ANNUAL TECHNICAL REPORT

October 1, 1995 - September 30, 1996

Moroccan Cooperative Agricultural Development Project

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This Annual Technical Report for the Moroccan Cooperative Agricultural Development Project was prepared by the San Diego State University Foundation utilizing input from participants in the Kingdom of Morocco, the State of Israel and the United States of America.

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OVERVIEW

Project Description

The Moroccan Cooperative Agricultural Development Project is funded by the Agency for International Development Bureau for the Near East. Initiated July 1, 1992, the Moroccan Project is being accomplished by participants from the Kingdom of Morocco, the State of Israel and the United States of America and is designed to meet a number of national development priorities set by the governments of Morocco and Israel.

The goal of the project is to promote world peace through cooperation in agriculture. Specific objectives are to contribute to the development of Morocco's agricultural sector by the introduction of new technology, training and demonstration. The project constitutes a new stage in the Middle East Regional Cooperation program, introducing a new partner with Israel and the United States.

Accomplishments

Progress in comparison with the work plan and in comparison to the goals and objectives outlined in our original proposal, has been satisfactory for the period of October 1, 1995 - September 30, 1996. Accomplishments during this report period include:

General

- Moroccan collaborators, Mr. Driss Lahlou and Mr. Karim Lahlou, met with SDSU Foundation staff in San Diego in October 1995 to review progress of project activities in Azemour and Agadir related to Technical Committee recommendations; another meeting was held in September 1996 to review accomplishments and work plans;
- Project coordinators met in Casablanca, Morocco in December 1995 to evaluate project activities in Azemour and Agadir; to develop work plans for the fifth year of the project based on recommendations made by the External Evaluation committee and the project's Technical Committee; and to prepare a request for continued funding for USAID; the coordinators visited the project sites in Azemour and Agadir;
- The Project, with Hassan II Institute in Agadir, sponsored a joint multinational horticulture seminar on April 15, 1996; presentations were given by the project Technical Committee members as well as scientists from Hassan II Institute; there were approximately 300 who attended the seminar including farmers, exporters and scientists; the seminar was organized by Maghreb Agriculture; a site visit to Amaris nurseries was made; an article about the seminar was published in, *"Le Monde Agricole"* in June 1996 (see Attachment A);
- Technical Committee members met prior to the seminar in April to review and revise the plans for the final year of the program;
- Contract required reports were submitted to USAID; informational meetings and calls with USAID project officers in Washington, D.C. and Rabat, Morocco were held;
- Spring 1996 newsletter was prepared and distributed;

Specific technical accomplishments, in comparison to stated objectives, are detailed in the next section entitled, "Progress Report."

PROGRESS REPORT
for
MOROCCO

October 1, 1995 - September 30, 1996

The following is a summary of the **Objectives** for each activity that is to be carried out at the project site in Azemour, as detailed in the grant. Following the description of each objective is a **Progress Report to Date.** The progress report covers the period from **October 1, 1995 - September 30, 1996.**

TRANSPLANT NURSERY

Objective:

The high root/shoot ratio production by transplant seedling technology allows for optimal production from drip irrigation and a high rate of germination of expensive hybrid seeds. Planting of transplant seedlings one month later than direct field sowing reduces environmental stress on the plants and results in savings of water, fertilizer, herbicides and field preparation. Thus, introduction of this technology is intended to result in yield gains and cost savings to the vegetable industry.

A transplant nursery will be erected in phases, with an initial capacity of one million seedlings per rotation supplied to farms in the target region. The size will increase five-fold during the project period. This activity is intended to influence the construction of similar nurseries in the country.

The nursery will specialize in the production of tomatoes, peppers, cucumbers, melons, and other crops to be identified. Experimentation will be directed towards the evaluation of locally produced growing media, utilization of fertilizers from various sources, and refinement of irrigation and management.

Progress to Date:

- continued development of the marketing strategy, established contacts for sales, provided support services (pre and post sales) to clients of Amaris Nurseries in Agadir and Azemour;
- continued marketing of transplants in Azemour and Agadir;
- continued provision of follow-up assistance to clients;
- developed additional marketing brochures; prepared informational articles for agricultural newspapers in the region in Arabic and in French; published article about the multinational seminar and visit to the Amaris Nurseries in Ait Melloul *(see Attachment A);* prepared other promotional literature *(see Attachment B);*

- marketing in winter months was targeted at the small producers and local markets; summer targets was large producers and the export market;
- in Ait Melloul (Agadir) orders realized included 20,000 tomato transplants in October, 20,000 melon transplants in December, and 200,000 transplants for the spring of 1996; summer orders included ½ million transplants for each of two cycles - 90% of the orders were tomatoes; the remaining orders were for peppers, eggplants and hot peppers; *(see Attachment C for the September activity reports for Agadir and Azemour);*
- in response to the demand for transplant materials in the Agadir region, one Israeli greenhouse was moved from Azemour to Agadir; *(see Attachment D for a letter of Commendation from a farmer client);*
- completed the installation of necessary equipment for the greenhouse in Agadir; constructed a new germination room in Agadir; installed a new irrigation pump; and revised the irrigation and fertigation programs in order to improve the plant growth;
- in Azemour, one million tomato and melon transplants were produced in June and repeat orders were made for July and August; by mid August, transplants produced included an additional 1,200,000 tomatoes, 125,000 artichokes, 22,000 peppers and 15,000 melons;
- improve technical capabilities and marketing of watermelon, pepper, and melons for transplant sales;
- conducted tests in Agadir transplant nursery to evaluate the optimal production and management practices.

POT-PLANT NURSERY

Objective:

This activity is seeking to utilize Morocco's comparative advantage of mild winter temperatures, high level of radiation, and low labor costs to (a) compete for markets in Europe and neighboring countries and (b) expand the local market. The facility is also producing low cost, quality starters for the local market.

The pot-plant nursery is generating two types of products: rooted seedlings and finished pot-plants. It includes both a mother plantation and a production unit. The mother plantation, based on the highest quality species available, provides propagation material for the production unit. The production nursery is divided into a rooting section and a pot-plant production section.

Linkages will be developed with leading European nurseries, and ornamental lines, mostly rooted seedlings, will be produced according to orders from these nurseries. Production for the local market is concentrated on a line of easy to

produce plants, with high quality seedlings being made available to local pot-plant producers and finished pot-plants also being produced.

Experiments includes the effects of dwarfing agents, utilization of local materials for plant growth medium, nutrition, and optimization of light and temperature. The nursery will be used for on-the-job training of a large number of farmers in the art of pot-plant production. It will also assist Moroccan farmers who wish to start their own nurseries.

Progress to Date:

- based on the recommendations of the Technical Committee in August 1995, the pot-plants were sold; all future ornamental plants grown in the nursery will be rooted cuttings - these cuttings will be sold to local nurseries for a year in order to build a local market; then, rooted cuttings will be exported;
- contacts with local nurseries were made;
- product samples were distributed to local nurseries;
- the classification system of plants was improved;
- a second greenhouse was prepared for mother plants; 10 varieties of mother plants were put in the ground for propagation of rooted cuttings;
- an irrigation system was installed in the second greenhouse; shade netting was installed;
- started marketing rooted cuttings but there were very few sales because the local nurseries are used to purchasing flowers and plants for immediate use not rooted cuttings for propagation;
- current attempts are being made to contact local nurseries in order to produce ornamentals for direct sales (interior and exterior plants); Mr. El Fahdi of "Eve" landscape company, purchased 15,700 ornamental plants;
- experiments in rooted cuttings of raspberries were initiated and selected cuttings of strelitzia (500) were put in pots in the nursery; the strelitizia did not do well in the nursery so future propagation will be open-field;
- tests on a variety of bush seeds were made including: eucalyptus, accacia, cypress; cuttings were made of geranium, sheflera and others; propagation of seedlings of sheflera, dracaena, melaleuca and ficus were begun;

OPEN-FIELD PRODUCTION OF ORNAMENTALS

Objective:

This activity is focusing on the production of hardy woody ornamentals since (a) out-of-doors production of ornamental is attractive to small farmers due to low investment requirements, and (b) this segment of the ornamental industry is little known in Morocco. The project is concentrating on three species of melaleuca.

Trials on the 2-hectare site are devised to produce optimal irrigation and fertilization regimes and post-harvest treatment.

Progress to Date:

- the Strelitzia field was weeded, cleaned and selected plants put into the pot-plant nursery (see above);
- continued development of melaleuca; test with saline water irrigation has been successful; continued to weed and mulch the fields with black plastic;
- market evaluations were initiated in France, Switzerland and Canada with good results in Canada but shipping costs proved to be too high; further market testing in Europe will be done;
- three experiments were made with melaleuca cuttings; eucalyptus seedlings were re-potted.

OPEN-FIELD and GREENHOUSE EXPERIMENTS WITH VEGETABLES

Objective:

This component includes experimentation, demonstration, and application of modern methodologies and technologies of open-field-crop production, addressing parameters of crop rotation, soil preparation, manuring and basic fertilization, seed-bed preparation, irrigation, herbicide application, flowering manipulation, planting, fertigation, insect and disease prevention and controls, pollination, harvest timing, and post-harvest treatment.

The activity will seek to introduce a range of species and cultivars of vegetables for the processing industry. The main crops to be tested, improved and disseminated are fresh salad tomatoes and melons, cucumbers, and artichokes. Varietal trials for each group is being thoroughly assessed.

Progress to Date:

- **asparagus** field was cleaned and cut for renewed bunches; a spraying program was initiated to control rust; the field was mulched with black plastic to prevent the development of nut grass; the asparagus did not sell well in the local markets so other markets will need to be identified;
- **raspberries** were cleaned and left in dormancy; in the summer, the fertigation program was evaluated in order to improve the plant quality; the raspberries were having a problem with too much salinity;
- **artichokes** were rogued and consolidated by variety into one field of 1000 square meters; a growth substance was applied for off-season flowering; saline water was applied; in June, selected artichoke suckers were planted in open-fields;
- **tomatoes** varieties will continue to be planted for observation of varietal performance; ten nematode resistant varieties were tested in greenhouses;
- **grafting vegetable crops** techniques are being examined and performed on a trial basis to determine the adaptability of this technique for Morocco *(see Attachment E for a summary of the trial proposal).*

TRAINING AND EXTENSION

Objective:

Training at the Azemour Project Site

All training at the project site will be carried out by a cadre of 10-15 Moroccan extension workers, drawing also on professionals from the Hassan II Institute of Agriculture and Veterinary Medicine and from the National Institute for Agricultural Research. Groups of farmers and farm technicians will be selected for extended on-the-job training at the project site in Azemour. Training will be provided on agronomic topics of general importance, and a training plan will be developed for each component. The Technical Committee will design the training, evaluate its effectiveness, and advise on equipment needs.
Short-term Project Site Courses of up to one week will be given on topics related to site activities.

Extension Program

In addition to providing training as discussed above, the extension specialists will conduct an advisory service to farmers who cooperate with the project. They will be employed by the project and will work in various activities; their extension work will be in addition to their every-day job obligations.
Extension will be carried out in at least three areas; plant protection, vegetables and ornamental production. The extension program will be devised by the Technical Committee.

Progress to Date:

- **weekly meetings** are held at the farm in Azemour with technicians and the farm manager to review plans and provide in-depth discussion and direction; weekly meetings are held with the Moroccan Project Coordinator, the Israeli Technical Advisor and the Moroccan Farm Manager; weekly meetings in Agadir are being initiated;
- **extension** and information on transplants and production techniques are being provided to growers through the marketing and sales activities; meetings have been held in the Agadir offices with wholesalers and retailers of seeds and farm supplies in order to encourage them to contract with Amaris to produce the transplants which in turn will be sold to the local farmers;
- **visits** to the project site are made by local farmers and potential clients; in Agadir the marketing coordinator visits the local farms;
- **publications** and informational bulletins have been produced and distributed to local farmers; articles about Amaris were published in local newspapers (see copies of articles from "*Le Monde Agricole*" in Attachments A & B);
- **seminar** by project technical experts from Morocco, Israel and the U.S. was accomplished in collaboration with Hassan II Institute in Agadir on Marketing and Horticulture Production Techniques on April 15, 1996 *(see Attachment A for a copy of press coverage for this seminar);* 300 farmers, exporters and scientists in the region attended;
- **training** of students from Moroccan agricultural institutes takes place on both sites; there have been 11 trainees working at the Azemour for up to three months each since January 1995; in Agadir 3 trainees have worked at the site - 2 from Hassan II Institute and one from a local agricultural institute; Amaris Nurseries is collaborating with the Moroccan extension service in Azemour to establish an on-going training program for student technicians from the Settat, Marrakech and Khouribga agricultural schools - additional trainees will begin in October 1996; *(see Attachment I for a list of the students who have received training at Amaris during 1995-1996);*
- **outreach** activities include disseminating information on transplants and production techniques to growers through the marketing and sales activities mentioned above; a group of 30 technicians from the Tadla region of Morocco visited the Agadir project site on April 18; a group of scientists and technicians from the University CADI Ayyad in Marrakech visited the same site on June 7 in order to observe production techniques being used; two groups of growers visited Amaris in Agadir for technical advise and demonstrations; - particular interest was expressed for information on grafting technique for vegetables;
- **Objective - Collaboration:** continued work on the collaborative research activities on Argan and Truffles; Moroccans will visit Israeli early 1997.

Objective:

Collaboration and Training Abroad

The training abroad aspects have been modified based on the identified needs in Morocco. Extension workers and agricultural technicians have been receiving training at the Amaris Nursery sites in Azemour and Agadir and discussed above. Local agricultural schools and institutes have been enthusiastic in their support for this activity. The training has benefited Morocco greatly.

The collaborative research projects on Argan and Truffles, between Moroccan and Israeli scientists, have involved travel to Moroccan by the Israeli scientists and proposed travel to Israel by the Moroccan scientists. This collaborative research exchange aspect to the program was added after the program began and was based on identified mutual scientific interests and needs. Also, the political constraints to implementing this exchange have been relaxed.

Progress to Date:

- plans for travel to Israel for collaborative research scientists, Dr. Aameur (argan) and Dr. Achouri (truffles) have been made; proposed travel will be in the winter of 1997.

PROGRESS REPORT
for
ISRAEL

October 1, 1995 - September 30, 1996

Research and Development in Israel

Breeding of High Quality Tomatoes for Morocco

Objective:

The average yield of open field tomatoes in Morocco is 30 tons per hectare, while in Israel it is 80 tons per hectare. The studies on tomatoes to be carried out at the Moroccan site will be supplemented by the breeding of high quality tomato hybrids in Israel that are adapted to the environment of the Middle East and are nematode tolerant.

Progress to Date:

- evaluations on varietal tests for adaptation to Moroccan conditions will continue, including nematode and disease resistance qualities and the agri-management practices; testing has continued in Azemour and Agadir;
- the Israeli scientist working on this project traveled to Morocco to evaluate field performance of lines;
- no further research will be done in breeding; however, field testing of five varieties will continue in Morocco in order to determine the adaptability of these varieties to the local conditions.

Effects of Growth Suppression on Green House Tomatoes

Objectives and Progress:

trials carried out to date demonstrated the effectiveness of growth suppression by paclubutrazol on extending the period that tomato seedlings stay in the nursery. This effect enables the nursery to keep the seedlings for an additional ten days for customers that did not prepare their fields on time. In both Morocco and Israel, tomatoes are planted in greenhouses from late August onwards. Greenhouse ambient air temperatures in August and September are very high. Tomato plants respond to this temperature by excessive elongation rates of the internodes. Growth suppression at this first stage may also be advantageous. A series of trials was carried out to assess the effect of growth suppression of tomatoes during the post planting period on growth, flowering and yield of tomatoes. *(See Attachment F for a final report on the work completed in Israel on growth suppressants.)*

Development of Verticordiaas an Ornamental Plant

Objective:

This genus has many species which produce attractive flowering branches and has good potential for becoming a novel product in the floral markets of Europe and North America. Studies are conducted on the effects of environmental and seed treatment on germination; edaphic and other environmental effects on plant growth and yield; formulation of appropriate agro-management procedures; post-harvest studies; and markets. (The verticordia species of ornamental plant has not yet been introduced in Europe. The branches are very good for decoration with good vase-life. The plants are wild and indigenous to Australia. However, it takes up to two years to germinate and therefore, it is a challenge to domesticate.)

Progress to Date:

- developed fertilization regime resulting in the improvement in plant performance; mass propagation of most successful cultivars; large section was prepared for planting to expand experiments;
- previous research showed problems in soil nutrients for Verticordia; new efforts are being made to graft Verticordia branches onto Melaleuca in order to produce a stronger more resistant plant;
- new species were introduced at the Azemour site including grafted branches on relative species from the same family (Myrtceae);
- work on the Eucalyptus tissue culture was redirected to raspberry chilling (see below).

Micro propagation of Ornamental Eucalyptus

Objective:

This work is conducted at a tissue culture laboratory of the Ben Gurion University which is also be responsible for training Moroccan technicians in methods of micro propagation, and advising on the construction and operation of the laboratory in Morocco. Results of this research will be applicable to the open-field ornamental production activity in Morocco.

This research program has been discontinued because it is no longer relevant to the project, since the decision to discontinue the construction of the tissue culture laboratory. A new research project on raspberry chilling is being conducted instead.

Evaluation of Chilling Raspberry Roots

Objective:

Evaluation of chilling of raspberry roots on flowering induction and yield. Raspberries are normally produced in regions where winter temperatures are lower than those experienced in morocco or Israel's coastal areas. Most cultivars require some winter chilling to induce flowering.

The research project set for year 5 will investigate the effect of artificial chilling of raspberry roots for flowering and yield. The effect of chilling will be compared with non-chilled controls. The trials will be carried out at the laboratories of the Ben Gurion University in beer Sheva and at a research site in the Negev coastal area.

The project commenced this year so results are still preliminary. *See Attachment G for the latest progress report on this activity.*

Collaborative Research

Commercial Production of Truffles

Objective:

Truffles are well-known and highly appreciated commodity in Morocco, and in Israel there is an on-going research aimed at the "domestication " of desert truffles. Intensive production of truffles will potentially introduce a new field on intensive agriculture production for both Morocco and Israel. This activity will seek to identify Moroccan scientists who would be interested in cooperating with Israeli research in this area, and to expand direct ties between involved research institutions in both countries.

Progress to date:

- Dr. Achour and Dr. Tsur prepared a revised work plan for this project;
- Dr. Mohamed Achouri will visit Israel for additional work on the truffle project in the winter of 1997; Dr. Achouri will collect truffles in Morocco and he will bring the samples to Israel for testing;
- tests will continue in Israel on the commercial production possibilities of the Moroccan truffle;
- additional tests will be made with other varieties of truffles;

Domestication of the Argan Tree (Argania spinosa) as an Oil Crop

Objective:

The argan is indigenous to areas of southwestern Morocco. Argan oil production has a high cash crop potential for Morocco and Israel, however, cultivation of argan is rare. The objective of this study is to determine the potential for domestication of the argan tree as an oil crop. Research will be conducted in Israel and Morocco by an Israeli researcher in collaboration with a Moroccan counter-part.

Plants at various Negev sites will be used for the research study. Specific objectives include: 1) to examine the establishment, yields and oil production or argan under various desert conditions; 2) to study its reproductive biology, especially factors associated with high oil content in the fruit; and 3) to select high productive clones for commercial plantations.

Progress to Date:

- collected seeds from 30 selected trees and germinated them; seedlings will be planted in experimental plots for evaluation;
- Dr. Aameur will visit Israel in the winter of 1997 to work with the Israeli collaborator in the Negev to study existing yielding trees;
- continued work on argania will take place in Morocco and Israel; *See Attachment H for a copy of the recent progress report.*

Executive Summary
for the
Work Plans for May 1, 1996 - June 30, 1997

The fifth year work plan was developed based on insights provided by the External Evaluation Committee's recommendations, the Technical Committee recommendations in August 1995 and subsequent input from the project coordinators meeting in December 1995. The initial draft of the plan was submitted to USAID on February 20, 1996. Subsequent amendments were made to the plan during the Technical Committee meeting on April 14, 1996. The following plan incorporates these most recent changes that were recommended by the Technical Committee.

The fifth year work plan is divided into five topics: management, production, research, marketing, and outreach and cooperation. A summary of the modifications to this plan, as recommended by the Technical Committee on April 14, 1996, include the following:

1. PROGRAM MANAGMENT

- Mr. Mimoun Mokhtari, Hassan II Institute in Agadir, will be the third Moroccan representative to the Technical Committee.

2. PRODUCTION

- Production goals for year five for the transplant nursery in Azemour will be 2 million transplants;
- Production goals for year five for the transplant nursery in Agadir will be 3 million transplants;
- Export of transplants to Europe will be evaluated as a means to expanding production and maximizing the use of the greenhouses;
- Production of pot plants used to purify water will be evaluated based on the potential collaboration with a Moroccan nursery, *Atelier Vert*;
- Propagation of "green" rose seedlings will be omitted from the work plans;
- Evaluation of the potential for propagating virus-free date palms from tissue culture will be initiated. If the procedure is cost-effective and simple, then the project will test this method in Azemour;
- in response to local market demand, a trial project will be introduced for production of grafted vegetables (tomatoes and melons). *See Attachment E for details.*

3. RESEARCH

Adaptive

- Testing of nematode resistant tomato cultivars will be continued - four varieties will be tested in Agadir at local farms and four varieties will be re-tested in Azemour;
- Demonstration of nematode resistant tomato cultivars will be accomplished.
- Mr. Lahlou will contact the USAID Mission in Rabat to identify a potential broker in Germany for exporting melaleuca branches. He will also identify a broker in Holland for potential export;

- Demonstrations of asparagus to local farmers will be accomplished in the summer of 1996. The particular attribute of the asparagus to be demonstrated in the salinity resistance;
- Limited experiments for growing asparagus transplants will be made;
- Raspberries will continue to be tested for adaptability - no production activities will be attempted.

Research and Development in Israel

- Research on the development of nematode resistant tomatoes has be completed. Continued testing of the varieties in Morocco will be accomplished;
- Research activities on the use of growth suppression on tomatoes, chilling of raspberry roots and verticordia will be continued and expanded.

Collaborative Research

- Dr. Aameur will work in Israel with Dr. Nerd on argan; additional collaboration on argan research will be accomplished with UNESCO and the GTZ Institute in Germany;
- Dr. Achouri will work with Dr. Tsur in Israel on Truffle research.

4. MARKETING

- Marketing/extension activities will be intensified in year five. No major changes to the original proposal except to emphasize the critical importance of marketing, demonstration and extension activities to the continued success and sustainability of the project.

5. OUTREACH AND EXTENSION

- The course in irrigation and fertilization management in Israel will be offered again in Israel. The initial discussions and recruitment of participants was not successful. Therefore, recruitment of 2-3 participants from the private sector will be attempted;
- Field days will be scheduled for May 1 and July 1, 1996;
- Another attempt will be made to offer a course in Morocco on greenhouse management co-sponsored by the Israeli Government and Amaris Nurseries. The first attempt was not successful;

In summary, the fifth year program emphasis will be to accomplish the following:

- ❒ Application of the results of the project's research activities.
- ❒ Expand outreach, cooperative, and collaborative activities to ensure long-term continuation of cooperation in science and technology between Morocco and Israel.
- ❒ Consolidate the transplant production facilities and activities to guarantee the sustainability of its operation following the termination of the project.

End of Executive Summary

Work Plans for May 1, 1996 - June 30, 1997

The fifth year work plan is divided into five topics: management, production, research, marketing, and outreach and cooperation.

1. PROGRAM MANAGEMENT

Resulting from the recommendations of the mid-term Evaluation Committee, the following changes the project management are being implemented:

Overall Management Policy. This task will be fulfilled by the Country Coordinators in project Year 5 in lieu of the Steering Committee.

Technical Committee. The Technical Committee will be reduced to two Israeli members, two U.S. members, and three Moroccans. The third Moroccan member will be a scientist from the Hassan II Institute facility in Agadir (Mr. Mimoun Mokhtari). The role of the Technical Committee will be expanded. Its members will also participate in cooperative outreach programs as described in the "outreach" section.

