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# **ICARDA's Outreach Activities**

## **Centre-Commissioned External Review**



**International Center for Agricultural Research  
in the Dry Areas (ICARDA)**

## About ICARDA and the CGIAR



Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is governed by an independent Board of Trustees. Based in Aleppo, Syria, it is one of 16 centers supported by the Consultative Group on International Agricultural Research (CGIAR).

ICARDA serves the entire developing world for the improvement of lentil, barley and faba bean; all dry-area developing countries for the improvement of on-farm water-use efficiency, rangeland, and small-ruminant production; and the Central and West Asia and North Africa region for the improvement of bread and durum wheats, chickpea, and farming systems. ICARDA's research provides global benefits of poverty alleviation through productivity improvements integrated with sustainable natural-resource management practices. ICARDA meets this challenge through research, training, and dissemination of information in partnership with the national agricultural research and development systems.

The results of research are transferred through ICARDA's cooperation with national and regional research institutions, with universities and ministries of agriculture, and through the technical assistance and training that the Center provides. A range of training programs is offered, from residential courses for groups to advanced research opportunities for individuals. These efforts are supported by seminars, publications, and specialized information services.



The CGIAR is an international group of representatives of donor agencies, eminent agricultural scientists, and institutional administrators from developed and developing countries who guide and support its work. The CGIAR receives support from many country and institutional members worldwide. Since its foundation in 1971, it has brought together many of the world's leading scientists and agricultural researchers in a unique South–North partnership to reduce poverty and hunger.

The mission of the CGIAR is to promote sustainable agriculture to alleviate poverty and hunger and achieve food security in developing countries. The CGIAR conducts strategic and applied research, with its products being international public goods, and focuses its research agenda on problem-solving through interdisciplinary programs implemented by one or more of its international centers, in collaboration with a full range of partners. Such programs concentrate on increasing productivity, protecting the environment, saving biodiversity, improving policies, and contributing to the strengthening of agricultural research in developing countries.

The World Bank, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), and the International Fund for Agricultural Development (IFAD) are cosponsors of the CGIAR. The World Bank provides the CGIAR System with a Secretariat in Washington, DC. A Science Council, with its Secretariat at FAO in Rome, assists the System in the development of its research program.

## Summary of Recommendations

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To ensure the effective involvement of all professional staff in the field and at headquarters in the evolution of the Centre's research agenda, and in the development and updating of the project portfolio, there is a need to use the annual planning meeting in a more effective manner.

**The Panel recommends that the annual planning meeting is organized in such a manner that it becomes the main joint research planning exercise during the year. All scientists need to be fully involved; projects should be discussed in project working groups and the outcome of the discussions presented to plenary. It should become a planning week where all professional staff members interact with each other and contribute to the updating of the projects and the development of the research agenda.**

Given the poor state of development in most highland regions and the high degree of poverty, considering the special interest of certain donors in supporting research activities for mountain areas, and noting also the research activities carried out by ICARDA over time in highland areas, **the Panel recommends that ICARDA establishes a highlands research network for the CWANA region to develop and implement a pragmatic agricultural research programme for the highland agro-ecologies.**

Outsourcing is a popular principle within the CGIAR System, but so far little effort has been made to carefully analyse the costs and benefits of it.

**The Panel recommends that Management reviews the available**

**information related to outsourcing to decide if ICARDA should spend more efforts on outsourcing. It is important to first analyse the current experiences in order to determine under which conditions outsourcing will be beneficial to the Centre. Such an analysis should also address the positive effects on the relationships with NARS.**

The Panel was not convinced that there is always adequate feedback from the results obtained under the field projects into the MTP projects, and that the objectives, outputs and work plans of the latter are updated accordingly.

**The Panel recommends that ICARDA prepares a status report on the flow of information from field to headquarters, and *vice versa*, of results obtained under special projects, as well as on the current practices of updating the MTP projects, and to use the information collected for the preparation of a set of best practices.**

The Panel considers that there should be no double messages to ICARDA partners and staff, and that all research activities and related matters in the field should fall under research and be reported as such.

**The Panel recommends that the Board of Trustees examines the current management structure with the purpose to develop new arrangements where there is one clear line of reporting for all research matters.**

Given the overall developments in agricultural research planning and implementation, and considering the increas-

ing importance of inter-disciplinary special projects in ICARDA's research agenda, **the Panel recommends that ICARDA undertakes a detailed review of the current breakdown of its research agenda, with the purpose to re-formulate the 19 MTP (Medium Term Plan) projects into a smaller number of inter-disciplinary projects that can effectively address the research needs of the major production systems in the dry areas.**

During the country visits the Panel was made aware that funds for research are available in a number of countries under rural development projects. However, in many cases these funds do not seem to be used for the strengthening of research activities in the countries concerned.

**The Panel recommends that ICARDA explores with the national partners the opportunities for strengthening linkages with rural development and related projects as a means to increase the financial contributions to agricultural research.**

Countries desire the involvement of ICARDA in activities outside its traditional mandate, because of its extensive experience and reputation as an International Centre, and its capacity to appraise and ensure the quality of the research undertaken. Such efforts can be undertaken at limited costs and are essential to address problems of major concern.

**The Panel recommends that ICARDA reviews the possibilities of expanding its role as an honest broker in triangular arrangements involving the Centre, specialized research institutes and countries in CWANA, for the promotion of research activities on problems outside its traditional mandate.**

Given the interest expressed by the scientists to make better use of students to strengthen their research activities, **the Panel recommends that in the light of the new funding realities leading to more limited permanent staff resources, the Centre revises its current training policy to facilitate the employment of students.**

In Latin America, there is considerable potential for the effective use of ICARDA inputs and technologies. Faba bean and barley are important crops in certain areas; natural resource management is a major concern in virtually the whole continent.

**The Panel recommends that the Board of Trustees reviews the costs and benefits of maintaining an active ICARDA Regional Programme in Latin America, as a basis for a decision to be taken on the development of further plans for the involvement of the Centre in this region.**

## 1. Introduction

In the course of 2002, the Board of Trustees of ICARDA decided to undertake a Centre Commissioned External Review (CCER) of ICARDA's Outreach Activities. This review is undertaken in partial response to one of the recommendations of the 1999 EPMR Panel, and in reaction to the interest expressed on a number of occasions by the Programme Committee for an in depth analysis of the Centre's outreach activities. The EPMR Panel had recommended that ICARDA undertake a strategic review of its outreach activities to examine issues of strategic importance including: regional coverage, devolution/outsourcing, interaction with NARS, interplay between research and outreach, information management and its role in the diverse regions. The Board of Trustees, while addressing this matter, noted that ICARDA's outreach programme has never been the subject of a Centre Commissioned External Review or strategic review. It agreed that the current review should be forward-looking. The terms of reference of the CCER are presented in Annex I.

In reviewing ICARDA's outreach programme the EPMR Panel summarized its concerns as follows:

- **Regional Coverage:**  
The Regional Programme has over the years developed into an extensive collaborative research network involving all CWANA countries and numerous collaborating partners from within and outside the region. However, there is a concern that growth of the outreach programme might outpace the Centre's ability to provide adequate scientific and logistic support. It is a question of balance and focus, and it is crucial for ICARDA to maintain a credible and viable research programme and a sustainable outreach programme, as well as maintaining good balance and synergy between the two.
- **Devolution/Outsourcing:**  
The twin policy of devolving some activities to NARS partners and outsourcing others has been widely implemented. Advanced NARS are able and willing to undertake specific activities at sub-regional or regional level (e.g. Tunisia, disease screening; Morocco, screening for Hessian fly resistance; Egypt, developing protocols for genetic transformation). Some NARS wish to see more arrangements for outsourcing. While agreeing to ICARDA's pragmatic and flexible approach, the Panel suggests that clearer policy guidelines be developed in consultation with the relevant NARS.
- **Relations with Policy Makers:**  
While ICARDA's work is well appreciated by scientists and research managers, it is less known by policy makers in some countries. To ensure greater understanding of the work of the Centre by policy makers and to solicit their support ICARDA might consider convening meetings involving policy makers and top research managers to discuss relevant strategic and policy issues. This will be more important for ICARDA in future, as it becomes more involved in policy and socio-economic research and in challenging issues such as *in-situ* on-farm conservation of germplasm and the development and release of GMOs.
- **Centre-Region Interactions:**  
ICARDA has developed unique opportunities for interaction and cooperation with and among NARS, as both are highly valued by NARS. The main venue for such interaction could be

national and regional planning meetings. As these meetings are increasingly dependent on non-core funding, fewer scientists are able to participate. NARS have expressed concern about the long-term sustainability of these activities and expressed the wish that ways and means of ensuring their continuity could be sought, particularly as they are basic to ICARDA's core functions. The Panel believes that dialogue and interaction with NARS are fundamental to ICARDA's mission and a long-standing tradition, and protecting such interactions is important.

- **Interplay between the Headquarters and Regional Programmes:**

The national and regional meetings, important in themselves, are equally important to effective interplay between ICARDA headquarters research and the regional programmes. The decline in attendance by scientists in these meetings, due to financial reasons, is leading to less interaction between headquarters and outreach research. The Panel was informed that normally advantage is taken when Regional Coordinators are called to headquarters during the annual Board meeting, offering opportunity for consultations among themselves, and with leaders of Research Programmes. This arrangement, together with excellent relations between the Assistant Director General for Research and the Director of International Cooperation mitigated the situation to a great extent, but ICARDA is advised to keep this under review.

- **ICARDA's Role in the Context of the Regional Programme:**

Within the Regional Programme context, ICARDA is seen by the NARS as a partner, facilitator, service provider, and technical back-stopper. The role of

ICARDA as a partner differs with NARS capacity, needs and the ability to make impact. There is general agreement that technical back-stopping and related activities have positive effects on the quality of national research, especially in research planning, management and reporting. It is important that expansion of outreach activities does not lead to recruitment of more generalist, technical assistance-type staff rather than scientists.

- **Information Management:**

The information generated by the regional programmes through the numerous special research and development projects is gathered and analysed at the Centre level as part of the 19 MTP (Medium Term Plan) research projects. However, other information and experience have been accumulated, which should be retrieved and used effectively inside and outside the region. The Panel suggests that ICARDA review its approach to total data management from its regional collaborative activities.

The CCER Panel was composed as follows: Dr Lukas Brader, former Director General of the International Institute of Tropical Agriculture (Chair); Dr Abderrazak Daaloul, Director General for Agricultural Production, Ministry of Agriculture, Tunisia; and Dr Mohammad H. Roozitalab, Deputy Head International Scientific and Research Cooperation, Agricultural Research and Education Organization, Iran. Dr Mohamed S. Zehni served, in his capacity as Member of the ICARDA Board of Trustees, as resource person/observer to the team. The *curricula vitae* of the Panel Members are presented in Annex II.

The review activities have been undertaken in the following step-wise manner:

- meeting with ICARDA Regional Coordinators on 30-31 January 2003 at ICARDA headquarters at Tel Hadya to review and discuss matters related to the terms of reference;
- submission of reports by the Regional Coordinators with specific comments and detailed information on each of the terms of reference;
- circulation of a questionnaire to ICARDA staff to solicit their feedback on a number of matters related to outreach activities;
- interviews with scientists at headquarters to obtain further information on the development of their research activities in recent years;
- sending of a questionnaire to a wide range of national ICARDA partners in the CWANA region to collect their views on the effectiveness of the collaboration with the Centre;
- visits by team members to Algeria, Azerbaijan, Egypt, Iran, Libya, Morocco, Syria, Tajikistan, Tunisia and Uzbekistan<sup>1</sup>, to seek the reaction of different partners to the ICARDA outreach activities;
- interaction with ICARDA management on matters related to outreach activities; and
- meeting of CCER team from 29 April to 3 May 2003 at ICARDA headquarters at Tel Hadya to review the information collected, discuss major findings and prepare the report.

