

## Sustainable Management of Natural Resources and Improvement of Major Production Systems of the Arabian Peninsula.

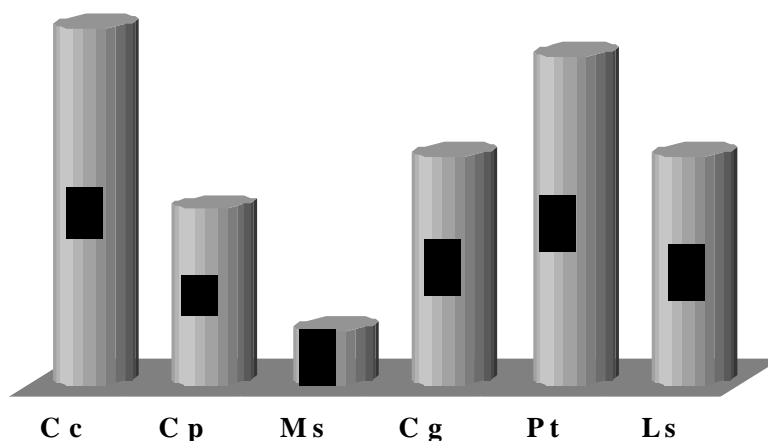
### Summary of achievements during 2001-2002 season

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#### 1. Research Activities

- Exotic species, in the form of Alfalfa (*Medicago sativa*) and Rhodes grass (*Chloris Gayana*) are ill adapted to the environment of the Arabian Peninsula, yet are being grown to accommodate the short fall of forage from rangeland. Utilizing the adapted genetic variation of indigenous forage species remains one of the main strategies of the rangeland/forage component of APRP during Phase II.
- Priority grass species are now identified in most countries of the Arabian Peninsula. These are *Panicum turgidum* and *Pennisetum divisum* in Kingdom of Bahrain; *Cenchrus ciliaris*, *Coelachyrum piercei*, *Lasiurus scindicus* and *Panicum turgidum* in Emirates; *Cenchrus ciliaris* and *Coelachyrum piercei* for Sultanate of Oman; *Panicum turgidum*, *Pennisetum divisum*, *Lasiurus scindicus*, *Cymbopogon parkeri* and *Chrysopogon aucheri* in Qatar; *Cenchrus ciliaris*, *Coelachyrum piercei*, *Panicum turgidum* *Pennisetum divisum*, *Stipagrostis ciliata* for the central region of the Kingdom of Saudi Arabia, and *Andropogon distachyos*, *Dechanthium annulatum*, *Pennisetum macroarum* and *Panicum turgidum* in the northern and southern regions of the Republic of Yemen.
- Shrub species are identified in the northern part of the Kingdom of Saudi Arabia. These include: *Atriplex leaucoglada*, *Salsola velosa*, *Salsola tetrandra*, *Atriplex halimus* and *Tragnum nudatum*.
- With priority species identified, a necessary step is to obtain large quantities of seeds from these species and lay the grounds for mechanized seed multiplication. Seed multiplication fields for indigenous grass are now established in Emirates, Sultanate of Oman, Yemen and Qatar. While shrub seeds are being produced in large quantities (5t/season) in Saudi Arabia.

- An experiment comparing the water use efficiency of four indigenous grass species: *Cenchrus ciliaris* (Cc), *Panicum turgidum* (Pt), *Lasiurus scindicus* (Ls) and *Coelachyrum piercei* (Cp) and two exotic species: *Medicago sativa* (Ms) and *Choris gayana* (Cg) was established in January 2002 in the United Arab Emirates. Known quantities of water are being applied (by drip irrigation) and the forage produced is being assessed at regular intervals. Preliminary results show that at least two indigenous forages *Panicum turgidum* (Pt) and *Cenchrus ciliaris* (Cc) are producing significantly higher forages than the exotic species, especially at low water rates. This experiment has been further supported with soil moisture monitoring using TDR instrument. The objective is to couple the existing observations on crop yield with data that could better explain the variation in performance amongst the different species and to provide a better understanding of the comparative water consumption of these crops.



*Dry matter production of six forages (t/ha) under low level of irrigation (26 liters/unit area of 6.25 m<sup>2</sup>) at Dhaid Research Station in UAE during May-June 2002*

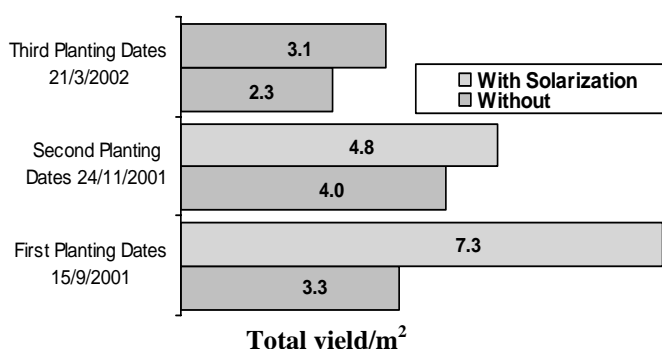
- A similar set of the experiments was established in the Central region of the Kingdom of Saudi Arabia comparing five indigenous grasses together with Alfalfa and Rhodes grass.
- In the Republic of Yemen two areas have been located (one in the northern highland and one in the southern region-Al Kud) to assess the effects of proper management on recovery of degraded rangeland sites. Both activities are done with joint involvement of the farming community.

- In Oman, an experimental study has been initiated to test the performance of four cultivated fodder crops and two selected indigenous pasture species under different conditions of soil moisture. The objectives of this experiment are to test the comparative growth and yield responses of indigenous pasture species to stress irrigation in order to explore their potential for saving irrigation water, and to identify irrigation levels for higher water use efficiency.



- In UAE, a research proposal was submitted to the National History Museum to study the effects of short grazing period (s) on the performance of a rangeland, which is been protected from grazing for over 8 years.
- A feeding trial (involving sheep/goats) to assess the forage qualities of an indigenous species was established in April 2002 in the Sultanate of Oman. The forage produced from Buffel grass (*Cenchrus ciliaris*) will be compared with Rhodes grass (*Choloris gayan*) when fed to these animals. The actual trial is expected to begin in December this year when sufficient quantities of forages are collected.
- The Integrated Production and Protection Management (IPPM) was developed by APRP to provide green house growers with simple applicable techniques for crop protection other than relaying mainly on pesticides, thereby reducing the use of hazardous chemicals. The extensive use of chemicals to control diseases and pests in greenhouses results in complex problems of resistance build-up, and health and environmental hazards. IPPM was implemented in all the Arabian Peninsula (AP) Countries by both research stations and private growers. Application of IPPM techniques in Sa'ada area in Yemen, led to significant results as expressed by farmers reaction to these techniques. The average number of pesticides application per growing season (4-5 months) of cucumber crop was 18-22 sprays. This was cut down to about 2-3 sprays per season when IPPM was applied. Similar results were obtained in the research stations in Bahrain, Qatar, Oman, UAE, Kuwait and Yemen.

**Influence of Soil Solarization on Cucumber yield/plan (Kg) during three planting dates**



- Soil Solarization is part of the IPPM which could provide growers with safe and effective method for soil sterilization instead of using chemical. The technique was developed and simplified for growers and a technical handbook has been published.
- Incidence and management of certain major pests of cucumber in Green Houses with and without cooling system was conducted in Oman. Effects of Certain Mechanical Methods and Bio-Rational Pesticides were tested for their effect on the control of certain major pests. Cucumber fruits were chemically analyzed to determine the residues of pesticide.
- Soilless growing techniques were developed by APRP and adopted in many of AP countries. The main objectives are to increase yield quality and quantity per unit of water, area and manpower. Soilless growing techniques might be the best alternatives for deteriorated GH soil due to salt accumulation or high infestation of with soil-borne pathogens. Simple growing systems constructed with locally available materials were developed and experimented with in UAE, Qatar, Oman, Kuwait and Yemen for the production of tomato, cucumber, pepper, and lettuce crops. The economics of this technique was compared with conventional soil-based growing techniques.



Top Right: Tomato growing in soilless culture (closed system) in Oman.;Down Right: Cucumber crop in sand beds in Dhaid Research Station, UAE.; Center up: High yield of tomato growing in soilless culture (closed system) at Dhaid Research Station UAE; Down Center: Sweet melon in sand bed (soilless open system) in Otoria Research Station, Qatar; Left : Cucumber growing in closed soilless system at Rumais Research Station, Oman.