Project Site Management. The most significant change in the project's management is the one which has taken place at the Azemour site.

A qualified Moroccan Farm Manager, Mr. Omar Mounaz, was hired. Mr. Mounaz is responsible for all managerial activities at the site. The Israeli Technical Advisor, Mr. Nissim Sroussi, is responsible for the execution of all research activities at the site and provides technical advise upon request to the Farm Manager. Mr. Driss Lahlou, Morocco Project Coordinator, has overall responsibility for the operation of the facility.

2. PRODUCTION

Vegetable Seedlings. In response to the recommendations of the Evaluation Committee, the production of vegetable seedlings was expanded to the Agadir area. The Agadir region is the largest production area for protected agriculture in Morocco and is the national customer for the Amaris nursery. A 3500 m^2 multispan greenhouse was constructed in Agadir during the summer of 1995. In the first season (summer through fall), the facility has produced 1.5 million seedlings. Work will continue in this facility as follows:

- A 1000 m^2 Israeli greenhouse structure, which was built in Azemour for hardening of the micropropagated plants, will be transferred to Agadir to increase the production area to 4000 m^2. The site will be connected to electricity and automated irrigation and ventilation equipment will be installed.

- A facility for germination will be installed in Agadir. The transplant production target for Year 5 is 3 million vegetable seedlings.

- In Azemour the production facilities will be maximized. The mixing and sowing equipment in Azemour will be used in production activities for both the Azemour and the Agadir regions. Production target for Azemour for Year 5 is 2 million seedlings. In order to maximize production, transplants may be exported to Europe in year 5. Currently production occurs during 5 months of the year. By exporting transplants, production activities could be expanded. A broker in France has been contacted. Transport of seedlings will be via truck. Development of this export capability will be evaluated and initiated if determined feasible.

- A trial project will be introduced on grafting of vegetable crops. The project is being undertaken in response to the local demand for grafted vegetable seedlings. The Israeli Technical Advisor will be trained in Israel in this techniques. He will work with this Moroccan counterparts in Morocco to initiate work on tomatoes and melons. *Details on this project are provided in Attachment E.*

Potted Plants/Rooted Cuttings. A mother plantation for the potted plants/cuttings was completed in a 400 m^2 greenhouse. There are 20 different species of potted plants. The heated propagation system has been overhauled and is in excellent working condition. A mist system will be introduced and electricity will be supplied by a new generator.

This facility will be used only for rooting of potted plant cuttings, not for production of final products. The number of rooted cuttings to be produced in 1996 will be a function of the marketing effort which is described later. It is proposed to evaluate the possibility of working with a Moroccan nursery, Atelier Vert, on a government project to produce plants to purify water.

Hardening of Tissue Culture Propagated Palm Trees. Soil born fungi are affecting many date-palm plantations in south Morocco. The possibility of hardening of micropropagated seedlings in Azemour will be evaluated, both from the technical and economical view points. Tissue culture laboratories in the United States and France will be visited to determine if plants are available and if hardening in Morocco is feasible. In June 1996, Mr. Lahlou and Dr. Pasternak will return to France in order to assess the availability, procedures, techniques and problems associated with the tissue culture propagation of date palms. If it is simple and cost effective, then activity will begin.

3. RESEARCH

Research is divided into three components: Adaptive research, cooperative research, and collaborative research. Adaptive research is carried out at the Azemour site, cooperative research in Israel, and collaborative research in both Morocco and Israel.

Adaptive Research. Five adaptive research activities will be carried out at Azemour.

- <u>Effect of the growth regulator (paclubutrazol) on growth suppression</u>. The growth regulator "paclubutrazol" is a very effective plant dwarfing agent. This substance can be used to prevent the fast growth of vegetable seedlings in the nursery. This will result

in savings for the nursery since seedlings which were not shipped on time will be able to stay in good conditions for additional weeks.

The Project's Israeli scientific team has experimented in Years 3 and 4 with paclubutrazol. The recommendations from their research results will be tested at the Azemour nursery to produce final recommendations.

- Testing of indeterminate nematode resistant tomato cultivars. All the vegetable production areas around Azemour and at Agadir are infested with nematodes. For this reason, growers must sterilize the soils annually with nematocides and other substances. These chemical treatments are both very expensive and they contaminate the soil, ground and surface waters, and the atmosphere. The introduction of nematode resistant tomato cultivars should result in significant production cost savings and also it will ensure the ecological sustainability of the industry.

  The cultivar "Daniela" which was developed in Israel is occupying more than 90% of protected tomato production in Morocco. At the Azemour site, the nematode resistant and nematode tolerant new cultivars of Daniela germ plasm will be tested. The successful cultivars will be propagated at the nursery for commercial products.

- Testing of determinate open field nematode resistant tomatoes (part of a cooperative research program). The determinate open field tomatoes are being produced in Israel and are being tested at Azemour. Selection of most promising lines will be carried out by the Israeli plant breeder in cooperation with members of the Moroccan Technical Committee. Four varieties will be tested on farms in Agadir. Four varieties will be retested on farms in Azemour. Nematode resistant varieties will be demonstrated.

- Production of Melaleuca for decorative branches. The exports of ornamentals from Morocco is limited to mainly two items, roses and carnations. Melaleucas are hardy shrubs or trees from Australia. Many Melaleuca species have very decorative branches which can be used as "greens" for floral decoration. Melaleucas are grown outdoors. Both investment and production costs are low. The branches can be exported by trucks so that transportation costs are also relatively low. Two species of Melaleucas (M.mesophylla and M.Sp.) which were planted in Azemour are also salt tolerant and are irrigated with local saline water.

  To date the two Melaleuca species have done extremely well. In 1995-97, export trials will be conducted to various markets in Europe and Canada. Based on these results, an economic analysis will be made and if positive, the nursery will commence production of Melaleuca seedlings with the intention of commercialization of this new product. Mr. Lahlou will contact the USAID Mission in Rabat for assistance in locating a direct marketing contact in Germany. Mr. Lahlou also will evaluate the Holland Market.

- Asparagus with saline water. The objectives of this trial are: a) to demonstrate the use of local saline water on a self tolerant crop; b) to introduce to Morocco the high

yielding and high quality asparagus hybrids of California; c) to explore the possibility of early season exports of asparagus to the European and Canadian markets. Four varieties are being tested.

First harvest will start in February 1996. In summer 1996, demonstrations of saline resistant varieties will be made to local farmers. Also, experiments will be made with asparagus seedlings. (It takes four weeks to germinate from seeds.) In 1997, we will conduct export trials to the European and Canadian markets.

- Artichokes with saline water. The objectives of this trial are: a) To demonstrate the use of local saline water on a salt tolerant crop; b) to introduce to Morocco the practice of sparse application of givverlic acid to reduce off-season production of artichokes. Trials will continue in 1996 and 1997.

- Raspberry—a new export crop for Morocco. Raspberry can become a very attractive export item for Moroccan agriculture: a) In the mild climate of Morocco's coastal area, raspberries mature long before they are produced in Europe and can, therefore, be sold at relatively high prices; b) this is a labor intensive crop which is advantageous for Morocco with its cost-effective labor; and c) both investments and production costs are relatively low. Thus, it can become an attractive crop for the small Moroccan farmers.

  The raspberry trials in Azemour with its five cultivars will continue in 1996 and 1997. Yield and quality will be assessed. No production will be done and no cuttings will be propagated.

Research and Development in Israel. All research projects in Israel will continue into the final year, except for the tissue propagation program for Eucalyptus. This research program is no longer relevant to the project, because of the decision to discontinue the construction of the tissue culture laboratory in Morocco. A new research program on raspberry chilling is suggested instead.

The following are descriptions of the research projects to be conducted in Israel during the fifth year of the program:

- Evaluation of chilling of raspberry roots on flowering induction and yield. Raspberries are normally produced in regions where winter temperatures are lower than those experienced in Morocco's or Israel's coastal areas. Most cultivars require some winter chilling to induce flowering.

  The research program set for Year 5 will investigate the effect of artificial chilling of raspberry roots for flowering and yield. The effect of chilling will be compared with non-chilled controls. The trials will be carried out at the laboratories of the Ben Gurion University in Beer Sheva and at a research site in the Negev coastal area.

- Breeding of nematode resistant open field tomatoes. The program in Israel involves the production of new hybrid lines of nematode resistant cultivars which are being tested at

the Azemour site. In year 5 nematode resistant varieties that were developed during the first four years of the project will continue to be tested and demonstrated at Azemour. It is expected that by the end of the project at least two new open field nematode resistant cultivars will be introduced to Morocco on a commercial basis. No additional research activities in Israel will be carried out in Israel during year 5.

- Effect of growth suppression by paclubutrazol on early growth of greenhouse tomatoes. Trials carried out to date demonstrated the effectiveness of growth suppression by paclubutrazol on extending the period that tomato seedlings stay in the nursery. This effect enables the nursery to keep the seedlings for an additional ten days for customers that did not prepare their fields on time. In both Morocco and Israel, tomatoes are planted in greenhouses from late August onwards. Greenhouse ambient air temperatures in August and September are very high. Tomato plants respond to this temperature by excessive elongation rates of the internodes. Growth suppression at this first stage may also be advantageous. A series of trials will be carried out to assess the effect of growth suppression of tomatoes during the post planting period on growth, flowering, and yield of tomatoes.

- Verticordia—a new floriculture product. Verticordia is endemic to Australia. It includes many shrub species with outstanding floral qualities. The shrubs which are planted outdoors produce high quality and attractive flowering branches. This is a totally new product with great potential for the horticultural industry of both Morocco and Israel.

  To date, numerous Verticordia species were selected, techniques of vegetable propagation were perfected and nutritional requirements have been identified. In Year 5 of the program, there will be concentration given to the management and floral aspects, growth media, irrigation processing, yield, post harvest, and recovery after harvest. Also, grafting verticordia onto relative species from the same family (Myrtceae) will be done.

Collaborative Research. When the project started in 1992, the program could not initiate collaborative research programs. In 1994, the first collaborative program between Morocco and Israel was initiated and continued in 1995. In 1995 a second collaborative program was initiated. The two new collaborative programs are:

- The domestication of the Truffle *Terfezia leouis*. This collaborative program, which is being carried out by Dr. Varda Zur from the Ben Gurion University and Dr. Mohamed Achouri of the Hassan II Institute in Agadir, is achieving domestication of the Moroccan truffle *Terfezia leouis*. This quite unique trial produces symbionts with annual plants. Therefore, we can obtain fruiting bodies within a few months from inoculation.

  There is very little knowledge on *T. leouis*, its host plants, the environmental requirements for inoculation growth and fruiting body, and general variation of *T.*

leouis in relation to rates of fruiting bodies formation.

The research in Israel concentrates on understanding the two basic relations between the fungus and its hosts, and in identifying two mechanisms leading to fruiting bodies formation. The research in Morocco will concentrate on the identification of the range of host plants, selection of productive gene types, and study the optimal environmental requirements for *Terfezia* inoculation and growth. In Year 5 of the project, Dr. Achouri will work together with Dr. Kagan-Zur at Ben Gurion University of the Negev on this project.

- The ecology and domestication potential of the Argan tree (*Argania spihosa*). This collaborative work between Dr. Fauzia Aameur of the University Ibn Zohr and Dr. A. Nerd of the Ben Gurion University started in 1995 and will continue into project Year 5. Dr. Aameur will work with Dr. Nerd on this project at Ben Gurion University.

  Argan grows in Morocco. It is a draught tolerant tree with multipurpose uses. The Argani oil which is extracted from its seed is a high quality culinary oil that fetches high prices. This oil is also used in the cosmetics industry. The branches and stems are used for firewood.

  In Morocco, the population of Argan trees is shrinking, due to over exploitation. The research objectives in Morocco are related to finding avenues to stop over exploitation of Argan and to restore the Argan tree.

  The research objectives in Israel are to demonstrate the uses of Argan and to develop the argan into a commercial crop for oil production. As a spin-off of this work, preliminary discussions with UNESCO and GTZ Institute in Germany have resulted in an agreement to cooperate with Dr. Aameur and Dr. Nerd on their research on Argan. UNESCO will contribute $10,000 towards this project.

4. MARKETING

Marketing activities will be intensified in project Year 5. In project Year 4 an Amaris office opened at the Eit Maloul Village near Agadir. This village is the center of trade for protected agriculture activities in the Agadir region. The office staff includes two marketing officers and a secretary.

Marketing of the Amaris products will be carried out in a variety of ways:

- One to one visitations to producers.
- Advertisement in local papers and on road sides.
- Organization of field days and tours of the Azemour and Agadir R&D production sites.

- Introduction of new attractive products (high quality transplant tomato cultivars, new nematode resistant tomato cultivars, etc.).

- In addition, the Amaris office will initiate new marketing efforts (see Outreach and Cooperative Activities).

At the Azemour site, marketing will also include:

- Response of the European and Canadian markets to Melaleuca branches.

- Marketing of early season asparagus and raspberries in Morocco and Europe.

- Marketing of out-of-season artichokes.

- Marketing of root cuttings of potted plants.

- Marketing of "green" rose seedlings.

Following the yield determination for the above crops and the marketing studies, an economical analyses will be carried out for each product to determine their profitability. These analyses will be presented to potential customers as a part of the marketing drive.

5. OUTREACH AND COOPERATIVE ACTIVITIES

Outreach and cooperative activities will be intensified during the project's last year. Overall emphasis will be given to cooperation between the project and the Horticulture Center of the Hassan II Institute at Agadir. The Center plays a central role in the development of horticulture in the Agadir region, and it has an enthusiastic young scientific staff which were trained in the U.S.

- Hassan II representative of the Technical Committee. Mr. Mimoun Mokhtari, of the Hassan II Institute of Agriculture and Veterinary Sciences in Agadir, has joined the joint Technical Committee. Mr. Mokhtari adds to the Technical Committee with his expertise on plant protection; knowledge of the farming community; and most important, he serves as a direct link between the project and his institute.

- Joint Seminars. The members of the project's Technical Committee will, during each annual meeting, organize joint seminars with Hassan III. These seminars will be sponsored and organized by Magreb Agriculture and its Amaris nurseries.

  The first seminar will be held April 15, 1996. Seminar participants were growers from the region, technicians and scientists from Hassan II Institute. They visited the Amaris nursery during the seminar.

- Joint course in greenhouse management. A joint 3-week course on greenhouse management is planned for spring 1996. The course will be developed and executed by

the Amaris project, the Israeli Mashav (Department of International Cooperation), and the Hassan II Institute of Agadir.

- Irrigation and fertilization management course held in Israel. Technical experts from the private sector will be organized through the Amaris nursery. This course will be developed jointly by the project's Technical Committee and the CINADCO (Center for International Agriculture Development Cooperation) organization. This course will last one month. The goal will be to get 3-4 private farmers to attend the course in Israel. The participants will be identified by Hassan II Institute Director and Amaris Nursery.

- Organized visit to Agritech. The Amaris nursery will organize a group of farmers from the Agadir region to visit the Israeli International Exhibition of Agriculture Technologies—"Agritech," which will be held during May 12-16, 1996.

  The group will also visit production sites with relevance to their activities.

- Field days. Periodically, the project will organize field days to demonstrate findings of the adaptive research activities at the Azemour site to the farmers. The proposed schedule is May 1, 1996 and July 1, 1996.

- Extension. Professional advise and follow-up visits will be arranged for the growers who have purchased seedlings from the Armaris nursery.

CHANGES IN PERSONNEL

Hassan II Research Scientist
In December 1995, Mr. Mimoun Mokhtari was hired as a consultant to supervise the Amaris Nursery in Ait Melloul and to conduct trials at the nursery in Agadir. Mr. Moktari assisted in organizing the collabortive seminar held at Hassan II and sponsored by the project.

Technician
In April 1996, Mrs. El Kacimi was hired as production manager for the Amaris Nurseries in Ait Melloul near Agadir. She had been trained in Azemour and then spent an additional training period of two years in Belgium.

As of September 21, 1996, Mrs. El Kacimi assumed responsibilities for production activities at the Amaris Nurseries in Azemour. Mr. Thami, who was the previous production manager at Azemour, became the production manager in Ait Melloul in place of Mrs. El Kacimi.

Marketing Director
In December 1995, Mr. Bouchtaoui was hired to assist in the marketing activities in Agadir.

MEETINGS AND COLLABORATIVE ACTIVITIES

The attached provides information on meetings and other collaborative activities accomplished during this reporting period: October 1, 1995 - March 31, 1996.

MEETINGS & OTHER COLLABORATION

Morocco, Israel and U.S. Project Coordinators Meeting December 1995

Meeting

Project coordinators and other participating individuals from the US, Morocco and Israel met in Morocco in December 1995. The purpose of this trip was to evaluate project activities in Azemour and Agadir; develop work plans for the fifth year of the project; and prepare a request for continued funding for USAID.

Members present at the meetings were Mr. Driss Lahlou from Morocco; Dr. Samuel Pohoryles and Dr. Dov Pasternak from Israel; Mr. Harry Albers, Ms. Frea Sladek, Mr. W. Timothy Hushen and Dr. Bonnie Stewart from the United States.

Field Trips

Project members visited Amaris nurseries at the project site in Azemour prior to the meeting. Members also visited the project site in Agadir.

Morocco and U.S. Project Coordinator Meetings October 1995 and September 1996

Meeting

Moroccan collaborators, Mr. Driss Lahlou and Mr. Karim Lahlou, met with SDSU Foundation staff in San Diego in October 1995 to review progress of project activities in Azemour and Agadir related to Technical Committee recommendation of the August 1995 meeting.

Another meeting was held in September 1996 to review the progress of technical activities, review the budget, and to discuss the work plans for the final year of the program. Mr. Karim Lahlou attended the meeting. Conference discussions were held by phone with Dr. Dov Pasternak in Israel.

Multinational Horticulture Seminar
April 15, 1996

A multinational seminar was hosted at Hassan II Institute of Agronomy and Veterinary Science in Agadir on April 15, 1996. Organized by Maghreb Agriculture, the semonar was co-sponsored by the Moroccan Cooperative Agricultural Development Project. Project scientists and technical experts from Morocco, Israel and the United States, along with their colleagues at Hassan II Institute, gave presentation on new horticulture production technologies. There were an estimated 300 farmers, agriculturalists, exporters, scientists, professors and students from the Agadir region who attended this seminar.

The seminar represented an opportunity for producers from the region to benefit from new information presented by scientists and horticulture professionals from Morocco, Israel and the U.S. Local farmers and producers were able to discover new horizons for modern horticulture production in Morocco.

The seminar was divided into four sessions:

1. Marketing Opportunities for Moroccan Horticlture
2. New Alternative products and Technologies for Morocco
3. Nursery Production Technologies
4. Post-harvest Biology and Technology.

Presentors included: Dr. Michael Reid and Dr. Richard Jones, University of California, Davis; Dr. Dov Pasternak, BenGurion University of the Negev, Israel; Dr. Irit Rylski, Volcani Institute, Israel; Mr. Eleizer Speigel, Ministry of Agriculture, Israel; Mr. Mimoun Mokhtari and Mr. Ahmed Ait Oubahou, Hassan II Institute, Agadir, Morocco.

A site visit was made by seminar participants to Amaris Nurseries at the project site in Ait Melloul. The visit allowed the participants an opportunity to see first-hand new producton technologies. The Amaris Nurseries staff members organized guided tours at which time detailed explanations of the latest technologies were offered to the visitors. Also, scientific and technical personnel were available during this visit to answer questions.

Published in the June 1996 edition of the Moroccan agricultural newspaper, *Le Monde Agricole* (The World of Agriculture), was a full page article with photographs about the seminar. *See Attachment "A" for a copy.*

Technical Committee Meeting and Site Visits
April 14 - 16, 1996

The project Technical Committee members met before the seminar to review progress to date and to refine the work plans proposed for October 1, 1996 - June 30, 1997. The Technical Committee visited the project sites in Ait Melloul (Agadir) and Azemour following the seminar.

International Participants from University Cadi Ayyad, in Marrakech Visit Amaris, Azemour
June 8, 1996

The Faculty of Science of the University of Cadi Ayyad, Semlalia, Marrakech, Morocco, organized a international course on "The Application of Bio-Technologies in Agriculture in the Country as a Means to Development." The Principal Course Organizer, Dr. Abdallah Oihabi, contacted Mr. Driss Lahlou, Morocco Project Coordinator, and requested a visit to the Amaris Nurseries in Azemour for twenty-five of the participants. The visit was made on June 8, 1996. Participants were researchers and teachers from different countries including Itally, Tunisia, USA, Moroccor, Germany, Colombia.

TRAVEL COSTS

The attached summaries details the costs, dates, names, origins and destinations for the project related travel that took place during this report period: October 1, 1995-September 30, 1996.