## 2. ICARDA's Outreach Activities

The geographical region covered by ICARDA's mandate includes 32 countries in CWANA, and a number of countries in Latin America. And, although, the expression "dry areas" is used as the common descriptor, it represents a large variety of agro-ecological conditions. For the management of its outreach activities the Centre has established seven regional programmes. These are the following:

- Nile Valley and Red Sea Regional Programme (NVRSRP)
- North Africa Regional Programme (NARP)
- West Asia Regional Programme (WARP)
- Arabian Peninsula Regional Programme (APRP)
- Highlands Regional Programme (HRP)
- Central Asia and the Caucasus Regional Programme (CACRP)
- Latin America Regional Programme (LARP)

The **Nile Valley and Red Sea Regional Programme (NVRSRP)** was ICARDA's first outreach programme. Conceived in 1978 and started in 1979 in Egypt and Sudan as the Nile Valley Project, it was expanded in 1989 to include Ethiopia; Yemen and Eritrea joined the programme in 1995.

The NVRSRP countries have diverse climates, production systems and crops grown. Egypt depends heavily on irrigated agriculture; Sudan has also considerable areas under irrigation. Rain-fed agriculture is more important in Ethiopia, Yemen and Eritrea, with small areas under irrigation. Cool-season cereals and legume crops such as wheat, barley, faba bean, chickpea, lentil, pea, grass-pea and vetches are grown in all the countries. However, warm-season crops are also important; maize and sorghum are extensively grown, millet is produced in all countries except Egypt, and rice is an important crop in Egypt. Livestock pro-

<sup>1</sup> The number of countries visited was reduced because of the special situation in the region at the time when the visits were planned.

duction is a major activity in these countries with Ethiopia and Sudan having more than 80% of the total livestock population. Livestock is well integrated into the cropping systems; cattle are the most important, followed by sheep and goats.

The main research thrusts are related to biotic and abiotic stresses that reduce crop yields and yield stability of the major crops such as wheat, barley, maize, and food and forage legumes. Biotic stresses include rust diseases in cereals and legumes, wilt and root-rot diseases, aphids and viruses, chocolate spot and other foliage diseases of legumes. The major abiotic stresses include heat, drought and salinity. Recently, more research has been undertaken on natural resource conservation to address soil and water degradation problems.

The involvement of ICARDA in the Maghreb region dates back to 1977. The five countries falling under the **North Africa Regional Programme** (NARP), Algeria, Libya, Mauritania, Morocco and Tunisia, show similarities, which relate to the geographical and climatic conditions, and their common cultural and historical heritage. However, the sub-region is characterized by a wide diversity of agro-ecologies: Mediterranean, arid, semi-arid and desert ecologies. There are wide variations in altitudes: Atlas Mountains (4165 m), high plateaus and lowlands. Rainfall varies from 1000 mm in the north of Morocco to 50 mm in the deserts in the south. The semi-arid regions, receiving between 200 to 600 mm, dominate agricultural production. Rangelands cover wide areas and constitute a barrier against the progress of the desert.

Cereal crops, wheat and barley, food legumes, forage crops, and small rumi-

nants constitute the major commodities in the sub-region. They suffer from a variety of biotic and abiotic stresses. Olive tree groves are grown under rain-fed conditions in most countries. Rangeland rehabilitation and management, and the production of sufficient amounts of animal feed, are a major challenge for all countries. Water scarcity characterizes the region. The impact of climate change is also an important concern. Annual land degradation/desertification is estimated at over 2%. The population continues to grow at a high rate.

ICARDA launched the **West Asia Regional Programme** (WARP) in July 1989 comprising Cyprus, Iraq, Jordan, Lebanon, Palestine, Syria, and the lowlands of Turkey, and established its headquarters in Amman, Jordan. The sub-region suffers from scarcity of water, desertification, biotic and abiotic stresses for crop production, degradation of natural resources, poverty, especially in rural areas, and difficulties of marketing the surplus of local products. It holds valuable genetic diversity of food and feed species of global importance, but these are seriously threatened by rapid loss. Rain-fed agriculture is predominant; the irrigated areas in Syria and Iraq are starting to suffer from scarcity of water because of depletion of groundwater, along with increased salinity.

Different agro-ecosystems are found in each of the countries, with a predominance of rain-fed agriculture and livestock. The desert and arid ecosystems are characterized by highly degraded rangelands supporting large numbers of sheep and goats. In the semi-arid and high rainfall areas, cereals are most important followed by food legumes. In the mountain areas, fruit tree orchards are predom-

inant with cereals and food legumes. The forests are continuously being degraded by overgrazing and land reclamation for new agricultural land, urbanization, and quarries. Industrial crops such as sugarbeets and cotton are found in the higher rainfall zones and irrigated areas. In a few cases, medicinal plants including cumin and fennel are grown in rotation with cereals. Under irrigated conditions, wheat predominates and the remaining area is used for horticultural, industrial and fruit tree crops along with forages.

The **Highlands Regional Programme** (HRP) was established in 1990 to serve the highland environments of Afghanistan, Iran, Pakistan, Turkey, and the Atlas Mountain region of Algeria and Morocco. The highlands of Central and West Asia and North Africa (CWANA) represent some of the most marginal areas where crops are grown usually under severe biotic and abiotic constraints.

Productivity in the mountain areas is low and the farming communities are among the poorest. Harsh conditions promote out-migration and land abandonment. Subsistence is obtained mainly from drought resistant crops, such as barley, as well as fruits and vegetables, and from flocks of small ruminants that move to mountain pastures in the summer. Much of agriculture is conducted on sloping land and soil erosion by water run-off is a major problem, especially in areas that have been degraded as a result of overgrazing or inappropriate farming practices.

ICARDA has strived to develop technologies that increase the incomes of the resource-poor farmers of the sub-region. This has been done within the framework

of a number of special projects which included among others (i) strengthening Turkey's crop improvement programmes for cereals and legumes in the highlands; (ii) enhancing the technical skills of research staff and agricultural research for dry-land farming in the high altitude areas of Pakistan; and (iii) strengthening of agricultural research in the high altitude areas of Iran.

**The Arabian Peninsula Regional Programme** (APRP) comprises Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE, and parts of Yemen. The sub-region is characterised by extreme aridity and limited renewable water resources. The programme started in 1988 addressing wheat and barley improvement and human resource development. The scope was broadened in 1993 to cover (i) on-farm water use and irrigation management, (ii) abiotic stresses of heat, drought and salinity, (iii) rangelands, shrubs, irrigated forages and livestock, and (iv) protected agriculture. Rapid economic development in the sub-region during the latter half of the twentieth century has resulted in significant changes in the traditional agricultural systems. Increased production has contributed to economic growth, but has often led to degradation of the natural resources. The issue of water availability and its use is fundamental to the sustainable development of agriculture in the Arabian Peninsula.

The major problems facing the sub-region and on which ICARDA can have an impact are: scarcity of renewable water combined with inefficient use of water; degradation of the large areas of rangeland existing in the region and the resulting desertification; and the need to develop a protected agriculture industry that generates high quality high-value

produce with reduced environmental and product contamination by agricultural chemicals.

The **Central Asia and Caucasus Regional Programme** (CACRP) was formally established in 1998, with its headquarters in Tashkent, Uzbekistan. It includes Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Armenia, Azerbaijan and Georgia. The sub-region covers an enormous area of 416 million ha, of which about 275 million ha are rangelands. The climate is characterized by low and variable rainfall and extremes of temperature. The landscape is a mixture of mountains, deserts and steppes.

Traditionally cotton was extensively grown in most of the countries, but this is now replaced by cereals, in particular wheat and, to a lesser extent, food legumes, both under irrigated and rain-fed conditions. In the mountain areas livestock is important; while fruit and vegetable production is expanding to increase income opportunities. Salinity in irrigated areas, erosion on sloping lands, and various biotic stresses are among the major agricultural production constraints.

The economic situation of these countries has changed abruptly with the disintegration of the Soviet Union. The newly independent States were obliged to re-consider their individual agricultural production needs because of the unreliability of

external supplies and the high cost of importation. Agriculture had to play an important role in the restoration of the national economies and in supplying the population with essential food products.

The CAC sub-region has unique agro-ecological and socio-economic characteristics, and it offers considerable potential for future agricultural growth. There has been uneven progress in transforming the formerly centrally-planned economies into market economies, and the process has had severe consequences in many countries. However, the region has strengths in terms of rich biodiversity of plants and animals, available institutional infrastructure and qualified specialists.

In Latin America there is considerable potential for the effective use of ICARDA inputs and technologies. Faba bean and barley are important crops; natural resource management is a major concern in virtually the whole continent. The **Latin American Regional Programme** (LARP) has established collaborative links with NARS in Bolivia, Chile, Ecuador, Mexico and Peru. Attempts have been made to launch a Latin American Regional Programme with a core-funded Regional Coordinator located at CIP Peru for three years, but so far without success because of lack of donor support. The needs of the Latin American NARS with respect to germplasm of ICARDA's global mandate crops continue to be met through the international nursery programme.

## 3. ICARDA/NARS Collaboration

### 3.1 Research Continuum: Links between Headquarters and NARS

The expression research continuum is a very broad concept and is used here in the context of collaborative research management and implementation between various partners. It covers matters such as: priority setting, project formulation, project implementation, monitoring of research activities, technology transfer, and feedback from field to headquarters. Ideally, and to the extent possible and practical, these matters should be addressed jointly by the major partners concerned.

ICARDA's research agenda is planned, conducted and reported within the 19 Medium Term Plan (MTP) projects. This agenda spans the themes of germplasm enhancement, production systems management, natural resource management, socio-economics and policy, and institutional strengthening. Research is conducted with numerous partners and in many locations throughout CWANA. The agenda runs from very upstream and basic issues through to research clearly aimed at development outcomes. Operationally, the planning of this research is done with various partners at a series of national and regional planning meetings, and at the ICARDA internal annual planning meeting.

Most of the research is now on special project funding, and these special projects dovetail into the 19 MTP projects. Coordination of special projects is either by a Regional Coordinator or by a scientist at headquarters depending on the nature and scope of the project.

Special projects are implemented by scientists, based at headquarters and in the field, as well as by Regional Coordinators and partners.

Various modalities are used to implement the planned research. These include:

- hands-on research of ICARDA scientists based at ICARDA Tel Hadya;
- joint research conducted by ICARDA scientists based in the sub-regions;
- joint research conducted primarily by NARS partners in cooperation with ICARDA scientists; and
- joint research with Advanced Research Institutions (ARI) inside and outside CWANA.

The different arrangements put in place have ensured that over the years of working in the dry regions the research priorities for the Centre have evolved based on the specific needs of this particular agro-ecological zone. There have been inputs from a wide range of stakeholders into the development of the overall strategic plan and the current 19 research projects, and in their updating. This has been achieved mainly through the above-mentioned national and regional coordination/planning meetings, but also in various other ways such as travelling workshops, direct contact among NARS and ICARDA scientists and research managers, visits of NARS scientists and leaders to ICARDA, and regular feedback from NARS, either directly or through staff in the regions.

With respect to the day to day research activities ICARDA has developed a pragmatic set of working practices of which the main thrusts may be summarized as follows.

- In the area of germplasm enhancement emphasis has always been placed by ICARDA on the development of improved materials for specific adaptation to marginal conditions. The training activities that were undertaken in parallel helped to build up a solid basis for decentralizing plant breeding activities to NARS. Currently, headquarters is providing improved germplasm upon request of NARS for further development locally. Often, crossing work is undertaken to meet specific demands of the national scientists, and segregating populations are provided to them for *in situ* selection. NARS scientists provide feedback through reports on assessment of tested germplasm, which helps in the mid-course correction of the breeding programmes to address emerging constraints in the region.
- In the area of the collection, conservation and utilization of plant genetic resources, the Centre has established long-standing relationships with various national programmes. These collections have been jointly developed with the countries in CWANA and are used for the benefit of all. This is done in collaboration with the ICARDA gene bank, which houses one of the world's largest germplasm collections.
- For natural resource management research, scientists from headquarters are addressing issues of general importance for CWANA, whilst collaborative research with NARS has been addressing the same issues taking into consideration the specific constraints and matching solutions with those tried and tested for adoption/verification in other regions.

These mechanisms as such seem adequate to further develop the research agenda as

necessary. But, the CCER Panel feels that it must be ensured that the wide range of information received from the joint research activities is reviewed in a systematic manner and that appropriate follow-up action is taken. An active flow of information from Programmes/Units to field and *vice versa* is essential to maintain the existing harmony between the research activities undertaken at both levels.

### 3.2 Coordination Mechanisms with NARS

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There are a number of mechanisms for the coordination of collaborative activities with NARS. The national and regional planning and coordination meetings are the more formal ones. But, for the day to day research activities, more important are the multiple direct contacts between researchers, through visits, training, workshops, correspondence, etc.