- A newly developed Soilless Vertical Growing System for the production of strawberry was adopted by



Soilless Vertical system for the production of Strawberries in Kuwait

NARS in Kuwait. The technology was transferred successfully to three growers in Wafra and Abdaly growing areas. An agro-economic appraisal was conducted to compare between the new system and the traditional growing techniques in soil. The study revealed in a major reduction in production cost of the Soilless vertical system by 50-65%. In addition, production per m<sup>2</sup> was doubled and the production season was longer. Higher return on the investment with major saving in water, fertilizers and labor was achieved with the new system.

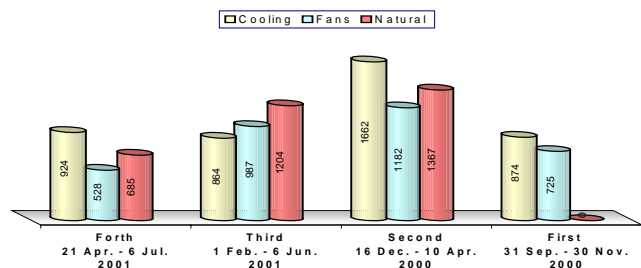
- To elevate farmer's income in the mountain Terraces of Yemen, cultivation of cash crops in greenhouses were introduced. Three plastic houses were constructed in farmers' fields in Al-Mahweet, Yareem and Al-Turba. The participatory approach was applied in the establishment of plastic houses in the three locations. The use of drip irrigation in plastic house was new intervention of interest to farmers under terrace conditions because of scarcity of water.



The cucumber produced from plastic houses was marketed in the nearby markets without the need to travel to major towns. The cost benefit analysis of plastic house cultivation revealed that the total cost of these constructions can be recovered in three seasons. Several farmers in each location expressed interest in the investment in plastic houses.

- An agro-economic assessment of year-round production of cucumber in cooled plastic houses and seasonal production in non-cooled plastic houses was carried out in Oman. In Qatar, the comparison was extended to include both natural and fan ventilated GHs in comparison with cooled GH.

Influence of GH Ventilation & Cooling System on Cucumber Yield (Kg) in Different Growing Season



## 2. Information Technology and Networking

- ICARDA – APRP website has been further developed. Most of the APRP Puplication have been up- loaded to the site as PDF files and now are available for all users. These documents are classified in the following groups: APRP newsletter, Technical Notes, Annual Reports, Proceeding of APRP workshops, Scientific Publication and General APRP. In addition, to make the access to the different part of the site easiar, the hole website has been re-structured. ([www.icarda.cgiar.org/APRP](http://www.icarda.cgiar.org/APRP))



- The weather stations Network for the Arabian Peninsula has been established. Eleven automatic weather stations were dispatched to all the AP



countries for installation at pre-specified locations. Most of these stations have been installed and connected. The network of the weather stations will be connected through telephone lines and linked to ICARDA-APRP Internet website to make data available for the estimation of near real time crop water requirement and irrigation management.

- Information Technology for Natural Resources Management in the Arabian Peninsula (ITAP) has been further developed with Irrigation and Fertigation Management Programme for Green House crops.
- An Internet based expert system for cucumber under protected agriculture has been developed and up-loaded on the Internet. Expert System (ES), is a computer program designed to combine the experimental and experiential knowledge with the intuitive



reasoning skills of a multitude of specialists to aid Growers, Extension Personnel and Researchers in making the best decisions for their crops.

[www.icarda.cgiar.org/aprp/it.htm](http://www.icarda.cgiar.org/aprp/it.htm)

### 3. Meetings, Seminars & Workshops

#### 3.1. APRP Regional Meetings

**3.1.1. APRP 2nd Regional Technical Coordinating Meeting (RTCM)** and Expert Consultation Meeting on Greenhouse Ventilation and Cooling have been held in Kuwait from 20 - 23 January 2002. The meetings organized jointly by the Public Authority for Agricultural Affairs and Fish Resources (PAAAFR) and ICARDA-APRP and attended by 38 Scientists from seven Arabian Peninsula countries. Technical sessions were led by experts from: ICARDA, Food and Agriculture Organization (FAO) of the United Nations, Central Laboratory for Expert Systems (CLES), Egypt; Central Laboratory for Agriculture Climate (CLAC), Egypt; University of Hanover, Germany; University of Al Ain, UAE; and Silsoe Research Institute, United Kingdom.



**3.1.2. The 2nd Regional Steering Committee Meeting (RSCM)** of the Arabian Peninsula Regional Program (APRP) was held on 26 January at the headquarters of the Arab Fund for Economic and Social Development (AFESD) in Kuwait. The meeting was opened by H.E. Sheik Fahad Salim Al Ali Al Sabbah, Chairman of the Board and Director General of the Public Authority for Agricultural Affairs and Fish Resources (PAAAFR) who expressed the importance of APRP for technology development, capacity building, and human resource development in the region.

H.E. Abdalatif Al Hamad, Chairman of the Board of Directors and Director General of AFESD, also welcomed participants and expressed his organization's keen interest in the Program, for its work improving agricultural production and developing linkages among countries of the Arabian Peninsula in the various aspects of research, human resource development, and technology development for sustainable use of agricultural resources and water.

ICARDA Director General Prof. Dr Adel El Beltagy thanked H.E. Sheik Fahad Salim Al Ali Al Sabbah for his patronage for the meeting and Kuwait for its support of APRP and scientific research at the regional and international levels. He also thanked H.E. Abdalatif Al-Hamad and AFESD for hosting the meeting, which he said, gave the program moral support in addition to the financial support. Prof. Dr El Beltagy then spoke on the importance of APRP, which links the national agricultural research systems in the seven countries of Arabian Peninsula and ICARDA in work on three research themes: water, forage and range, and protected agriculture, and enhances human resource development through training and technology transfer. The Director General also spoke of the challenges that face the CGIAR, which necessitate changes in the research strategy at the regional level.

Prof. Dr El Beltagy thanked AFESD, International Fund for Agricultural Development (IFAD), and the OPEC Fun for International Development for their financial support to the program.



*H.E. Sheik Fahad Salim Al Ali Al Sabbah , Chairman of Board and Director General of the Public Authority for Agricultural Affairs and Fish Resources, Kuwait; H.E. Addalatif Al Hamad, chairman of the Board of Directors and Director General of the Arab Found for Economic and Social Development; and ICARDA Director General Prof. Dr. Adel Beltagy, inaugurating ICARDA-APRP RSCM in AFESD, Kuwait.*

**The Steering Committee** Meeting followed the opening ceremony and was chaired by ICARDA's Assistant Director General for International Cooperation (ADG-IC), Dr Mahmoud Solh. The meeting was attended by twenty participants (List of participants are in Annex I) representing the Arabian Peninsula countries: UAE, Bahrain, Kingdom of Saudi Arabia, Qatar, Sultanate of Oman, Kuwait, Republic of Yemen, representatives of AFESD and ICARDA management and scientists. Representatives of IFAD and OPEC were unable to attend the meeting.

Dr Mahmoud Solh welcomed the participants and thanked AFESD for hosting this meeting. He also expressed appreciation and gratitude to AFESD, IFAD and OPEC for their highly valued contribution to APRP and agricultural development in the Arabian Peninsula.

Mr Samir Jarrad, representative of AFESD welcomed the group. He praised the achievements made in APRP documentations since last RSCM. He also stressed the importance of working towards sustainable links "networking" among participating countries, so that contacts among NARS in the Arabian Peninsula will continue after the program finishes. He concluded by saying that in the final year there must be a study on evaluation and impact assessment for the program.



### 3.1.3. The 3rd Regional

**Technical Coordination Meeting of APRP** was held in Sana'a Yemen from 28th September to 2nd October. The meetings was inaugurated by H.E. Mohamed Farid Megwar Undersecretary, Ministry of Agriculture and Irrigation at the University of Sana'a. The under secretary praised the productive cooperation with ICARDA and welcomed the participants from AP countries and ICARDA scientists.

Dr. William Erskine ICARDA's ADG for research gave a general overview of research activities in Yemen within the two ICARDA regional programs: Nile Valley and Red Sea (NVRSRP) and Arabian Peninsula (APRP). He welcomed the participants and thanked the Ministry and AREA for the excellent organization.



*Dr. Ismail Muharram, Chairman of the Board of the Agricultural Research and Extension Authority (AREA) introducing the activities of AREA during visit of the RTCM participants to Dhammar.*

Dr. Ismail Muharram, Chairman of the Board of the Agricultural Research and Extension Authority (AREA) stressed in his welcoming address the importance of research for the development of agriculture in Yemen and highlighted the historical links with ICARDA. He welcomed the participants and wished them productive meetings.