TRAVEL COST SUMMARY: October 1, 1995 - September 30, 1996
Morocco Project

NAME	DATE	PURPOSE	ORGIN/ DESTIN.	DESCRIPTION		EXPENSES
Mr. Nissim Sroussi	18-Oct-95 through 1-Nov-95	Travel to Israel	Agadir/Israel/ Agadir	Transportation (Air/Ground)	$	1,129
				Hotel/Lodging	$	-
				Per Diem	$	-
				Misc	$	-
				Total Mr. Sroussi	***$***	***1,129***
Mr's Driss & Karim Lahlou	22-Oct-95 through 25-Oct-95	Meet with Foundation re: Morocco Proj	Casablanca/ San Diego/ Casablanca	Transportation (Air/Ground)	$	6,000
				Hotel/Lodging	$	243
				Per Diem	$	63
				Misc	$	62
				Total Mr.'s Lahlou	***$***	***6,369***
Dr. Dov Pasternak	1-Dec-95 through 7-Dec-95	Attend Steering Committee Mtng	Tel Aviv/Casa Agadir/Casa/ Tel Aviv	Transportation (Air/Ground)	$	1,179
				Hotel/Lodging	$	674
				Per Diem	$	327
				Misc. (Phone & Fax)	$	6
				Total Dr. Pasternak	***$***	***2,185***
Dr. Samuel Pohoryles	30-Nov-95 through 6-Dec-95	Attend Steering Committee Mtng	Sevile/Casa/ Agadir/Casa/ Tel Aviv	Transportation (Air/Ground)	$	2,414
				Hotel/Lodging	$	561
				Per Diem	$	443
				Misc. (Phone & Fax)	$	72
				Total Dr. Pohoryles	***$***	***3,490***
Dr. Bonnie Stewart	29-Nov-95 through 6-Dec-95	Attend Steering Committee Mtng	San Diego/ Casa/Agadir/ San Diego	Transportation (Air/Ground)	$	1,976
				Hotel/Lodging	$	695
				Per Diem	$	493
				Misc. (Phone & Fax)	$	51
				Misc. (Film & Developing)	$	41
				Total Dr. Stewart	***$***	***3,256***
Mr. Harry Albers	1-Dec-95 through 6-Dec-95	Attend Steering Committee Mtng	Cairo/Casa/ Agadir/Casa San Diego	Transportation (Air/Ground)		
				Hotel/Lodging		
				Per Diem		
				Misc. (Phone & Fax)		
				Total Mr. Harry Albers	***$***	***1,590***

TRAVEL COST SUMMARY: October 1, 1995 - September 30, 1996
Morocco Project

NAME	DATE	PURPOSE	ORGIN/ DESTIN.	DESCRIPTION		EXPENSES
Ms. Frea Sladek	1-Dec-95	Attend Steering	Cairo/Casa/	Transportation (Air/Ground)	$	2,308
	through	Committee Mtng	Agadir/Casa	Hotel/Lodging	$	582
	6-Dec-95		San Diego	Per Diem	$	333
				Misc. (Phone & Fax)	$	-
				Total Ms. Frea Sladek	***$***	***3,224***
Dr. Moshe Bar	14-Dec-95	Attend Tomato	Tel Aviv/Casa/	Transportation (Air/Ground)	$	1,670
	through	Experiment	Madrid/Tel Aviv	Hotel/Lodging	$	217
	15-Dec-95			Per Diem	$	259
				Total Dr. Bar	***$***	***2,145***
Mr. Nissim Sroussi	1-Jan-96	Long Term Tech	Agadir/Israel/	Transportation (Air/Ground)	$	1,110
	through	Support	Agadir	Hotel/Lodging	$	-
	31-Jan-96			Per Diem	$	-
				Misc	$	-
				Total Mr. Sroussi	***$***	***1,110***
Mr. Nissim Sroussi	3-Mar-96	Long Term Tech	Agadir/Israel/	Transportation (Air/Ground)	$	953
	through	Support	Agadir	Hotel/Lodging	$	-
	29-Mar-96			Per Diem	$	-
				Misc	$	-
				Total Mr. Sroussi	***$***	***953***
Dr. Bonnie Stewart	10-Apr-96	Technical	San Diego/Casa/	Transportation(Air/Ground)	$	1,688
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	664
	17-Apr-96	& Seminar	San Diego	Per Diem	$	491
				Misc. (phone,fax,film,etc.)	$	114
				Total Dr. Stewart	***$***	***2,957***
Dr. Richard Jones	11-Apr-96	Technical	Sacramento/	Transportation(Air/Ground)	$	1,401
	through	Committee Mtng	Casablanca/	Hotel/Lodging	$	560
	17-Apr-96	& Seminar	Agadir/	Per Diem	$	414
			Sacramento	Misc. (phone,fax,film,etc.)	$	42
				Total Dr. Jones	***$***	***2,417***

TRAVEL COST SUMMARY: October 1, 1995 - September 30, 1996
Morocco Project

NAME	DATE	PURPOSE	ORGIN/ DESTIN.	DESCRIPTION		EXPENSES
Dr. Michael Reid	11-Apr-96	Technical	San Diego/Casa/	Transportation(Air/Ground)	$	2,012
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	560
	17-Apr-96	& Seminar	San Diego	Per Diem	$	413
				Misc. (phone,fax,film,etc.)	$	17
				Total Dr. Reid	***$***	***3,002***
Dr. Dov Pasternak	12-Apr-96	Technical	Tel Aviv/Casa	Transportation(Air/Ground)	$	1,386
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	280
	17-Apr-96	& Seminar	San Diego	Per Diem	$	446
				Misc. (phone,fax,film,etc.)	$	51
				Total Dr. Pasternak	***$***	***2,163***
Dr. Irit Rylski	12-Apr-96	Technical	Tel Aviv/Casa	Transportation(Air/Ground)	$	1,009
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	-
	17-Apr-96	& Seminar	San Diego	Per Diem	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Dr. Rylski	***$***	***1,009***
Mr. Eliezer Spiegel	12-Apr-96	Technical	Tel Aviv/Casa	Transportation(Air/Ground)	$	1,024
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	-
	17-Apr-96	& Seminar	San Diego	Per Diem	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Spiegel	***$***	***1,024***
Mr. Driss Lahlou	13-Apr-96	Technical	Casablanca/	Transportation(Air/Ground)	$	83
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	93
	15-Apr-96	& Seminar	Casablanca	Meals and Incidentals	$	36
				Misc. (phone,fax,film,etc.)	$	11
				Total Mr. D. Lahlou	***$***	***223***
Mr. Karim Lahlou	13-Apr-96	Technical	Casablanca/	Transportation(Air/Ground)	$	149
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	-
	15-Apr-96	& Seminar	Casablanca	Meals and Incidentals	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. K. Lahlou	***$***	***149***

TRAVEL COST SUMMARY: October 1, 1995 - September 30, 1996
Morocco Project

NAME	DATE	PURPOSE	ORGIN/ DESTIN.	DESCRIPTION		EXPENSES
Ms. Nadia Chouri	13-Apr-96	Technical	Casablanca/	Transportation(Air/Ground)	$	83
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	93
	15-Apr-96	& Seminar	Casablanca	Meals and Incidentals	$	31
				Misc. (phone,fax,film,etc.)	$	-
				Total Ms. Chouri	***$***	***207***
Mr. Omar Mounaz	14-Apr-96	Technical	Casablanca/	Transportation(Air/Ground)	$	83
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	93
	15-Apr-96	& Seminar	Casablanca	Meals and incidentals	$	31
				Misc. (phone,fax,film,etc.)	$	1
				Total Mr. Mounaz	***$***	***208***
Mr. Nissim Sroussi	14-Apr-96	Technical	Casablanca/	Transportation(Air/Ground)	$	150
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	47
	15-Apr-96	& Seminar	Casablanca	Meals and Incidentals	$	31
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Stroussi	***$***	***228***
Mr. Fouad Akesbi	14-Apr-96	Technical	Casablanca/	Transportation(Air/Ground)	$	150
	through	Committee Mtng	Agadir/San	Hotel/Lodging	$	47
	15-Apr-96	& Seminar	Casablanca	Meals and Incidentals	$	31
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Akesbi	***$***	***228***
Mr. Nissim Sroussi	15-Apr-96	Long Term	Casablanca/	Transportation(Air/Ground)	$	925
	through	Technical	Tel Aviv/	Hotel/Lodging	$	-
	1-May-96	Support	Casablanca	Meals and Incidentals	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Sroussi	***$***	***925***
Mr. Nissim Sroussi	17-May-96	Long Term	Casablanca/	Transportation(Air/Ground)	$	754
	through	Technical	Tel Aviv/	Hotel/Lodging	$	-
	27-May-96	Support	Casablanca	Meals and Incidentals	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Sroussi	***$***	***754***

TRAVEL COST SUMMARY: October 1, 1995 - September 30, 1996
Morocco Project

NAME	DATE	PURPOSE	ORGIN/ DESTIN.	DESCRIPTION		EXPENSES
Mr. Driss Lahlou	11-May-96 through 14-May-96	AgriTech Visist	Casablanca/ Tel Aviv/ Casablanca	Transportation(Air/Ground)	$	-
				Hotel/Lodging	$	1,246
				Meals and Incidentals	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Lahlou	$	1,246
Mr. Nissim Sroussi	23-Jun-96 through 8-Aug-96	Long Term Technical Support	Casablanca/ Tel Aviv/ Casablanca	Transportation(Air/Ground)	$	1,059
				Hotel/Lodging	$	-
				Meals and Incidentals	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Sroussi	***$***	***1,059***
Ms. Nadia Chouri	23-Jun-96 through 7-Jul-96	Travel to San Diego for Computer training & observe local agriculture	Casablanca/ San Diego/ Casablanca	Transportation (Air/Ground)	$	263
				Hotel/Lodging	$	1,317
				Per Diem	$	729
				Misc. (Phone & Fax)	$	144
				Total Ms. Chouri	***$***	***2,453***
Mr. Nissim Sroussi	21-Aug-96 through 10-Sep-96	Long Term Technical Support	Casablanca/ Tel Aviv/ Casablanca	Transportation(Air/Ground)	$	860
				Hotel/Lodging	$	-
				Meals and Incidentals	$	-
				Misc. (phone,fax,film,etc.)	$	-
				Total Mr. Sroussi	***$***	***860***
Mr. Karim Lahlou	5-Sep-96 through 8-Sep-96	Meet with Foundation re: 5th Year Morocco Project	Casablanca/ San Diego/ Casablanca	Transportation (Air/Ground)	$	62
				Hotel/Lodging	$	389
				Per Diem	$	416
				Misc. (phone,fax)	$	244
				Total Mr.'s Lahlou	***$***	***1,111***

PROCUREMENT

Attached is an updated list of equipment, materials and supplies procured for the project.

Equipment for Azemour and Agadir

	Maghreb Agriculture						
	List of Materlials and Supplies Actual vs. Planning		**Actual**	**Actual**	**Actual**	**Actual**	
	July 1, 1992 - March 31, 1996		**Purchases**	**Purchases**	**Purchases**	**Purchases**	**Source**
		Approved	**1st &**	**3rd Year**	**4th Year**	**4th Year**	**Origin**
			2nd Year		**Azemour**	**Agadir**	
1	**Infrastructure & Machinery**						
	a. Meterological Station	$ 20,000		$ 6,587			USA
	b. Electrical Generator	$ 18,000					
	c. 110 HP Tractor	$ 25,000	$ 28,351				M/USA
	d. 60 HP Tractor	$ 15,000					
	e. Subsoiler	$ 3,000	$ 3,230				M
	f. Rotovator	$ 5,000	$ 1,170				M
	g. Disk Harow	$ 2,000	$ 2,107				M
	h. Riverside Triple Head Plough	$ 7,000					
	i. Boom Sprayer 500 liter stainless	$ 4,000	$ 3,564				M
	j. Fertilizer Spreader	$ 1,000					
	k. Fogger			$ 5,500			M
	l. Organic Spreader	$ 4,000					
*	m. Water Development (not in original approved List)		$ 1,752	$ 27,713			M
	Sub Total	**$ 104,000**	**$ 40,174**	**$ 39,800**	**$ -**	**$ -**	
2	**2000 m2 Transplant Nursery**						
	a. 2000m2 Steel Structure (3000m2)	$ 15,000	$ 20,470	$ 31,000		$ 43,652	ISR/M
	b. Plastic Cover IR AF	$ 12,000			$ 1,090	$ 5,197	M
	c. Concrete Paths & Works	$ 10,000		$ 6,152			M
	d. Benches & Trays	$ 68,000	$ 22,422	$ 38,952	$ 12,193	$ 31,511	ISR/M
	e. Heating system	$ 25,000	$ 16,050				ISR
	f. Cooling & Ventilation	$ 22,000		$ 3,100			ISR
	g. Irrigation & Fertilization	$ 25,000	$ 10,000	$ 12,432	$ 348	$ 10,511	ISR/M
	h. Electrical Works	$ 8,000		$ 9,549			M
	i. Preparation Area & Germination Roo	$ 10,000		$ 64,752			M
	j. Automatic Seeding System	$ 14,000	$ 17,550	$ 9,320			ISR
	k. General Supplies			$ 4,718			M
	Sub Total	**$ 209,000**	**$ 86,492**	**$ 179,975**	**$ 13,631**	**$ 90,871**	
3	**10,000 m2 Open Field**						
	a. Initial Field Treatment, Drains, Pipe	$ 20,000		$ 43,326	$ 413		M
	b. Drip Irrigation System	$ 120,000	$ 38,187	$ 31,944	$ 2,125		M/ISR
	c. Automation & Main Head	$ 25,000					
	Sub Total	**$ 165,000**	**$ 38,187**	**$ 75,270**	**$ 2,538**	**$ -**	
4	**1,000 m2 Pot Plant Nursery**						
	a. Galvanized Steel Structure	$ 8,000	$ 18,920				ISR
	b. Cover	$ 10,000					
	c. Benches & Trays	$ 50,000	$ 11,658				ISR
	d. Concrete Path & Works	$ 10,000					
	e. Root Heating System	$ 14,000	$ 2,100		$ 2,905		ISR
	f. Space Heating System	$ 10,000					
	g. Cooling System	$ 15,000					
	h. Thermal Screen	$ 8,000		$ 372			M
	i. Irrigation & Fertilization	$ 10,000	$ 7,000		$ 357		ISR
	j. Pot Plant - Strilizia				$ 470		
	Sub Total	**$ 135,000**	**$ 39,678**	**$ 372**	**$ 3,732**	**$ -**	
5	**Micropropagation Laboratory**						
	a. Construction	$ 160,000					
	b. Air Conditioning & Positive Pressure	$ 65,000					
	c. Light, Electricity, Gas and Vaccuum	$ 20,000					
	d. Internal Furniture	$ 20,000					
	e. Equipment including five hoods, aut	$ 35,000					
	f. Hardening nursery (included in construction budget)		$ 18,920				ISR
	Sub Total	**$ 300,000**	**$ 18,920**	**$ -**	**$ -**	**$ -**	

Equipment for Azemour and Agadir

	Maghreb Agriculture						
	List of Materlials and Supplies Actual vs. Planning		**Actual**	**Actual**	**Actual**	**Actual**	
	July 1, 1992 - March 31, 1996		**Purchases**	**Purchases**	**Purchases**	**Purchases**	**Source**
		Approved	**1st &**	**3rd Year**	**4th Year**	**4th Year**	**Origin**
			2nd Year		**Azemour**	**Agadir**	
6	**Soil Mixing Plant**						
	a. Concrete Structure	$ 10,000					M
	b. Conveyers	$ 10,000					M
	c. Mixing Machine	$ 6,000		$ 31,630			ISR
	d. Steam System	$ 10,000					USA
	e. Packing System	$ 3,000					USA
	Sub Total	**$ 39,000**	**$ -**	**$ 31,630**	**$ -**	**$ -**	
7	**Fertilizer & Chemicals**						
	a. Super Phosphate - 60 tons	$ 5,000					
	b. Ammonium Sulfate - 60 tons	$ 5,000					
	c. Potassium Chloride - 60 tons	$ 3,000					
	d. Compounded Fertilizer - 20 tons	$ 10,000	$ 3,308	$ 8,367			M
	e. Organic Manure	$ 10,000	$ 13,904	$ 29,659			M
	Sub Total	**$ 33,000**	**$ 17,212**	**$ 38,026**	**$ 3,070**	**$ 3,021**	
8	**Nursery Supplies**						
	a. Seeds	$ 50,000	$ 4,070	$ 20,096			M,ISR,US
	b. Plant Stock	$ 40,000		$ 11,677			M,ISR,US
	c. Vermiculte	$ 10,000	$ 2,025	$ 1,620	$ 2,127	$ 23	M,ISR
	d. Peat	$ 10,000	$ 936	$ 3,527	$ 3,110	$ 1,919	M
	Sub Total	**$ 110,000**	**$ 7,031**	**$ 36,920**	**$ 5,237**	**$ 1,942**	
9	**Office Equipment and Supplies**						
	a. Fax machine	$ 4,000	$ 1,003			$ 294	USA
	b. Photocopier	$ 6,000					
	c. Desk tables	$ 2,000					
	d. Typewriter and general office equipm	$ 4,000				$ 5,424	
	e. Computer and software	$ 10,000	$ 4,567	$ 3,245			USA
	f. Office supplies	$ 2,000			$ 250	$ 603	
	Sub Total	**$ 28,000**	**$ 5,570**	**$ 3,245**	**$ 250**	**$ 6,321**	
10	**Other Supplies and Equipment**						
	a. Plastics	$ 10,000	$ 26,394	$ 27,032	$ 1,650		M,ISR
	b. Benches	$ 10,000		$ 2,932			M
	c. Water Chemicals and Fuel	$ 15,000	$ 26,060	$ 38,502	$ 18,295	$ 3,329	M
	d. Hoods	$ 10,000					
	e. Growth Chamber	$ 30,000					
	f. High Resolution Microscope	$ 50,000					
	g. Tensiometer (not on original approved list)		$ 360				M
	h. General supplies		$ 4,589	$ 21,219	$ 1,149	$ 671	M
	i. Maintenance		$ 7,493	$ 19,618	$ 8,661	$ 3,361	M
	j. hangar storage					$ 2,082	
	k. oil motopump				$ 1,655	$ 893	
	Sub Total	**$ 125,000**	**$ 64,896**	**$ 109,303**	**$ 29,755**	**$ 10,336**	
	Grand Totals	**$ 1,248,000**	**$ 318,160**	**$ 514,541**	**$ 58,213**	**$ 112,491**	
Total Actual Expenditures Year 1,2,3 & 4		**$ 1,003,405**					
otal Approved minus Total Expenditures		**$ 244,595**					
*	Water development costs were covered by project revenue.						

PUBLICATIONS SUBMITTED TO USAID

The following Technical Reports have been submitted to USAID, as requested by the Moroccan Cooperative Agricultural Development Project grant.

Technical Reports Required by Grant	*Date Submitted*
• **Quarterly Technical Progress Report**	
October 1, 1992 - December 31, 1992	January 10, 1993
April 1, 1993 - June 30, 1993	July 10, 1993
October 1, 1993 - December 31, 1993	January 3, 1994
April 1, 1994 - June 30, 1994	July 10, 1994
October 1, 1994 - December 31, 1995	February 10, 1995
April 1, 1995 - June 30, 1995	July 10, 1995
October 1, 1995 - December 31, 1995	February 10, 1996
April 1, 1996 - June 30, 1996	July 10, 1995
• **Semi-Annual Technical Progress Report**	
July 1, 1992 - September 30, 1992	October 10, 1992
October 1, 1992 - March 31, 1993	April 10, 1993
October 1, 1993 - March 31, 1994	April 10, 1994
October 1, 1994 - March 31, 1995	April 10, 1995
October 1, 1995 - March 31, 1996	April 10, 1996
• **Annual Technical Report**	
July 1, 1992 - September 30, 1992	October 10, 1992
October 1, 1992 - September 30, 1993	October 10, 1993
October 1, 1993 - September 30, 1994	November 10, 1994
October 1, 1994 - September 30, 1995	December 15, 1995
October 1, 1995 - September 30, 1996	Current Report
• **Semi-Annual and Annual Technical Report**	
November 1992 Update	November 30, 1992

Financial Reports Required by Grant	
• **Quarterly Financial Report**	
July 1, 1992 - September 30, 1992	October 10, 1992
October 1, 1992 - December 31, 1992	January 10, 1993
January 1, 1993 - March 31, 1993	April 10, 1993
April 1, 1993 - June 30, 1993	July 10, 1993
July 1, 1993 - September 30, 1993	October 10, 1993
October 1, 1993 - December 31, 1993	January 10, 1994
January 1, 1994 - March 31, 1994	April 10, 1994

Financial Reports Required by Grant

- **Quarterly Financial Report -continued**

April 1, 1994 - June 30, 1994	July 10, 1994
July 1, 1994 - September 30, 1994	October 10, 1994
October 1, 1994 - December 31, 1994	January 10, 1995
January 1, 1995 - March 31, 1995	April 10, 1995
April 1, 1995 - June 30, 1995	July 10, 1995
July 1, 1995 - September 30, 1995	October 10, 1995
October 1, 1995 - December 31, 1995	January 10, 1996
January 1, 1996 - March 31, 1996	April 10, 1996
April 1, 1996 - June 30, 1996	July 10, 1996
July 1, 1996 - September 30, 1996	October 10, 1996

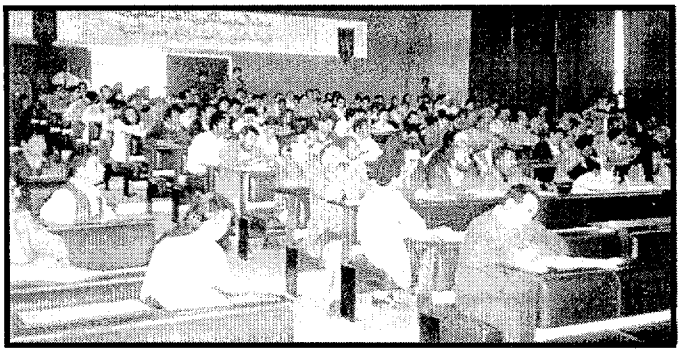
- **Projection of Funding Requirements Report**
  Fiscal Year July 1, 1993 - September 30, 1994
  Fiscal Year October 1, 1994 - March 31, 1995
  Fiscal Year April 1, 1995 - June 30, 1996
  Fiscal Year July 1, 1996 - June 30, 1997

The "Morocco Report" Newsletters

Spring and Fall 1993
Spring and Fall 1994
Spring 1996 - Attached

AMARIS Nurseries
America - Morocco - Israel

Morocco Project Newsletter **Spring 1996**



Participants listen to Lectures given during the Horticulture Seminar at Hassan II Institute in Agadir, Morocco

Multinational Horticulture Seminar is a Success

A multinational seminar was hosted at Hassan II Institute of Agronomy and Veterinary Science in Agadir on April 14, 1996. Organized by Maghreb Agriculture, the seminar was co-sponsored by the Moroccan Cooperative Agricultural Development Project, funded by the U.S. Agency for International Development. Project scientists and technical experts from Morocco, Israel and the United States along with their colleagues and collaborators at Hassan II Institute, gave presentations on new horticulture production technologies. There were an estimated 300 farmers, agriculturists, exporters, scientists, professors and students from the Agadir region who attended this seminar.

The seminar represented an opportunity for producers from the region to benefit from new information presented by scientists and horticulture professionals from Morocco, Israel and the United States. Local farmers and producers were able to discover new horizons for modern horticulture production in Morocco.

The seminar was divided into four sessions.

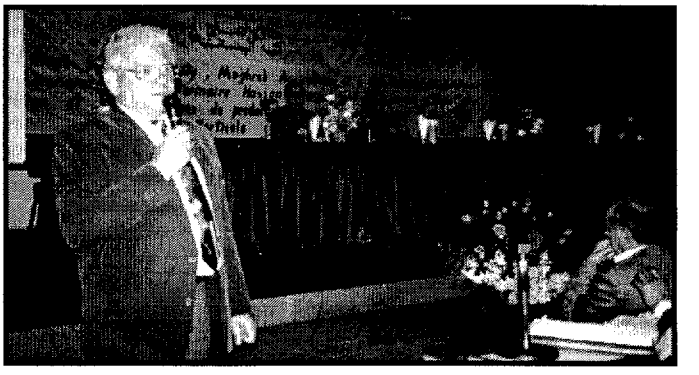
The first session focused on the **marketing opportunities for Moroccan horticulture.** Dr. Michael Reid, University of California, Davis, U.S.A., gave a presentation on *Future Market Opportunities for Moroccan Horticulture Products.*

The second session dealt with **new alternative products and technologies for Morocco.** Dr. Dov Pasternak, Ben Gurion University of the Negev, Israel, gave a talk on *New Technologies in Greenhouse Production;* Dr. Richard Jones, University of California, Davis, U.S.A. gave a presentation on *Alternative Horticultural Products: A Potential for Morocco;* Dr. Irit Rylski, Volcani Institute, Israel, spoke on the *Fruit Quality Traits in Tomatoes and Peppers ; and* Mr. Eleizer Speigel, Ministry of Agriculture, Israel, talked on the *New Market Opportunities for Ornamentals.*

The third session concentrated on **nursery production technologies.** Dr. Richard Jones gave a talk on *Vegetable Transplant Production and Stand Establishment*, and Mr. Mimoun Mokhtari, Hassan II Institute in Agadir, spoke on *Environmental Aspects of Nursery Production.*

The final session dealt with **post harvest biology and technology.** Dr. Michael Reid gave a presentation on the *Fundamental Principles of Post Harvest Technology for Horticulture Crops,* and Mr. Ahmed Ait Oubahou, Hassan II Institute in Agadir, spoke on the *Post Harvest Physiology and Technology of Fruit Crops.*

Continued on page 2



Dr. Dov Pasternak, Ben Gurion University of the Negev giving a presentation on new technologies in nursery production at Hassan II Institute in Agadir, Morocco

The Moroccan Cooperative Agricultural Development Project
Funded by the Agency for International Development/Bureau for the Near East
Administered by San Diego State University Foundation, SD, California 92182

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Left to Right: Dr. Irit Rylski, Volcani Institue in Israel; Dr. Dov Pasternak, Ben Gurion University of the Negev; Israel; and Mr. Driss Lahlou talk during a break at the Horticulture Seminar.

Seminar continued from page 1

An integral component of the seminar was a site visit to Amaris Nurseries at Ait Melloul. This well attended demonstration allowed the participants an opportunity to see first-hand new production technologies. The Amaris Nurseries staff members organized guided tours at which time detailed explanations of the latest technologies were offered to the visitors. Also, scientific and technical personnel were available during this visit to answer questions.

Left to Right: Dr. Dov Pasternak, Ben Gurion University, Israel; Dr. Brahim Hafidi, Director, Hassan II Institute, Agadir; Dr. Ahmed Ait Oubahou, Hassan II Institute listen to presentations during the Horitculture seminar.

The Moroccan Cooperative Agricultural Development Project is being accomplished by participants from the Kingdom of Morocco, the State of Israel and the United States of America.