The national planning/coordination meetings have the advantage of bringing national leaders and researchers together. They constitute a forum to assess national agricultural research and development needs and to determine research priorities. The meetings also offer the opportunity for NARS researchers from different departments or institutes within the country to meet, to share and review results and ideas on national research and research-related issues, to interact with ICARDA scientists participating in the meetings, and to develop joint work plans for the following season. The number of ICARDA scientists participating in the meetings varies, but is usually rather limited.

Sub-regional annual coordination and planning meetings are held within sub-

regions where two or more countries, often geographically contiguous, share common issues, interests, and projects (e.g. Mashreq and Maghreb project; dry-land agro-biodiversity project for West Asia; Sunn pest project for Syria, Turkey and Iran, cereal rusts project in the Nile Valley etc.). These meetings allow ICARDA scientists to interact with scientists from different countries. Results of inter-country experiments and activities are jointly reviewed and work plans prepared for the following season. These meetings also offer the opportunity for contacts with policy makers or senior research managers.

National and regional meetings are generally held annually, however, the option of holding national meetings every two years might be considered. Alternatively it has been suggested that headquarter staff might be attending each other year. Adequate representation in the coordination meetings should be planned between Programme Directors, Unit Heads and International Cooperation. In that respect it would be useful if criteria for attendance at national and regional planning meetings were developed, to ensure that the various Programmes and Units of ICARDA are well represented.

The feedback of relevant information to the ICARDA research agenda from the national and regional meetings requires special attention. Care must be taken to ensure that national meetings do not give rise to too many expectations that cannot be fulfilled by ICARDA.

### **3.3 Annual Research Planning Cycle**

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ICARDA's internal planning process has changed in recent years in response to the

requirements of the CGIAR. The logical framework was formally adopted at International Centres' Week 1998 as the basis for CGIAR planning, financial monitoring and evaluation. This reflected a paradigm shift in research planning, financing, monitoring and evaluation. Beginning in 1998 the CGIAR also adopted a three year forward planning horizon, based on rolling three year Medium Term Plans, requiring a revised three year plan each year. Since 2000 the logical framework approach had to be explicitly incorporated into the Centre's project descriptions, starting with the 2001-2003 MTP.

Given these developments in the CGIAR's planning process, ICARDA incorporated the log-frame approach into the Centre's project management planning process and streamlined its planning and reporting procedures. These changes are reflected in the reporting to the Programme Committee of the Centre's Board of Trustees and the interim Science Council of the CGIAR.

The annual cycle of research planning at ICARDA begins with the national coordination/planning meetings followed by the regional coordination/planning meetings, which take place primarily in the period from September to November. Feedback from these meetings with national programmes is brought to ICARDA headquarters by individual scientists and Regional Coordinators. ICARDA staff also interacts with their NARS partners within specific projects, throughout the year and develops joint plans based on these interactions. In late January/early February the Internal Research Planning Meetings are held at ICARDA Tel Hadya to review the research plans for the 19 Medium Term Plan projects. The framework for most of the discussion in the

internal planning meetings is that of the MTP projects. Adjustments to research plans are made on the basis of discussions involving various staff members, outreach and headquarter based.

The 19 MTP projects are designed to cover all the research, including that conducted at headquarters and within special projects funded through restricted grants and undertaken with NARS partners<sup>2</sup>. As some of these special projects are managed from the regional programmes, and may cut across a number of MTP projects, it is important that the outreach staff attend the Internal Research Planning Meetings to ensure that the results of these projects are integrated within the MTP project planning process. Moreover, the Internal Research Planning Meetings offer the prime opportunity for the outreach staff to learn about new research developments and their implications for the outreach programme. This includes matters such as new methodologies and approaches, advances in science, and the current structural changes within the CG towards Challenge Programmes and greater integration between Centres and with other non-traditional partners,

Since 2000 to meet the requirements of the CGIAR and the Board of Trustees, two planning documents are produced: (i) logframes for each of the 19 MTP projects, and (ii) rolling three year Medium Term Plan project updates. The steps to produce these documents are as follows:

- Based on discussions and feedback in the internal planning meeting, Research Project Managers (RPMs) for each MTP project update the project logframe with respect to milestones and any other adjustments for the current year and the three MTP plan years.

- Based on the logframe, RPMs update their MTP project descriptions. This includes a list of collaborators and anticipated funding sources that contribute to the planned research in each MTP project.
- The updated MTP is submitted to the Programme Committee of the Board of Trustees for approval, and then to the interim Science Council.

### 3.4 Linkages between Regional Programmes and Headquarters

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Linkages between regional programmes and headquarters are established through the office of International Cooperation. The Regional Coordinators keep regular contacts with the office on all subjects concerning their outreach programme. Besides, all outreach research programmes have been developed with the assistance of the Directors of the two Research Programmes: Germplasm Enhancement and Natural Resources Management. Close linkages are maintained with scientists in headquarters in particular those acting as Project Coordinators for specific field projects. The Project Coordinators are keeping continuous contact with outreach staff and national scientists on all matters related to project implementation. Consequently, in the specific areas of expertise informal thematic networks have often evolved.

All administrative linkages between regional programmes and ICARDA headquarters, concerning matters such as finance, administration, purchasing and personnel, are established following ICARDA general rules and policies. The Regional Coordinator is administratively responsible to the Assistant Director

<sup>2</sup> Restricted grants for special projects are grants awarded according to a specific fixed-term proposal and itemized budget and governed by a specific contract or agreement with the donor. Within ICARDA, each Special Project is managed by a Project Coordinator. Each of these special projects has its own workplan, which contributes to achieving the overall research plans of the Centre through direct links to the 19 MTP projects. ICARDA currently has 66 operational special projects.

General for International Cooperation and scientifically accountable to the Assistant Director General for Research and the Leaders of the two Research Programmes. All project collaborative activities concerning, for example, annual meetings and workshops, are organized through the regional offices. The Project Coordinators or other staff members develop itemized budgets for their activities in the respective sub-regions, and the Regional Coordinator facilitates their timely implementation.

Financial reporting is done on a monthly basis from both the headquarters and the regional offices. Financial statements are usually handled and finalized by headquarters. All financial reporting to the donors, like the technical reporting, is handled by headquarters. With regard to administrative procedures, purchases of equipment and human resource development activities, the institute manual and guidelines are followed. Training activities are organized in close collaboration with the Human Resources Development Unit at headquarters.

Information technology is an important component of all regional programmes and keeps growing. Close contact is maintained with the Communication, Documentation and Information Services (CODIS) and the Computer and Biometrics Services Unit (CBSU), both for technical advice and inputs, and for training. In some regional offices a specialized staff member has been appointed. Regional web sites have been developed in the regions and transmitted to CODIS for editing and placing on the Internet. In some regions e-mail services for NARSs have been set up with the assistance of CBSU.

### 3.5 Role of Regional Coordinators

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The role of the Regional Coordinators has been described as follows:

- contribute to the sustainability of the research continuum between ICARDA and its NARS partners by ensuring coordination of activities, follow-up of implementation, and providing feedback to headquarters;
- enhance interaction among countries of the sub-region through research networks, regional special projects, and to forge partnerships among NARS and ICARDA; and
- contribute to the mobilization of funds in support of bilateral and regional collaborative projects.

Regional Coordinators are the first formal line of contact with the countries in the CWANA region. Their responsibilities have evolved considerably over time. Originally countries were assisted mainly by undertaking specific research tasks to ensure that a national or regional research agenda could be implemented that addressed the major agricultural production constraints in the country or region. Nowadays, the Regional Coordinators are to a much larger extent involved with advisory and supervisory activities, in addition to their extensive liaison responsibilities. This requires special communication capabilities and a broader knowledge of a wider range of agricultural research and development matters. Thus, the job requirements and responsibilities have changed and there may be a need for training for new skills development.

The Regional Coordinators are paid out of special projects when and wherever possible. When special projects end they revert back to the core budget. This seems

logic considering their direct responsibility for the outreach activities, which are now almost exclusively paid through restricted funding. However, it must be assured that their activities will continue to be financed when certain projects come to an end, given the key role they play in the collaboration between ICARDA and the NARS, which is such a dominant part of the Centre's research agenda.

### 3.6 Human Resources Development

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Training clearly strengthens links with NARS, and while it is not implicitly part of the CCER's terms of reference, it is considered useful to include in this report a brief overview of ICARDA's training activities. Training is coordinated by the Human Resources Development Unit, but the two Research Programmes have also a training officer. The Centre has a training policy which is regularly updated.

A systematic evaluation of training has never been undertaken but, a follow-up study to determine the effectiveness of the training activities has been conducted during 1988-1990 by a consultant, and published in 1991. Occasionally, information has been gathered on a case by case basis. Planning of training is currently done annually; the Regional Coordinators consider that it would be useful if this was done over a longer time-span.

The first ICARDA training courses were offered during the 1977/78 cropping season, with only a modest number of participants. Since then, the number of training participants, countries served, and the type of training opportunities have gradually increased. To date more than 11,500 agricultural technicians and scientists

from over 100 countries have been trained at/or with the help of ICARDA. The number of participants by type of training was as follows:

- long-term group training 643
- headquarters short-term training 2446
- non-headquarters short-term training 5983
- individual non-degree training 1632
- individual degree training 929

Training is well appreciated by the countries, but comments were received that the information provided on training opportunities offered by ICARDA is not always up to date. With the evolution of the NARS there is a stronger need for individual training. At the same time the countries in the CAC region regret, for example, the current lack of season-long crop improvement courses. Furthermore, the value of short term training was questioned by a number of NARS and in that respect it was noted that ICARDA should ensure that participants in the same course have about the same level of basic knowledge. There was a strong demand from countries in North Africa for more assistance for the training of PhDs and Post-docs to help the countries to develop the necessary new manpower for strengthening their agricultural research capacity.

### 3.7 Information Management

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ICARDA has a very active information management and dissemination programme. Information management is listed by its partners as one of the priority areas for future support by ICARDA. The Regional Coordinators are of the opinion that they generally receive good support from the Communication, Documentation and Information Services. However, access to headquarter databases remains

an issue in certain cases where there is no direct e-link to headquarters.

The information services, sources and databases that are currently available are the following:

- tables of contents, literature searches and document delivery;
- training on information management and scientific writing;
- support to the information functions of specific networks;
- a whole range of ICARDA publications;
- technical support to NARS;

- ICARDA web site, which includes also information on the regional programmes; and
- meteorological and GIS data bases.

Some countries feel that certain ICARDA publications are of little technical and scientific value. It was suggested that an annual list of ICARDA publications in scientific journals could be sent to NARS collaborators while offering the opportunity to ask for reprints of the articles of particular interest to them. This would compensate somewhat for the current difficulties of some NARS to have access to international scientific journals.

## 4. The Perception of NARS Partners of ICARDA's Activities

The replies to the questionnaire sent to ICARDA partners are summarized in Annex III. A total of 111 responses have been received. The overall rate of return was generally over 60%, and this may be interpreted as a positive reflection of the respect shown by NARS partners for ICARDA.

Twenty-seven countries have sent in comments; a relatively high number of replies have been received from Egypt, Iran, Morocco, Uzbekistan and Yemen; Pakistan, Sudan, Tunisia and Turkey should also be mentioned. A large majority of the questionnaires was filled out by Institute Directors, Programme Leaders and Department Heads. This shows the commitment of the research leaders from the various countries to the collaborative work undertaken with ICARDA.

The following conclusions can be drawn from the replies received and from the countries visited. Cereal and food legume improvement, and human resource devel-

opment and institutional strengthening are clearly the major areas of collaboration between ICARDA and the countries. One might call these the traditional areas of collaboration. Not surprisingly some of the newer areas of international agricultural research, such as cropping systems management, soil and water management, integrated resource management and integrated pest management are mentioned less frequently. The relatively low frequency of forage improvement and livestock production management is probably due to the fact that most of the respondents were working in institutes which did not carry out research on livestock matters.

As shown by the replies received to the question related to which areas should be strengthened, cereal and food legume improvement were highlighted, as well as natural resource management related matters. There is also interest for further assistance in human resource development and institutional strengthening.

The above outcome is in line with the development of ICARDA's research agenda where increased emphasis has been placed during the last decennium on research projects related to natural resources management. A variety of other collaborative activities are mentioned by the respondents (Annex III), most seem to be areas of specific interest to the respondent concerned.