*Filed visit to a green house grower in Dhammar*



*Field visit to Walan, Northern Highland*

APRP RTCM was attended by over 60 participants representing the Agricultural Research Institutions from Bahrain, Emirates, Kuwait, Oman, Qatar, Saudi Arabia and Yemen, Universities (Sana'a and UAE) and International Organizations (FAO and ICARDA). During the two-day meetings, scientists from the different countries discussed their research activities and results. One day visit was organized for farmer's fields and for AREA Head Quarters in Dhammar.

**3.1.4. The APRP Brain Storming meeting** was held on Wednesday 2nd October 2002 and attended by 25 participants representing all seven AP countries, invited experts from FAO, UAE University and Sana'a University, ICARDA's ADG-R and ICARDA-APRP scientists.

Following a short statement from Dr. Ahmed Moustafa Acting APRP Coordinator, the floor was opened for all to share their views and discuss the future of ICARDA-AP program. In his opening statement Dr. Moustafa indicated that the program is approaching its current phase (ending July 2003). The purpose of the meeting was to come up with new ideas for the continuation of program activities. He asked the participants to take into consideration the new changes which are taking place. One of these changes is the decision by Gulf Cooperative Council (GCC) to become a member of the CGIAR. He also suggested the idea of developing a number of sub-projects under APRP rather than one "mega" project. This might make it easier to secure funds from many donors with project preferences. Dr. Erskine, ICARDA's ADG-R called on the participants to give their thoughts and ideas for the new project based on the priority set by the region. He emphasized that the APRP is a shared program for seven countries and should be based on "give what you have and take what you need".



*Dr. William Erskine ADG-R addressing APRP Brain Storming Meeting in Sana'a, Yemen*

The participants in their deliberations stressed the importance of highlighting what had been achieved by the program and what need to be done. The following main points summarize what has been agreed upon.

- a) The priority research themes of the program will remain the same, which are rangeland, protected agriculture and water. Under these three themes will remain the shared common tools i.e. information technology and biotechnology.
- b) Attention should be given by APRP to reach out for the end users (emphasis on technology transfer). This would require more links and involvement of the extension.
- c) The meeting agreed that projects be developed linking one or more countries outlining the objectives and the expected outputs within the main themes of the program. The original initiative will come from individual countries which will be developed further by ICARDA and submitted to donors.
- d) APRP to coordinate initiatives in the area of biotechnology in AP countries. It must be noted that a committee has already been established by APRP (consisting of scientists from the region) to develop and strengthen this area.
- e) It was agreed that APRP should work only on thematic topics of interest to all or at least four member countries. Topics of socio-economic should be given special considerations while topics of individual interest should be considered by NARS.
- f) It is recognized that the date palm is gaining more emphasis by many AP countries (reference the priority setting meeting in ICARDA). The specific research area to be recommended for APRP involvement by the individual countries shall not be in conflict with the activities carried by NARS, the Regional and or International Organizations.
- g) Member countries agreed to exercise the identification of donors in the region who can support the program. This is necessary, as funds from international donors are getting less reliable.
- h) AP countries are still in vital need for more support in the field of capacity building, training workshops and seminars.

**3.1.5. The 3rd Regional Steering Committee Meeting (RSCM) of the Arabian Peninsula Regional Program (APRP) was held on the 3rd October 2002 in Sana'a, Yemen. The meeting was opened by H.E. Mr. Ahmed Salem Al Jabaly, Minister of Agriculture and Irrigation. In his address, the Minister focused on water shortages in Yemen and the need to refrain from exporting Banana which is a high water demanding crop. The irrational use of chemicals is another problem facing Yemen he said, which needs to be addressed seriously. The efforts by APRP in introducing protected agriculture (growing vegetable crops) and in the area of improving grazing lands by utilizing the local indigenous species are in the right direction of addressing both problems (chemicals and water shortages). Growing of "Qat" is one of the biggest problems, because of its high water requirements and because of the excessive use of chemicals**

by the growers. More efforts are needed to reduce the construction cost of the Green Houses and to provide the farmer with crops of high water use efficiency, the Minister added.

Dr. William Erskine, Assistant Director General for Research welcomed the participants on behalf of ICARDA-DG to the 3rd RSCM and thanked the Donors: the Arab Fund for Economic and Social Development (AFESD), the International Fund for Agricultural Development (IFAD) and the OPEC Fund for International Development for their continuous support to APRP. The Program is at the cross roads, he said, since it is approaching the end of its current phase by June 2003. This meeting therefore is extremely important to come up with new directions for the future financing of the program. Dr. Erskine welcomed the recent step taken by the Cooperation Council for the Arab States of the Gulf to be member in the CGIAR.

Dr. Ismail Muharram, Chairman of the Board of the Agricultural Research and Extension Authority (AREA) expressed his deep appreciation on behalf of AREA for the long and fruitful collaboration with ICARDA. He praised the dedicated efforts of ICARDA-Arabian Peninsula Program in Yemen in the area of range management and Protected Agriculture. Dr. Muharram welcomed members of APRP-Steering Committee and wished them a successful meeting.

The Steering Committee Meeting followed the opening ceremony which was chaired by Dr. William Erskine. The meeting was attended by 18 participants representing AP countries: Bahrain, the Emirates,



Kuwait, Oman, Qatar, Saudi Arabia and Yemen and ICARDA – APRP Specialists.

### 3.2. Regional and International Conferences, Seminars and Workshops

- APRP organized a number of seminars with the Extension Department in the Municipality of Abu Dhabi, UAE for growers and extension staff. The first seminar was on **Integrated Production and Protection Management Program for GH Crops was held on October 2001 in Abu-Dhabi**. Three more seminars on rangeland rehabilitation, fodder crops and protected agriculture are also have been scheduled.
- At the “Experts Meeting of Soilless Culture Techniques” organized by the Federation of Arab Scientific Research Councils and held 1-2 November 2002 in Amman, Jordan, Dr. Ahmed Moustafa presented a keynote address on: Soilless Culture in the Arabian Peninsula – Research and Applications.
- APRP participated in a Regional Workshop on Municipal Wastewater in West Asia organized by UNEP/PERSGA/ROPME in Bahrain from 10-12 Nov. 2001. More than 40 experts from Governments, Regional Governmental and non-Governmental Organizations discussed and endorsed a regional multi-stakeholder work programme to address the major impediments and the priorities and recommendations for action on municipal wastewater management.
- APRP participated in the Second Saudi Symposium on Halophytes Plantation 17-20 March, 2002. Dr. Ahmed E. Osman presented a technical paper (see publication section).
- Dr. Ahmed T. Moustafa and Dr. Ahmed Osman presented ICARDA in the Desertification conference held Salalah, Dhofar, Sultanate of Oman 25-27 March, 2002. Dr. Ahmed E. Osman presented a working paper on the role of ICARDA in combating desertification and in the rehabilitation of degraded rangeland in the Arabian Peninsula.
- The staff of the Arabian Peninsula Regional Program (APRP) in Dubai, Dr. A.T. Moustafa, Dr. Ahmed Osman and Dr Asadullah Al-Ajmi and ICARDA Senior Irrigation & Water Management Scientists, Dr. Theib Oweis participated in the “Sustainable Management of Water Resources in Arid Environment” Workshop held on 14-16 April, 2002 in Dubai.

- The main address of the workshop was, water resources in arid environment, it's efficient generation, management and essential role in sustainable development of regions such as Middle East. Dr. Theib Oweis presented a paper on "Coping with Water Scarcity in the Dry Areas – ICARDA's Research on Improving Water Use Efficiency". The lecture was followed by a discussion session.
- The Workshop was organized and coordinated by Daimler Chrysler AG, Euronatur (European Nature Heritage Fund) and Dornier System Consult and over 30 participants from the AP countries and from regional and international organizations attended this meeting.
- Dr. Ahmed E. Osman presented a seminar in the Kingdom of Bahrain and Qatar "Combating desertification and rehabilitation of degraded rangelands in the Arabian Peninsula" during the visit of above mentioned countries in the 15-23 April, 2002.
- The 27th session for the General Assembly of the Arab Organization for Agricultural Development (AOAD) was held in Abu Dhabi 28-29 April, 2002. The meeting was attended by delegations from all Arab Countries headed "in most cases" by their Ministers of Agriculture. Dr. Ahmed E. Osman from APRP represented ICARDA.