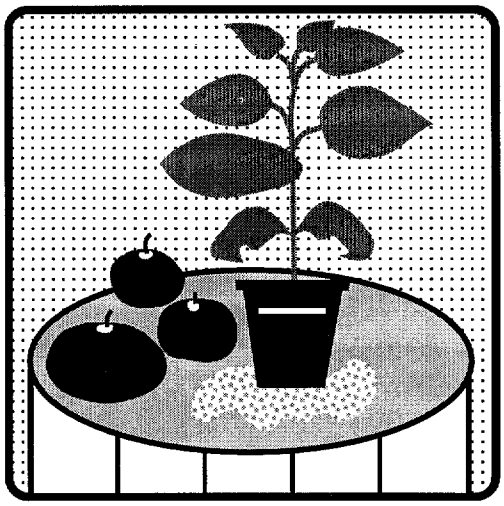
The goal of the Morocco Project is to promote world peace through scientific and technological cooperation in agriculture. Specific objectives are to contribute to the joint development of Morocco and Israel's agricultural sector by the introduction of new technologies, training and demonstration.

Moroccan Press Highlights Maghreb Agriculture

Published in the March 1996 edition of the Moroccan agricultural newspaper, ***The World of Agriculture*** (Le Monde Agricole), was an article about Maghreb Agriculture and Amaris Nurseries in Azemour and Agadir. Maghreb Agriculture is the Moroccan business enterprise and partner in the tri-lateral cooperative project with Israel and the United States. Amaris Nurseries are the production, demonstration and outreach sites for the project's activities.

The magazine article highlighted the multinational aspects of the project's activities. Of particular interest were the new approaches for producing transplants from seeds. The techniques being introduced include utilizing proper plant management practices, using controlled greenhouse environments and monitored irrigation systems. The immediate benefits for farmers are stronger, pest-free plants, more homogenous and properly hardened plants, and purchasing 100% plants irrespective of the germination percentage of the seeds. These improved production practices will result in positive economic gain for the farmers due to strong-er and healthier plants. Maghreb Agriculture through its Amaris nurseries, is the only organization in Morocco today that provides farmers with access to this type of transplant material.

Left to Right: Mr. Driss Lahlou, Morocco Coordinator; Mr. Eleizer Speigel, Israeli Ministry of Agriculture; and Dr. Michael Reid, University of California, Davis, in front of Hassan II Institute in Agadir before the seminar on April 15, 1996.



Amaris Nurseries Logo

Amaris Nurseries have a new logo. The logo will be used for product identification and promotion for all of Amaris Nurseries' products.

The name Amaris stands for America, Morocco (Maroc in French) and Israel, the three cooperating partners in the project. Amaris Nurseries are located in Azemour and in Ait Melloul (Agadir) Morocco. The two project sites are where the Morocco project's production, demonstration and outreach activities are centered.

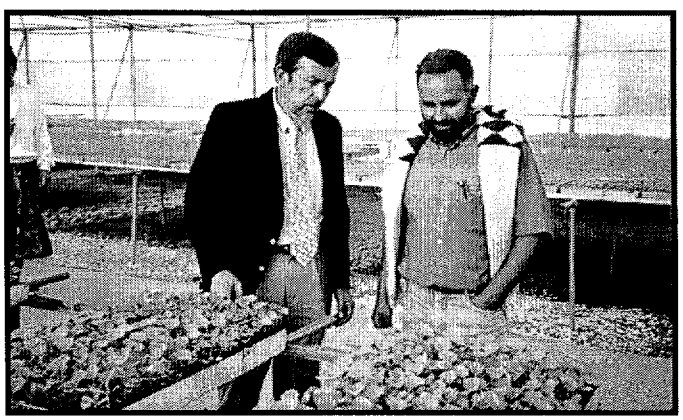
Local Producer Applauds Amaris

Amaris Nursery client, IKAMEL, purchased 301,448 vegetable transplants in the fall of 1995. They realized a very successful crop and harvest and commended Amaris Nursery for the fine quality of its products. In a letter to Amaris Nursery on December 19, 1995, Mr. Iraqi Mohamed of IKAMEL Company, wrote, "The results obtained by the Amaris Nursery in Ait Melloul, with respect to germination levels, was excellent and the quality of live plants was outstanding. Therefore, we encourage all farmers who produce vegetables to utilize the services offered by Amaris Nursery in Ait Melloul."

Amaris client, Mr. Iraqi, and Morocco Project Marketing Coordinator, Mr. Karim Lahlou, in Agadir holding a box of tomatoes grown from Amaris Nursery transplants.

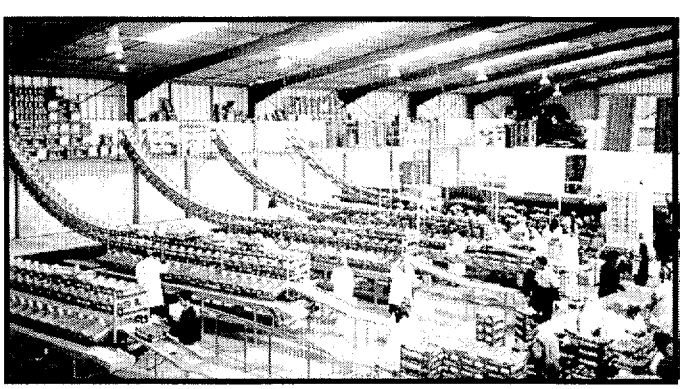
New Products for Moroccan Farmers

Local farmers in the Azemour and Agadir regions are utilizing Amaris transplants. Clients include small, medium as well as large farmers. Between August and September of 1995 local farmers in Azemour purchased over two million vegetable plants. In the Agadir region, over 1.6 million plants were purchased. Farmers have been very satisfied with the Amaris transplants.



Dr. Richard Jones, University of California, Davis explains transplant production technology to a grower in Agadir.

Farmers realize many advantages in utilizing plant materials from Amaris. The amount of seed needed to produce a hectare of vegetables is greatly reduced by first seeding in the controlled environments of Amaris Nurseries. After the plants are cultivated for a month in the Amaris greenhouses under controlled conditions, then farmers are able to pick-up their transplants and plant them in open fields or covered houses. Thus, farmers gain an additional month to properly prepare their ground and they gain a head start when environmental conditions are marginal for crop development. Loss of plants after transplanting these materials is greatly reduced because the plants are stronger, healthier and more resilient. Consequently, farmers are able to increase their profits due to record costs of production.



Inside the IKAMEL packing house in Agadir showing packing of tomatoes that were grown commercially from Amaris transplants.

Technician at Amaris Nursery looks at transplants.

Marketing is Key to Success of Amaris

New production techniques and new plant materials are being offered to farmers in Morocco through Amaris Nurseries. However, a key to the success of these efforts is marketing....dissemination of critical know-how and information on products available, and providing follow-up advice once the products are purchased.

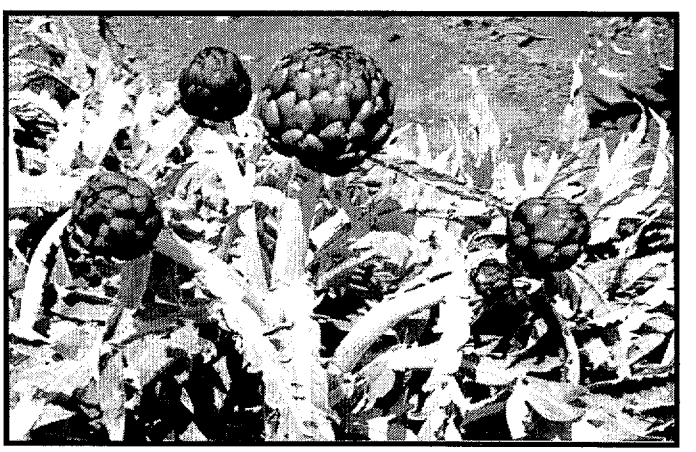
Amaris staff have devoted considerable time to these activities. Staff are contacting farmers in the Azemour and Agadir regions to explain and demonstrate their products. Informational brochures are being prepared to help farmers improve their management practices. Once clients have purchased transplant materials, Amaris staff make follow-up visits to monitor the production cycle and to help solve any problems that arise. Amaris staff are working on expanding their marketing and promotion activities in order to benefit greater numbers of Moroccan farmers.

Dr. Richard Jones and Dr. Michael Reid of the University of California, Davis look at the transplant materials in Amari Nurseries.

New Innovations for Morocco

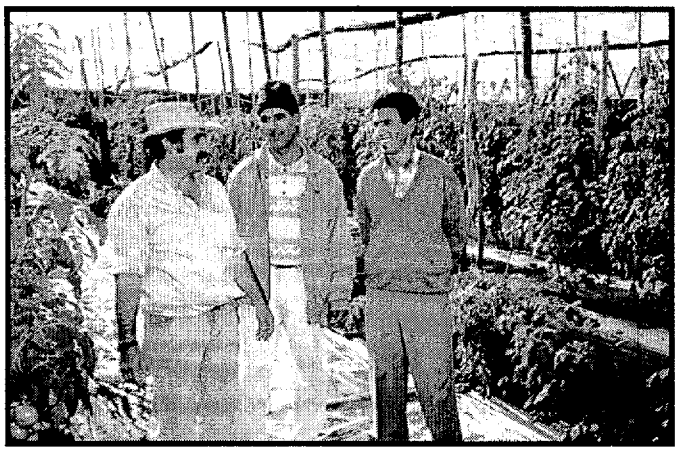
Adaptive research trials are being done on asparagus, artichokes, tomatoes and raspberries at the project site in Azemour. Preliminary results of the trials suggest good possibilities for Moroccan farmers.

Asparagus is being grown to demonstrate how local saline water can be used to grow a salt tolerant crop and to successfully bring to market a new, high demand fresh vegetable for export. New varieties to Morocco are being tested to determine their adaptability to local growing conditions. The possibility for early season exports of asparagus to European and Canadian markets is also being evaluated. Currently, four varieties are being tested.



Artichokes are being tested to demonstrate the integration of a cool-season crop in winter production schedules for export market development. New varieties are being evaluated for their local adaptability.

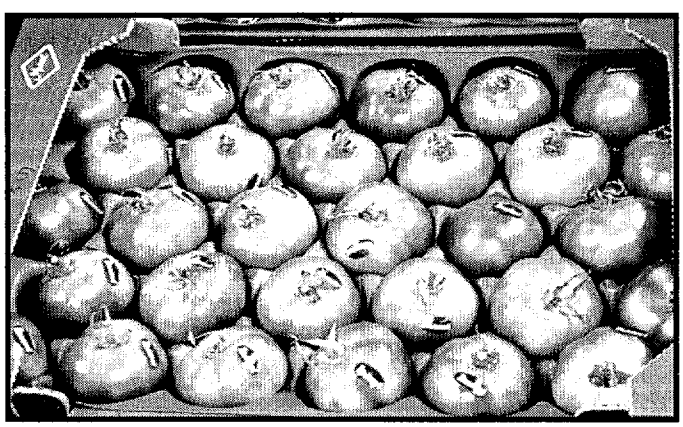
Innovations continued on page 5



Tomato trials for nematode resistance. Right to left: Mr. Nissim Srousi, Israeli Technical Advisor; Mr. Omar Natifi, Farm Supervisor; Mr. Omar Mounaz, Project Farm Manager.

Innovations continued from page 4

Tomato varieties developed in Israel are being tested to determine their adaptability to Morocco. Early results of a nematode resistant tomato cultivar have shown positive results. Additional testing will be done in Azemour and in the Agadir regions to confirm the early results.

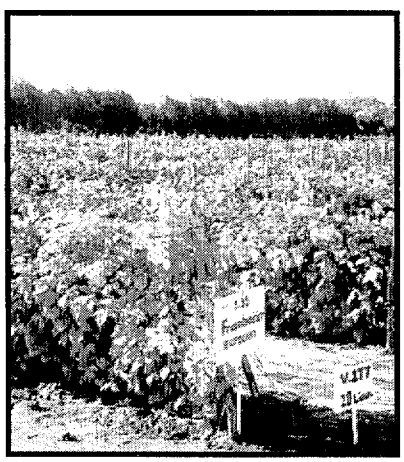


Tomatoes grown in Azemour.

Melaleuca is a hardy shrub or tree native to Australia. Many melaleucas have decorative branches which can be used as green material in floral decorations. Melaleucas are grown outdoors, they are salt tolerant and are irrigated with local saline water. Both investment and production costs are low. The branches can be exported by trucks to Europe which reduces transportation costs over air freight. The melaleuca is not well known to the Moroccan ornamental industry.

The Moroccan Cooperative Agricultural Development Project has grown two species of melaleuca on one hectare in Azemour. Initial market evaluations confirmed the demand for the branches, however; additional evaluations are being made to determine the economic feasibility of producing and exporting this product. If the market studies are successful, Amaris Nurseries will begin production of melaleuca seedlings. Melaleuca may prove to be a new and innovative product for the Moroccan export market.

Raspberries are being grown to determine their adaptability to Moroccan growing conditions. Raspberries have considerable potential of becoming a very attractive export item for Moroccan agriculture. Raspberries mature early in Morocco due to the mild climate of Morocco's coastal area and therefore could be sold at relatively high prices in the European market. Raspberries also are a labor intensive crop which is advantageous for Morocco with its cost-effective labor. Finally, investment and production costs are relatively low, making raspberries quite attractive as a new crop.



Raspberry field in Azemour.

Close up of a raspberry fruit.

Feasibility trials of five cultivars of raspberries will continue at the Azemour site through the end of the project. Activities will focus upon chilling requirements, and yield and quality assessments. Cane material will not be propagated from the project's site.

Mr. Driss Lahlou, Moroccan Coordinator (left) and Mr. Omar Mounaz, Amaris Farm Manager, look at the melaleuca growing in the field at the project site in Azemour.

Moroccan & Israeli Scientists Collaborate on Research

The project has been actively involved in building a collaborative research projects between scientists from Hassan II Institute and Israel. When the project started in 1992, such collaborative programs were not possible. Moroccan scientists are now collaborating with Israeli scientists on two projects of mutual interest and benefit. One program on truffles was initiated in 1994. The second project on argan was initiated in 1995.

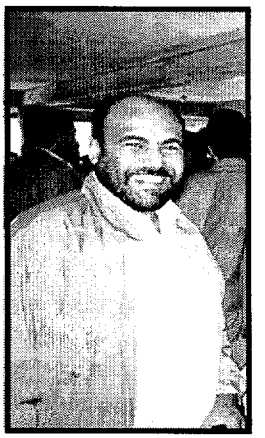
Truffles

The first program focuses on the domestication of the local Moroccan truffle *(Terfezia leouis)*. The work is being done by Dr. Mohamed Achouri of Hassan II Institute in Agadir, Morocco and Dr. Varda Zur from the Ben Gurion University of the Negev, Israel. Little is known about the truffle as a fruiting body. These researchers hope to develop a body of research that will contribute to understanding the truffle and possibly lead to its domestication.

The collaborative research activities are aimed at determining optimal conditions for truffle inoculation, fruiting body development and growth. The research in Morocco is identifying host plant ranges and selecting productive genotypes. The research in Israel has concentrated on understanding the two basic relationships between the fungus and the host.

Argan

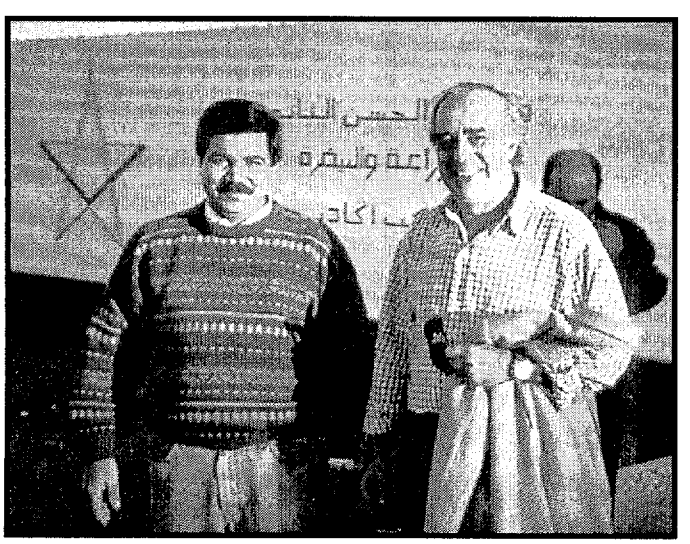
The newest program is on the domestication potential of the argan tree *(Argania spihosa)*. This collaborative work is being done by Dr. Fouzia Aameur of the University Ibn Zohr in Agadir, Morocco and Dr. Avinoam Nerd of the Ben Gurion University of the Negev, Israel. Argan is grown in Morocco. It is a draught tolerant tree with multipurpose uses. Argan oil extracted from its seed, is a high quality culinary oil that brings high prices. This oil is also highly sought after for use in the cosmetic industry. The branches and stems are used locally for firewood.



Truffle researchers Dr. Varda Zur, Ben Gurion University, Israel (Left) and Dr. Mohamed Achouri, Hassan II Institute in Agadir, Morocco (Right).

In Morocco, the population of Argan trees is shrinking due to overexploitation. The research objectives in Morocco are related to finding avenues to stop overexploitation of argan and to restore the argan tree. Other objectives of the research are to demonstrate the uses of argan and to develop the argan into a commercial crop for oil production. UNESCO has shown a great interest in this project and has agreed to cooperate with Drs. Aameur and Nerd in the development of this program.

Dr. Irit Ryeski, Volcani Institute in Israel (left), discusses project actuaries with Mr. Driss Lahlou, Moroccan Project Coordinator.



Dr. Brahim Hafidi, Director Hassan II Institute, Agadir (Left) and Mr. Driss Lahlou, Moroccan Coordinator and President of Maghreb Agriculture, in front of Hassan II Institute.

POUR LES LECTEURS FRANÇAIS du bureau de l'éditeur.....

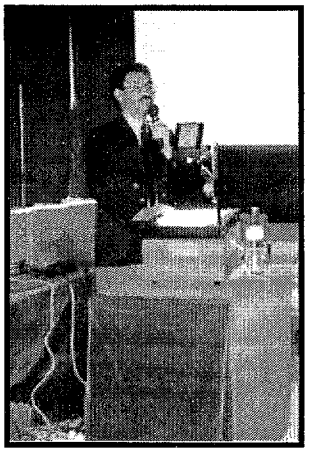
Le nouveau nom de ce journal est "Amaris Pépinière." Ce nom représente les trois pays, Amérique, Maroc et Israël, qui collaborent pour atteindre le but du projet. Dans ce petit journal il y a quelques articles et photos qui présentent les nouvelles actuelles des activités du projet.

Au cas où vous désiriez de plus amples renseignements sur ce projet, veuillez vous mettre en contact avec Dr. Bonnie Stewart, à l'adresse de l'expéditeur sur ce petit journal.

Le Projet de Coopération pour le Développement Agricole Marocain est fondé par le Bureau de Développement International aux États Unis (USAID). L'Université de l'État de San Diego, l'Université Ben-Gourion en Israël et la Société Maghreb Agriculture au Maroc travaillent et collaborent pour accomplir le but du projet.

Le but du projet est de promouvoir la paix mondiale par la coopération des trois pays dans les activités agricoles. L'objectif est de contribuer à l'amélioration du secteur agricole au Maroc par l'introduction de nouvelles technologies et en démontrant les bénéfices de ces innovations aux fermiers de la localité. On espère que le projet pourra démontrer l'efficacité économique de cette entreprise ainsi que ses bénéfices.

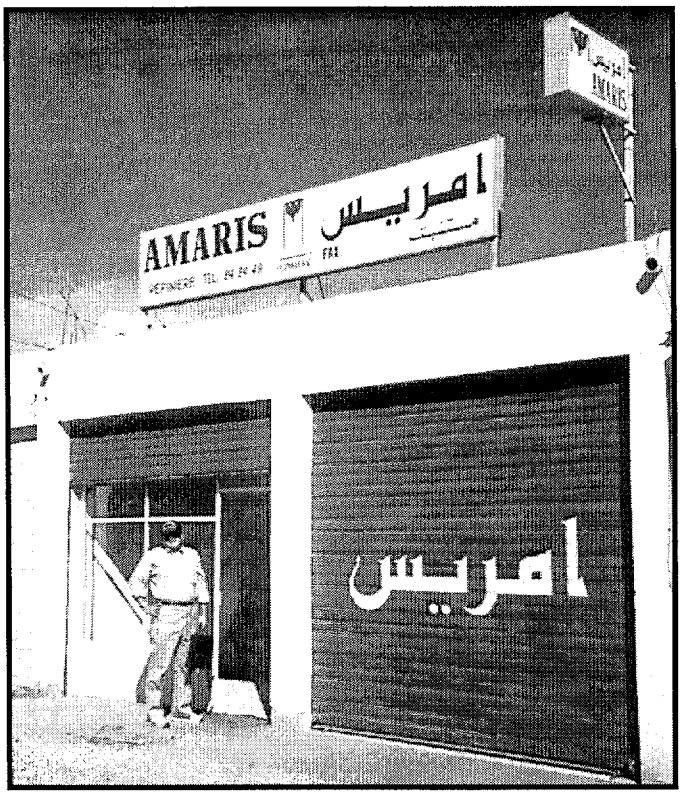
Mr. Karim Lahlou, Morocco Project Marketing Coordinator, talks to the seminar participants at the Amaris Nursery site in Ait Melloul near Agadir, Morocco on April 15, 1996.



Mr. Mimoun Mokhtari (Left), Hassan II Institute in Agadir, and Dr. Ahmed Ait Oubahou, give presentations at the seminar co-hosted by Hassan II Institute and the Moroccan Cooperative Agricultural Development Project.

Correction

Previous issues of Morocco Report discussing activities and products of AMARIS Nurseries in Morocco and Israel have improperly used the registered trademarks SPEEDLING and SPEEDLING and Plant Design which are the subject of U.S. Trademark Registrations Nos. 967,911 and 1,099,084 and corresponding foreign registrations of Speedling, Inc. of Sun City, Florida. Such use was without permission of Speedling, Inc. and was a violation of the rights of Speedling, Inc. which is not affiliated with AMARIS Nurseries in any manner. This error is sincerely regretted.



Mr. Harry ALbers, Executive Director, San Diego State University Foundation , in front of the Amaris Nursery Office in Ait Melloul near Agadir, Morocco.

Left to Right: Mr. Harry Albers, Executive Director, San Diego State University Foundation; Professor Sam Pohoryles, Israeli Coordinator; Mr. Driss Lahlou, Morocco Coordinator; Dr. Dov Pasternak, Technical Committee Chairman; and the U.S. Ambassador Marc Charles Ginsberg visit the project site in Azemour.

This is a U.S. Agency for International Development Project.
Comments or questions may be forwarded to:

Dr. Bonnie Stewart
U.S. Director, Morocco Project
Phone (619) 594-5644 Fax (619) 583-5734

Moroccan Cooperative Agricultural Development Program
San Diego State University Foundation
6330 Alvarado Court, Suite #220
San Diego, California 92120 U.S.A.

TO:

ACCOMPLISHMENTS IN REGIONAL COOPERATION

The attached provides information on collaborative activities accomplished during this reporting period: October 1, 1995 - September 30, 1996.

ACCOMPLISHMENTS IN REGIONAL COOPERATION

- **Mr. Driss Lahlou** and **Mr. Karim Lahlou** met with the SDSU Foundation staff in San Diego in October 1995, to review project activities in Azemour and Agadir relative to the recommendations of the Technical Committee;
- **Dr. Moshe Barr** from Israel, traveled to Morocco in December 1995, to provide consultation on the tomato experiments being conducted at the project site in Azemour;
- **Mr. Driss Lahou, Dr. Samuel Pohoryles, Dr. Dov Pasternak, Mr. Harry Albers, Ms. Frea Sladek, Mr. W. Timothy Hushen** and **Dr. Bonnie Stewart** met in Casablanca in December 1996 to evaluate project activities; to make a site visit to the Amaris Nurseries in Azemour and Agadir; to re-evaluate the work plans for the fifth year of the project; and to prepare a request for continued funding for USAID;
- **Dr. Dov Pasternak, Dr. Irit Rylski, Mr. Eleizer Speigel** from Israel; **Dr. Mike Reid, Dr. Rick Jones** and **Dr. Bonnie Stewart** from the United States; **Mr. Driss Lahlou, Mr. Karim Lahlou, Mr. Omar Mountaz** from Morocco participated in a multinational horticulture seminar at Hassan II in Agadir, Morocco in April 1996; the seminar was co-sponsored by the Project and Hassan II Institute; scientists from Hassan II participated in the seminar; 300 local farmers, exporters and scientists attended;
- **Mr. Driss Lahlou** traveled to Israel in May 1996 to attend the Agritech Exposition in Tel Aviv; Mr. Lahlou met with the Israeli collaborators during his visit;
- **Ms. Nadia Chouri** traveled to San Diego in June 1996, to receive training in computer applications and for site observations of local agricultural production operations;
- **Mr. Karim Lahlou** met with SDSU Foundation staff in September 1996 to review the progress of technical activities in Azemour and Agadir, to review the budget and to discuss the progress on the work plans for the final year of the program.