None of the respondents rated the benefits of the collaboration with ICARDA as poor; 90% gave a rating of excellent or good. This shows a very high appreciation of the various partners in CWANA for the efficiency and effectiveness of working with ICARDA. In this respect food production is mentioned most frequently, followed by human resource development and natural resource management. The high number of impact studies and, in particular, joint publications is unique and impressive. For example, one respondent from Pakistan mentioned that as a result of the long-standing collaboration there were over 200 joint publications from researchers in his country and ICARDA.

These results are an excellent example of true partnership, which is often mentioned in the CGIAR system, but there is probably nowhere else such a resounding proof of it. The joint publications cover all areas of research undertaken by ICARDA as shown by the comments received from NARS partners. An analysis of ICARDA publications for the period 1998-2002 indicates that of a total of 504 papers 204 were jointly published/presented with NARS colleagues from the national systems; this included 19 workshop proceedings, 77 journal articles, and 108 conference papers.

Of the various collaborative mechanisms that seem to best suit the needs of countries, workshops/training and joint projects are given the highest score, very closely followed by research networks and coordination/planning meetings. However, ICARDA staff posted in-country and appointment of national staff as ICARDA affiliates is considered less favourably. As mentioned already above, countries would like to see that, notwithstanding the already highly productive partnerships, collaboration be further strengthened in all areas of research. The high rating for research on soil and water management and integrated resource management is especially noticeable in this regard. During the country visits the strong interest for more joint NRM research was also mentioned regularly.

Some 80% of the respondents replied that their national programme would be willing to share the costs of collaborative research with ICARDA. In the large majority of cases this would be in the form of in-kind contributions, however, close to 20% felt that direct financing might be possible. This again is a strong indication of the high interest for collaborative work with ICARDA by its wide range of partners.

During the visits to countries in North Africa the positive impact of the regional projects implemented by ICARDA was often emphasized. The focus on inter-disciplinary research approaches involving various institutions and networking with national partners has resulted in the development of new methodologies in relation to participatory community development and effective technology development and transfer activities. Successful examples, often cited by different authorities, are the Marsa-Matrouh

project in Egypt and the Mashreq-Maghreb project in WANA. These projects, and the resulting new methodologies, appear to have become an inspiration for a new approach to the planning and implementation of field research in the West Asia and North Africa Region.

The visit to CAC confirmed the sub-region's unique position because of its high number of well-trained scientists, but the research facilities and equipments are mostly obsolete, outdated and non-functional. In the early 1990s after independence, and the gradual abandonment of collective, state controlled farming, tremendous challenges had to be faced by the agricultural research community in the countries in the CAC sub-region. This was further exacerbated by the worsening economic situation, and as a result average agricultural yields have dropped by over 50%. Research and extension activities came almost to a standstill, in particular because of the lack of operational funds.

The countries in CAC show a strong interest in collaboration with the CG Centres. Limited inputs and support from

IARCs have already had a very significant impact on improving research facilities and activities, and in creating new agricultural development opportunities. It is essential that these achievements are well documented and evaluated, preferably also to determine to what extent they can be further used as international public goods. Development and release of drought and salinity tolerant wheat varieties, as well as the testing of cotton-wheat double cropping systems in Uzbekistan, could be good examples in this regard.

The collaboration between NARSs and ICARDA and other Centres in the CAC region provides excellent examples of cost-effective and productive partnerships between CGIAR Centres and National Agricultural Research Systems. Undoubtedly these joint efforts will lead to significant benefits for agricultural development in the sub-region. However, these activities should be sustained and preferably expanded for at least another five years to fully achieve the expected goals, as well as to consolidate the progress made so far.

## 5. Issues Raised by the EPMR Panel

The CCER Panel wholeheartedly agrees with the assessment of the EPMR Panel that ICARDA enjoys high standing among its partners and is well respected by national scientists and research managers. The Panel in the course of its field visits found also high regard by top policy makers, and noted that they were well aware of various details of activities carried out jointly by their country and ICARDA.

Through its collaborative networks, training programmes and various coordinat-

ing and planning mechanisms, extensive intra- and inter-country interaction and cooperation among NARS of CWANA has been promoted. The regional programmes are giving greater impetus to the work of ICARDA and have improved the Centre's ability to generate donor income.

However, as noted in the introduction to this report the EPMR Panel raised seven issues and these were examined in detail by the CCER Panel.

### Regional Coverage:

There is a concern that growth of the outreach programme might outpace the Centre's ability to provide adequate scientific and logistic support. It is crucial for ICARDA to maintain a credible and viable research programme and a sustainable outreach programme, as well as maintaining good balance and synergy between the two.

While this concern is a real one, the CCER Panel has seen no apparent evidence of a decline in the quality of science at headquarters. There are also no signs that the scientific credibility of the Centre has been diminished in the CWANA Region. On the contrary, there is a continued high interest and strong demand to work with the Centre. The Panel was assured by Management and Programme Leaders that high quality research remains of utmost importance to the Centre. Within the restrained funding situation all possible avenues are pursued to maintain and preferably expand the research capacity of the Centre, for example, through the recruitment of post-docs.

In recent years, with the increased importance of restricted funding, scientists had to spend more time on the preparation of project proposals and reports, and to participate in a range of project activities and meetings of direct interest to them. Thus, there is more demand on scientist's time for the development and implementation of a much larger variety of activities. However, as a result of these special projects the interaction with NARS has increased and this is mutually beneficial.

Traditionally the CG system has used the number of publications in refereed journals as the criterion to measure the research outputs of the Centres. This

remains probably the easiest one to use, notwithstanding the fact that it should certainly not be the only way to determine the quantity and quality of the work of research institutes that depend mainly on special project funding. The following table summarizes the annual number of ICARDA publications since 1990, using two year averages.

Year	Number of scientists	Publications in refereed journals		Conference/workshop papers and book chapters	
		no./year	no./scientist /yr	no./year	no./scientist /yr
1990/91	31	60	1.94	12	0.39
1992/93	32	75	2.34	65	2.03
1994/95	22	76	3.45	64	2.91
1996/97	23	59	2.57	83	3.61
1998/99	26	45	1.73	66	2.54
2000/01	25	44	1.76	61	2.44

Although the number varies from year to year the above figures show clearly a reduction in publications in refereed journals per scientist per year since the mid-1990s. Over the same period the number of conference/workshop papers and book chapters has only slightly decreased. Thus, while there may be no apparent reduction in the quality of research, there seems to be no doubt that there has been a gradual reduction in the quantity of quality research. And, as long as the Centre lacks the means to recruit additional staff, it will have to live with this reality, while in the meantime continuing to explore possible solutions.

### Devolution/Outsourcing:

In the history of ICARDA there is one example of devolution of a substantial part of its research responsibilities to a NARS. This concerned the transfer of faba bean research to Morocco in 1989. For a variety of reasons this became a failure and in 1997, ICARDA started the activities again at its headquarters. There have

been no further attempts to devolve part of the research agenda, except for the devolution of responsibilities in the chain of activities in developing "finished" cultivars.

The EPMR Panel noted that some NARS wish to see more arrangements for outsourcing. While agreeing to ICARDA's pragmatic and flexible approach, the Panel suggested that clearer policy guidelines be developed in consultation with the relevant NARS.

Outsourcing has been done on a couple of occasions, but the total effort has been rather limited. This matter is reviewed in more detail in chapter 7.4 where it is noted that: "outsourcing is a popular principle within the CGIAR system, but so far little effort has been made to carefully analyse the costs and benefits of it". Consequently, a recommendation has been presented to address this.

No action has been taken by the Centre to follow up on the suggestion of the EPMR Panel to develop clearer guidelines. However, the CCER Panel believes that the current practice of preparing a contract indicating mutual responsibilities for each of the specific outsource arrangements, may well prove to be the easiest and most cost-effective approach.

### **Relations with Policy Makers:**

The EPMR Panel noted that while ICARDA's work is well appreciated by scientists and research managers, it is less known by policy makers in some countries.

The CCER Panel has found no evidence in support of this concern. On the contrary discussions with Ministers or Deputy-Ministers of Agriculture showed

that the Centre is well known at the highest levels. Also, ICARDA is attracting regularly many visitors including national policy makers. Ministers of Agriculture, Ambassadors, and other high level guests can be encountered frequently at the Centre. During visits by senior staff to countries meetings with high level officials are routinely organized. As a result ICARDA is well known at all levels as an effective partner for the further enhancement of national and regional agricultural research and development efforts in CWANA.

Nevertheless, this should not be a reason for complacency; continued efforts are needed to maintain this interest. During the country visits it became apparent that there is a need for a more systematic information/public relations approach at the regional level.

*The Panel suggests that for ICARDA to maintain the excellent relations with its partners in CWANA two initiatives might be envisaged:*

- *the holding of a presentation day in each of the major regions once every three years; and*
- *the regular publication of an information note especially addressing policy makers and their staff.*

The holding of regional presentation days would offer an opportunity to reach a wider range of policy makers beyond the Ministries of Agriculture, for example, Directors in the Ministries that play a key role in donor relations and project development at the national level. Regional presentation days could be combined with other meetings to reduce costs. The publication of information notes should attempt to create a sense of belonging by

highlighting agricultural research and development issues and possible solutions, as well as examples of productive ICARDA/NARS collaboration. Such a publication should be produced in the main language of the region concerned.

### **Centre-Region Interactions:**

The EPMR Panel stressed that dialogue and interaction with NARS are fundamental to ICARDA's mission and are long-standing tradition; protecting such interactions is important.

The EPMR Panel notes that the main venue for interaction with NARS could be the annual and regional planning meetings. And it is concerned that fewer scientists are able to participate in these meetings. This concern could stem from the fact that not enough credit is given to the various other interactions between ICARDA scientists and NARS colleagues during the year. The most frequent and intensive form is the direct contact with scientists and research managers of the NARS. As noted earlier this is done through among others correspondence, e-mailing, workshops, training and in particular joint research projects.

Currently ICARDA is implementing 66 special projects and for 54 of them 21 scientists<sup>3</sup> are the coordinator; the number varying from 1 - 9 projects per scientist. The rest of the projects are managed by the Regional Coordinators. Coordination of projects requires close interaction with national colleagues and the above numbers are the best proof that these interactions are intensive. A concern raised in some countries is that collaboration is more and more directed to countries where it is easiest to develop and implement projects. This matter requires adequate attention from ICARDA's management.

The national and regional meetings continue to serve as an effective contact point, in particular with a broader group of NARS scientists and managers. And to meet their objectives adequate representation by ICARDA staff is essential. As noted earlier, it may be considered to hold the regional meetings less frequently, as also recommended by some of the countries visited, and to focus on major agricultural development topics relevant to the region concerned. Participation could then be decided based on the major agenda items. Also, the meetings could take place before or after the regional meetings proposed to keep regional policy makers and other relevant stakeholders well informed.

### **Interplay between the Headquarters and Regional Programmes:**

The EPMR Panel noted that the national and regional meetings, important in themselves, are equally important to effective interplay between ICARDA headquarters research and the regional programmes. The decline in attendance by scientists in these meetings, due to financial reasons, is leading to less interaction between headquarters and outreach research.

This issue has already been addressed partly. There is no doubt that the countries would like to have more frequent interaction with ICARDA scientists and this is a good sign of respect for the Centre. Modern communication means have a very positive effect on the necessary information flows. The headquarters and outreach programmes are operated as one single programme, and this is well recognized by the management and most of the staff. As discussed in chapter 7.2, however, it is the Panel's impression that there may be opportunities to further

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<sup>3</sup> There are currently 30 international scientists at Tel Hadya, who do not have the responsibility of being either a Programme Director or Unit Head.

enhance the interaction between headquarters and the regional programmes.

### **ICARDA's Role in the Context of the Regional Programmes:**

The EPMR Panel noted that it is important that expansion of outreach activities does not lead to recruitment of more generalist, technical assistance-type staff rather than scientists.