- The United Arab Emirates University organized its 3rd Annual Research Conference at Al-Ain during 30th April through 1st May, 2002. Sheikh Nahyan Mubarak Al-Nahyan Minister of Higher Education & Scientific Research and Chancellor of UAE University inaugurated the conference. The Staff of the University presented over 110 papers in 26 different sessions. Dr. Ahmed E. Osman, Pasture Forage & Range Ecologist and Mr. Arash Nejatian Information Management Aid represented APRP in the meeting.
- In the light of ICARDA-APRP's efforts in supporting the national agricultural research activities in the Arabian Peninsula countries, a Technical Forum was held at the United Arab Emirates University (UAEU) between ICARDA and the Center for the Externally Funded Research Activities (EFORS) of UAEU. Dr. Maitha Salem Al-Shamsi Deputy Vice-Chancellor for scientific research and Director of EFORS chaired the meeting. ICARDA was represented by Dr. W. Eriskin ADG-R, Dr. Thomas Blake, Head of germplasm unit, and the scientists from the APRP Dr. Ahmed Moustafa, Acting Regional Coordinator and protected agriculture specialist, Dr. Ahmed Osman, rangeland management specialist and Dr. Asadullah Al-Ajmi water management specialist all attended the meeting.

The objective of the meeting was to explore possible areas of mutual interests for future cooperation in the areas of applied research, technology transfer, and training.

Dr. Shamsi in her opening speech expressed the interest of the UAEU to strengthen the cooperation with ICARDA in general and APRP in particular in the current and future research activities. Dr. Ibrahim Sidawi, the Executive Director, introduced EFORS and highlighted the current research activities with different institutes, organizations, and industrial firms in UAE.

Dr. Eriskin briefed the audience about ICARDA in general and the important role it plays in elevating poverty, natural resource management and human recourse development, and capacity buildings. Dr. Moustafa made a short presentation about the history and achievements of ICARDA in the Arabian Peninsula region and the present program themes that cover the ICARDA-APRP activities and elaborated further on protected agriculture theme. Dr. Osman and Dr. Al-Ajmi covered activities in rangeland management and water use efficiency consequently.

The opportunity was then given to the participants from Faculty of Food Systems to make a short presentation outlining the main activities that are undertaken. Prof. Abd El-Alim Metwaly, Dean of the Faculty presented the new vision of the higher education in Agriculture. This was followed by short presentation from Dr. Ghaleb Alhadrami, Dr. Ahmed Almasoum, Dr. Salih Al-Shorepy, Dr. Abdou Soaud, Dr. Ahmed Al Obeidi and Dr. Karim Farag.

After the general discussion on ideas and suggestions for possible joint activities in the future, It was agreed that Dr. Sidawi and Dr. Moustafa would work closely on drafting an MOU that establishes the framework for cooperation between the two parties.

- Following Abu Dhabi Declaration on perspectives of Arab Environmental Action, a workshop was jointly organized by UNEP, ESCWA and CAMRE and hosted by the Federal Environmental Agency of the UAE in Abu Dhabi during the period 14-16 May 2002 with the aim to develop a plan of action for the

implementation of the above mentioned declaration. The workshop was attended by a number of regional and international organizations related to activities in environmental issues. ICARDA was represented by Dr. Ahmed Moustafa, the APRP Acting Regional Coordinator and Dr. Asadullah Al-Ajmi, water/irrigation management specialist (APRP). Three working groups comprising scientists and experts were formed to discuss issues related to integrated marine resource management, rehabilitation of degraded land resources and combating desertification and integrated water resources management. A number of recommendations have been formulated by the groups and were discussed and approved by the meeting.

- A meeting was held on 9 June 2002 between APRP and the International Center for Biosaline Agriculture (ICBA) to review the ongoing activities and to come up with new ideas for strengthening collaboration between the two institutions. The meeting was attended from ICARDA-APRP by Dr. Ahmed T. Moustafa (Acting Regional Coordinator and Protected Agriculture Specialist), Dr. Ahmed Osman (Range/Forage Specialist) and Dr. Asadullah Al Ajmi (Water Management Specialist). Participants from ICBA: Dr. Faisal Taha, Director-Technical Program, Dr. Shoaib Ismail (Halophyte Scientist), Dr. Basam Hasbini (Irrigation specialist), Dr. Abdulla Al Dakheil (Plant Physiologist) and Mr. Jugu Abraham, (Donor Relations Specialist). It was agreed that the scientists involved in the previous activities would get together to evaluate the ongoing experiments and propose ideas for future work.
- Dr. Ahmed Moustafa visited Bahrain in the second week of July 2002 in response to a request by the United Nations Industrial Development Organization (UNIDO). The Organization (UNIDO) is considering establishing an Agricultural Incubation Center similar to the successful Business Incubation Center in Bahrain. The purpose is to train young entrepreneurs in the field of agriculture. The Center will provide trainees with extensive courses and practical knowledge on how to establish their own Agricultural Business. The center will also provide a small scale farm with facilities for a period of 3-5 years, after which the entrepreneurs will have gained enough experience to run his/her own business. ICARDA role will be to provide technical support in the training of the entrepreneurs. Such activity will be a joint project between UNIDO, ICARDA, Bahrain Development Bank and the Ministry of Housing and Agriculture in Bahrain.
- The trip also included a visit to the Arab Gulf University, to discuss possible collaboration between ICARDA-APRP and the University. A memorandum of Understanding (MOU) is being developed as a starting point for such collaboration.
- Dr. Siham Assad Seed Health Specialist – ICARDA presented a seminar on ICARDA Seed Health Testing and Quarantine Regulations on 14 July 2002. The seminar has been organized by ICARDA-APRP in the Ministry of Agriculture and Fisheries in Dubai, UAE. A total of 50 researchers and scientists from different related organizations within UAE participated.
- Dr. Ahmed Osman, Pasture and Range Management Specialist with APRP visited IRAN during the first week of September; with the objective of developing collaborative activity between ICARDA-APRP and the Research Institute of Forests & Rangelands (RIFR) in the area of marginal land development. This visit came in response to a request from Dr. Habib Ketata, ICARDA representative in Iran. The new proposal is expected to be within the framework of the existing IRAN/ICARDA Project.
- Dr. Moustafa gave a seminar to a group of leading growers on Soilless Technique for the producing of cash crops in Green Houses. The seminar was organized by Department of Extension of Abu Dhabi Municipality on first week of September. 2002. Dr. Moustafa visited the Municipality and held meetings with senior staff to discuss ways of strengthening collaboration between ICARDA-APRP
- Dr. Ahmed Osman APRP-Range/Forage Specialist represented ICARDA during the Fourth Regional Conservation Forum of the World Conservation Union (IUCN) which was held for West-Central and North Africa (WESCAN) in Kuwait during September 15-17, 2002. The Forum was attended by over 100 participants from 16 countries, representing: Morocco, Algeria, Tunisia, Egypt, Jordan, Syria, Lebanon, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, Yemen, Iran, Pakistan and Tajikistan. The meeting reviewed activities related to membership and statutory issues and reviewed activities of Regional/Sub-Regional Committees. It also reviewed WESCAN Strategy and Program priorities as well as future initiatives. One main recommendation which came out of the meeting was a request to bring the regional office from Geneva/Switzerland to a country in WESCAN.



## 4. Capacity Building

### 4.1. Establishment of Weather Stations Network in AP

Eleven automatic weather stations for agricultural climate monitoring have been distributed to all the member countries of the APRP for installation at pre-specified locations. The following Table shows the countries and the locations for these stations.

S/N	Country	Number of W/S	Locations
1	Bahrain	1	Budaiya Gardens
2	Kuwait	1	Wafra Agricultural area
3	Oman	2	Agricultural Research Station, Rumais Agricultural Research Station, Salalah
4	Qatar	1	Om Al-Gihab (Farm No. 278)
5	Saudi Arabia	2	National Agricultural and Water Research Center (Riyadh) Animal Development Research Center (Al-Jouf)
6	UAE	2	Desert Park, Sharja Al-Fujaira
7	Yemen	2	Northern Regional Research Station (Highlands). Livestock Improvement Research Center (Lowland-Coastal area)

The objective is to develop a network of weather stations capable of providing near real time weather data that is required to estimate the actual water requirements of the crops grown and hence to optimize irrigation management to avoid excessive water application, a feature that characterizes the Arabian Peninsula region.