PROBLEMS

Problems and Actions Taken to Address them

Speedling Inc. Infringement of Tradename and Plant Design (Reported in Annual Report 1995)

As reported in the 1995 Annual Report, to resolve the infringement issue, the following plan of action was agreed upon by the SDSU Foundation Legal Counsel and the Speedling, Inc. legal representative: 1) a full disclaimer was to be made in the project newsletter; 2) a full disclaimer was to be made in the 1995 annual report; 3) the use of the word "speedling" was discontinued; 4) the signs at Azemour and Agadir were to be changed, using a different logo that had no similarity to the Speedling, Inc. logo.

All actions were taken and the problem was resolved. The attached letter from the Speedling, Inc. lawyer confirms their agreement.

POPHAM HAIK

SCHNOBRICH & KAUFMAN, LTD.

INCLUDING THE LAW PRACTICE OF
MASON, FENWICK & LAWRENCE, ESTABLISHED 1861

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TEL 303-893-1200

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METROPOLITAN SQUARE BUILDING, SUITE 800
1450 G STREET
WASHINGTON, D.C. 20005-5717
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MINNEAPOLIS, MINNESOTA
TEL 612-333-4800

INTERNATIONAL AFFILIATION:
BEIJING, CHINA
TEL 011861-5135261

NATHANIEL A. HUMPHRIES
DIRECT DIAL (202) 824-8075

September 3, 1996

Ms. Juanita Brents
Director of Legal Affairs
San Diego State University Foundation
5250 Campanile Drive
San Diego, California 92182-1942

Re: Morocco Report (Amaris Nurseries) Infringement of Speedling, Inc. Trademarks (1) SPEEDLING and (2) Plant Design
Our Ref.: 19468.145

Dear Juanita:

Thank you for your letter and attachments of July 3, 1996.

The problem seems to have been resolved and we wish to thank you on behalf of Speedling, Incorporated for your assistance.

Very truly yours,

Nat

Nathaniel A. Humphries

NAH:mvh

407/7092225

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ACCRUED EXPENDITURES AND PROJECTION OF CASH NEEDS

23-Jan-96

MOROCCO PROJECT

	STATUS OF THE USE OF PRIOR YEAR FUNDS			ADDITIONAL FUNDS REQUIRED THROUGH 30 JANUARY 1997	
	TOTAL AMOUNT PROVIDED THRU FY-95	AMOUNT EXPENDED BY Sept 30. 1995	AMOUNT COMMITTED Sept. 30 1995	BARE MINIMUM	NORMAL
San Diego State University Foundation					
Program Costs	$423,311	$345,549	$77,762	$30,288	$40,000
Procurements for SDSUF	$6,009	$231	$5,778	$6,842	$7,000
Direct Expenditures by SDSUF in Support of Israeli Subgantee	$145,830	$113,125	$32,705	$26,396	$30,000
Direct Expenditures by SDSUF i n Support of Moroccan Subgantee	$470,183	$402,635	$67,548	$55,495	$65,000
SDSUF Indirect Costs	$492,818	$402,837	$89,981	$103,764	$120,000
Sub-Grant Ben-Gurion University of the Negev	$877,789	$708,765	$169,024	$158,881	$165,000
Sub-Grant Maghreb Agriculture Company of the Kingdom of Morocco	$1,433,060	$1,172,931	$260,129	$313,662	$315,000
TOTAL	$3,849,000	$3,146,073	$702,927	$695,328	$742,000

Aldfn86a

ATTACHMENTS

A. Article about the Project sponsored Multinational Seminar held at Hassan II Institute, Agadir, Morocco, published in "Le Monde Agricole," Casablanca, Morocco

B. Promotional Brochure for Maghreb Agriculture, Amaris Nurseries in Azemour and Ait Melloul, Morocco and an Articles about Amaris Nurseries published in, Le Monde Agricole, Casablanca

C. Amari, Azemour and Amaris, Ait Melloul Activity Reports for September 1996

D. Letter of Commendation from Farmer in Agadir who Purchased Amaris Nursery Transplants

E. Proposal for a Trial Project on Grafting of Vegetable Crops

F. Final Report on Israeli Cooperative Research Project, "Growth Suppression on Green House Tomatoes"

G. Work Plan for Israeli Cooperative Research Project, "Chilling Requirements of New Cultivars of Raspberries"

H. Progress Report for the Israeli and Moroccan Collaborative Research Project, "Domestication of Argan as an Oil Crop"

I. List of Trainees at Amaris Nurseries, Azemour and Agadir during 1995-1996

J. Status of Morocco Project Research Activities

A. Article about the Project Sponsored Multinational Seminar held at Hassan II Institute, Agadir, Morocco, published in "Le Monde Agriculture" in Casablanca

Initiée par la Société MAGHREB AGRICULTURE.

JOURNEE D'ETUDE SUR LA COMMERCIALISATION ET LES TECHNIQUES DE PRODUCTION EN HORTICULTURE

En collaboration avec l'Institut Agronomique et Vétérinaire Hassan II, d'Agadir, la Société MAGHREB AGRICULTURE, la Fondation SDSU (San Diego State Université-Californie) et l'USAID ont organisé le 15 avril dernier une journée d'Etudes sur " la commercialisation et les Techniques de Production en Horticulture"

Cette Journée était destinée à familiariser les producteurs nationaux de la région du SOUSS-MASSA avec de nouveaux horizons et de nouvelles technologies de l'horticulture à travers des communications et des exposés faits par d'iminents experts américains de l'Université DAVIS et Israéliens de l'Université BEN GURION.

Elle s'inscrivait dans le cadre de la collaboration entre chercheurs nationaux et internationaux dans le but de promouvoir les échanges et le dialogue entre eux et avec les professionnels de la filière horticole.

THEMES RETENUS

Les travaux de ce séminaire se sont axés sur les sujets suivants :

- Perspectives commerciales en horticulture
- Diversification des produits horticoles
- Technique de production de plants en pépinière
- Biologie et Technologie de "Post-Récolte" des produits horticoles frais

Plus de 300 personnes ont pris part à cette journée scientifique et technique, qui a eu pour cadre l'Institut Agronomique et Vétérinaire Hassan II, complexe d'Agadir, à Aït Melloul.

Parmi l'assistance, on a noté la présence de Directeurs régionaux de Départements Agricoles professionnels (complexe horticole d'Agadir, ORMVA-S.M, DPA), d'officiels et de représentants d'organismes et d'Associations professionnelles (Chambre d'Agriculture d'Agadir, ASPAM, APEFEL) et des initiateurs de la journée, dont le Président de la société MAGRHREB AGRICULTURE et le Directeur du projet USAID.

DEBATS ANIMES

Les intervenants ont relevé l'intérêt d'une telle rencontre dans la promotion de la filière horticole en profitant au maximum des progrès de la recherche scientifique et des échanges techniques multilatéraux.

Les débats ont également permis de constater l'implication de l'USAID dans le développement de l'agriculture marocaine en général et également l'instauration de liens étroits avec des sociétés marocaines comme la société Maghreb Agriculture pour promouvoir des activités agricoles spécifiques, comme l'horticulture. A cet égard, certains orateurs ont salué avec enthousiasme la création, à Aït Melloul, d'une annexe de cette société, ce qui ne manquera pas de faire bénéficier le Souss Massa de transferts de technologies nouvelles, pour contribuer à améliorer la production agricole régionale en faisant jouer des synergies à travers ses propres installations.

A cet égard, on a souhaité que les retombées de cette journée puissent aider à l'edification de la technopole d'Agadir.

PERSPECTIVES COMMERCIALES

Ce thème a été développé par le Dr **Michael REID**, de l'Université de Californie à Davis.

Son intervention a été axé sur la mondialisation du commerce horticole. Il a invité les professionnels marocains de la filière à s'insérer rapidement dans les circuits commerciaux internationaux en faisant preuve d'agressivité commerciale, en demeurant plus concurrentiel , en cultivant la qualité et en exploitant tous leurs atouts.

Trois niveaux ont été retenus par l'orateur pour arriver à la différenciation du produit marocain par rapport à la concurrence :

- Produire plus en dehors des saisons habituelles
- Rechercher des marchés particuliers et avoir un label
- Veiller à la qualité, qui est la clé de la réussite commerciale

Dr REID a particulièrement insisté sur la nécessité de diversifier la production en investissant pleinement dans la recherche variétale afin de maîtriser cette diversification et pour mieux répondre aux besoins du marché mondiale, besoins très exigeants et très changeants.

TECHNOLOGIE DES SERRES ET DIVERSIFICATION DES PRODUITS HORTICOLES

- TECHNOLOGIE DES SERRES : Le volet a été développé par le Dr **Dov PASTERNACK**, de l'Université BEN GOURION. Il a exposé un nouveau procédé de chauffage des serres, mis au point en Israël, qui consiste à emmagasiner l'énergie solaire dans des poches latérales remplies d'eau. Il s'agit de deux types de chauffage destinés soit aux cultures palissées ou sans palissage.

Les gains de températures réalisés grâce à ce procédé ont été évalués à 6/7°C en hiver.

A cet égard, le Directeur de l'ORMVA-S.M. a informé l'assistance de l'existence de recherches similaires initiées par l'Office en collaboration avec l'I.A.V. Hassan II et que les résultats enregistrés sont encourageants.

-DIVERSIFICATION DES PRODUITS HORTICOLES : Ce thème, développé par Dr **Jones RICHARD**, de l'Université Davis (Californie), a fait ressortir la nécessité de diversifier la filière horticole en jouant sur les atouts que possède le Maroc. A savoir, la proximité de l'Europe, comme grand débouché pour ses produits et le micro-climat qui l'enrobe.. L'intervenant a même recommandé de s'intéresser à certains produits comme le frambolsier, testé à Azemmour par la Sté MAGHREB AGRICULTURE.

LES EFFETS DE LA POLLINISATION SUR LA FORMATION DU FRUIT ET UTILISATION DES HORMONES

Dr **Irit RYLSKY**, du centre de VOLCANIC-ISRAEL a présenté une étude documentée sur la pollinisation et l'effet de la Température qui conditionne énormément la formation du Fruit.

Elle a par la suite exposé l'application des hormones, telles que : les effets de la Gibberiline G13 et du 2-4-D sur la formation des fruits parthénocorpiques.

PRODUCTION ET COMMERCIALISATION DES PLANTES ORNEMENTALES

Dr **Elieser SPIEGEL** de l'Université BEN GURION a également développé ce thème et mis en évidence l'acquité de la compétition mondiale dans ce domaine.

Le Dr SPIEGEL recommande la diversification en produits d'ornement à travers des techniques de production maîtrisées et à base de recherche variétale. Il a cité l'exemple d'Israël pays importateur, devenu exportateur en la matière.

PRODUCTION DE PLANTS EN PEPINIERE

PRODUCTION DE PLANTS : Dr **Richard JONES** a fait une étude comparative entre le semi-direct et le semi issu de plants de pépinière dit "TRANSPLANT"

Les avantages de ce procédé sont :

- L'absence de contamination du plant : utilisation de substrat stérile.
- Meilleure reprise, car meilleure adaptabilité du "TRANSPLANT", en culture
- Système Racinaire plus développé et plus robuste et résistant aux chocs lors *de manipulations*.

Dr JONES met en évidence certaines techniques utilisées pour favoriser l'adaptabilité à savoir :

- techniques d'endurcicement ou d'acclimatation favorisées par le froid, la déshydratation partielle et par l'ajustement de la fertilisation.

Ces techniques sont destinées à endurcir la plante, car les plus tendres sont les plus faibles et donc les plus menacées.

En conclusion, Dr JONES a développé le volet économique de la production de plants en pépinière et a félicité la société MAGHREB AGRICULTURE d'avoir initié le projet AMARIS dont l'apport technologique bénéfique pour la région est évident.

- ENVIRONNEMENT

L'effet des facteurs d'environnement en pépinière a été traité par le Professeur **MIMOUN MOKHTARI** Enseignant chercheur à l'Institut Agronomique et Vétérinaire Hassan II.

Dans cet exposé le Pr MOKHTARI a étudié les facteurs qui influent sur la croissance du plant tels que :

- la température - la lumière - l'humidité
- les Gaz : CO_2, O_2 ...

La réflexion sur l'optimisation du microclimat de la serre en pépinière est à prendre en considération.

BIOLOGIE ET TECHNOLOGIE DE POST-RECOLTE

Sujet présenté par Dr REID

Après la récolte d'un produit, des pertes considérables, allant jusqu'à 40%, peuvent être occasionnées malgré tous les efforts déployés pour la production d'un produit de bonne qualité.

Pour Dr REID, la température étant le facteur limitant car elle influence négativement les autres paramètres tels que :

- la perte en eau
- l'activité respiratoire et métabolique
- le désordre physiologique, etc.

Le Dr **Aït OUBAHOU** de l'IAV a enchaîné dans la même voie en expliquant la place du conditionnement des fruits et légumes au Maroc.

L'intervenant a montré les aspects défaillants de la chaîne du transport et de la commercialisation de ces produits en visualisant les pertes occasionnées au niveau de chaque poste. Le Dr Aït OUBAHOU a fait des propositions pour améliorer et éviter ces pertes soulignant l'effort considérable à faire.

LA VISITE DE LA PEPINIERE AMARIS

En fin de journée les participants se sont rendus sur les lieux de la pépinière AMARIS. M **Karim LAHLOU** de la Sté MAGHREB AGRICULTURE accompagné de **M Omar MOUNAZ** Dr d'AMARIS et du Staff de la pépinière, a présenté les lieux et les différentes techniques mises en oeuvre pour la production de plants.

M. LAHLOU a rappelé les objectifs de ce projet et la place qu'il occupe dans le développement de l'agriculture marocaine.

En produisant des plants de qualité AMARIS fait bénéficier l'agriculteur de cette technologie, et lui assure un service exemplaire et une meilleure vulgarisation technique.

Les participants, lors de cette visite ont constaté que les plants produits par AMARIS sont bien homogènes, robustes, sains. Leur meilleure adaptabilité en culture contribuera sans aucun doute à un rendement final élevé.

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BEST AVAILABLE COPY

B. Promotional Brochure for Transplants
and an
Article about Amaris Nurseries, published in "Le Monde Agricole,"
Casablanca, Morocco

مشتـل أمريـس

- تقنيـاة عاليـة
- ظروف الإنتاج محكمـة
- الدقـة في الوقـت
- ربح في البدور وفي الإنتـاج
- إلغـاء كل الأخطـار
- جـودة عاليـة
- ثمـن منخفـظ

POUR TOUS RENSEIGNEMENTS, VEUILLEZ CONTACTER NOS BUREAUX

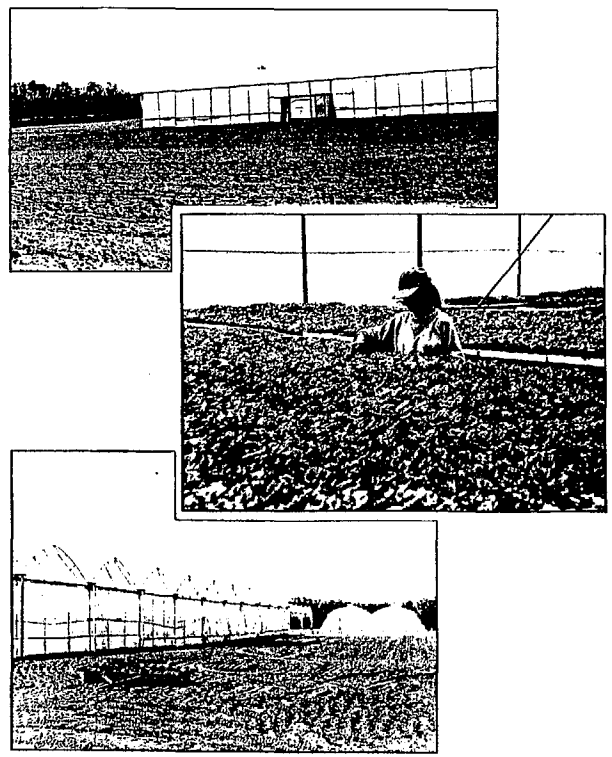
Adresses et Téléphones

***PEPINIERE AMARIS** - AIT MELLOUL*
Route de Biougra 1,5 km
Téléphone & fax (08) 24.24.49

***PEPINIERE AMARIS** - AZEMMOUR*
Route côtière : Casa - Azemmour
à km 6 d'Azemmour
Téléphone (03) 35.75.05

SIEGE : STE MAGHREB AGRICULTURE
36 A. Boulevard d'Anfa, 13ème étage
Résidence Anafe - Casabalanca
Téléphone (02) 27.16.45
Téléphone & fax (02) 27.89.85

SOCIETE MAGHREB AGRICULTURE
PEPINIERES AMARIS



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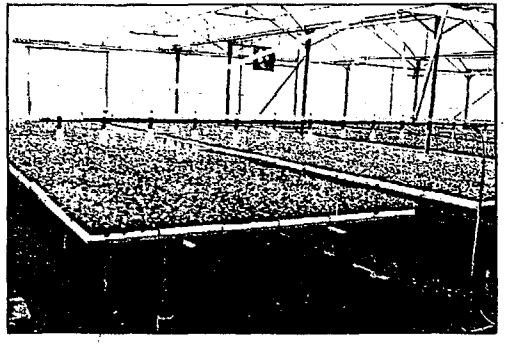
PRODUCTION DE TOUTES ESPECES ET VARIETES DE PLANTS MARAICHERS

MAITRISE PARFAITE DES NOUVELLES TECHNIQUES DE PRODUCTION DE PLANTS

- Doté d'équipements de pointe
- Structure des serres appropriées
- Atmosphère et environnement contrôlés
- Utilisation de substrats sélectionés
- Programmes de fertirrigation adaptés
- Encadrement par des scientifiques étrangers



INFRASTRUCTURE DES PEPINIERES AMARIS

AVANTAGES TECHNIQUES

GRACE A UN SUIVI METICULEUX DES PROGRAMMES D'ELEVAGE DES PLANTS EN PEPINIERE

- Taux de germination maximal assuré
- Plants d'excellente qualité :
  - Sains, homogènes, vigoureux et faciles à manipuler et transplanter
- Reprise rapide et parfaite
- Assurant une production précoce et déterminée :
  dates de production prévisibles.

Voici des plants issus des Pépinières Amaris :

PLANT DE [redacted]

PLANT DE MELON

AVANTAGES ECONOMIQUES

POURQUOI TOUS LES PRODUCTEURS DU MONDE ENTIER, (EUROPE, MOYEN-ORIENT, (ETATS-UNIS) UTILISENT-ILS LE SERVICE PEPINIERE ?

- **Gain de semences** (jusqu'à 30 % d'économie)
- **Gain de temps,** pour l'agriculteur
- **Gain d'espace,** pour d'autres cultures
- **Gain d'investissements** pas d'alvéoles, pas d'abri de la pépinière.
- **Economie en frais de :**
  - Tourbe.
  - Main d'oeuvre
  - Produits phytosanitaire
  - Energie (gasoil, etc...)
  - Eau.
- **Suppression des risques :**
  - Climatiques (chergui....)
  - Techniques (maladies, dosages produits)
- **Rendements plus élevés (+ 20 %)**
  Meilleurs tonnages par hectare
- **Coût du plant réduit..**

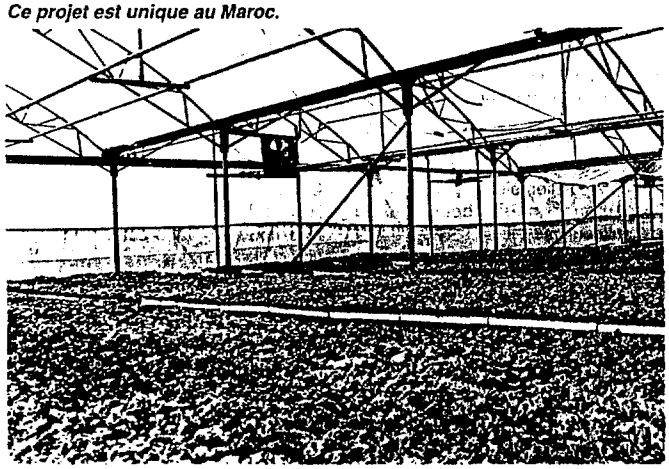
Nouveau au Maroc :
"MAGHREB AGRICULTURE", PROJET MULTINATIONAL DE PRODUCTION DE PLANTS A PARTIR DE SEMENCES APPORTEES PAR L'EXPLOITANT

Intermédiaire entre revendeurs de semences et Agriculteurs, MAGHREB AGRICULTURE a, grâce à ses pépinières AMARIS, introduit des techniques nouvelles de production de plants maraîchers et ornementaux.

Ces méthodes permettent à l'agriculteur Marocain de bénéficier de plants de qualité, lui réduisant ses coûts de production tout en lui augmentant considérablement ses rendements.

Pour répondre à ces exigences, Maghreb Agriculture a su mettre en place toute une infrastructure rationnelle et importante desservant l'ensemble du Maroc grâce à ses pépinières installées au centre (AMARIS-AZEMMOUR) et au Sud (AMARIS-AIT MELLOUL).

Ce projet est unique au Maroc.



MAGHREB AGRICULTURE a pu industrialiser cette technique de production de plants maraîchers, contribuant ainsi au développement de l'agriculture marocaine.

MAGHREB AGRICULTURE oeuvre sans cesse pour améliorer et pour aller au devant, toujours dans le souci de servir au mieux l'agriculteur.

Pour cela MAGHREB AGRICULTURE s'est doté d'un équipement performant permettant un travail soigné.

Pour offrir un plant de qualité à l'agriculteur, toutes les opérations sont parfaitement maîtrisées par MAGHREB AGRICULTURE.

Avant d'entamer le semi, un bon choix de substrat s'impose suivant des critères techniques bien définis (ph, texture, structure, éléments fertilisants, capacité de rétention...)

Ce substrat est alors traité, désinfecté, aéré puis humidifié mécaniquement.

La réussite de la germination des graines dépendra beaucoup de cette préparation de substrat.

Les graines sont ensuite disposées automatiquement une à une dans des alvéoles spéciales en plastic. La profondeur de semi est réglable: elle varie selon la taille et la variété de chaque graine.

Une fois la graine bien logée, elle est immédiatement recouverte d'un deuxième substrat dont les caractéristiques diffère du premier. Ce substrat constitu donc la couche superficielle, très décisive à la levée. Une levée homogène...

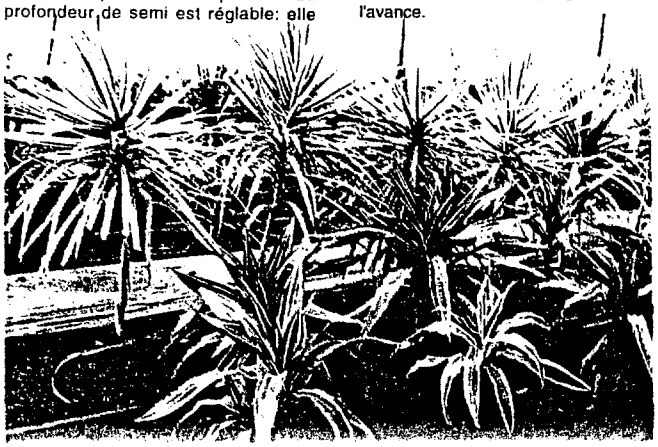
Le tout, étant bien arrosé automatiquement avant d'aller dans la chambre de germination : enceinte chauffante spécialement conçue pour accélérer la germination des graines.