The Panel has seen no signs of this. As discussed earlier, in particular the increased responsibility for special projects has reduced in a number of cases the quantity of quality research, but there are apparently no clear signs of a reduction in quality. But given these developments in recent years the Centre could undoubtedly benefit from an expansion of its scientific capacity, especially through the recruitment of post docs, and carefully selected junior professional officers. Thus, the Panel welcomes the inclusion of such positions in some special projects, and encourages the Centre to continue to explore these and other avenues. This may have as a consequence that the senior staff members will increasingly become research managers and will carry out less and less research themselves. This must be considered as a normal evolution and may have the benefit of shielding the young scientists from too much administrative responsibilities.

### **Information Management:**

The EPMR Panel noted that the information generated by the regional programmes through the numerous special research and development projects is gathered and analysed at the Centre level as part of the 19 MTP research projects. However, other information and experience have been accumulated, which should be retrieved and used effectively

inside and outside the region. The Panel suggests that ICARDA review its approach to total data management from its regional collaborative activities.

This is a matter of concern for all the CGIAR Centres and can be resolved only through well planned efforts and extensive interaction with the scientists. The major issue is to decide/agree when and how data generated by scientists can be accessed by others. And this requires the development of guidelines that are followed in an effective manner by all concerned. ICARDA is moving in this direction, it is currently developing an ethics policy and a policy on data management. Drafts are under study by the Management Committee. In the meantime steps are also taken to establish the necessary communication facilities and data bases for this, for which the name extranet has been adopted.

## **6. Examples of Technology Transfer Activities and Impact of the Outreach Programme**

The headquarters and field research activities constitute one overall programme and, consequently, it may seem difficult to appraise the technology transfer and impact of the outreach activities separately. However, there are many useful examples, which would not have occurred without the additional research activities funded through special projects and implemented under the outreach programme. A number of examples of technology transfer activities and impact in different sub-regions are presented in Annex IV. This information has been summarized mostly from reports provid-

ed by the Regional Coordinators. In general impact assessment remains a difficult and costly exercise. Comprehensive impact studies have not always been carried out, but in cases where this has been done the excellent results obtained have been clearly demonstrated. There is no doubt that similar results may have been achieved if economic on-farm surveys had been carried out to determine the impact of the work undertaken under all the regional programmes. The main results obtained under different regional programmes are as follows.

- **Central Asia and Caucasus Regional Programme**

Only five years after the official start of the programme various new varieties have been submitted for official approval and two winter wheat varieties, one chickpea and one lentil variety have already been released.

Impressive progress has been made in this short period of time with the adaptation and introduction of improved soil and water management, and feed and livestock production technologies. The programme has contributed significantly to the strengthening of NARS. In addition, it has provided a neutral forum for an active interface among scientists and NARS leaders of the eight countries of the CAC region, which have been working in isolation, and lacked the means to carry out the necessary research, since 1991.

- **Iran/ICARDA Project on Strengthening Agricultural Research for Dryland Farming in the Highlands of Iran**

This project started in 1990 and has continued to constitute the basis for active research collaboration between ICARDA and the Agricultural Research and Education Organization

(AREO). The project has led to the establishment in 1993 of the Dryland Agricultural Research Institute (DARI) at Maragheh. ICARDA provides annually about 1000 kg of germplasm seed, representing more than 6000 entries/genotypes of different crops, to researchers from DARI and the Seed and Plant Improvement Institute (SPII). Iranian researchers have evaluated and used this germplasm in their breeding programmes, which has led to the release of seven wheat cultivars, five barley cultivars, two chickpea cultivars and one lentil cultivar.

Farmers using improved crop production technologies, in particular improved tillage practices, in rain-fed areas have seen their yields increased by 10-50 % for wheat, and 100-300 % for chickpea, despite the severe drought that prevailed during the past four years. These new technologies were applied on some 4,000 ha during 2002, and on 55,000 ha in 2003. ICARDA, through the hiring of three consultants and active involvement of AREO, also contributed to the introduction, development and production of oilseed crops, particularly rapeseed. The area grown to rapeseed has increased from 11,000 ha in 1999 to 48,000 ha in 2002. In addition to the training of over 700 scientists and technicians, 60 scientists have been sponsored by the project for PhD degree training in foreign universities. They are now contributing effectively to the enhancement of the research capacity in their respective institutes.

- **West Asia Regional Programme**

Under this programme several improved crop and livestock technologies have been introduced into the farming systems of Iraq, Jordan,

Lebanon, and Syria. The adoption of these technologies has been determined through on-farm surveys. The percentage of farmers using improved barley varieties was over 50% in Iraq, Lebanon and Jordan, and 32% in Syria. Areas planted to improved barley varieties constituted 54% of the total barley growing area in Iraq, 67% in Jordan and 21% in Syria. The feed block technology has been adopted rapidly. In Iraq sheep owners are routinely supplementing the feeding of their sheep with feed blocks; the adoption rate was 21% in Jordan. *Vetch* introduction in barley rotations and early weaning of lambs showed adoption rates of respectively 28.5 and 28.8% in Syria, and influenced in a positive manner sheep production and related economic returns.

Performance indicators have been used to assess technology impact on farm income and distribution, and on household food/feed security and productivity. In Iraq the net benefit of improved varieties on barley productivity was 19%. Similarly in Syria improved varieties resulted in a gain of 20%. These varieties increased the household food security, measured in kg of barley grain/household/year, by 14% compared to local varieties. The use of feed blocks increased sheep production efficiency by 32% in Iraq as a result of the increased number of lambs, and increased meat and milk production. The calculated benefit/cost ratio was 1.56 and the internal rate of return (IRR) was 87%. Economic analysis of the introduction of forage legumes in Iraq showed that the rotations of barley/vicia, barley/vicia-barley mixture and barley/fallow are more profitable than other alternatives.

- **Arabian Peninsula Regional Programme**

Three main research themes are pursued by this programme with, at the same time, strong emphasis on strengthening the national institutional and human resource capacities. These are (i) on-farm water use and irrigation; (ii) rangeland, shrubs, irrigated forages and livestock; and (iii) protected agriculture. To improve water-use efficiency specialized measurement equipment has been introduced and an automated weather stations network has been established. To address water shortage and rangeland problems indigenous species have been collected and evaluated. A total of 114 accessions were collected in the United Arab Emirates and 68 in Oman, out of which 27, including 10 grasses and 15 shrubs/trees, were classified as high priority according to various criteria, including their nutritional value. Heavily degraded rangeland in Saudi Arabia has been successfully rehabilitated through seeding and transplanting of indigenous drought tolerant shrubs and trees. Priority grass species have now been identified in Bahrain, Emirates, Oman, Qatar, Saudi Arabia and Yemen, and their seeds multiplied for use in forage production and rehabilitation of rangelands.

Cash crops in greenhouses have been promoted to increase farmer's income in Yemen. The use of drip irrigation in plastic houses proved of interest to farmers because of more efficient water use. Cost/benefit analysis revealed that total costs can be recovered in three seasons. Integrated Production and Protection Management practices provided greenhouse growers with easily applicable techniques for crop protec-

tion instead of relying exclusively on pesticides. Economic analysis after the introduction of soil-less production techniques showed significant returns on the investment, with major savings in water, fertilizers and labour, in addition to reduced salt accumulation and infestations by soil-born pathogens.

- **North Africa Regional Programme**

This programme has evolved from a commodity focus, emphasizing technology testing/demonstration at the farm level, to a community and participatory based approach, addressing technical, socio-economic, institutional, and policy dimensions. Strengthening of NARS' capacities has been an integral part of most of the project activities undertaken. Regional networks and meetings have significantly fostered exchanges of experiences among NARS' scientists. Various on-farm surveys have been undertaken to determine the adoption of improved technologies. A large proportion of farmers' fields are now planted with new cereal and food legume varieties, and in particular the adoption of improved wheat, barley and winter chickpea varieties is widespread across the region. Improved barley varieties are now grown on 40% of the cultivated area in Morocco resulting in a 35% increase of productivity. Surveys have shown that the average yield advantage of improved varieties of cereals and food legumes ranges from 20 and 50%.

A bio-economic model predicting the effect of macro-economic reforms on farmers' production strategies at the community level has been developed under the Mashreq-Maghreb project. It allows policymakers and researchers to better assess the implications of policy

and institutional reforms on technology uptake. For rangeland development encouraging results have been obtained through the introduction of new plant species, in particular *Lathyrus* and vetch, as well as fodder shrubs, for example, *Acacia* and *Atriplex*. The feed block technology has been widely adopted in countries of the region; the estimated IRR was 57%. Another technology developed/revived to overcome feed shortages has been cactus, *Opuntia* spp., production. The internal rate of return for cactus in marginal cereal production areas in Tunisia ranged from 61-66 %; while for cactus growing in the form of alley cropping with barley the IRR was between 81-89%. A large number of scientists and technicians have been trained at ICARDA, contributing to the strengthening of their national programmes.

- **Nile Valley and Red Sea Regional Programme**

This programme has had a strong impact on agricultural development in Egypt, Ethiopia and Sudan. Until 1995 the total number of improved cultivars released was 17 for faba bean, 6 for chickpea, 7 for lentil, 5 for field pea, 8 for wheat and 3 for barley. In addition improved production practices have been developed and transferred to farmers. These varieties and improved practices have been widely adopted and have resulted in significant production increases.

The Matrouh Resource Management Project in Egypt serves as a good example, because an in depth impact analysis has been carried out at the end of this project in 2001. The project has used holistic inter-disciplinary approaches to research and develop-

ment in full participation with the local Bedouin communities. It addressed the whole watershed as the physical development unit, the whole farm as the agricultural development unit, and the local communities as a consolidated social development unit, in bottom up planning.

Improved water harvesting systems increased water supply by 45%, and the net benefits of the overall farming systems by 88% on average for about half of the beneficiaries. More than 5.1 million fodder trees have been planted on more than 15,000 feddan (1 feddan = 0.42 ha), and perennials and annuals have been re-seeded on more than 2,500 feddan. Productivity of barley has been increased by about 70% on 45% of the total barley growing area. Fodder shrub plantation has reduced concentrate use and animal feed expenses by 37% on average for about 40% of the beneficiaries. Shelter belts have been planted on a total length of 64 km of sandy soils suffering from erosion and sand dune movements; 33% of farmers increased their orchard area, 19% adopted crop rotation, and 16% inter-planted fodder shrubs with barley, all contributing to soil conservation. Fig and olive productivity has increased by 60% and that of vegetables by 27%. The beneficiary social pool was enlarged from 6,000 households at the time of the original project preparation, to more than 18,600. Over 3,620 illiterate girls have been educated, and many thousands of women benefited from extension workshops and other activities to increase environmental, nutritional, and health awareness.

## 7. General Assessment

### 7.1 ICARDA's Approach to Working with NARS

Among the International Agricultural Research Centres ICARDA is unique to the extent that it has evolved a very productive partnership with the widest range of individuals and institutes, in particular within the countries in CWANA. It has virtually become a Centre without walls working with NARS on a broad range of research activities to address the large variety of agricultural research and development needs of the dry-land areas. Networking has been used effectively; the Mashreq and Maghreb project and projects in the Nile Valley and Red Sea Programme are excellent examples of this. ICARDA has facilitated in a very positive manner the interaction between scientists and countries. A good example is the current strong relationship between cereal and food legume pathologists in North Africa. In Central Asia and the Caucasus it has created new opportunities for researchers of the various countries to exchange ideas and jointly develop research plans that are so badly needed under the current socio-economic conditions. ICARDA has been actively involved in the building of scientific bridges between countries within and outside the region.

Undoubtedly these extensive collaborative efforts put a heavy burden on the management and staff of the Centre to plan the research agenda and to use the available resources most efficiently. It must be ensured that the necessary critical mass is available to carry out the various research responsibilities. To achieve this, ICARDA has worked increasingly with national scientists to undertake research activities in the various sub-

regions, and has outsourced certain tasks to NARS. Lessons have been drawn from these new approaches to international agricultural research as a basis for the establishment of appropriate collaborative arrangements with the national partners. Thus, the expressions research continuum and partnership that are so frequently referred to in the CGIAR System have become a reality at ICARDA; they are part and parcel of the Centre's day to day operations.

However, in the increasing complex set of joint activities, the changes that have occurred within the international and national agricultural research systems over the last decennium must be given adequate consideration. This, because of the effect they have on the needs and opportunities for collaborative arrangements. These developments include the following.