### 4.2. Establishment of Seed technology unit established in Emirates

Utilizing the adapted genetic variations of the indigenous forage species is a major strategy for the Range/Forage component of the ICARDA-Arabian Peninsula Regional Program (APRP). A number of these indigenous forages have now been identified and tested for productivity, quality and water use efficiency under the conditions of UAE. These species are needed to replace the water hungry exotic forages such as Rhodes grass and Alfalfa and for the rehabilitation of degraded rangelands. A major constraint however for the full utilization of these species is availability of good quality seeds. In order to help the program of seed multiplication and processing ICARDA-APRP have proposed to the Ministry of Agriculture and Fisheries in UAE the establishment of a seed technology unit. Among the equipments suggested to be included in the unit are seed scarifying and seed-cleaning units. Both units have now been purchased by APRP and installed at Dhaid Research Station. The Ministry on its part have provided the building and hired a qualified scientist to operate the Unit. The unit will help in seed multiplication (foundation seeds), processing, storage and quality control of all range and forage species. The unit can also help in examining seed materials for import and export to and from the country.



## 5. Specialized Training Course

### 5.1. Information Technology for Natural Resource Management in the Arabian Peninsula Region - Weather Station Network and Expert Systems, Cairo, Egypt. 22-27 June 2002

Water use efficiency is considered one of the most important issues for sustainable agricultural production in the Arabian Peninsula countries because there are no natural perennial surface water sources such as rivers and lakes, and because groundwater recharge is very low. In addition, the actual water applied is usually more than crop water requirements. There is a real need to improve management, and one of the most effective ways to do so is to provide timely and usable information to producers. The information technology that is available today holds tremendous promise to deliver high quality information in a quick and cost effectively way.

In this context, ICARDA-APRP in collaboration with The Central Laboratory for Agricultural Expert Systems (CLAES) and The Central Laboratory for Agricultural Climate (CLAC), both in Cairo, Egypt have initiated a joined project to develop "Information Technology Systems for Agriculture and Natural Resource Management in the Arabian Peninsula (ITAP)". The specific objectives were:



1. To develop an internet based expert system for the AP for protected cucumber and tomato production, encompassing crop protection and husbandry, and general crop management
2. To develop an internet based weather station network to provide near real time data for use in open field and protected agriculture irrigation and fertilization scheduling.

As a requirement for ITAP, ICARDA-APRP is also launching a network of fully automated weather stations for the Arabian Peninsula region that are inter-connected through a telephone line and Internet. The main objective of this Network is to provide the region with near real time data for estimating the actual water requirement and scheduling of irrigation and fertigation.

In order to train the concerned scientists in AP countries to cope with this technology and the specialized internet-based expert systems, this training Course was organized in collaboration with CLAC and CLAES of the Agricultural Research Center (ARC), Egypt during the period 22-27 June 2002.

The TC consisted of two main components.

1. Weather Station Network (CLAC)
2. Expert System (CLAES)



### Objectives

The main objective of the course was to provide theoretical and practical training to the candidates on :

- Installation, Programming, Communication and Data Retrieving and Calculation of Water Requirement from Weather Data.
- Expert System for Crop Management under Protected Agriculture.

### Course outline

The main topics covered by this course are:

#### a. Items covered by CLAC

- Weather station installation, maintenance and trouble shootings
- Data Acquisition system.
- Sensor wiring and calibration.
- Memory and programming concepts of CR10X module.
- Measurement devices (attaching and programming).
- Communication methods and data retrieving.
- Data storage and storage module software SMS.
- Information System for Irrigation and Fertigation Management.

#### b. Items covered by CLAES

- Expert System for Diagnosis of Disorders on Cucumber
- Expert System for Disorder Treatment on Cucumber

**Participants** :Fourteen scientists from all the seven countries (Bahrain, Saudi Arabia, UAE, Oman, Qatar, Kuwait and Yemen) comprising the Arabian Peninsula region have attended the course. A list for the names of the trainees and their countries is attached (see List of Trainees from Arabian Peninsula...).

## 5.2. Seed Production and Processing of Indigenous forages

Utilizing the adapted genetic variations of the indigenous forage species is a major strategy for the Range/Forage component of the ICARDA-Arabian Peninsula Regional Program (APRP). A number of these indigenous forages have now been identified in almost all countries participating in APRP. Four of these forages have been tested for productivity, quality and water use efficiency under the conditions of UAE. These species are needed to replace the water hungry exotic forages such as Rhodes grass and Alfalfa and for the rehabilitation of degraded rangelands. A major constraint however for the full utilization of these species is availability of good quality seeds. In order to help the program of seed multiplication and processing ICARDA-APRP have purchased seed scarifying and cleaning equipments as part of seed technology unit established at Dhaid Research Stations (Ministry of Agriculture and Fisheries), UAE.

*Objectives:* The main objectives of the course were to provide theoretical and practical background on:

- Seed multiplication of perennial grasses
- Processing and cleaning of grass seeds
- Quality aspects of seeds



A group of participants examining a field of *Coelachyrum piercei* (Dakhna), one of the important indigenous forages at Dhaid Research Station, UAE



Seed scarification before cleaning, which was demonstrated to the course participants

*Course Instructors:* Several scientists contributed to the instructions of the course namely:

- Dr. Ahmed E. Osman Pasture Forage and Range Ecologist (ICARDA-APRP)
- Dr. Tony van Gastel, Head of Seed Unit, ICARDA-Aleppo, Syria
- Dr. Siham Assad, Seed Health Specialist, ICARDA-Aleppo, Syria
- Dr. Mahdi Al Tamimi, Forage Agronomist, Ministry of Agriculture and Fisheries, UAE
- Mr. Mohamed Makawi, Seed Technology Specialist, Ministry of Agriculture and Fisheries, UAE

*Course outline:* The course was divided into two sections, theoretical and practical. In the theoretical part specialists gave the followin

g lectures:

### 1. Lectures:

- Seed Program Development with Special Reference to Pasture and Forage Seeds
- Characteristics of Indigenous Forages and the Importance of Seed Multiplication
- Agronomic Practices of Seed Production
- Seed Health Control
- Seed Processing (why and how)
- ICARDA Seed Health Testing and Quarantine Regulations

### 2. Practical:

- Field visits to seed production units.
- Seed Scarification (hand tools and machinery)
- Seed Cleaning Process (hand tools and machinery)
- Assessing Seed Quality

*Course Opening:* The course was inaugurated by H.E. Abdulla Bin Abdul Aziz, Assistant Undersecretary on behalf of the Minister of Agriculture and Fisheries in UAE. In his opening statement he praised the role played by APRP for the Arabian Peninsula in the area of management and utilization of the natural resources (water and vegetation). He also acknowledged the assistance by ICARDA to the Emirates in establishing a seed technology unit, which will help in the production and processing of seeds of indigenous forages. Dr. Ahmed Moustafa, Acting Regional Coordinator of APRP welcomed the participants and praised the support to APRP by the Ministry of Agriculture and Fisheries, which enabled the program to serve all AP countries Fifteen participants representing Kingdom of Bahrain, Emirates, Kuwait, Sultanate of Oman, Kingdom of Saudi Arabia and the Republic of Yemen attended.

## 6. PUBLICATIONS

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3. ICARDA-APRP 2002, **International Center for Agricultural Research in Dry Areas (ICARDA)**. Ghars Zaied Magazine, January 2002.
4. Ahmed T. Moustafa and Walid Abu Gharbieh, 2002. **Soil Solarization for Protected Agriculture**, Al-Morshed Magazine, February 2002.
5. ICARDA-APRP 2002, **Arabian Peninsula Regional Program - ICARDA**. Ghars Zaied Magazine, April 2002.
6. Ahmed T. Moustafa, 2002. **Soilless Culture**, Al-Morshed Magazine, May, 2002.
7. ICARDA – APRP, **Strengthening Agricultural Research and Human Resource Development in the Arabian Peninsula 1995-2002 (Final Report)** Dubai, UAE.
8. ICARDA- APRP, **APRP Annual Report 2001/2002**, Dubai, UAE.
9. ICARDA- APRP 2002 , Sustainable Management of Natural Resources and Improvement of Major Production Systems of the Arabian Peninsula, **Proceeding of the Third Regional Technical Coordination Meeting**. 28 September - 2 October 2002, Sana'a, Yemen
10. ICARDA-APRP 2002, **Expert System for Protected Agriculture in Arabian Peninsula** , Al-Morshed Magazine , November 2002.
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12. ICARDA-APRP 2002. **Work Plan 2002-2003** , Dubai , UAE
13. ICARDA-APRP 2002, **Introductory Technical Note on Expert System for Protected Agriculture in the Arabian Peninsula**, September 2002.