A chaque variété correspond donc une température et une humidité bien définies.

Après un bref séjour dans cette chambre de germination, et dès apparition de germe, les alvéoles sont ensuite transportées dans la pépinière pour achever le cycle avant plantation.

La pépinière est une serre métallique équipée d'un matériel entièrement électrique, où les alvéoles sont disposées sur des tables métalliques surélevées (du sol).

La ventilation, l'irrigation, la fertigation et les traitements sont programmées à l'avance.



Toutes ces opérations sont automatiques.

Une équipe de techniciens veille en permanence à leur bon déroulement. Et de ce fait, le hasard a peu de place. Tout est judicieusement étudié et contrôlé.

Les plants sont soigneusement achevés et livrés à l'agriculteur dans des alvéoles les protégeant des dégâts qui peuvent subvenir lors du transport.

LA PRODUCTION DES PLANTS MARAICHERS

L'industrialisation de cette technique offre donc plusieurs avantages à l'agriculteur :

- GAIN DE TEMPS, MOINS DE SOUCIS

L'agriculteur en confiant à AMARIS sa semence se libère entièrement, et dispose de tout son temps pour accomplir d'autre tâches. Il ne se soucie plus de la réussite de ses plants, AMARIS s'en charge totalement.

- RISQUES SUPPRIMES

AMARIS se porte garant pour produire les plants.

- GAIN DE PLACE

Cette surface couverte généralement réservée à la pépinière pourra servir directement à la culture.

Sachez qu'un hectare de plantation nécessite environ 100 à 150 m2 couverts de pépinière.

- INVESTISSEMENTS SUPPRIMES

Les frais d'installation d'une serre réalisée pour pépinière sont supprimés.

Aujourd'hui les coûts du matériel, (Armature, Plastic de Couverture et Filet sont très élevés.

COUTS SUPPRIMES

Pas d'Achat de Tourbe
Pas d'Achat d'Alvéoles
Pas d'Achat de produits phytosanitaires
Pas d'Achat de Fertilisants
Pas de Frais de main d'oeuvre

- GAIN DE SEMENCE

Habituellement l'agriculteur perd beaucoup de semence en pépinière.

En confiant sa semence à AMARIS, l'exploitant gagne jusqu'à 30% uniquement sur ce poste. Ce gain est important surtout lorsqu'il s'agit de semences hybrides très coûteuses : 130.000 DH pour le kilo de semence de Tomate Hybride.

- GAIN DE PRODUCTIVITE

Les plants obtenus à AMARIS sont :

* Homogènes
* Sains et Robustes
* Faciles à transporter et à repiquer
* Présentent une reprise rapide
* Contribuent à un meilleur rendement final.

MAGHREB AGRICULTURE

AMARIS Nurseries - Pépinières

Funded by : THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

Pourquoi Les Plants Maraîchers de la Pépinière AMARIS

Haute Qualité !

Sécurité !

PLANTS SAINS

Les plants produits par la pépinière AMARIS sont issus de semences de haute qualité

CONDITIONS DE PRODUCTION MAITRISEES

• Structure des serres adaptée.
• Atmosphère contrôlée.
• Substrat adéquat et sain.

HOMOGENEITE ET FACILITE DE MANIPULATION

Les plants Maraîchers d'AMARIS sont Homogènes et Faciles à manipuler au transport et à la plantation.

PRECOCITE

Une reprise RAPIDE et PARFAITE des plants d'AMARIS permet une bonne précocité.

AFFAIRE ECONOMIQUE

Gain de 30% par rapport aux plants produits par l'agriculteur lui-même.
Gain de temps : Plants disponibles selon le calendrier de plantation.
Gain d'espace et d'investissement.
Gain sur les intrants.
La pépinière AMARIS assure la production des plants.

PRODUCTION DES PLANTS DE TOUTES LES ESPECES ET VARIETES MARAICHERES

La pépinière AMARIS produit les plants de toutes les espèces et variétés maraîchères. Les variétés sont de hautes performances agronomiques et commerciales, destinées a l'exportation et au marché local.

HAUTE TECHNICITE

La qualité des plants est assurée par des ingénieurs et techniciens spécialisés, dont dispose la pépinière AMARIS

ASSISTANCE TECHNIQUE

La pépinière AMARIS garantie l'assistance technique après vente.

Oulja de Chtouka - Azemmour - Tel : 03- 35-75-05-
Casablanca, 36/A Bd d'Anfa- Tel : 02 - 25-16-45 - Fax : 02- 27-89-85
Aït Melloul- Route Biougra - Tel/Fax : 08- 24-24-49

C. Amaris, Azemour and Amaris, Ait Melloul Activity Reports for September 1996

ACTIVITY REPORT

SEPTEMBER 96

AMARIS AZEMOUR

FIELD OF ACTIVITY	WORK DONE

ARTICHOKE:

- Preparation Of the second Unit field
- Plowing, leveling and laying out of the field
- Selection and soaking in a fungicide solution (CRYPTONOL) and in an insecticide solution (ARRIVO). All those before transplantation
- Placing the irrigation covers
- Abundant irrigation the transplantation the varieties kept are:
    - Violet
    - Salanquet
    - Macao
    - Imperial Star (1,5 line)

On the first unit field, we have done the manual weeding labor, cleaning of the whole parcel and a deep harrowing between the lines.

ASPARAGUS:

- Weeding and cleaning
- Treatment of rust preventive with M45

RASPBERRIES:

- Slaking out the rest of the parcel
- Weeding and climatization of the necrosis parts
- Abundant irrigation with sweet water
- The fertilization program is to be reviewed. All is to be changed from next month because the one used right now does not answer to the needs of this culture, it is to heavy in salts.
- Fungicide treatment done (DACONIL)

STRELIZIA:

- Manual weeding
- Irrigation with sweet water

MELALEUCA:

- Abundant irrigation with sweet water
- Trials of propagation of plants: 3 (three) experiments have been done without conclusion (results).

The temperature and the humidity parameters are to be defined more precisely.

SEEDLINGS PRODUCTION:

- Sowing of the latest orders of tomato in the nursery

ORNAMENTAL NURSERY:

- Propagation of seedlings of Schefflera, Dracaena, Melaleuca, Ficus and Laurel.
- Treatment (phytosanitary) with MORESTAN, VERTIMEC AND ANVIL

STAFF:

- Exchange of Posts
    - Mrs. El Kacimi Saadia/Mr. Thami Bourriche.

From September 21st, 1996, Mrs. El Kacimi is in charge of the Azemour site activities and Mr. Thami is in charge of the Ait Melloul project site while we are looking forward to replace him with someone else.

TRAINING OF TRAINEES:

- After many different contacts done with the Agriculture Schools four (4) trainees have already started the training. Others will follow from October 15, 1996.
- Mr. Baldiri Ali, from the Technical Institute Agricol of CHAOUIA
- Mrs. Ezzikari Souad, from the Center of Qualification Agricol of KHOURRIBGA.
- Mrs. Makhroute Faliha, from the Center of Qualification Agricol of KHOURRIBGA.
- Mrs. L'Mbareki Faliha from the Center of Qualification Agricol of KHOURRIBGA.

EXPERIMENTATION TRIALS:

- Tomato trials
    - Objectives: Resistance evaluation of five (5) indeterminate varieties of tomato to NEMATODE.
        - Variety No. 1: K562 preparation of three (3) green house D9; weeding/cleaning

- Variety No. 2: K846 and deep harrowing 09/01/96.
- Variety No. 3: K593 leveling 09/05/96.
- Variety No. 4: K580 sowing of five (5) varieties of seed in the nursery 09/08/96.
- Variety No. 5: DANIELA general disinfecting of one green house D9.

AMARIS AIT MELLOUL

SEPTEMBER 1996 ACTIVITY REPORT

I) Seedlings Production

Seedling production slowed down by the end of August. Amaris seedlings production was devoted mainly to tomato (more that 90%), followed by pepper and melon. For tomato, 'Daniella' was the leading cultivar. Other cultivars such as 'Gabriella', Argenta' and others were also produced. Pepper cultivars were: 'Andalous', Drago', and 'Pical'. 'Arava' was the melon produced this month.

II) General cleaning, insect control, tray and peat disinfection

AMARIS has now a tradition from time to time to clean the greenhouse surroundings by a general treatment. Cleaning and treatments are also done for the different equipment and for the screen suing 1/1000 house bleach called: JAVEL. DECIS was used as a general treatment around the greenhouse space to limit the growth and spread of pests and avoid their invasion. Disinfection of propagating frames and trays was done with JAVEL also. Peat disinfection was done by CRYPTONOL. A general operation of weed control was done manually as long as the seedling production start to slow down.

The medium 'tray substrat peat' used, has always been disinfected using 2ml/liter (30mo/15 liters) of CRYPTONOL. The same treatment was used again at the seedling emergence at 1 ml/l only. This treatment is used to prevent soil disease's to which seedlings are generally sensitive at the germination stage.

III) Equipment renewal and maintenance

A new pumping machine was purchased and installed at the irrigating head station. This machine was purchased in order to avoid irregularities in water flow and have a better control of fertigation. This will solve many problems generated through the use of the main pumping machine.

Propagating steel frames were painted against rust and arranged in order to limit their deterioration. As before, the wooden frames were fixed continuously.

IV) Irrigation and fertigation

Most of the problems we faced with regard to this task, were about watering irregularities. Because of the changing of pressure flow in the main watering line, irrigation and fertigation were not easy to manage. Pressure varies when switching between the two pumping machines or when operating different

watering lines at the greenhouse location. To avoid this variation a new pressure pump was purchased and the following test was run to regulate the flow and calculate the fertilizers dose taken by the proportioner from the tanks (Tank 1 and Tank 2).

Test 1:

Valve fully open in Tank 1 and valve of Tank 2 closed:

Pumping rate = 7.2 liters of the concentrated solution /100 liters of diluted solution.

Test 2:

Both valves are fully open, in Tank 1 and Tank 2, but the level in Tank 2 > Tank 1.

Pumping rate = 6.6 liters/100 liters from Tank 1 and 0 from Tank 2.

Test 3:

Both valves are fully open in Tank 1 and Tank 2, but the level in Tank 2 = Tank 1.

Pumping rate = 5.6 liters/100 liters as average from Tank 1 and Tank 2.

Besides theses tests, verification of the propotioner is necessary to avoid back flow and plugging by flushing the conducting line of the propotioner. For the watering system, fertilizer concentration is estimated by the EC meter at the arrival and when irrigating. This way we start irrigating newly germinated seedlings first, using a less concentrated solution and as the EC solution rise up, irrigation of seedlings at more advanced stages is made.

In conclusion, the concentration of feeding solution depends not only on the concentrated solution, but also on the flow, the pressure pump, the pumping rate of the propotioner and the time that the system takes to get a homogeneous solution at the end of the water system.

Irrigation and fertigation with the climate seems to play a key role in affecting growth and therefore the quality of seedlings. Experiment will be made on the effects on combination effects of 1) Watering regimes, 2) EC levels, 3) Substrat water holding capacity, and 4) the microclimate effects will be tested by repeating the experiments through the year.

Continuous observation of the medium and plant is the best indicator to control watering. From seed emergence up to the end of the first week, medium is held wet to let easy and complete germination to happen. During this time, a

small quantity of fertilizer is applied, and as the seedling grow the EC is elevated for better tapped growth.

Fertilizers are mixed in a tank of 100 liters and injected into the irrigation system.

For Tank 1, we used:

- Nitric Acid: 300cc/hl
- Phosphoric Acid: 350cc/hl
- Potassium Nitrate: 600 to 900 g/hl
- Ammonium Phosphate: 600 to 900 g/hl
- Ammonium Nitrate: 300 to 400 g/hl

For Tank 2, we used:

- Kanieltra (microelements): 100 ml/hl
- Nitric Acid: 100 to 200 cc/hl
- Nitrophoska: 400 cc/hl
- Sequestrene: 30 to 50 g/hl

Fertigation from Tank 1 is used daily for plants that are at advanced stages. But injections from Tank 2 are used every two or three days. pH levels of the watering solutions is about 6.5 to 7.00 and EC with plant age, from 2.4 for young plants (3 to 10 days), 2.9 to 3.4 for advanced plants (10 to 25 days). At later stages, EC is again lowered and the medium is leached before subjecting it to an EC of 2.9 to 3.2 mS/cm.

We are aware of the fact that it is the integration of watering, EC levels, medium water holding capacity, temperature, humidity and light that are effecting greatly the growth habit of the seedling. Therefore our tests will lead us to find how each of these can be managed. But to better adjust our fertigation now, water and plant samples were analyzed to make a better fertilizer program. (see results for the analyses).

V) Phytosanitary and growth control

As stated in previous reports, peat disinfection was made of 2 ml/l of CRYPTONOL prior to sowing and 3 days after seedling appearance at a rate of 1 ml/liter. Insecticide treatments were more frequent than the previous month. Preventive and curative treatments against leaf miner in tomato was done twice with VERTIMEC (50cc/hl) at about 2 week intervals, and with TRIGARD (100cc/hl). The later compound was more effective than the first one. The leaf miner is a serious insect that can last in the leaves and severely reduce production if not treated at the nursery. Treatment against other

insects was done by DECIS and TAMARRON. Use of PACLOBUTRAZOL was used for etiolated plants. BENLATE, ROVRAL, RIDOMIL AND DITHANE45, were used for fungi control, either once or twice depending on the product. These were used only as preventive treatment against damping off, Botrytis and Downey Mildew.

VI) Maintenance

Bedding is always done to complete filling the tray cells. Spread of thin strain of perlite over the trays was done to limit evaporation. Movement of the trays is usually done to have a homogeneous growth in similar trays. Growth was done by the end of the first week with extra plants disposed on different trays. Defoliating was practiced for eggplants, by taking off dead leaves or leaves damaged by worms. Shading sheets were rolled off above plants to permit enough light and produce a better seedlings.

VII)Grafting trial

This is a preliminary trial, done as a preliminary experiment for tomato grafting, Thirty two scions were made of 'Daniella' shoots with 3 fully expanded leaves and were grafted upon a tomato rootstock. Two grafting methods were use:

Splice tip grafting and Stem perforation:

Humidity was maintained near 100% R.H., in a closed glass container. After three days, grafted plants were put under shade. 5 days later they were evaluated and 25/32 of the plants have undergone hardening, gave good results, and are growing normally now.

Other experiments were planned for this month to test the effect of scion and rootstock stage, the grafting method and degree of humidity and time span in the closed chamber on grafting.

VIII) Water and plant analysis

Results of water analysis shows that the Amaris well water is a good water for irrigation, but care should be taken when irrigating. Magnesium (7.16 meq/l) and Calcium (5.82meq/l) shows that these elements are high and should not be supplied when irrigating. Also , Magnesium, can even cause a problem for Potassium availability, and we should make a majoration when giving Potassium fertilizers. Carbonates and other components are acceptable.

Using selected leaves and coltyledones, taken from both, selected deficient plants and healthy plants for 'Daniella' and 'Gabriella' tomato, showed that the

deficiency was of Potassium and Nitrogen. As we said for water analysis, high levels of Magnesium and Calcium in the water, can antagonized the Potassium and Calcium and this more correct when watering plants without low or no calibrated fertilizer program.

In order to have better plants, a fertilization program should start at the earlier seedling stage and the equilibrium should take into consideration water quality (high Mg, Ca, Bicarbonates, etc.).

AMARIS AIT MELLOUL

INSTITUT AGRONOMIQUE ET
VETERINAIRE HASSAN II
-=-=-=-=-=-=-
COMPLEXE HORTICOLE
-=-=-=-=-=-=-
LABORATOIRE DES SCIENCES DU SOL
-=-=-=-=-=-=-

Date : 24 /09 /96

RESULTATS ANALYTIQUES DE L'EAU

Situation géographique : Laklea 3Km vers Biougra

Propriétaire: Ste AMARIS.

N°		127	Classe
Références		puits.	
Résidu sec	g / l		
pH		7.5	normal
C E	mmhos/cm à 25°c	0.95	moyen
Carbonates CO_3^{--}	méq / l	0.00	
Bicarbonates HCO_3^-		3.20	moyen
Chlorures Cl^-		4.60	moyen
Potassium K^+	méq / l	0.17	faible
Sodium Na^+		3.49	moyen
Calcium Ca^{++}		5.82	moyen
Magnésium Mg^{++}		7.16	moyennement élevé

OBSERVATIONS : Eau favorable pour l'irrigation.

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INSTITUT AGRONOMIQUE ET
VETERINAIRE HASSAN II
COMPLEXE HORTICOLE D'AGADIR

LABORATOIRE DES SCIENCES DU SOL

Date : 24/09/96

RESULTATS ANALYTIQUES DES TISSUS VEGETAUX

Situation géographique : Laâdar 3 Km vers Biougra

Culture Tomate
Variété: Gabriella
Stade: Pepinière
Propriétaire: Ste AMARIS

Analyses / Méthodes	N° du laboratoire					52	Classe
	Références		Feuilles temoins				
Kjeldahl	Minéralisation	Azote	Total		%	2.14	
	Extraction par le		minéral	NH4 +	ppm		
	Chlorure de Calcium		" "	NO3 -			
Argentimétrie	Extraction à l'H2O	Chlorures		Cl -	%		
Colorimetrie	calcination	Phosphore total		P	%	1.05	
Spectrophotométrie d'absorption atomique		Macro-élements	Potassium	K	%	3	
			Sodium	Na		0.15	
			Calcium	Ca		2.98	
			Magnésium	Mg		1.45	
		Oligo-élements	Fer	Fe	ppm	387.5	
			Manganèse	Mn		188.6	
			Cuivre	Cu		8.1	
			Zinc	Zn		64	

OBSERVATIONS

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INSTITUT AGRONOMIQUE ET
VETERINAIRE HASSAN II
COMPLEXE HORTICOLE D'AGADIR

LABORATOIRE DES SCIENCES DU SOL

Date : 24/08/96

RESULTATS ANALYTIQUES DES TISSUS VEGETAUX

Situation géographique : Lakdar 3Km vers Biougra

Culture Tomate
Variété Daniella
Stade : Pépinière
Propriétaire : Ste AMARIS

Analyses / Méthodes	N° du laboratoire					53	Classe
	Références		Feuilles Saines				
Kjeldahl	Minéralisation	Azote	Total		%	2.52	
	Extraction par le Chlorure de Calcium		minéral	NH4 +	ppm		
			" "	NO3 -			
Argentimétrie	Extraction à l'H2O	Chlorures		Cl -			
Colorimetrie	calcination	Phosphore total		P	%	0.84	
Spectrophotométrie d'absorption atomique		Macro-élements	Potassium	K	‰	2.67	
			Sodium	Na		0.14	
			Calcium	Ca		2.49	
			Magnésium	Mg		1.08	
			Fer	Fe		375	
		Oligo-élements	Manganèse	Mn	ppm	125.7	
			Cuivre	Cu		8.2	
			Zinc	Zn		64	

OBSERVATIONS

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INSTITUT AGRONOMIQUE ET
VETERINAIRE HASSAN II
COMPLEXE HORTICOLE D'AGADIR

LABORATOIRE DES SCIENCES DU SOL

Date : 24/09/96

RESULTATS ANALYTIQUES DES TISSUS VEGETAUX

Situation géographique : Laâdes 3Km vers Biougra

Culture Tomate
Variété Daniella
Stade : pépinière
Propriétaire : Ste AMARIS

Analyses / Méthodes	N° du laboratoire					54	Classe
	Références	Feuilles carencées					
Kjeldahl	Minéralisation	Azote	Total		%	1.33	
	Extraction par le Chlorure de Calcium		minéral	NH4 +	ppm		
			" "	NO3 -			
Argentimétrie	Extraction à l'H2O	Chlorures		Cl -			
Colorimetrie	calcination	Phosphore total		P	%	0.7	
Spectrophotométrie d'absorption atomique		Macro-élements	Potassium	K	‰	1.11	
			Sodium	Na		0.39	
			Calcium	Ca		2.14	
			Magnésium	Mg		1	
		Oligo-élements	Fer	Fe	ppm	312.5	
			Manganèse	Mn		190.5	
			Cuivre	Cu		27.2	
			Zinc	Zn		71.1	

OBSERVATIONS

- Plantes déficitaire en azote et potassium
-
-
-
-

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INSTITUT AGRONOMIQUE ET
VETERINAIRE HASSAN II
COMPLEXE HORTICOLE D'AGADIR

LABORATOIRE DES SCIENCES DU SOL

Date : 24/09/96

RESULTATS ANALYTIQUES DES TISSUS VEGETAUX

Situation géographique : Laâlea 3Km vers Biougra

Culture Tomate
Variété Daniella
Stade : pépinière
Propriétaire : Ste AMARIS

Analyses / Méthodes	N° du laboratoire					55	Classe
	Références		Cotyledons saines				
	Minéralisation	Azote	Total		%	1.82	
Kjeldahl	Extraction par le		minéral	NH4 +	ppm		
	Chlorure de Calcium		" "	NO3 -			
Argentimétrie	Extraction à l'H2O	Chlorures		Cl -			
Colorimetrie		Phosphore total		P	%	0.81	
			Potassium	K		0.83	
Spectrophoto-		Macro-élements	Sodium	Na		0.23	
métrie			Calcium	Ca	‰	3.79	
d'absorption	calcination		Magnésium	Mg		1.76	
atomique			Fer	Fe		250	
		Oligo-élements	Manganèse	Mn	ppm	257.1	
			Cuivre	Cu		20.4	
			Zinc	Zn		40	

OBSERVATIONS

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INSTITUT AGRONOMIQUE ET
VETERINAIRE HASSAN II
COMPLEXE HORTICOLE D'AGADIR

LABORATOIRE DES SCIENCES DU SOL

Date : 24/09/96

RESULTATS ANALYTIQUES DES TISSUS VEGETAUX

Situation géographique : Lakdar 3Km vers Biougra

Culture Tomate
Variété Daniella
Stade : pépinière
Propriétaire : Ste AMARIS

Analyses / Méthodes	N° du laboratoire					56	Classe
	Références		Cotyledons carencées.				
Kjeldahl	Minéralisation	Azote	Total		%	1.05	
	Extraction par le Chlorure de Calcium		minéral	NH4 +	ppm		
			" "	NO3 -			
Argentimétrie	Extraction à l'H2O	Chlorures		Cl -			
Colorimetrie	calcination	Phosphore total		P	%	0.71	
Spectrophotométrie d'absorption atomique		Macro-élements	Potassium	K	%o	0.83	
			Sodium	Na		0.22	
			Calcium	Ca		3.71	
			Magnésium	Mg		1.81	
		Oligo-élements	Fer	Fe	ppm	314.5	
			Manganèse	Mn		228.6	
			Cuivre	Cu		20.4	
			Zinc	Zn		53.3	

OBSERVATIONS

- Carence en azote
-
-
-
-

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D. Letter of Commendation from Farmer in Agadir who Purchased Amaris nursery Transplants

IKAMEL
Route Ait Milk
Biougra

Biougra, December 19, 1995

To Whom it may concern,

From: Mr. Iraqi Mohamed, IKAMEL Company

We are:

- producers of citrus
- producers of vegetables
- packers of citrus and vegetables
- exporters of citrus and vegetables

Our area of production for vegetables includes:

40 hectares under green houses
20 hectares open-field
Total: 60 hectares

Our major production includes: tomatoes, corn, peppers, green beans, potatoes and melons - as follows:

30 hectares of tomatoes
5 hectares of peppers
5 hectares of melons

- For the 1994-95 production season we exported 2,500 tons and for the next season, 1995-96, we expect to export 4,000 tons;
- In order to accomplish this and to improve our yields, we have used the service of the nursery (were plants are cultivated) for the first time in this country;

- **The results obtained by the Amaris Nursery in Ait Melloul are not only determining the levels of germination realized for the tomato seeds (excellent) but also for the quality of the live plants (outstanding).**

Therefore, we encourage all farmers who produce vegetables to utilize the services offered by the Amaris Nursery in Ait Melloul.

IKAMEL

ROUTE AIT MILK
BIOUGRA

N / Réf. :

V / Réf. :

Biougra, le 19 Décembre 1995

Aux personnes intéressées,

Nous nous présentons : Mr IRAQI Mohamed,
Société IKAMEL.