- There have been very significant changes in the financial environment that have impacted strongly on the planning and implementation of the research agenda. There is less money available for international agricultural research, and more importantly there has been a dramatic reduction in unrestricted core funding. These changes took place from the mid 1990s onwards, and for example in the case of ICARDA, the amount of unrestricted core dropped from close to 80% to less than 40% of the total annual budget. Thus, the research conducted risks to be more determined by specific donor preferences and the availability of funding through special projects, than by the Centre's strategic plan. This is also pushing the research activities more to the applied side. Funding of important new research initiatives with

countries from unrestricted core funds as was regularly done in the past, has become almost impossible.

- In most cases the capacity of the national systems has been strengthened and their needs and interests for collaborative work have changed. For example, as shown in the West Asia and North Africa sub-regions, there is a stronger demand for integrated multi-disciplinary research activities, and for participatory work with farmer communities. The specific conditions of the CAC region require an intensification of policy research, in addition to the more traditional research support. With the development of the national systems it might be concluded that the Centre has become more a learner and less a teacher.
- The number and range of stakeholders has increased significantly, and now include NGOs, farmer organizations, private sector and others. This has increased the complexity of agricultural research by creating different demands; it can be time-consuming and requires increased communication efforts.
- The recent emphasis on poverty reduction through increased income generation requires changes in the traditional research priorities with for example more emphasis on cash crops, post-harvest utilization and marketing. Also, there seems to be a gradual change in donor interests, placing less emphasis on quantity of agricultural products and more on quality. Some donors stress that outreach is the problem and the solution.

These new realities need to be faced in a professional manner. ICARDA Management is well aware of these changes and experiences them every day

in the tough challenges it faces in its difficult balancing act of maintaining the highly appreciated strong collaborative research agenda, with an annual budget over which it has increasingly less control. However, not all the ICARDA staff may be fully up to date on these developments, and the possible implications for their research activities. For example these changes imply the need for a more multi-disciplinary approach to the ICARDA research agenda. In particular, during the country visits, it became apparent that many collaborators in the national agricultural research systems are also not sufficiently informed about these developments, and this has created misunderstandings on the continued interest of the Centre in collaboration with NARS partners.

## 7.2 Collaboration between ICARDA Staff and NARS

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A questionnaire was sent to ICARDA staff in order to receive feedback on their perception of the importance of collaboration with NARS for the development and implementation of the Centre's research agenda. Staff members were requested to provide information on the number of colleagues they interacted with, the type of interaction, and the benefits derived from these collaborative efforts. They were also asked if the increasing demand from NARS and regional programmes affected the efficiency and quality of their research activities.

Less than 50 per cent of the ICARDA scientists reacted to the questionnaire sent to them. All responded that they were actively involved in joint research activities with NARS. On average each scientist maintains contacts with some 25 colleagues in various countries of CWANA

and Latin America, and in some cases also in other countries. These contacts include a combination of joint research activities, correspondence and planning. Virtually all researchers consider working with NARS essential and beneficial for the planning and implementation of their research activities. Some 75 per cent of them reported that these contacts constitute a relatively heavy demand on their time, and that it reduces, for example, their capacity to carry out innovative research at headquarters.

After the analysis of the written replies received from the scientists it was considered useful to seek further clarification on a number of matters and this was done through personal interviews. All scientists confirmed that the outreach activities benefit in a significant manner their research activities and a variety of reasons was given for this.

- Special projects are aimed at applied and adaptive research and this is very useful for the overall effectiveness of the research undertaken. In the past many of the developed technologies collapsed under farmer conditions; outreach helps to identify new researchable issues, and this is also beneficial to the NARS.
- Outreach is essential for the job to be done; it stimulates innovative research.
- Some problems can only be studied in certain countries that usually have the necessary expertise, consequently both basic and applied research are benefiting from field projects.
- Outreach projects stimulate collaborative research activities with advanced research institutes.
- Research on development matters is very challenging and useful.
- The active involvement of ICARDA in

rural development projects is very beneficial to the Centre; it ensures that research and extension are working closer together. It helps to partly solve the problem of technology transfer.

- The dialogue with NARS colleagues is very important to shape the research agenda, and outreach is essential for the job to be done.
- Outreach activities make it possible to test new working hypotheses; under unrestricted core funding. This type of initiatives might not have been undertaken.

However, while the benefits were strongly emphasized by all staff interviewed, a number of issues were raised.

- The sustainability of the outreach activities needs to be increased; a major problem is that after the closure of projects the collaborative arrangements developed with national scientists cannot be maintained in an adequate manner.
- Special projects limit the work to certain regions/countries to the detriment of others; more efforts are needed to reach all potential collaborators.
- There are two kinds of projects (i) those planned and executed by headquarter scientists, and (ii) those executed by regional coordinators. The latter are not sufficiently coordinated with headquarters, and can become a real burden. The first type in particular promotes extensive interactions with a wide range of national staff.
- The outreach activities are very useful to strengthen NARS, but in the meantime ICARDA is moving closer to development activities. Consequently the credibility of ICARDA as a Centre of Excellence is under pressure.

The time devoted to outreach activities has increased over the last 5-10 years. The sustainability of these activities is considered an issue, which may create a stop and go situation. For example, for some special projects additional capacity had to be established at headquarters for which no funding is available after the closure of the project concerned.

Opinions on the effect of the increase of outreach activities on the time available for innovative research varied considerably. A majority felt that there was no significant negative effect. In general it may be concluded that scientists consider that special projects add value to the research undertaken by ICARDA. But some noted that only some 20-30% of the time was still available for quality research. No doubt, there is always much pressure on research time, for example as a result of frequent meetings. It may make the Centre less attractive for young researchers that have fewer opportunities to develop a scientific career. However, it should also be noted that more of the routine work is now undertaken by NARS. Thus, the overall impression is that the increase in outreach activities has not resulted in a decrease of research outputs, although this varies from scientist to scientist.

Virtually all scientists consider that they have adequate influence on the special projects that have been implemented by the Centre in their area of expertise. Thus, donor preferences do not influence in a significant manner the individual research activities. But, it is of course easier to obtain funding for a certain type of research activities. In that respect it was, for example, mentioned that an adequate balance needs to be maintained between support for traditional plant breeding and biotechnology.

In general, scientists expressed some concern about the evolution of the ICARDA research agenda. Matters listed included:

- Too many MTP projects that do not promote sufficiently inter-disciplinary research;
- NARS need help to improve/modernize their own organization and international Centres are not doing enough in that respect. Marketing aspects and new applied research issues need to be addressed.
- With the lack of resources for attracting new staff ICARDA should make better use of students. The costs currently to be paid by students or their sponsors are considered too high and have been a disincentive for certain students to work at the Centre. ICARDA's training policy should be changed making it more attractive for students to come to ICARDA, keeping in mind that students can increase substantially the overall research capacity. It was also suggested that more efforts could be made to outsource group training and to limit training events to a certain period of the year.
- There is the constant worry about adequate special project money being available. Thus, there is uncertainty about the continuity of the research activities undertaken; not so much about the content of the research agenda.

It is generally felt that the annual planning meeting could be made a more productive event. It is not sufficiently used to update projects in a systematic manner and the participation of regional coordinators is considered very limited. It was generally felt that there is insufficient interaction between scientists at headquarters and regional programmes. There

should be discussions between scientists and regional coordinators for in-depth analysis of problems and to develop new ideas. The planning meeting needs to be organized in such a manner that it becomes the main joint research planning exercise during the year. All scientists need to be fully involved; projects should be discussed in project working groups and the outcome of the discussions presented to plenary. Considering the experience elsewhere it should become a planning week where all professional staff members interact with each other and contribute to the updating of the projects and the further development of the research agenda.

In the meeting of the CCER Team with the Regional Coordinators, it was noted that the interactions between field and headquarters were effectively maintaining a two-way flow of information and dialogue. They consider that this assures congruence of headquarters and NARS priorities, and that there is good complementarity between the research carried out at headquarters and in the field. During the country visits, national scientists met generally expressed strong appreciation for the various interactions with headquarters staff. However, it was brought to the attention of the Panel that there was a need for more frequent visits by scientists.

Given the interest expressed by the scientists to make better use of students to strengthen their research activities, **the Panel recommends that in the light of the new funding realities leading to more limited permanent staff resources, the Centre revises its current training policy to facilitate the employment of students.**

To ensure the effective involvement of all professional staff in the field and at headquarters in the evolution of the Centre's research agenda, and in the development and updating of the project portfolio, there is a need to use the annual planning meeting in a more effective manner.

**The Panel recommends that the annual planning meeting is organized in such a manner that it becomes the main joint research planning exercise during the year. All scientists need to be fully involved; projects should be discussed in project working groups and the outcome of the discussions presented to plenary. It should become a planning week where all professional staff members interact with each other and contribute to the updating of the projects and the development of the research agenda.**

### 7.3 Regional Coverage

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Through the regional programmes, ICARDA is well represented in the countries of CWANA. The Centre's mandate crops cover a very large part of the food production interests of the countries. However, as noted in particular during the country visits, there is an increased demand from countries for research support for the production of other crops, in particular fruits and nuts, and medicinal and plants.

All regional programmes cover well defined geographical areas, except the Highlands Regional Programme (HRP). Before 1991, the HRP as designated by ICARDA included Iran, Turkey, Pakistan, Afghanistan, and the Atlas Mountains of North Africa, i.e. areas with an elevation  $\geq 900$  m. Although high elevation areas differ in many respects, agricultural conditions have similarities that made the

HRP an acceptable entity. These similarities include: (i) long, cold winters with little or no vegetative growth, with  $\geq 2$  months of sub-zero temperatures, (ii) latitude of 25-42° C, (iii) rugged topography, (iv) isolation and difficult access, (v) lack of improved technologies, and (vi) general neglect by national and international research and development organizations.

After the involvement of ICARDA in the CAC countries, large areas with highlands were added to its mandate region. Consequently, the sub-region was linked to the HRP until 1998, when an ICARDA/CGIAR office was established in Tashkent and the CAC became a full-fledged regional programme. Despite the higher latitude, environmental conditions in the highlands of the CAC region resemble those of the former HRP; yet they are now part of another regional programme. In some other countries like Ethiopia and Yemen, agricultural lands are located at high elevations, but the agro-ecological conditions resemble more those of the lowlands in CWANA. Finally, there are certain continental areas, that have an altitude lower than 900 m, yet they have long and harsh winters, such as in Turkey and Kazakhstan. Thus, in the highlands a wide variety of agricultural production systems are found, but they are all characterized by the dominance of resource poor farmers, who are in urgent need of assistance.

A number of individual projects are currently implemented in the highland regions, however there is currently no Regional Coordinator for the programme, and this limits the development of a more comprehensive set of activities.

*The Panel suggests that ICARDA reconsiders the usefulness of maintaining the current Highlands Regional Programme and studies*

*the possibilities to combine it for example with the West Asia Regional Programme.*

The projects implemented by ICARDA in the highlands in CWANA are mostly addressing specific problems in individual countries, but they are not part of an overall highlands research initiative. Given the poor state of development in most highland regions and the high degree of poverty, considering the special interest of certain donors in supporting research activities for mountain areas, and noting also the research activities carried out by ICARDA over time in highland areas, **the Panel recommends that ICARDA establishes a highlands research network for the CWANA region to develop and implement a pragmatic agricultural research programme for the highland agro-ecologies.**

#### **7.4 Outsourcing of Research**

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Outsourcing concerns the contracting out of a well defined research activity to one or more institutes, usually within the region, that have the necessary capacity. Outsourcing is done because the work is an essential part of the research agenda, but there is inadequate expertise or essential infrastructure for it at the Centre.

The research landscape is changing, including the relative strength of NARS, type of research to be undertaken etc. ICARDA needs to respond adequately to these shifts. There are a number of examples of outsourcing to NARS, these include: Tunisia, disease resistance screening, Morocco, screening for Hessian fly resistance; Egypt, biotechnology research by the Agricultural Genetic Engineering Institute, the development of a faba bean expert system by the Central Laboratory for Expert Systems, and the development of an internet based weather

station network for collecting real-time weather data for use in the Arabian Peninsula, by the Central Laboratory for Agricultural Climate. In each case, a specific contract spelling out the various conditions and obligations of both parties is prepared.

