	Dates	Name	Purpose
1990	July 22-Aug 7	Mohamed El-Beltagy	Desert Conf Beijing
	July 22-Aug 7	Ayman Abou-Hadid	Desert Conf Beijing
1991	March 10-April 7	Mohamed Hashim	Plant Breed Symp NC/Cornell Univ /San Diego/UCDavis
	March 10 April 7	Hamed Mazied	Plant Breed Symp NC/Cornell Univ /San Diego/UCDavis/Irrigation Utah
	March 10 April 7	Hamdy El-Downey	Plant Breed Symp NC/Cornell Univ /San Diego/UCDavis/Irrigation Utah
	March 10-April 7	Dia Hassanien	Plant Breed Symp NC/Cornell Univ /San Diego/UCDavis/Irrigation Utah
	April	Mohamed Hashim	Agricultural Management Meet Agadir
	May 5 18	Abdel Aziz Sheta	Beltsville Symp MD/Univ of MD/San Diego/US Salinity Lab Riverside/Univ of AZ
	August 15 30	Ayman Abou-Hadid	Wye College UK/London/Avignon France
	August 21-30	Mohamed Medany	London/Avignon
	Nov 91 Feb 92	Sayed Singer	Univ of Minnesota
1992	Feb 13-26	Ayman Abou-Hadid	Salt Symp Bangkok
	Feb 13-26	Mohamed El-Beltagy	Salt Symp Bangkok
	March 3-6	60 Egyptian Scientists	ISHS Conf Cairo
	March 8-12	Mahmoud Hafez	New Crops Conf Jerusalem
	March 8-12	Baki El Sawy	New Crops Conf Jerusalem
	March 8-12	Murdi Ata Ali	New Crops Conf Jerusalem
	March 8-12	Salah Mohamedien	New Crops Conf Jerusalem
	March 18 22	Ben Ami Bravdo	Sci Vis to Cairo
	April July	Mohamed Zahow	Modeling/Simulation Conf Pittsburgh/US Salinity Lab Riverside CA
	August 19-Sept 3	Mohamed El Beltagy	Wye College UK
	July 1-11	Refaat Helal	INRA Climatologic Conf Avignon/Eucarpia Cong Angers France
	July 10 - 20	Abdel-Aziz Sheta	Agricultural Research Inst Netherlands
	July 10 20	Mohamed Edris	Agricultural Research Inst Netherlands
	July 10 20	Hamed El-Saeed	Agricultural Research Inst Netherlands
	July 10 - 20	Magdy Wadeed	Agricultural Research Inst Netherlands

Year	Dates	Name	Purpose
	July 10 - 20	Mohamed Saleh	Agncultural Research Inst Netherlands
	July 10 - 20	Mahmoud Hafez	Agncultural Research Inst Netherlands
	July 10 20	Samı Abdel-Gawad	Agncultural Research Inst Netherlands
	July 10 20	Zakı Hegab	Agncultural Research Inst Netherlands
	July 10 - 26	Mahmoud Medany	Agncultural Research Inst Netherlands / Transplant Symp Yokohama
	July 31-August 7	Zakı Lacheene	Am Soc Horticultural Scıence Conf Honolulu
	July 31-August 18	Mohamed El-Beltagy	Am Soc Horticultural Scıence Conf Honolulu/ Wye College UK
	July 6-August 15	Mostafa Mostafa	Irngatıon Management Servıces Conf Casa Grande AZ
	August 17 29	Ayman Abou-Hadıc	UCBerkeley/Ohıo State/Steenng Comm San Dıego
	August 28 Oct 1	Abdallah Hefny Omer	Scı Vıs Unıv of MD
	Sept 9 Oct 1	Hamdy El-Downey	Scı Vıs Unıv of Wısconsın/Cucurbıt conf NC/NY State Agncult Center
	Sept 16-Oct 22	Wafaa El-Gındy	Unıv of MD/Vısıts to nurseries ın No CA/UCDavıs
	Sept 92 Apnl 93	Gamal Rahman	Scı vıs Ohıo State/Prof Plant Growers Mtg Mıch/Am Soc Ag Eng MTg Nashvılle
	Oct 6 16	Adel El Beltagy	AID WDC/Unıv of Anzona Tucson/San Dıego/ UCDavıds/WDC
	Oct 6 16	Abdel-Azım El-Gazaar	AID WDC/Unıv of Anzona Tucson/San Dıego/ UCDavıds/WDC
	Oct 27-Nov 8	Zakı El Sawı	Wye College UK/Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx
	Oct 19 Nov 8	Ayman Abou-Haıdı	Soıl Meet Cyprus/Horticultural Scı Meet Tucson/Irngatıon Meet Phoenıx/UCDavıs
	Nov 4 8	Mohamed Hashım	Soıl Meet Cyprus/Horticultural Scı Meet Tucson/Irngatıon Meet Phoenıx/UCDavıs
	Nov 4 8	Usama El Behaıry	Soıl Meet Cyprus/Horticultural Scı Meet Tucson/Irngatıon Meet Phoenıx/UCDavıs
	Nov 4 - 8	Hamdy El-Downey	Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx
	Nov 4 8	Mohamed Hafez	Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx
	Nov 4 8	Salah Mohamedıen	Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx
	Nov 4 8	Tarek El Raggaı	Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx
	Nov 4 - 8	Mohamed Medany	Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx
	Nov 4 - 8	Adel El-Beltagy	Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx
	Nov 4 8	Abdel Ghany El Gındy	Horticultural Scı Meetıng Tucson/Irngatıon Meetıng Phoenıx