Nous sommes : - Producteur d'Agrumes.
- Producteur de Maraichage.
- Conditionneur d'Agrumes et légumes.
- Exportateur d'Agrumes et légumes.

Notre superficie de cultures maraichères est de :

40 ha sous serre
20 ha plein champ

Total : 60 ha

Nous cultivons principalement de la tomate, mais aussi, poivron, haricots verts, pomme de terre et melon répartis comme suit :

30 ha tomate
5 ha poivron
5 ha melon

- Notre tonnage réalisé à l'export pour la saison 94/95 est de 2.500 T et, celui estimé lors de la saison 95/96 sera de 4.000 Tonnes.

- Pour cela, afin d'améliorer nos rendements, nous avons utilisé le service pépinière (ou cultivation des plantes) pour la 1ère fois lors de cette campagne-ci.

- Les résultats obtenus par la pépinière AMARIS AIT MELLOUL sont déterminants pour ce qui concerne les taux de germination réalisés pour les semences de tomate (excellent), mais aussi pour la qualité des plants livrés (remarquable).
Nous encourageons donc tout agriculteur ou producteur de Maraichage à utiliser les services offerts par la pépinière AMARIS AIT MELLOUL.

E. Proposal for a Trial Project on Grafting of Vegetable Crops

AMARIS

PROPOSAL FOR A PROJECT ON GRAFTING OF VEGETABLE CROPS

PREAMBLE

The present proposal for a project to produce grafted seedlings aims at a maximum annual production of 5 million grafted seedlings. This study uses data of trials on tomato and melon carried out in the Souss Massa and other Mediterranean regions.

INTRODUCTION AND OBJECTIVES OF THE TECHNIQUE

The Agadir area holds great potential for producing vegetable seedlings and has a promising future in horticultural activities. Soil fatigue, environmental considerations and the need for profitability make grafting a topical and necessary technique. Aware of the economic importance of this technique, several horticultural firms in the Souss Massa region have recently converted to grafting, using this technique on up to 90% of the area planted. This season, some large firms imported grafted plant material at great risk of introducing viruses and insects which come under quarantine regulations.

Objectives of grafting:

1) As a solution to many **phytosanitary problems** (control of fusariose, verticilliose, nematodes, strains of *Agrobacterium* etc.): With grafting, there is no need to treat the soil with methyl bromide which is very costly to the farmer (a saving of 35 000 DH/ha) and the risk of polluting the underground water is eliminated and time is saved.

2) To conduct **research on resistance** to salinity, cold, water strees and other types of stress. Several production areas are affected by salinity and drought. Other areas have relatively cold temperatures in winter and out-of-season horticulture remains difficult. Grafting is a means of extending horticulture to these areas.

3) To **improve yield and quality**: Trials have shown that grafting significantly increases the quantity and quality of yield. An increase of 60 to 80% as compared with a non-grafted control was noted. In a trial carried out in 1995 on melon in the Souss Massa, using RS 1596 stock improved the size, the appearance of the fruit skin and gave an increase of 61.4% in yield.

A) GRAFTING TECHIQUE

1) Possible methods

- Approach scioning (sticking one to another)
- Head or terminal split grafting (recommended for tomato)
- Grafting by lateral perforation (tomato and aubergine: to be tried)
- Grafting by inlaying (recommended for melon)

2) Technique

Grafting consists firstly of simultaneously producing stock (seedlings known for their resistance and which will receive the grafted variety), and scions known for their productivity (cultivated varieties such as Daniella, Gabriella, Alma ...) and secondly, grafting them (scion on stock).

When both the stock and the scion, raised from seed, reach the desired stage (2 to 4 real leaves, between 20 and 25 days old, maximum one month), the head of the stock is removed, the hypocotyl of the scion is bevelled, inserted into the stock and bound.

3) Duration

Successful grafting requires 7 days divided into two phases:

- The scion is soldered 3 to 4 days after the grafting operation
- The vessels are completely united 3 or 4 days later
- After complete soldering, the grafted seedlings are placed in an acclimatized zone where they remain for one week, after which they are ready to be transplanted to the farm.

The normal duration of the cycle is 40 to 50 days depending on the species and varieties, assuming that conditions are favorable.

4) Management

4.1) Phase 1: Production (raising) of stock and scion

This phase consists simply of simultaneously producing the desired stock and scion (Daniella, Gabriella, etc.). The quality of seedlings and their stage of development influence the success of the other phases of grafting. During certain periods of high temperature, ventilation alone is not sufficient to bring the temperature below 32°C and a cooling system must be installed.

4.2) Phase 2: The grafting operation + soldering + union

The type of graft depends on the species and the type of equipment (see the possibility of mechanizing this technique). The clearly defined micro-climatic conditions given below must be respected in order to ensure perfect soldering and union of the scion/stock.

Temperature:

- The night-time temperature should be maintained between 16 and 18°C minimum.
- The maximum temperature should not exceed 25°C.

Heating and cooling systems are essential to maintain these temperatures.

Air Humidity:

During phase 2, humidity must be high (above 90%). A fogging system must be installed (not mist but very fine drops of water).

Shading:

Mobile shading is essential during this phase.

4.3) Phase 3: Acclimatization

Acclimatization conditions are intermediary between the conditions for grafting and those for producing young seedlings. This phase remains critical to the complete success of the operation. Favorable microclimatic conditions must therefore be maintained. The greenhouse must have good ventilation (adjustable openings). Shading and fogging are essential to avoid drying out.

B) EVOLUTION OF PRODUCTION IN TIME AND SPACE

1) Estimate of the production capacity

1.1) Summer season:

3 600 000 stocks + 3 600 000 scions to give a total of 3 600 000 grafted seedlings

1.2) Winter season:

1 400 000 stocks + 1 400 000 scions to give a total of 1 400 000 grafted seedlings

Total annual production = **5 000 000** of grafted seedlings

GRAFTING PROJECT
FOR
THE AMARIS NURSERIES

Preamble:

The present proposal for a project to produce seedlings (grafted and normal ones) aims on estimated annual production of 5 million plants this between Azemour and Ait Melloul Nurseries.
This study uses data of trails on tomato and melon carried out in the Souss Massa and Marrakech region in addition to the Azemour zone.

A) INTRODUCTION

The Moroccan demand (especially in Agadir region) of grafting plants is holding a great potential for producing vegetable seedlings, and has a great promising future in horticultural activities.

Soil fatigue and environmental considerations and the need for profitability make grafting a necessary and urgent technique to offer to the Moroccan producers and exporters of vegetables.

B) OBJECTIVES OF GRAFTING

1/a This brings a phytosanitary solution to many problems that occur from the soil.
Example: Melon grafted plants are resistant to: Fusariose, Verticilliose, Nematodes, strains of Agrobacterium, etc.)

1/b Also, with grafting plants (tomato or melon) there will be no need for the farmer to treat the soil with Methyl Bromide. Which is very costly to him (a savings of $4000 US$/ha) by the way this will eliminate risks of polluting the underground water.

2/ The use and the proper conduct of grafting plants will increase the yeild and the quality of the fruits. Trails have shown that grafting significantly increases the yield by 30% to 40% compared to non-grafted plants.

The trials done in the Souss Massa region in 1995 campaign brought:

- Better fruit size, better appearance of fruit skin, almost no "dècheis", and all these factors brought to that producer an increased yield of 61.4%

3/ In summary, we can tell that for more investments by the farmer, he will get great savings during the campaign for all his charges and more revenues.

- Higher price of the plants
  - Reducing the number of plants by hectare by 50%
  - Reducing labor costs
  - Reducing the use of phytosanitary products
  - No need of soil treatments (for the melon)

- Better production, because more vigorous and resistant plants
  - Better yield
  - Better caliber of fruits
  - Better shape and coloration of the fruits
  - better percentage of export fruits

And the main advantage is that the producer is insured of getting his production and profits. Not like if he used no grafted plants that can die during the campaign, or that can produce sick fruits or very low yield and may be no profit at all.

C) **CONCLUSION**

Now, to sum-up the situation of the actions to the actions to be taken by the AMARIS NURSERIES and the trilateral project, we have learned that there are some serious producers that seem to have understood (by experience or knowledge) the differences and the advantages in using grafted plants instead of normal plants. Even if these plants are more expensive than the others.

So, the challenge for us is now to satisfy this demand and be prepared for the melon campaign. We know that the farmer needs the grafted plants to be ready to transplant from the end of December to the end of February.

And because of this concerning demand in grafted plants (for vegetable crops) in Morocco, we have then agreed with Dr. Dov Pasternak (from the Ben Gurion Institute), to send Mr. Nissim Sroussi (the Technical Advisor) to go for training in Israel.

This task was completed during the month of September.

And just after the return of Mr. Sroussi, in mid-October, he started the trails of graftings, in order to be operational in mid-November.

And knowing after making the technical study on grafting (vegetables: melon or tomato) that the time needed in the nursery is 50 to 55 days for getting quality

grafted plants to transplant, this means that all equipment and staff should be prepared and organized for the beginning of November.....

of course, we have made this possible by studying the subject for three months, but we are requiring from you the budget necessary to activate the processes in order to show the Moroccan producers and farmers that we really are up dated producers and working for them properly.

F. Final Report on Israeli Cooperative Research Project, "Growth Suppression on Green House Tomatoes"

Final Report on:

Technology of developed (older) vegetable transplants

Applied to the Moroccan Cooperative Development Project

By: Etan Pressman, Katerina Rosenfeld and Rachel Shaked.

Dept. of Vegetable Crops, ARO, The Volcani Center, Bet Dagan, Israel.

Introduction

Eaeliness in fruit-set and harvesting are of great importence for the tomato as well as other vegetable growers. Earliness enables growers to harvest and export high-quality fruits during the high prices season, thereby increasing their incomes.
For early production in the fall the grower must transplant the seedlings into the greenhouse during the summer. Two major obstacles interfere with this approach and must be considerd:
(a) Transplanting takes place under very high temperature conditions which severely affect the plants development and especially the flowers shape, viability and functioning.
(b) In the summer the plants are vulnerable to whiteflies, the major vector of the yellow mosaic virus. For preventing the whitefly penetration the greenhouse should be thoroughly coverd by an insectproof net which causes an additional elevation in temperatures.
For early production and marketing in the spring transplanting should take place in the winter, which means that the plants, particularly outdoor vegetables, are exposed to low temperatures and other stresses like wind and hail.
By developing methods for shortening the time from transplanting to fruit set and harvest, the farmer will be able to delay the planting-out, untile more suitable weather conditions prevail, and yet be early in the market.One of the alternatives for shortening the time from transplanting to harvest is using more developed, older, transplants. These transplants may bear flowers or even young fruitlets. However, in order to obtain transplants of reasonable price they sould be grown at a relatively high density in the nursery. Overcrowded population of the plants may cause etiolation which severely reduces their quality. Therefore, controlling the height and size of the transplants is a prerequsite for keeping them in a suitable, commercial shape. The traditional techniques for controlling the transplants size are by using growth retardants. Alternatively, mechnical treatments for obtaining the same purpose are under intensive research and development.
This report summarizes three years studies aimed at adapting and developing the best techniques for obtaining older transplants for shortening the growing and production period without affecting the yield or the its quality. Most of the work was carried out with tomatoes, but melons were also studied.

I. Comparison between paclobutrazol and mechanical treatment

Tomato cv. 144 seedlings were sown in 1.5" Speedling trays. At the stage of 4-5 leaves the seedlings were plantrd in 10 cm plastic pots containing tuff. Two days later the plants were divided into 3 groups which were treated as followes:
(a) Ten ml of paclobutrazol solution at 10 ppm were applied by drench (PP).
(b) The shoot of the plants was shaken by hands 10-15 times every day - mechanical treatment (MT).
(c) Control, non-treated seedlings.
Concomitantly with the PP treatment other seeds of the same cv. were sown and the seedlings were used as young control.
Five weeks later the older transplants had 2 trusses each and some of the flowers of the first truss set fruits. The younger control plants had no visible inflorencses. At that stage 6 to 8 plants of each tretment were transplanted into 10 l pots containing tuff.
The height of the plants was weekly measured for 5 weeks and 44 days after transplanting the shoots and the roots were separately weighed and the number of ripe fruits was recorded.

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Results- data in Fig. 1 show that at transplanting the height of the older control transplants was double that of the PP or MT treated ones, the MT treated plants were somewhat longer than the young control. These results indicate that the retarding treatments allowed only a very restricted elongation in the trays. After transplanting the elongation rate of th MT treated plants was similar to that of the young controls and the PP-treated plants showd the lowest elongation rate.
Forty four days after transplanting the highest plants were those which were developed from the older control transplants and those from the PP- treated ones were the lowest (Table1). The young control and MT treated plants were smilar in height. The shoot weight of the older control plants was double and the root weight was triple that of the young control and similar in both parameters to the treated ones.
Treating the transplants either by PP or by MT caused a marked delay in flowerig and fruit set. Therefore, 0.6 and 0.2 ripe fruits were harvested from the MT and PP treated plants, respectively, and 1.6 fruits from the older control. No ripe fruits were detected on the young control plants.

Fig. 1 : The effect of PP or MT treatments on tomato, cv. 144, plants development

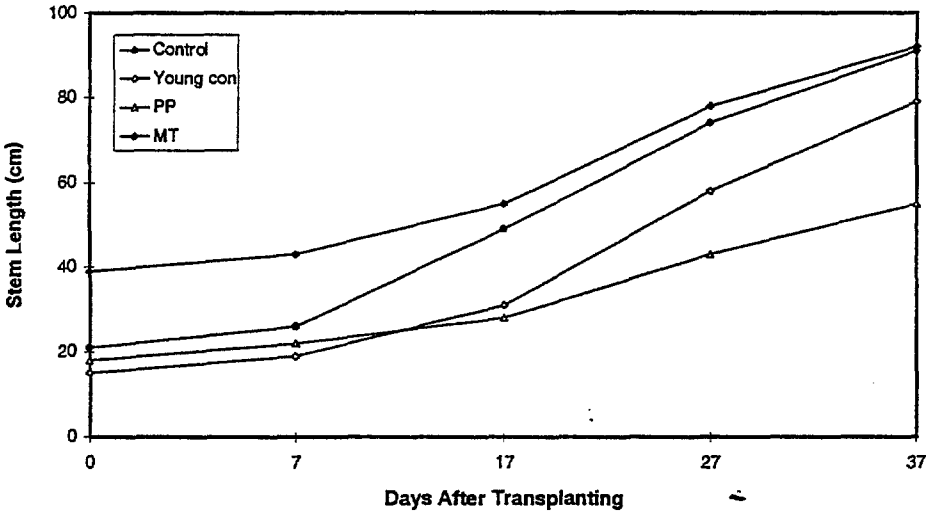

Table 1: The effect of PP (20 ppm) and MT applied on tomato cv. 144 seedlings on their development 44 days after transplanting.

	Plant height (cm)	Shoot wieght (gr)	Root weight (gr)	Fruits per plant
PP	37	71	19	0.6
MT	69	86	17	0.2
Control	91	95	21	1.4
Young control	57	46	7	0.0

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II The effect of paclobutrazol concentration

Tomato, cv. 144, seedlings with 4 leaves grown in 1.5" Speedling trays were sprayd with 3 concentrations of paclobutrazol (PP) solution: 10, 20 or 40 ppm. Other seedlings were mechanically treated (MT) by shaking the shoot every day. Part of the transplants were planted in 10 l pots on 6.8.94 and another part one week later. Forty two days after the second transplanting date the plants were evaluated for their reproductive stage.

Results - PP treatment (all concentration examined) markedly accelerated the flowering (Table 2). The PP- treated plants of the first planting date were bearing fruitlets and flowers on the first truss in comparison with only flowers in the control plants, open flowers vs. buds on the second truss and flower buds vs. nothing on the third one. MT had only a slight effect on the flowering and fruit set. Similar effect of PP was observed also in the plants of the second planting date. In these plants the higher concentrations of PP (20 and 40 ppm) were more effective than the lower one.

Table 2: The effect of PP concentration and MT applied to tomato (cv. 144) seedlings, transplanted at two dates, on their subsequent reproduction.

	First planting date (6.8.94)			Second planting date (13.8.94)		
Treatment	truss 1	truss 2	truss 3	truss 1	truss 2	truss 3
Control	flower	buds	0	buds+flowers	buds	0
MT	flowers+ fruitlets	buds+ flowers	buds	"	"	"
PP 10	fruitlets+ fruits	flowers	"	flowers	flowers	buds
PP 20	"	"	"	fruitlets	"	"
PP 40	"	"	"	"	"	"

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III The effect of seedling age on its response to PP

Tomato, cv. 189, seedlings were grown in 1.5" Speedling trays. At the stage of 2 true leaves part of the seedlings were sprayd with 20 ppm PP solution (2 leaves stage). Another part was sprayd at the stage of 3 leaves, and another at the stage of 4 leaves (3 and 4 leaves stage, respectively). One week after the last spray the seedlings were transplanted into 10 l pots. The effect of the treatments on the transplants and on the plants development, one month later, was recorded.

Results - Seedlings treated at the stage of 2, 3 or 4 leaves did not differ in their response to PP at 20 ppm. Data in Table 3 show that the shoot and root weight and the number of leaves were similar in all the treatments including the control. The stem lenght of the PP-treated plants increased with seedling age at treatment, and the 4 leaves and control seedlings had a similar stem length. The seedling age at treatment had a remarkable effect on its development after transplanting (Table 4). One month after transplanting plants developed from the 2 leaves stage were much shorter and with a lower shoot and root weight in comparison with the other ages or control plants. Plants of the 3 or 4 leaves stage possessed heavier shoots and roots than the control. All the PP-treated plants, but not the control, possessed fruit trusses. In this regard, the plants of the 3 and 4 leaves stage had more trusses than the 2 leaves stage ones.

Table 3: The effect of paclobutrazol (20 ppm) on tomato, cv. 189, seedlings which were treated at different stages of development.

Stage at treatment	Shoot wt (gr)	Root wt (gr)	No. of leaves	Stem length (cm)
Control	11.28	0.535	5.6	18.2
2 leaves	13.75	0.809	5.4	12.6
3 leaves	8.50	0.652	5.7	14.4
4 leaves	11.25	0.801	5.9	18.6

Table 4: The effect of paclobutrazol (20 ppm) sprayed on tomato (cv. 189) seedlings at different developmental stages, on their subsequent development (determined 1 month after transplanting).

Developmental stage	No. of trusses per plant	Shoot length (cm)	Shoot wt. (gr)	Root wt. (gr)
Control	0.0	63.9	66.1	14.5
2 leaves	0.29	46.4	47.7	12.5
3 leaves	0.86	61.1	70.9	20.3
4 leaves	0.50	66.0	77.6	18.5

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IV Experiments with cherry tomatoes

Cherry tomatoes cvs. 7225 and 508 were treated with PP 10 or 20 ppm, by drench, at the stage of 4-5 leaves. The effect of the treatments on different parameters of the transplants development were recorded 26 days after transplanting into 10 l pots.

Results - The stem length of the treated cv. 7225 plants was half that of the control, and there were no differences between the two concentrations (Table 5). The stem diameter and number of leaves were similar, but the PP-treated plants had less fruitlets than the control plants. Similar vegetative results were obtained with cv. 508 (Table 6). In this cultivar however, the growth retardation was associated with enhanced flowering.

Table 5: The effect of two paclobutrazol concentrations, applied to cherry tomatoes, cv. 7225, seedlings on their subsequent development. Determined 26 days after transplanting.

Treatment	Stem length	Stem diameter	No. of leaves	No. of inflorences	%		
					buds	flowers	fruitlets
Control	39.6±1.44	0.51±0.03	8.8± 0.13	1.4± 0.16	40	30	30
PP 10	16.1±1.08	0.52±0.01	8.3± 0.15	1.1±0.23	40	60	0
PP20	23.2±0.57	0.53±0.01	8.1± 0.10	1.2±0.20	10	80	10

Table 6: The effect of two paclobutrazol concentrations, applied to cherry tomatoes, cv. 508, seedlings on their subsequent development. Determined 26 days after transplanting.

Treatment	Stem length cm	Stem diameter cm	No. of leaves per plant	No. of inflorences per plant	%		
					buds	flowers	fruitlets
Control	40.3±2.16	0.8 ±0.01	8.7± 0.15	0.4± 0.16	40	0	0
PP 10	24.0±1.08	0.7±0.02	8.9± 0.28	0.8±0.20	70	0	0
PP 20	26.0±0.66	0.7±0.02	8.9± 0.23	0.8±0.29	50	0	0

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V Experiments with open field tomatoes

The main goal of this experiment was to induce concentrated fruit maturation in order to obtain high yield in a single harvest. Seedlings of the deteminated cv. M 82 were grown in 1.5" trays. At the stage of 4-5 leaves per plant half of the seedlings were sprayed with PP at 20 ppm. Concomitently seeds of the same cultivar were sown in other trayes (young control). One month later the older and younger plants were transplanted into 10 l pots. Before transplantig the inflorensces (2 per seedling) were removed from half of the PP and half of the older control plants. One month after transplanting the older plants (both PP treated and control- those with the inflorensces removed or not) had 4.5 to 5.5 inflorensces per plant, and the young control 1.3. At that stage half of the plants of each treatment was sprayed with auxin (Al Zera 0.5%) to the point of run-off. The fruits were harvested 58 days after the spray.

Resuits - Generally, the number of fruits per older or young plant was similar (Table 7). PP treatment in the nursery did not affect the fruit number and caused some delay in ripening. Auxin treatment caused a reduction in the fruit number but accelerated their ripening in the older as well as youner plants. The removal of inflorensces led to a reduction in fruit number only if it was followed by a auxin spray.

Table 7: The effect of paclobutrazol, flower removal and auxin spray on tomatoes, cv. M82 reproduction and fruit ripening.

Transplant age	PP	Inflor. removal	Auxin	Fruits per plant	% red fruits	% mature green fruits
Old	+	yes	+	22.8	48.2	19.3
Old	+	no	+	33.0	66.6	15.1
Old	+	yes	-	50.0	20.0	52.0
Old	+	no	-	41.0	21.9	26.8
Old	-	yes	-	40.5	33.5	37.8
Old	-	no	-	38.9	22.8	47.3
Young	-	no	+	45.5	21.9	25.3
Young	-	no	-	40.0	13.7	47.8

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VI Experiment with melons

Cv. M-8 seedlings were grown in 2" Speedling trays. Seedlings with 2 true leaves were sprayed either with PP, 10 ppm or CCC, 500 ppm solutions or mechanically treated (MT) every day for one month, after which transplants of all treatments were measured and planted in 10l pots. After another month the plants were evaluated.
Results - PP caused the most pronounced reduction in seedling legth (Table 8), while CCC and especially MT were less effective. The PP and MT treated plants were shorter than the control ones, weareas CCC had no effect. Only the treatment with CCC caused a significant reduction in the number of side shoots and only MT led to a significant decrease in the number of female flowers.

Table 8: The effect of PP, CCC and MT on melon seedlings length at transplanting and their subsequent development.

Treatment	Stem length at transplanting	Stem length	Side Shoots	Female flowers
Control	52.6±3.1	163.5±13.4	5.3± 0.8	1.4± 0.4
MT	43.2±2.2	125.5± 11.6	4.0 ±0.4	0.2± 0.1
CCC 500	34.4±1.4	158.0 ±15.6	2.8 ±0.5	1.7± 0.3
PP 10	21.5±1.1	123.0± 13.1	4.1± 0.6	1.0± 0.6

Disscussion

As expected treatment with paclobutrazol markedly decreased the seedling height in tomatoes and in melons. The effect of CCC and mechanical treatments were smaller, but, significant. Retarding the seedlings size prevents their etiolation, which brings about a short, sronger and healthier plant which is easier for handling and transplanting. Retardation of the shoot generally leads to a more developed root system, which is of a great advantage in the transplant's start and establishment. Regarding plant developmental rate following transplantig, the MT-plants are faster than the PP-treated ones. Indicating that the release from the MT stress, in contradiction with PP, is an immediate one.
All the plants developed from older transplants set fruits and were harvested much earlier than those of the young control (transplanted at the commercial stage) plants. These results confirm the assumption that using older transplants can enable earliness in fruit harvest. Furthermore, it was found in some of the experiments that PP and to a lesser extent MT, causes further earliness in tomatoes. In melons CCC was found to enhance female flowering. Therefore, in addition to their effects on the seedling quality, the use of growth retardants or MT can be a very beneficial proceedure also when earliness neto is considerd.
Another benefit of using older transplants and shortening the time to harvest, is the ability to grow two crops in one season. This is especially importent for single, concentrated harvests of tomatoes.