In general it seems that the contractual arrangements have operated in a satisfactory manner. From the feedback received from some of the institutes it is evident that outsourcing offers excellent opportunities to maintain productive links with NARS that have undergone a significant evolution of their research capacity. Consequently, there are ample opportunities for outsourcing certain research activities to advanced NARS in CWANA. For example, countries in North Africa, as well as Iran, emphasized strongly that they have the capacity to undertake a variety of regional research and training activities, and they wish to see this capacity more effectively used by ICARDA. However, in recent years there has been no significant increase in the number of outsourced activities, and the Centre may not have taken full advantage of the existing possibilities. There is no doubt that outsourcing is a popular principle within the CGIAR System, but so far little effort has been made to carefully analyse the costs and benefits of it.

**The Panel recommends that Management reviews the available information related to outsourcing to decide if ICARDA should spend more efforts on outsourcing. It is important to first analyse the current experiences in order to determine under which conditions outsourcing will be beneficial to the Centre. Such an analysis should also address the positive effects on the relationships with NARS.**

*The Panel suggests that on the basis of the conclusions reached the Board of Trustees might develop a policy for institutionalizing outsourcing.*

## 8. Conclusions and Recommendations

ICARDA has the most extensive and intensive set of collaborative research and related activities with partners in its mandate region. In the early days these activities were largely undertaken through unrestricted core funding with well balanced medium term plans developed for this purpose. With the shift to restricted core funding this changed significantly and a multitude of special projects are now largely determining which areas will get major attention. Although these areas fall within the overall strategic plan, the Centre has less control over the balance between the main priority areas. This has also consequences for the management of the relationship between ICARDA and its partners.

The establishment of the regional programmes has allowed the Centre to adjust efficiently to new realities and to carry out research together with partners on areas of direct relevance to countries and donors. The Centre merits to be commended for the successful establishment and expansion of the six regional programmes which cover all the countries in CWANA in a comprehensive manner. The development and implementation of this well adapted and unique research management mechanism, as well as the mobilization of the necessary resources for it, is a good demonstration of the excellent foresight and communication and planning capabilities of ICARDA management and staff.

The special position of the Highlands Regional Programme has already been discussed, and *the Panel suggests that ICARDA reconsiders the usefulness of maintaining the current Highlands Regional Programme and that it should look for possibilities to combine it for example with the West Asia Regional Programme.*

Given the poor state of agriculture in most highland regions and the high degree of poverty, considering the special interest of certain donors in supporting research activities for mountain areas, and noting also the research activities carried out by ICARDA over time in highland areas, **the Panel recommends that ICARDA establishes a highlands research network for the CWANA region to develop and implement a pragmatic agricultural research programme for the highland agro-ecologies.**

Certain advanced NARS have expressed a strong interest to become more actively involved in joint research activities with ICARDA through outsourcing. However, in recent years the number of newly outsourced activities have been very limited, consequently, **the Panel recommends that Management reviews the available information related to outsourcing to decide if ICARDA should spend more efforts on it. It is important to first analyse the current experiences in order to determine under which conditions outsourcing will be beneficial to the Centre. Such an analysis should also address the positive effects on the relationships with NARS.**

The CCER Panel concludes contrary to the EPMR that ICARDA has established good relations with policymakers. But, to further maintain and enforce these links it is *suggested that two new initiatives might be envisaged:*

- *the holding of a presentation day in each of the major regions once every three years; and*
- *the regular publication of an information note especially addressing policy makers and their staff.*

To ensure the effective involvement of all professional staff in the field and at headquarters in the evolution of the Centre's research agenda, and in the development and updating of the project portfolio, there is a need to use the annual planning meeting in a more effective manner.

**The Panel recommends that the annual planning meeting is organized in such a manner that it becomes the main joint research planning exercise during the year. All scientists need to be fully involved; projects should be discussed in project working groups and the outcome of the discussions presented to plenary. It should become a planning week where all professional staff members interact with each other and contribute to the updating of the projects and the development of the research agenda.**

The panel reviewed extensively the balance between headquarters and the outreach programme, that are all part of one integral research agenda. It hesitated between the maintenance of the status quo and the development of proposals for change. It concluded that the latter would be best for the Centre, and on that basis developed a number of recommendations.

All the current 66 special projects are linked to the 19 MTP projects which are coordinated by Research Project Managers, while the special projects fall under the responsibility of Project

Coordinators. Research Project Managers can be at the same time Project Coordinators. But not all Project Coordinators are Research Project Managers. Some special projects are for 100% linked to one MTP project. But that is not the case for almost all of the larger projects for which the Regional Coordinators are the Project Coordinator. With respect to these latter special projects in particular, but also for the others, the Panel was not convinced that there is always adequate feedback from the results obtained under these projects into the MTP projects, and that the objectives, outputs and work plans of the latter are updated accordingly. With such a large number of special projects, and so many people involved this is a major exercise that needs to be planned systematically.

**The Panel recommends that ICARDA prepares a status report on the flow of information from field to headquarters, and *vice versa*, of results obtained under special projects, as well as on the current practices of updating the MTP projects, and to use the information collected for the preparation of a set of best practices.**

The extra burden of the expanded field activities on the scientists is mentioned regularly. This burden may be decomposed in the following elements: (i) country visits to obtain a good understanding of the research carried out; such visits are an essential part of international agricultural research; (ii) visits related to project operations; scientists have less to say on the planning of these, and consequently they constitute an extra demand on their time, and may reduce research outputs; (iii) an increased number of project/programme planning meetings that are an additional burden. Thus, undoubtedly

changes have occurred, and under the current circumstances scientists have to address a broader range of matters than their colleagues of 20 years ago. The best approach is to be well aware of these new realities and adjust to them accordingly, because these are normal developments also outside the CGIAR system. As discussed in chapter 7.2, a very positive point is the fact that all scientists consider that the extensive interactions with field projects benefit their overall research activities.

The research continuum from basic to applied research, from headquarters to the field, is considered to be managed and implemented as one unified research programme. Many issues may and have been raised in relation to this, but the Panel sees two major concerns: the overall management responsibility for the outreach and research programme, and the linkages between the MTP projects and the large range of field projects.

The outreach and research programmes are handled as two different structures, each with their own Assistant Director General reporting to the Director General. This may not be the best management structure to ensure optimal interaction between staff in the field and at headquarters. In chapter 3.4 the reporting relationships have been discussed and in general they seem to have been working well under this double management structure.

The EPMR Panel was also indirectly referring to this matter when it discussed the interplay between headquarters and regional programmes. It noted that advantage is taken of the annual Board Meeting to bring the Regional Coordinators to headquarters, which offers an opportunity for consultations

among themselves and with Leaders of the Research Programmes. It concluded that this arrangement, together with excellent working relations between the Assistant Director General for Research and the Director of International Cooperation mitigates the situation to a great extent.

The Panel considers that there should be no double messages to ICARDA partners and staff, and that all research activities and related matters in the field should fall under research and be reported as such. The Panel notes the EPMR Panel's reference to excellent working relations between the two managers concerned, but this offers no guarantee that these will stay the same over time, especially so with a newly recruited international cooperation manager.

**The Panel recommends that the Board of Trustees examines the current management structure with the purpose to develop new arrangements where there is one clear line of reporting for all research matters.**

*In addition, it is suggested that in light of this recommendation the Board might want to reconsider the terms of reference for and the filling of the position of the Assistant Director General for International Cooperation.*

The larger field projects implemented by ICARDA under the regional programmes are all multi-disciplinary projects. This is a logical development given the complex production and resource management problems that have to be addressed. Inter-disciplinary research has become common practice in international agricultural research undertakings and increasingly also at national levels. However, a scrutiny of the 19 MTP projects shows

that they mainly represent research activities with a very limited involvement of various research disciplines. That is also clear from the fact that the above mentioned multi-disciplinary field projects are linked to a range of MTP projects.

Given the overall developments in agricultural research planning and implementation and considering the increasing importance of inter-disciplinary special projects in ICARDA's research agenda **the Panel recommends that ICARDA undertakes a detailed review of the current breakdown of its research agenda, with the purpose to re-formulate the 19 MTP projects into a smaller number of interdisciplinary projects that can effectively address the research needs of the major production systems in the dry areas.**

ICARDA has always obtained most of its funding from the traditional CGIAR donors. In addition, it is unique in the way it has succeeded in attracting financial support from bi-laterally managed funds as in the case of the Nile Valley Project. During the country visits the Panel was made aware that funds for research are also available in a number of countries under rural development projects. However, in many cases these funds do not seem to be used for the strengthening of research activities in the countries concerned.

**The Panel recommends that ICARDA explores with the national partners the opportunities for strengthening linkages with rural development and related projects as a means to increase the financial contributions to agricultural research.**

Countries have raised on various occasions the need to undertake more research on crops outside the current

ICARDA mandate. This includes crops that can help to increase farmer income, in particular in dry areas, and fruit and nut trees are frequently mentioned. At the request of certain countries, the Centre assists already in some research activities beyond its traditional mandate. For example, it has recruited consultants to help with the production of oil seed crops in Iran and the development of protected cultivation in the Arabian Peninsula. Countries desire the involvement of ICARDA because of its extensive experience and reputation as an International Centre, and its capacity to appraise and ensure the quality of the research undertaken. Such efforts can be undertaken at limited costs and are essential to address problems of major concern.

**The Panel recommends that ICARDA reviews the possibilities of expanding its role as an honest broker in triangular arrangements involving the Centre, specialized research institutes and countries in CWANA, for the promotion of research activities on problems outside its traditional mandate.**

ICARDA has already an excellent record on training, and continues to manage an active programme. Nevertheless a number of countries consider that new efforts are needed in this respect, including the provision of better information on the training programme and the conditions under which individuals can participate in training courses. In addition, further expansion of opportunities for individual training, and a more aggressive visiting scientist programme were mentioned. The Panel also observed a need for training of international cooperation staff in the Ministries of Agriculture on matters related to project formulation and fund raising. At the same time in the CAC

region there is a continued need for the more traditional type of training courses. Generally, in all countries a strong desire was expressed to take advantage of ICARDA for the increase of the research capabilities of the national scientists, and the Centre is encouraged to seek additional funding for training.

*The Panel suggests that ICARDA reviews its current training programme to ensure that it effectively addresses the needs of the countries in CWANA, and that it explores opportunities for strengthening links with universities in CWANA, and the possibilities of outsourcing training through cooperation with institutions in the region.*

Given the interest expressed by the scientists to make better use of students to strengthen their research activities **the Panel recommends that in the light of the new funding realities leading to more limited permanent staff resources, the Centre revises its current training policy to facilitate the employment of students.**

The Panel did not obtain much evidence of collaboration of ICARDA with NGOs, farmer organizations, private sector etc., although it is aware of some examples of farmer participatory research carried out by the Centre. Given the importance of working with these important stakeholders in agricultural development activities *the Panel suggests that ICARDA explore the possibilities of giving greater visibility to its work with NGOs, farmer organizations, private sector, and others.*

In Latin America there is considerable potential for the effective use of ICARDA inputs and technologies. Faba bean and barley are important crops; natural resource management is a major concern in virtually the whole continent. There is

some exchange of improved plant materials through the international nurseries. However, ICARDA is not very well known in the region and there is competition from other Centres for getting support from countries. This makes it rather difficult to develop a comprehensive research programme. An understandable problem is also the difficulty of headquarter staff to provide effective backstopping to a region that is located far away from headquarters. However, there are extensive opportunities and needs for ICARDA inputs in this region.

**The Panel recommends that the Board of Trustees reviews the costs and benefits of maintaining an active ICARDA Regional Programme in Latin America, as a basis for a decision to be taken on the development of further plans for the involvement of the Centre in this region.**

## 9. Annotated Terms of Reference

The Panel has attempted in its report to address the spirit of the terms of reference, but in doing so it has not necessary addressed each of them. Consequently, an annotated list of the terms of reference is presented herewith.

- **Regional coverage of ICARDA's outreach considering the diversity of CWANA agro-ecologies, cultural and geographic dimension and global aspects of its mandate.**

This has been addressed in this report; it may be noted that in general the NARS in CWANA have evolved considerably since the establishment of ICARDA and that the Centre has well adapted its approaches in line with these developments. However, the extensive involvement in the CAC

region requires a more traditional approach and this seems to be well covered by the current arrangements in place. The funding of these activities requires continued attention.