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1. Ahmed T. Moustafa, 2001. **Soilless Culture in the Arabian Peninsula, Research and Implementation**. Paper presented at the Expert Consultation Meeting for Soilless Culture in the Arab World. November 2001 Amman, Jordan.
2. Ahmed E. Osman, F. Bahhady and F. Ghassali 2002. **The Role of Edible Shrubs in Rehabilitation of Degraded Rangelands (A case study from north Syria)**. Proceedings of the Second Saudi Symposium on Halophytes Plantation (17-20 March, 2002 Riyadh, Kingdom of Saudi Arabia), in press.
3. Ahmed E. Osman, 2002. **The Role of ICARDA in Combating Desertification and in the Rehabilitation of Degraded Rangelands in the Arabian Peninsula**. Proceedings of Conference on Combating Desertification (25-27 March, 2002, Salalah, Sultanate of Oman), in press
4. Asadullah Al Ajmi, S. Nortcliff and L. Simmonds 2002. **A Physically-Based One Dimensional Irrigation Management Model for Soil Salinity Control**. Soil Use and Management Volume 18 (3) 184-190.

## 6.3. Consultants Presentation and Reports

1. Ahmed A. Almasoum, UAEU, 2002. **Greenhouse Cooling and Ventilation**. presented at Second Protected Agriculture Regional Technical Coordination Meeting, 20-23 January 2002 Kuwait.
2. Bernard J. Baily, Silsoe Research Institute, 2002. Ventilation and New Methods of Cooling Greenhouses. presented at 2nd Regional Technical Coordination Meeting (PA), 20-23 January 2002 Kuwait.
3. Christian Von Zabeltitz, University of Hanover, 2002. Ventilation and Cooling of Greenhouses in Hot Arid Climate. presented at 2nd Regional Technical Coordination Meeting (PA), 20-23 January 2002 Kuwait.
4. Mostafa Mahmoud, CLAES, 2002. **Expert System for the Management of Greenhouse Crops**. presented at 2nd Regional Technical Coordination Meeting (PA), 20-23 January 2002 Kuwait.
5. Samir Tantawi, Aymen F. Abou Hadid, CLAC, 2002. **Information Technology for the Arabian Peninsula**. presented at 2nd Regional Technical Coordination Meeting (PA), 20-23 January 2002 Kuwait.
6. Wilfried Baudoin, FAO, 2002. **Integrated Greenhouse Production and Protection (IGPP) for Improved Quality of Horticulture Produce**. presented at 2nd Regional Technical Coordination Meeting (PA), 20-23 January 2002 Kuwait.
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1. A. Alhamdan and A. Habib, (KSA). **The Response of Wheat Cultivars to Deficit Irrigation in Central Region of Saudi Arabia**.

2. A. Alshankiti, A. Alhamdan, A. Habib, A. Aljouiead, A.E. Osman, (KSA). **Performance, Productivity and Water Use Efficiency of Five Indigenous Forage Grasses Under Central Saudi Arabia Environmental Conditions.**
3. Abdul Rahman S. Al-Mohamadi (Qatar). **Water Use Efficiency for Cucumber Crop in Qatar.**
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8. Ahmed Salem Bataher, (Yemen). **Progress Achieved in Restoration of Range Land in Selected Site of Wadi Al-Khawn (Seiyn).**
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12. Hadi Shobaihi (Yemen). **Review of Research Activities in Water Component Implemented In Yemen throughout the Project Period.**
13. Hamdan Salem Said Al-Wahaibi (Oman) **Performance of Four Cultivated Fodder Crops and Two Selected Indigenous Pasture Species Under Different Conditions of Soil Moisture.**
14. Hassan Abu Sukar, (Qatar). **Comparative Study of Cucumber Production under Cooled and Non-Cooled GH Conditions.**
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17. Khalid Al-Mehfadi, Adnan Al-Qureshi, Abdulla Al-Jafari (Yemen). **Implementation of IPPM Program for GH Growers in Sa'ada, Yemen.**
18. Khalid Al-Qurashi and Khairi Al-Abyadh **Production of cucumber in protected agriculture in the mountain terraces of Al-Turba area in Taiz, Yemen.**
19. Mohamed Al-Dhobhani (Yemen). **Introduction of Protected Agriculture in Al-Mahweet Terraces in Yemen.**
20. Mohamed Ali Hassan, (Qatar), **Rangeland Rehabilitation in Qatar.**
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22. Muthar Al-Rawahi & research team, (Oman). **Agro-Economic Assessment of Production of Major Vegetable Crops in Cooled and Non-Cooled Greenhouses at Rumais Research Station of Oman.**
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24. Rashid Said, Basil Mubarak and Ahmed Moustafa (UAE) **Adaptation of Soilless Culture (Open System) for The Production of Tomato in UAE.**
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30. Syed Ali Razvi, Yousuf Mohammed Al-Raeesy, Moh'd M. Basheer, Najma Mahmood Al-Zadjali, Rashid Al-Shidi and Ahmed Al-Mandhari, (Oman). **Incidence and Management of Certain Major Pests of Cucumber in Two Sets of Green Houses One with Cooling System and the Other Only With Ventilation.**
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## **Forage and range germplasm collection in Dhofar, Oman (November 8-18, 2001)**

*By Ahmed E. Osman*

As part of ICARDA-Arabian Peninsula Regional Program (APRP) activity with the Sultanate of Oman a collection mission for rangeland germplasm was organized in Dhofar Province in the period November 8 to 18, 2001. A similar mission was supported by ICARDA-APRP in 1998 for the Sohar region in Oman. The germplasm materials collected then are being evaluated within the collaborative program between the Sultanate and ICARDA-APRP, for their forage value and water use efficiency, with the objective of replacing the 'water-hungry' exotic forages in the Sultanate. Participants in the mission were Ali Shehade (ICARDA-GRU, Aleppo); Ahmed Osman (ICARDA-APRP, Dubai); Saleem Nadaf, Salih Al Hinahi and Safa'a Al Farisi (Research & Extension Ministry of Agriculture, Rumais, Oman). From Salalah (Range and Forest group) participated: Saeed Bin Masoud Al Omari (local coordinator), Ahmed Awad Bakeir, Mohamed Bin Mahad Al Awaeid, Salem Bin Mosalam Geid, Ahmed Suhail Al Marhoun, Msalam Ali Hardan and Ahmed Mosalam Al Amri.

### **Itinerary**

#### **November 8**

Ali Shehada who arrived the day before from Aleppo Syria joined me on the ride from Dubai to Oman by car, arriving Novotel Seeb Hotel in the afternoon (close to Seeb International Airport and not too far from Rumais Research Station).

#### **November 9**

Met Saleem Nadaf and Salih Al Hinahi from Rumais at Seeb Airport and flew to Salalah. The other participant (Safa'a Al Farisi) took another flight late in the day.

#### **November 10**

A short meeting was held at the Agricultural Directorate with Eng. Mosalam Ahmed Bin Suhail Tabouk Assistant DG, Agricultural Directorate. The participants from Salalah: Saeed Bin Masoud Al Omari (local coordinator), Mohamed Bin Ali Al Awaaid and Ahmed Awad Bakir (Eastern region); Ahmed Bin Gamaan Al Marhoun (Central region); Mosalam Bin Faraj Ali Hardan and Ahmed Mosalam Al Amri (Western region) joined the meeting. The meeting discussed and agreed on the general plan for the field visits. The group of participants then moved to the Range and Forestry Building where the details of the mission were reviewed. Maps, Flora of Dhofar and Herbarium were checked. Field tools, pressing boards, old news papers, GPS, Campus, bags, tags scissors were prepared. For the purpose of this mission the Directorate provided two to three pickups everyday for the field trips.

#### **November 11**

Accompanied by the range and forest staff: Saeed Bin Masoud Al Omari (local coordinator), Mohamed Bin Ali Al Awaaid and Ahmed Awad Bakir we drove east of Salalah for about 40 km in the direction of Taqah (29 km) before turning north to our first stop at Wadi Dirban.

The site is characterized by a permanent spring and crowded with camels and cattle. The pasture has been grazed to the ground and it was clear that the animals were relying on hand feeding. Sogot (*Anogeissus dhofarica*) and sidr (*Ziziphus spina-christi*), which are the most dominant tree species, are showing clear demarcation of the grazing line. Camels unable to reach for the high branches of the trees have turned into grazers on what ever they find on the ground (Figure 1). Nevertheless the site is showing a wide diversity of species especially the trees. The grasses that are mostly annuals (*Al aali Themeda quadrivalis* and *Al shipzaph Apluda mutica*) have been grazed to the ground.