Conclusions

1. Seedling or transplant growth and development can be controled by growth retardants or mechanical treatments.

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2. Growth-retarded plants can be kept in the nursery for a longer duration without being etiolated, thereby obtaining older transplants.
3. Older transplants can be used for delaying the transplantation without causing lateness, or obtainig earliness folowing a regular transplanting.
4. Growth retardants may cause further earliness.
5. Auxin can be used for concentrating the fruit ripening.,allowing higher yields in single harvests.

Plans for the next (last) year

Since nurseries became a major issue in the morrocan project, and on the basis of the our results, we would like to focuse on two aspects of seedling production:

1. To learn how to prevent rapid elongation (etiolation) of the of high populated seedlings, especially under high summer temperatures conditions.

2. How to treat transplants, ready for planting out, which under extenuating circumstances should be kept in the nursery for different periods of time.

In the first issue, treatments can be carfully planed according to the expected weather or temperatures. In the second issue, treatments should immediately stop the seedling elongation, but for a relatively short period of time. Thus, it will resume its growth upon transplantation.
These experiments will include different greenhouse or field cvs.

G. Work Plan for Israeli Cooperative Research Project, "Chilling Requirements of New Cultivars of Raspberries"

Work plan for 1996 - 1997

Chilling requirements of new cultivars of raspberry

Investigators:
Dr. David Mills and Dr. A. Benzioni
The Institutes for Applied Research, Ben-Gurion University of the Negev, P.O.B. 653, Beer-Sheva 84105. Tel. 461958 ; FAX: 972-7-472984

Scientific Objectives

The overall proposed research program aims at developing raspberry as a new crop for warm Mediterranean climates. This crop is intended to be a cash crop for off-season export to the European market.
As most commercial cultivars have high chilling requirements selection of varieties with lower chilling requirement is needed. Therefore the first important objectives are to estimate the chilling requirements needed for breaking bud dormancy of new cultivars and to develop a methodology for exposure of raspberry canes to the chilling conditions in cold room before planting in the field.

Background

The red raspberry (Rubus idaeus L.) is one of the most popular berry crop species for consumers. It is supplied to both the fresh and industrial markets. In many parts of the temperate zones in the northern hemisphere the supply to the fresh market is low while consumer demand remains high. Raspberry production is limited by the high labor requirement of pruning and harvesting. The price, however, received by the farmer is usually high which economically justify the cultivation of the crop. In Israel, commercial raspberry orchards exist in the Golan heights. Production takes place in June to August and is only for the local market which is already saturated. Increase of production has to be therefore in an earlier or later season than the current one and should be aimed for export. Raspberry was introduced to the Azimour site of the Cooperative Moroccan Program. Early results show that it is possible to receive yields from April to September.
Red raspberry is a perennial plant which produces biennial canes. In the first year the plant normally produces vegetative canes (primocanes) which become dormant in the autumn. Dormancy is lost during the winter and flowering laterals (floricanes) develop from the axillary buds in the following season (Jennings 1988). The floricanes die after fruiting and have a negative impact by

competing with actively growing primocanes. The floricanes are also a potential source of inoculum for diseases. Removal of the latter as soon as possible after fruiting is therefore recommended, but it is a labor intensive and expensive practice. An alternative to annual pruning is ground level-mowing after the fruiting year to produce a crop only in alternate years. The disadvantages of "alternate-row pruning" practice is having yields once in two years, and overall reduced yield due to high cane density and small fruits.

Innovation

Raspberry grows outdoors. The natural conditions dictate the periods of dormancy, break of dormancy, vegetative growth and fruiting. Raspberry grows exclusively in temperate climate where fruiting in the northern hemisphere occurs mainly in June through August. In order to develop raspberry as a cash crop we intend to obtain raspberry fruits from February to June and in September. We suggest that the method to obtain this goal is to manipulate both the temperature and period of cold storage and the temperature at the period of bud-burst. This will be done by removing primocanes with the roots for appropriate cold storage and retransplanting them for fruit production. The cultivation will be carried out in soil-less cultures in a cool greenhouse. We will develop raspberry production as an annual crop. After every harvest the plants will be rooted out.

Primocane will be collected from the yielding plots and/or from a mother plot, kept in storage and transplanted. By having up-rooted plants, It will be easier to control the size and status of the propagated material and the density of planting. This will enable to obtain limited adventitious shoots and root suckers and to obtain the optimal fruit number and size by the right density and the selection of cane thickness.

Relevance

The Israeli and Moroccan farmers and farmers elsewhere are seeking new cash crops. These are either new crops or old crops that can be supplied off-season to the market. Raspberry is supplied mainly during June to August in the European market. It is sold for more than $ 10 per kg. We suggest that raspberry can be produced in the Negev in February - June and in September and supplied to the market when only limited amounts of fruit is available.

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Work plan

Three new hybrid cultivars were obtained from California, USA. These cultivars are currently being grown and propagated in pots in our greenhouse. In September half of the plants will be placed outdoors to stimulate dormancy. In November at the beginning and end of the month the plants will be taken out of the pots. The canes with the root systems will be treated with a fungicide (Benlate) and stored for 200, 400, 800, and 1500 hrs at 4°C. Other plants of three other cultivars of raspberry that are currently cultivated in the Golan Heights will be shipped from Moshav Sha'al by the curtesy of Mr. Ami Berkovitz. These plants will be treated as above and stored in the cold room. Eight canes per treatment per cultivar will be used. After each storing period, the canes will be transplanted in 10 liter pots in a temperature-controlled greenhouse. The plants will be irrigated daily and fertilized twice a week with 7:3:7 Shefer fertilizer. The following parameters will be determined: no. of total nodes at transplantation, no. of lateral growing branches, mean length of lateral branches, no of inflorescence, no of fruits, fruit weight and total yield.

H. Progress Report for the Israeli and Moroccan Collaborative Research Project, "Domestication of Argan as an Oil Crop"

Domestication of argan (*Argania spinosa*) as an oil crop

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Introduction

Argan – *Argania spinosa* L. (Skeels) – is a medium-to-large evergreen tree native to the semiarid areas of south-western Morocco. The plum-sized fruit has a fleshy, bitter-tasting pericarp and a stone-like central portion containing one to three seeds rich in oil (> 50%) (Fairness et al. 1984; Morton and Voss 1987). The argan tree is well adapted to dry conditions and yields reasonable crops even in areas prone to periods of severe drought. It constitutes the main component of the ecosystem in its growth area, and the rural population there use it as a source of fine edible oil, firewood, charcoal, and forage for livestock (Morton and Voss 1987; Predergast and Walker 1992).

Attempts to cultivate argan in Morocco and in other countries have not been numerous. The present report summarises studies of argan fruit characteristics carried out in Israel and Morocco in the hope of identifying morphological traits correlated with oil yield. Such traits could then be considered in the selection of genotypes as candidates for cultivation.

Methodology

Israel – Fruits were harvested in Israel in 1994-1995 from trees planted in the Negev desert at two sites: Qetura (Arava valley) and Ramat Negev (Negev Heights) (Nerd et al. 1994). Qetura is warmer than Ramat Negev and has a lower annual rainfall (35 mm vs. 90 mm). At both sites the trees were irrigated throughout the year, at Qetura with brackish water (~ 4 dS/m) and at Ramat Negev with good quality water (~ 1 dS/m).

During Dr. Nerd's visit in Morocco, fruits were sampled from trees growing in the natural habitat of argan, from Ait Baha in the south (120 km south-east of Agadir, in the Anti-Atlas) to Argana (90 km north-east of Agadir, in the High Atlas), and Essaouira (163 km north of Agadir, on the Atlantic coast) in the north. Annual rainfall (winter) is ~ 200 mm in Ait Baha and ~ 400 mm in the northern areas. Average temperatures in the hottest months (July-August) and the coldest month (January) are 28.7C and 12.4C respectively in Ait Baha, 28.6C and 11.4C respectively in Argana, and more moderate along the coast – for example, 22.4C and 13.7C respectively in Agadir.

Total number of trees sampled was 21 in Israel and 23 in Morocco. The components of 20-30 sun-dried fruits in each tree were separated and weighed. The relationship between various fruit parameters (stone weight, kernel weight and the number of kernels in the fruit) was analysed by regression analysis.

Morocco – A brief study was made of the ecology at Ait Mellul, Argana and Ait Baha, three stations in south-western Morocco. The information thus obtained was supplemented with information on soils, rain, temperature, and the relative position of the trees on a map. At each site, thirty trees were selected and numbered. The phenology and morphology of leaves, flowers, pollen, fruit, stone, nuts and seedlings were examined. Statistical analysis was used to estimate environmental effects, as well as genetic components of variance within and among populations.

Results and Discussion

Israel – Total kernel weight per fruit tended to be higher at Qetura than at Ramat Negev; thus, weights recorded ranged from 0.22 g to 0.37 g at Qetura versus 0.17 g to 0.27 g at Ramat Negev (Fig. 1). This finding supports results obtained in our previous study in 1991-1992 (Nerd et al. 1994). The environmental conditions at Qetura – higher temperatures and/or brackish water – probably favor kernel growth in argan. In most of the trees the majority of the fruits contained a single kernel, and fruits with two, three or four kernels were in the minority. The correlation between kernel content (g/fruit) and the percentage of fruits with two or three kernels was positive and

significant at Qetura (p=0.05) but not significant at Ramat Negev (P=0.1) (Fig. 1). At both sites, a significant negative correlation (p=0.05) was found between percentage kernel weight [(kernel weight/stone weight) x 100] and stone weight (Fig. 2A and C). Thus, heavier stones have relatively more wall content. However, kernel content (g/fruit) tended to increase with increasing stone weight, significantly so in Qetura (P=0.05) and not significantly in Ramat Negev (P=0.1) (Fig. 2B and D).

Fruits harvested by Dr. Nerd in Morocco were found to contain mainly a single kernel, but kernel content (g/fruit) was not significantly correlated with the percentage of fruits with two or three kernels (data not shown). Kernel weight per fruit ranged between 0.16 and 0.47 g and showed a more pronounced increase with increasing stone weight than in the Negev (P=0.01), Fig. 3A). Moreover, the negative correlation between percentage kernel weight and absolute stone weight was more significant (P=0.01) in Morocco than in the Negev (Fig. 3B).

The results of this study indicate certain trends associated with kernel production and thus with oil production in argan. Whether a higher frequency of fruits with more than one kernel correlates with higher kernel content remains questionable. To settle this question it will be necessary to carry out further studies of factors affecting seed set and kernel growth. Stone weight may prove to be a criterion for kernel content, and it is expected that trees bearing heavier stones will have a higher oil content in the fruit. However, given the same total stone yield, trees bearing smaller stones may be expected to produce a higher oil yield than trees with larger stones, because smaller stones contain a higher percentage of kernel (and thus have a relatively thin wall). We have clear evidence that the size of the stone differs between genotypes, i.e., is genetically inherited. However, to determine whether the production of small stones is compensated by higher fruit number will require further studies.

This work will be extended, and the traits investigated in this work – as well as others such as ovule number in the flower, oil concentration and composition, fruit set and fruit yield – will be examined in a larger diversified population

(new plantations in the Negev) for the purpose of identifying traits capable of predicting improved oil yielders.

Morocco - The team in Morocco were able to define discriminating characters as well as clusters of similar genotypes for fruit and stone traits among the three populations. We are in the process of collecting samples, identifying morphological traits and purchasing laboratory equipment.

References

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Morton J.F. and Voss G.L. 1987. The argan tree (*Argania syderoxylon*, sapotaceae), a desert source of edible oil. Econ. Bot. 41: 221-233.

Nerd A., Eteshola E., Borowy N. and Mizrahi Y. 1994. Growth and oil production of argan in the Negev desert of Israel. Industrial Crops and Products 2: 89-95.

Prendergast H.D.V. and Walker C.C. 1992. The argan – multipurpose tree of Morocco. The Kew Mag. 9: 76-85.

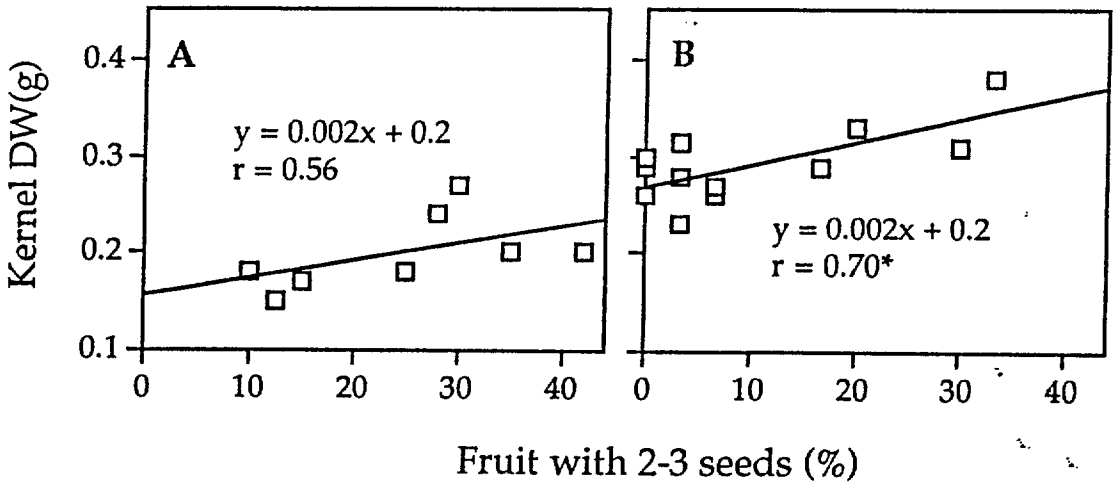

Fig. 1. Relationship between kernel dry weight per fruit and the percentage of fruits with 2-3 kernels. Fruits (20-30 per tree) were sampled at Ramat Negev (A) and Qetura (B). *= significance at P=0.05.

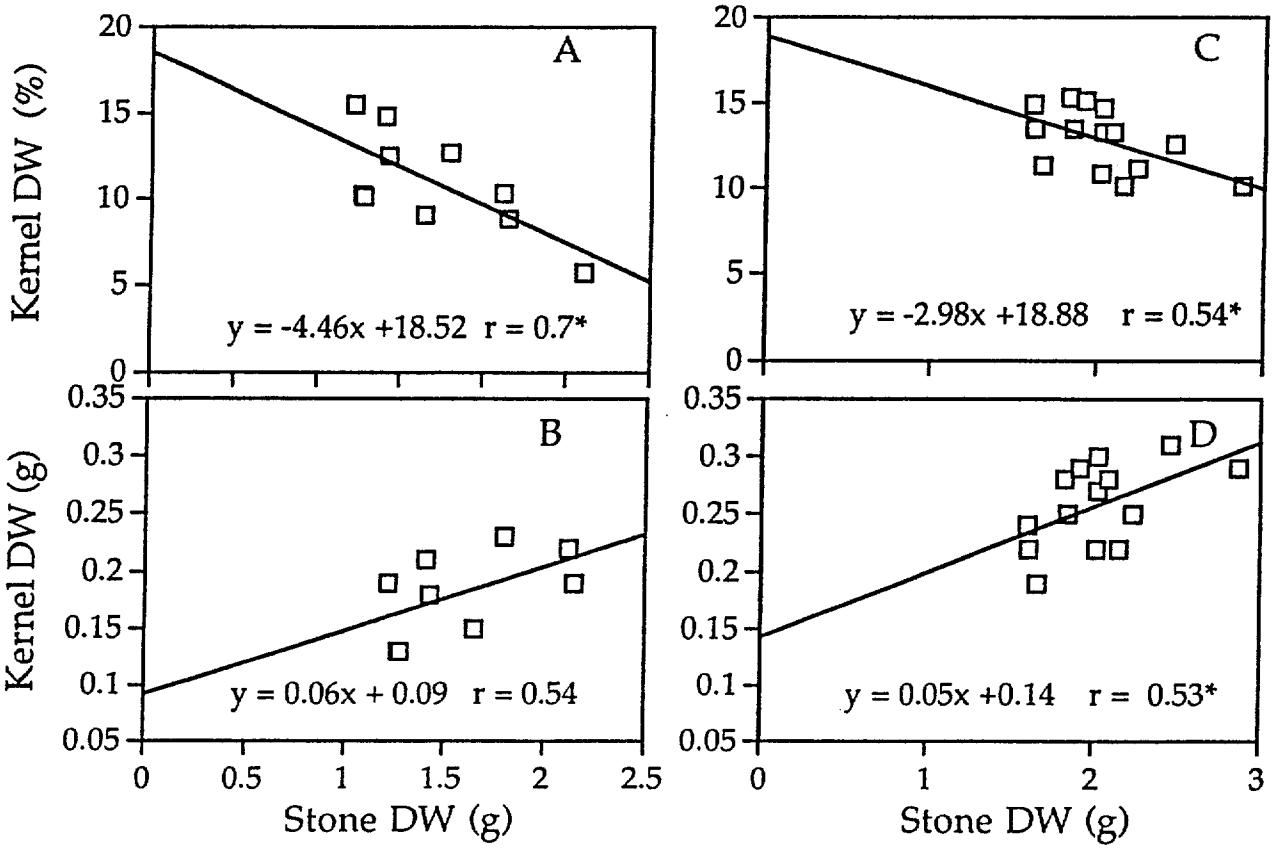

Fig. 2. Percentage of kernel dry weight and absolute kernel dry weight in fruits samples at Ramat Negev (A, B) and Qetura (C, D) in relation to stone weight. At each site 20-30 fruits were sampled per tree. *= significance at P=0.05.

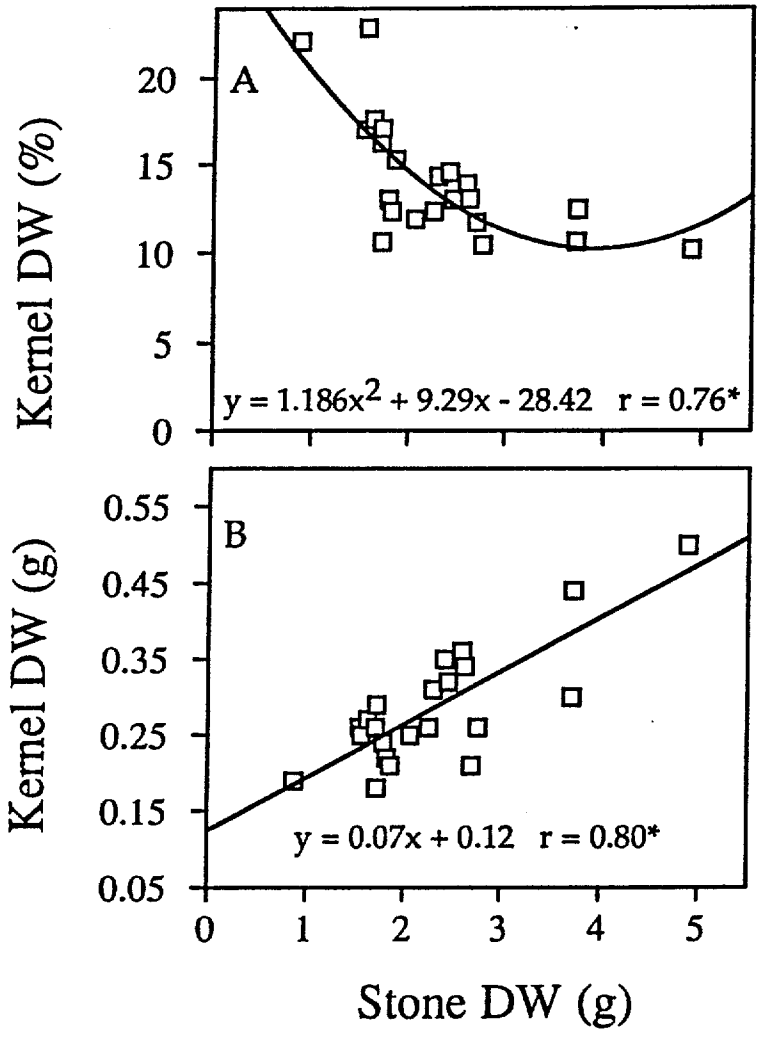

Fig. 3. Percentage of kernel dry weight (A) and absolute kernel dry weight (B) in fruits sampled in Morocco in relation to stone weight. Thirty fruits were sampled from each tree. **= significance at P=0.01.

I. List of Trainees at Amaris Nurseries, Azemour and Agadir during 1995-1996

TRAINEES

AMARIS AZEMOUR

AQUINI, Jamâa
Centre de qualification Agricole de TAROUDANT
Période du stage: 08/21/95 au 11/30/95
Secteur: Ornementate

KANISSI, Brahim
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 11/03/95 au 03/03/96
Secteur: Mécanique agricole

MOUNIM, Abdellatif
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 11/03/95 au 03/03/96
Secteur: Mécanique agricole

BEL GHAZOUANI, Mustapha
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 04/05/96 au 08/15/96
Secteur: Polyculture

CHAIF, Rachid
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 03/08/96 au 07/30/96
Secteur: Polyculture

NJILI, Fatna
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 04/25/96 au 07/25/96
Secteur: Polyculture

ELLIHOUNI, Fatima
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 04/25/95 au 07/25/95
Secteur: Polyculture

BALDIRI, Ali
Centre de qualification Agricol de CHAOUIA
Période du stage: 9/95

EZZIKARI, Souad
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 9/95

MAKHROUTE, Faliha
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 9/95

L'MBAREKI, Faliha
Centre de qualification Agricol de Bir Mezioui KHOURIBGA
Période du stage: 9/95

AMARIS AGADIR

AMAHRIR, Hakim
Institut Agronomique Hassan II d'Agadir
Période: 12/25/96 au 02/25/96
Secteur: Seedling

ZOUHEIR, Nora
Institut Technique Agricole de la Chaouia Ben Ahmed
Période: 04/08/96 à ce jour
Secteur: Seedling

BOUAZZA, Homman
Mekknes University
Période: 8/95

J. Status of Morocco Project Research Activities

Status Report of the Morocco Project Research Activities - September 1996

Adaptive Research Activiities (Azemour, Morocco)

Topic	Principal Investigators	Begin	End	Status
1. growth regulators	Nissim & Omar	Jan-96		on-going
2. nematode resistant tomatoes: indeterminate/determinate	Nissim & Omar	May-95		on-going
3. melaleuca	Nissim & Omar	Jul-92		on-going
4. aparagus grown with saline water	Nissim & Omar	Jul-92		on-going
5. artichokes grown with saline water	Nissim & Omar	Jul-92		on-going
6. raspberries	Nissim & Omar	Jan-94		on-going
7. grafting vegetable crops	Nissim & Omar	Aug-96		on-going
8. hardening of tissue culture propagated date palm trees	Nissim & Omar	Apr-96		on-going

Cooperative Research Activities (Israel)

Topic	Principal Investigators			
1. chilling of raspberry roots	Mills	Apr-96		on-going
2. breeding of nematode resistant tomatoes (completed)	Barr	Jul-92	Dec-95	completed
3. growth suppression on green house tomatoes	Pressman	Jan-93	Jun-96	completed
4. verticordia	Ben Dov	Jul-92		on-going
5. Micropropagation of Ornamental Eucalyptus	Mills	Jul-92	Jul-95	discontinued
6. Physiological and Nutritional Studies of Onions	Rabinovic	Jul-92	Oct-94	discontinued
7. Economic and Marketing Study	Pohoryles	Jul-92	Jan-95	completed

Collaborative Research Activities (Israel & Morocco)

Topic	Principal Investigators			
1. truffles	Tsur/Achour	Jul-92		on-going
2. argan	Nerd/Aameur	Dec-94		on-going