Year	Dates	Name	Purpose
	Nov 4 - 8	Abou El-Fettoh Abdallah	Horticultural Sci Meeting Tucson/Irrigation Meeting Phoenix
1993	April 12 May 4	Ayman Abou-Hadid	ISHS Symp Turkey/Sci vis Rome/Cultivar Symp Caglian IT/Wye College UK
	April 12-May 1	Usama El-Behairy	ISHS Symp Turkey/Sci vis Rome/Cultivar Symp Caglian IT
	April 12 May 4	Mohamed El-Beltagy	ISHS Symp Turkey/Sci vis Rome/Cultivar Symp Caglian IT/Wye College UK
	April 12 May 1	Mohamed El-Shinawy	ISHS Symp Turkey/Sci vis Rome/Cultivar Symp Caglian IT
	April 12 May 1	Mahmoud Saleh	ISHS Symp Turkey/Sci vis Rome/Cultivar Symp Caglian IT
	May 3 9	Sayed Abdel-Al	Agritech Meeting Israel
	May 3 9	Mohamed Abdel-Aziz	Agritech Meeting Israel
	May 3 - 9	Helmie Abou-Naga	Agritech Meeting Israel
	May 3 - 9	Ahmed Ahmed	Agritech Meeting Israel
	May 3 - 9	Amin Mohye El-Din	Agritech Meeting Israel
	May 3 9	Salah El-Din Hashim	Agritech Meeting Israel
	May 3 - 9	Mahmoud El-Hanbaly	Agritech Meeting Israel
	May 3 9	Khamis El-Okby	Agritech Meeting Israel
	May 3 9	Abdel Fattah El-Serafi	Agritech Meeting Israel
	May 3 9	Mohamed El-Shafii	Agritech Meeting Israel
	May 3 9	Ahmed El-Zuhairy	Agritech Meeting Israel
	May 3 - 9	Adel Kader	Agritech Meeting Israel
	May 3 - 9	Ahmed Nasef	Agritech Meeting Israel
	May 3 - 9	Avi Nerd	Agritech Meeting Israel
	May 3 - 9	Dov Pastemak	Agritech Meeting Israel
	May 3 - 9	Irit Rylski	Agritech Meeting Israel
	May 3 9	Ali Saleh	Agritech Meeting Israel
	May 3 9	Dov Sitton	Agritech Meeting Israel
	May 3 9	Mohamed Ibrahim	Agritech Meeting Israel
	May 3 9	Mohamed Khalifa	Agritech Meeting Israel
	May 3 9	Mohamed Soliman	Agritech Meeting Israel
	May 3 - 9	Mustafa Mohamed	Agritech Meeting Israel
	May 3 - 9	Zaki Abdel-Halim Hegab	Agritech Meeting Israel
	May 10 21	Mahmoud Medany	Computer simulation Muscel Shoals Alabama
	July 13 August 3	Ayman Abou-hadid	Sci vis Wye College UK/Texas A&M/SDSDUF/Int'l Conf Desert Dev Mexico City
	July 93-July 94	Wael El-Tohamy	Sci vis to Univ of Minnesota
	Oct 8 - 27	Magdy Awad	Sci vis to Ohio State

Year	Dates	Name	Purpose
	Nov 22 - 25	Yomna Helmy	Desert Symp Bahraın
199 4	Jan 15 - 22	Mordy Atta Aly	Postharvest Symp Agadır
	Jan 3 - 10	Mohamed El-Hamalawy	Managenal Mtg ın Caıro
	Jan 3 - 10	Mohamed Rahman	Managenal Mtg ın Caıro
	Jan 3 - 10	Dov Pastemak	Managenal Mtg ın Caıro
	Feb 94-Feb 95	Abdel Mawgoud	Scı vıs to UCDavıs
	Feb 7	Usama Behaıry	Scı vıs to Wye College UK
	May 16 - 19	Yosef Bendov	Unıv of Anzona ınjunctıon wıth Workshop
	May 8 10	Samır El-Abd	UCDavıs ınjunctıon wıth Workshop
	August 14 - 30	Ayman Abou Hadıd	Int l Hortıculture Conf Kyato Japan
	Sept 3 - 11	Ayman Abou-Hadıd	Conf Land & Water Barı IT/Inst for Hort Crops Rome