**Figure 1. Grazing line on trees created by camel browsing and (in the insert picture), a Camel unable to reach for branches is reaching for what ever it can find on the ground.**

The pasture was in great need for reducing the stocking rate (currently 2 to 3 times its carrying capacity) in order for it to recover. Enclosure at Tawi Ateir our next stop (few km from Wadi Dirban site) is showing excellent recovery of *Themeda quadrivalis* and *Apluda mutica* both are highly palatable. At Tawi Ateir enclosure we noticed beside the annual grasses, the presence of a palatable perennial grass ‘zadrut’ *Dichanthium aristatum*. The enclosure also contained several trees of ‘thour’ *Acacia senegal*, which were planted.

We stopped at the office of the governor of Tawi Ateir who expressed concerns over the range degradation and he is looking forward to see the government plan for reducing the current camel numbers by purchasing the excess animals from herders. We then traveled east on Jebal Samhan for our next stop at 1255m altitudes. The area is also degraded but the stunted shrubs ‘Tashgout’ *Euphorbia balsamiphora* is dominating the seen. The local people use this tree for producing gum ‘Elka’ by squeezing the juice ‘milklike’

from the branches. Present also was ‘Halqoum’ *Solanum incanum* which is considered an indicator of overgrazing. Another non-palatable tree, which was noticed here and later on encountered in other locations in Dhofar, was ‘Sheraz’ *Dodonaea angustifolia*.

At a lower elevation (1014m) we came across a good stand of ‘Qarat’ *Acacia nilotica* subspecies *indica*. We also noted an interesting climber plant, which is destroying other shrubs by climbing and smothering them. It is known locally as ‘Itra’ *Cissus quadrangularis* (Figure 2) Apart from heavy grazing those weedy species ‘Itra’ and ‘Sheraz’ are becoming a threat on the range, which need a quick action like what has been taken for Mesquite *Acacia juliflora* (*Prosopis juliflora*). The species was introduced by the municipality but turned into a very serious weed, which had to be destroyed following a decree from H.H., the Sultan late 2000. The fight against Mesquite is still progressing. The two more stops on the range before sunset: at Karhanut (longitude: E 54 38 12, latitude: N 17 06 49) and Wadi Hashir (longitude: E 54 36 33 and latitude: N 17 03 12) confirmed the previous seen of overstocking. The noticeable *Acacia* species ‘tall’ *Acacia geradi*, ‘geirat’ *Acacia nilotica* subspecies *indica* seems have already contributed their share of the animal feed judging by the camel grazing line on them.



*Figure 2. Several unwanted species are now spreading on the range ‘Itra’ Cissus quadrangularis is the most serious one climbing and smothering Acacia species.*

## November 12

Accompanied by: Saeed Bin Masoud Al Omari and the two staff from the central region (Salem Bin Mosalam Geid, Ahmed Suhail Al Marhoun) we traveled north of the Salalah on the road to Muscat, turning left before Heiritti to visit an enclosure at Hajif about 18 km north of Salalah. Rainfall is about 200 mm, yet perennial grasses ‘dafeid’ *Dyschoriste dalyi* and ‘kazareit’ *Dactyloctenium scindicum* and ‘zadrout’ *Dichanthium aristatum* were able to flourish and produce seeds under the protection from grazing inside the enclosure.

## November 13

Visiting the western region for two days (13&14) we were accompanied by Saeed Bin Masoud Al Omari, Msalam Ali Hardan and Ahmed Mosalam Al Amri. Our first stop was Shahab Isaeb (Geishan Mountains) altitude 1065m, with low rainfall (less than 100mm). The characteristic species noted was ‘airoub’ *Dracaena serrulata*, which was heavily browsed on by camels. The tree produces fibrous leaves similar to sisal, which was popular in the past for rope making by local inhabitants. The other tree species ‘saab’ *Acacia etbaica* is scattered on the slope. Perennial grasses were surviving on water harvesting by the roadside: These include ‘zadrut’ *Dichanthium micranthum*, ahier’ *Loudetia flavida* and ‘kazareit’ *Dactyloctenium scindicum*. We stopped on our way at a veterinary center belonging to the Ministry of Agriculture. A man in his fifties told that in the old days the whole area around there was covered by trees, but he added due to the increased camels number are all gone. Our second stop was Anatokh (longitude:E 53 20 07; latitude: N 16 46 12, 18 and Altitude of 850 m). A new road is being constructed (30 km) linking the main highway to the coastal town of Rakhut. The area is enjoying a relatively high rainfall 300 mm, but more importantly low animal population probably due to the rough terrain. Here the most dominant trees are ‘Sogot’ (*Anogeissus dhofarica*), ‘khair’ (*Ormocarpum dhofarensis*) which our local companions described as very palatable to all livestock. Well represented also was ‘aayloub’ *Belepharis dhofarensis*, ‘khofout’ *Belepharispermum hirtum* and ‘thour’ the gum Arabic tree *Acacia senegal*. Our last stop before sunset was to examine an enclosure at Ambroof, 12 km from the coastal town of Anatokh. The grasses of *Apluda mutica* and *Themeda quadrivalis* were up to two meters high. The only tree species was ‘qatait’ *Ficus sycomorus*. It is interesting to note that these enclosures are opened every year for local people to harvest the forage. This is done at the end of the season after taken plant measurements and after seed collection. By so doing a good relation is maintained with the herders. Our night stay was at a guesthouse provided by the governor of Rakhut.

## November 14

Back to the main road we continued west towards the Yemen boarder, then into a narrow road towards the coastal town of Dalkut. Our stop before Dalkut was Wadi Saiq (longitude E 53 13 06 and latitude N 16 45 03). Rainfall was not more than 150 but the area supports many tree species: ‘qarad’ *Gerwia bicolor*; ‘shebhait’ *Premna resinosa*; ‘thour’ *Acacia senegal* and *A. laeta*. At Dalkut we were welcomed by the Assistant Governorate (the Governor was out on a trip), who spoke of the Governorate concern over the spread of the weedy shrub ‘sheraz’ *Dodonaea angustifolia* which he feels if nothing is done it will create a similar problem like *Prosopis juliflora* (*Acacia juliflora*) in the eastern part of the province which is now being actively controlled by uprooting.

## November 15

Meeting at the Directorate of Agriculture, going over the information collected, seeds, herbaria and soil samples. Present were: Saeed Bin Masoud Al Omari, Saleem Nadaf, Salih Al Hinahi, Msalam Ali Hardan, Ali Shehade and Ahmed Osman. At the end of the day we visited the tree garden, which contain over 90 species, collected from the different areas of province and present a valuable source of seeds for these trees.

## November 16

A rap up meeting was held at the Hotel with Eng. Mosalam Ahmed Bin Suhail Tabouk Assistant DG, Agricultural Directorate. We provided a summary of the trip and our recommendations for future activities. The main areas discussed included seed collection and storage, maintenance of seed viability through proper storage facilities, rehabilitation work on degraded rangeland, In-situ conservation of genetic material, and training of support staff. We left Salalah late afternoon for Muscat.

## November 17

A final meeting was held at Rumais Station, where herbaria were split into two leaving one half for Oman. Due to lack of proper germplasm storage facilities in Oman the seeds collected in Dhofar were send with Mr Ali Shehadeh for storage at ICARDA Genebank after phytosanitary papers were issued. A Field visit was made to the animal research station with Dr Abdul Mohsen Al Nadi (water relation expert) to see experimental plots assessing water use by different forages including two indigenous species (*Cenchrus ciliaris* and *Coelachyrum piercei*). Sprinklers are irrigating the plots and germination has just started. Settlement was made for outstanding bills for Air tickets.

## November 18

Back to Dubai by car

- **Summary of activities**

The mission was guided by the list of species provided by Oman researchers as priority (Table 1). As agreed in a previous meeting ICARDA-APRP contributed:

- Two scientists
- Airline return tickets Muscat-Salalah for five participants

Also provided (on loan basis):

- GPS units (three)
- Pressing boards (ten)
- Two Cameras (one movie)

The Ministry of Agriculture and Fisheries contributed:

- One senior scientist and nine technicians
- Cars/fuel during the mission (2-3)
- Accommodation and perdiems of participating national staff.

At each site soil samples were taken to help describe the site. The samples will be analyzed at the soil laboratory at Salalah for physical and chemical characteristics. Herbaria samples were taken at all sites while seeds were collected in most sites. The Herbaria were split between Rumais and ICARDA-Dubai, while all the seeds were sent to the Genetic Resources Unit, ICARDA, for 'blackbox' storage, until suitable storage facilities become available within the country.

A database has been collected for passport data in all sites, which will be used for Herbaria samples.

On the job training was provided for all support staff during the mission in all aspects of germplasm collection, use of GPS and in the handling and storage of Herbaria samples (Figure 3)



*Figure 3. On the job training for Omani Researchers on various aspects of germplasm collection*

### • **Discussion and Recommendations**

Dhofar province consists of many ecological niches created by the topography rainfall and condensation. The Salalah plain receives a mean annual rainfall of 100mm but a few kilometers to the north; the mountains receive up to 500 mm. The escarpment and plateau receive dense mists during the Kharif, where condensation is a major source of moisture for the vegetation. The large numbers of camels, cattle and goats quickly consumes the lush growth of the range during the 'kharif'. Both herders and government officials mentioned the problem of overstocking during our mission, and it was clearly demonstrated by the grazing lines on the trees (Figure 1), and by camels turning into grazers for what ever they find on the ground. Camels normally browse on tree-branches. The tree-barks have also been eaten up by camels in some cases, which could lead to death of these trees. Many of the sites visited are in immediate need for de-stocking if they have to recovery. Annual grasses are the dominant species, suggesting that perennial grasses especially in areas of high rainfall have been eaten up. Attempt for reseeding of the range was tried at Tawi Ateir in 1996 but failed due to open grazing.

Based on our field visits and discussions with government officials and herders the following recommendations are suggested:

- The stocking rate on the range is currently estimated at 2-3 times the carrying capacity, every effort need be given to reduce animal numbers. Without such step no range improvement program can succeed. The government program to create a market for excess animals is the only hope in the horizon.
- Range enclosures (currently about 25) are providing useful information on the

potential for rangeland recovery. Also they are important for seed collection. The numbers of these enclosures need to be increased (doubled) for In-situ conservation of biological diversity on the rangelands of Dhofar

- Currently the enclosures are opened for the herders at the end of each season. The new enclosures (10m x 10m) should be kept closed for a longer time in order for perennials (grasses) to recover and establish.
- The tree garden behind the building of the Agricultural Directorate, comprising over 90 tree and shrub species is important source of seeds for these species. A similar field need be established for seed multiplication of important range grasses. Large seed quantities will be needed if rehabilitation programs for the degraded rangelands are to be attempted.
- Small quantities of seeds of range plants are currently stored at room temperature. Proper cold storage facility is needed if seeds are to be stored for long time.
- Staff working on range/forestry are under the Agricultural Directorate (The Range Directorate was moved to Muscat in 1999) have received training (Diploma) in forestry and range work. They are in need of more training on all aspects of seed production, seed and herbaria storage and maintenance.
- A vacuum seed collector is available, but seed threshers and cleaners are lacking. ICARDA-APRP is providing seed scarifiers and seed cleaner equipments for the Sultanate of Oman. The seed multiplication efforts at Salalah can benefit from these facilities.

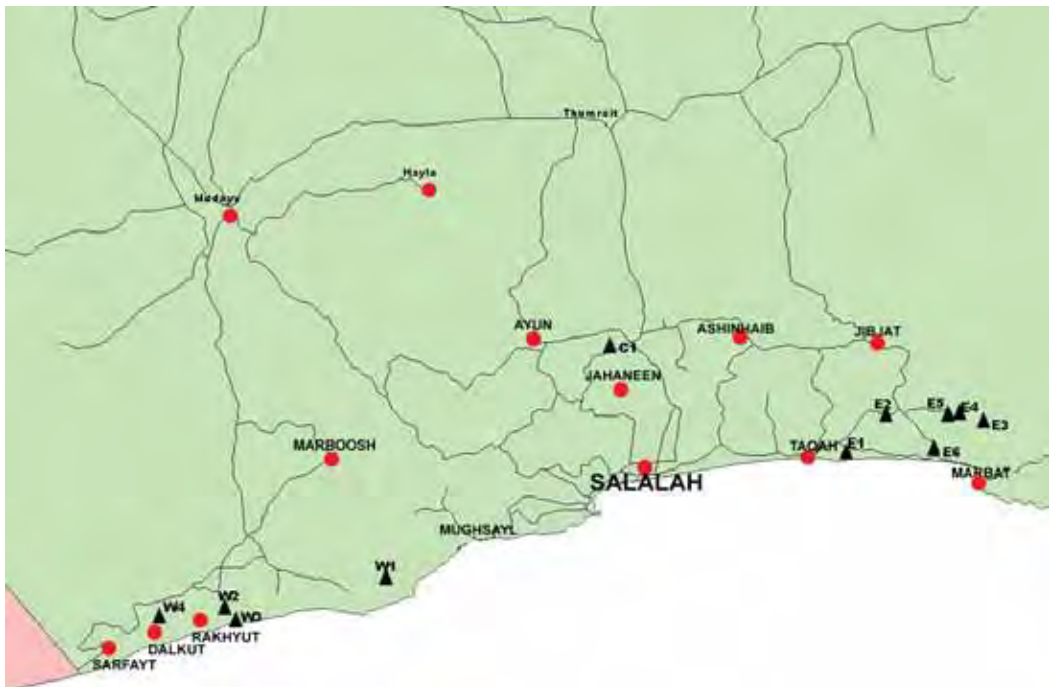


Figure 4. Map showing germplasm collection sites (▲) in Dhofar province during November 2001.

**Appendix**

**Table 1:** List of target species as suggested by the Omani researchers for the collection mission in Dhofar, November 2001.

**Multipurpose fodder trees and shrubs**

*Acacia gerardi*  
*Acacia laeta*  
*Acacia nilotica*  
*Acacia oerfota*  
*Acacia senegal*  
*Acacia tortilis*  
*Allophytus rubifolius*  
*Anogeissus dhofarica*  
*Cadaba spp*  
*Euclea schimperi*  
*Ficus spp*  
*Grewia spp.*  
*Maytenus spp*  
*Moringa peregrina*  
*Phamnus staddo*  
*Prosopis spp.*  
*Tamarindus indica.*  
*Tamarix aphylla.*  
*Ziziphus spp.*

**Grasses**

*Apluda mutica.*  
*Aristida spp.*  
*Cenchnus spp.*  
*Dactyloctenium spp*  
*Dichanthium spp*  
*Dyschoriste dalyi*  
*Loudetia flavida*  
*Panicum spp.*  
*Vigna radiata*  
*Setaria spp.*  
*Themda quadrivalis*

**Table 2:** Identification of herbaria collected in Dhofar province November 2001

**Trees and shrubs**

*Acacia etbaica*  
*Acacia gerardi*  
*Acacia nilotica (subspecies indica)*  
*Acacia laeta*  
*Acacia Senegal*  
*Anogeissus dhofarica*  
*Belepharis dhofarensis*  
*Belepharispermum hirtum*  
*Dodonaea angustifolia*  
*Delonix elata*  
*Dracaena serrulata*  
*Euphorbia balsamiphora*  
*Ficus vasta*  
*Ficus sycomorus*

*Gerwia bicolor*  
*Maytenus dhofarensis*  
*Ormocarpum dhofarensis*  
*Premna resinosa*  
*Tamrindos indica*  
*Zizyphus spina-christi*

### **Grasses**

*Apluda mutica*  
*Cenchrus sp.*  
*Cyprus rotundus*  
*Dactyloctenium scindicum*  
*Dichanthium micranthum*  
*Dichanthium aristatum*  
*Dyschoriste dalyi*  
*Loudetia flavida*  
*Seteria sp.*  
*Themeda quadrivalis*  
*Trigonella sp.*

**Table 3:** Number of accessions of each species collected in Dhofar, Sultanate of Oman in November 2001

### **Trees and shrubs Grasses and Legumes**

<i>Acacia etbaica</i>	1
<i>Apluda mutica</i>	2
<i>Acacia gerardi</i>	1
<i>Cenchrus sp.</i>	1
<i>Acacia nilotica (subspecies indica)</i>	1
<i>Dactyloctenium scindicum</i>	1
<i>Acacia laeta</i>	1
<i>Dichanthium aristatum</i>	1
<i>Acacia Senegal</i>	2
<i>Dyschoriste dalyi</i>	1
<i>Anogeissus dhofarica</i>	2
<i>Loudetia flavida</i>	1
<i>Belepharispermum hirtum</i>	1
<i>Seteria sp.</i>	1
<i>Euphorbia balsamiphora</i>	1
<i>Themeda quadrivalis</i>	2
<i>Ormocarpum dhofarensis</i>	1
<i>Trigonella sp</i>	1