- **Strategic planning of research in outreach with adequate input from a range of partners.**

ICARDA has a good reputation on this matter, and the recent extensive involvement together with AARINE-NA in the setting of agricultural research priorities for the Central and West Asia and North Africa Region is an excellent example of this. This may be seen as a culmination of earlier initiatives which included:

(i) Technical Consultation on Agricultural Research in the Near East and North Africa organized by FAO, ICARDA and ISNAR, held in Cyprus in 1983;

(ii) West Asia and North Africa Regional Forum: Towards on Shared Vision on Agricultural Research in WANA, organized by AARINENA, IFAD, FAO and CGIAR in 1995 at ICARDA; and

(iii) Meeting of the CGIAR Task Force on the Involvement of the CGIAR in Central Asia and the Caucasus, held in Tashkent 1996.

- **Devolution/Outsourcing of research.**

Devolution and outsourcing have been discussed in the report. It may be recalled here that outsourcing could also be extended to training activities.

- **Adequacy of annual research planning exercise.**

Details have been discussed and it is recommended that better use is made of the annual research planning meeting. The feedback and use of data obtained under the large number of

special projects also merits further attention.

- **Mechanism linking Centre's research priorities in outreach to resource allocation.**

These linkages are addressed in the various contacts between Regional Coordinators and Project Coordinators with staff and management at headquarters. However, there is no formal mechanism in place.

- **Centre's Coordination mechanisms with NARS.**

These have been extensively discussed and are considered adequate. Since its establishment in 1977, ICARDA has always collaborated with the widest range of partners from the countries in its mandate area. In this it fully recognized the need for different types of support to countries with different levels of development. There has been an active interaction with NARS representatives ranging from membership of specialists from countries on the Board of Trustees and its Programme Committee, to NARS and ICARDA staff working together on matters of direct interest to the countries and the region.

- **Research continuum: Relationship between research at headquarters and collaborative research with NARS.**

The research at headquarters and collaborative research with NARS are addressed as one integral activity. This was extensively discussed by the Panel and possible steps to be taken for the further enhancement of this relationship have been presented.

- **Out-posting of technical staff versus technical affiliation with national institutions and outsourcing of NARS scientists.**

ICARDA has extensive experience with both out-posting of staff and research linkages of various forms with NARS. The mode and intensity of use of them depend on the complementarity between the needs and research capacity of both ICARDA and the national partners.

- **Quality of science in both joint research with NARS and outsourced research.**

The Panel did not have the time to carry out an in depth study on the quality of science in joint research with NARS and outsourced research. But like in every research undertaking it is to be expected that quality varies from case to case. The Panel has no reason to conclude that there is a systematic difference in quality between these two approaches. Reactions received were generally positive, and proper planning and effective monitoring are essential to maintain the good results. From the examples looked into in more detail it may be concluded that ICARDA has taken the right decisions in outsourcing certain pieces of research.

- **Role of Regional Coordinators.**

Under the current set up the Regional Coordinators fulfil a key role for the smooth and productive management of the large outreach programme. In this respect it must be emphasized that this programme is much larger than the headquarters research programme defined in the narrow sense. Without exception the Panel was strongly impressed by the high esteem shown for the Regional Coordinators by the countries in their respective regions.

- **Information management in the outreach.**

This remains an essential task and the Panel welcomes the steps taken to make further progress on the use and storage of data generated under the field projects. It urges the Centre to continue to give the necessary priority to these efforts. Another matter that merits attention is the high expectations that national scientists and research managers have in relation to the assistance that ICARDA should provide to them. Some see the Centre as a funding organization and most are not adequately aware of the changes in funding in recent years. ICARDA should better inform its partners on what they can expect from the Centre.

- **Linkages between outreach programmes and headquarters: technical, administrative and information technology.**

These linkages have been described, and special attention has been paid to the management of the research and outreach programme, and it is recommended that this be reviewed and steps taken to ensure continued harmony between the two.

- **ICARDA's relations with national policy makers.**

Contrary to the concern expressed by the EPMR Panel it was observed that ICARDA has excellent relations with national policy makers. The Centre is encouraged to ensure that these relations are maintained effectively.

## Annex I. Terms of Reference for the Centre Commissioned External Review on ICARDA's Outreach Activities

The review is undertaken in partial response to one of the recommendations of the 1999 EPMR panel, and in reaction to the interest expressed on a number of occasions by the Programme Committee for an in depth analysis of the Centre's outreach activities. The Board noted that ICARDA's outreach programme had never been the subject of a Centre Commissioned External Review or strategic review, and stressed that this forward-looking review should examine the following matters.

- Regional coverage of ICARDA's outreach considering the diversity of CWANA agro-ecologies, cultural and geographic dimensions and global aspects of its mandate.
- Strategic planning of research in outreach with adequate input from a range of partners.
- Devolution/outsourcing of research.
- Adequacy of annual research planning exercise.
- Mechanism linking Centre's research priorities in outreach to resource allocation.
- Centre's Coordination mechanisms with NARS.
- Research continuum: relationship between research at headquarters and collaborative research with NARS.
- Out posting of technical staff versus technical affiliation with national institutions and outsourcing of NARS scientists.
- Quality of science in both joint research with NARS and outsourced research
- Role of regional coordinators.
- Information management in the outreach.
- Linkages between outreach programmes and headquarters: technical, administrative and information technology.
- ICARDA's relations with national policy makers.

## Annex II. *Curricula Vitae* of Panel Members

**Name:** BRADER Lukas (Netherlands)

**Position:** Retired, former Director General of the International Institute of Tropical Agriculture, Ibadan, Nigeria.

**Expertise:** Pest management, agricultural development in Africa, research management.

**Education:** 1953-1959: University of Wageningen, The Netherlands. M.Sc. Agricultural Sciences (Entomology, Phytopathology, Plant Physiology, Organic Chemistry); 1959-1964: University of Wageningen, Doctoral Thesis (Entomology).

**Experience:** 1959-1964: Responsible for the Dutch Centre at ORSTOM, Adiopodoume, Ivory Coast, research on coffee pests; 1964-1971: Head Entomology Department, IRCT, Cotton Research Station, Bebedjia, Chad Republic; 1966-1971: Director, IRCT Cotton Research Station; 1971-1975: Head, Department of Entomology, Institute for Plant Protection Research (IPO), Wageningen; 1975-1977: FAO, Rome, Global Programme Coordinator, Integrated Pest Control; 1977-1982: FAO, Rome, Chief Plant Protection Service; 1982-1985: Head, Environmental Affairs Division, Shell International Petroleum Maatschappij, The Hague; 1985-1990: FAO, Director, Plant Production and Protection Division. 1986-1990: Director, FAO Emergency Centre for Locust Operations; 1989-1990: Director, FAO Screwworm Emergency Campaign for North Africa; 1989-1994: part-time Professor Plant Protection in the Tropics at the Agricultural University, Wageningen; 1990-2001: Director General, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria.

Chairman of the Dutch Working Party on Integrated Pest Control 1971-1975; Chairman of the Dutch Association for Applied Entomology 1972-1975; Secretary General of the West Palaeartic Regional Section of the International Organization for Biological Control 1971-1977; Member of FAO Expert Panel on Integrated Pest Control 1971-1975; Adviser for the re-organization of the Commonwealth Institute for Biological Control 1975; Member of the OECD Steering Group on Pest Control under the Conditions of Small Farmer Food Crop Production in Developing Countries 1976-1977; Member first Quinquennial Review of IRRI 1975; Member Quinquennial Review of ICRISAT 1977; Board and Programme Committee Member of the International Board for Plant Genetic Resources 1985-1990; Board Member of the International Crops Research Institute for Semi-Arid Tropics 1987-1990; Member of Permanent Committee for the International Congress of Plant Protection 1983-1994; Review of the FAP Crop Production Programme 2003. Author of over 50 publications

**Name:** DAALOUL Abderrazak (Tunisia)

**Position:** Director General for Agricultural Production, Ministry of Agriculture, Tunisia.

**Expertise:** Genetics, plant breeding, agricultural development and planning in dry areas.

**Education:** 1964-1968: ENSAT, Tunisia, Agricultural Engineer; 1968-1969: Faculty of Sciences Tunis, Certificate of biochemistry, microbiology and plant physiology; 1969-1972: Oregon State University, USA, M.Sc. Agronomy/Plant Breeding; 1972-1974: Oregon State University, USA, Ph.D. Genetics/Plant Breeding.

**Experience:** 1968-1969: Researcher at the Institut National de Recherche d'Agronomie de Tunisie (INRAT);

1969-1973: Graduate studies at Oregon State University; 1973-1974: Principal Scientist Cereal Genetics Laboratory, INRAT; 1974-1976: Assistant Professor of Genetics and Plant Breeding at the Institut National Agronomique de Tunisie (INAT); 1976-1980 Director Ecole Supérieure Agriculture du Kef (Tunisia); 1980-1982: Associate Professor of Genetics and Plant Breeding and Head of the Genetics, Plant Breeding and Biometry Unit at INAT; 1982-2003: Professor of Agronomy, Genetics and Plant Breeding, INAT; 1982-1989: Head Agronomy and Plant Breeding Department, INAT; 1989-1991: Director General INAT; 1991-1994: President Institut de la Recherche et de l'Enseignement Supérieur Agricoles; 1994-2003: Director General for Agricultural Production, Ministry of Agriculture.

Member of INAT Scientific Board 1980-1989; Member of the Plant Genetic Resources National Committee 1980-2003; Member of the Operational and Coordinating Committees of A.T.T. Project (MIAC/ USAID) 1979-1988; Member of several negotiating teams for bilateral cooperation projects with USA, France and International Funding Agencies, 1979-2003; Member of the Consultative Board of the Arab Centre for Studies of Agriculture in Dry Areas 1974-1976 and 1991-1994; Representative of Tunisia to the International Commission on Plant Genetic Resources FAO-Rome 1982-1999; Regional Representative of WANA Region to the Consultative Group on International Agricultural Research 1990-1993; Member Consultative Scientific Board Centre International des Hautes Etudes Agronomiques Méditerranéennes 1992-1994; Member Agricultural Programme Committee of the Permanent Scientific Council for Francophone

Countries 1992-1994; Board Member of CIMMYT 1994-1999. Author of some 60 publications.

**Name:** Roozitalab Mohammad H. (Iran)

**Position:** Deputy Head, Agricultural Research and Education Organization (AREO), Tehran, Iran.

**Expertise:** Soil genesis, classification and management, land suitability evaluation, land use planning, agricultural research planning and management.

**Education:** 1970-1974: University of Tehran, Iran; B.Sc. Soil Science; M.Sc. Soil Science, Oklahoma State University, USA 1974; Ph.D. Soil Science, Oklahoma State University, USA 1978; Post Doctorate, Soil Salinity and Land Reclamation, Oklahoma State University, USA 1979.

**Experience:** 1980-1982: Director of Agricultural Office, City of Golpaygan, Iran; 1980-1984: Project Leader, Land Reclamation and Drainage of North Golpayegan Plain, Golpayegan, Iran; 1983-1995: Director General, Soil and Water Research Institute of Iran, Tehran; since 1995: Deputy Head, Agricultural Research and Education Organization, Ministry of Agriculture, Iran; 2001-2003: Deputy Head, Agricultural Research and Education Organization (AREO) for International Scientific and Research Cooperation, Tehran, Iran.

Member of Agricultural Commission of National Scientific Research Council, since 1995; Member of the High Council for Policy Formulation and Coordination of Agricultural Research, Ministry of Agriculture, 1996- 2001; Member of the High Council for Agricultural Research, Education and Extension Organization, Ministry of Agriculture, since 1983; Member of the Agricultural Committee of the High Council of Academic Planning, Ministry of Science and Higher

Education, 1988-2000. President of the Soil Science Society of Iran since 1992; Member of the NARS-Steering Committee of GFAR since 1998; Member GFAR Steering Committee since 1998; Member Executive Committee AARINENA since 1996; Member CGIAR Consultative Council 1998-2000; Vice- President

AARINENA 1996-1998 and since 2002; President AARINENA 1998-2000; Chairman GFAR since 2002; Member of the Board of Directors, International Centre for Biosaline Agriculture (ICBA) since 2003. Author of various scientific and technical publications.

## Annex III. Questionnaire Sent to Partners in CWANA Region

In total 111 filled out questionnaires have been received from the countries listed in the following table. The figure behind the countries gives the number of questionnaires filled out for that country.

**Table: Number of filled out questionnaires received from countries in the CWANA region.**

Algeria	1	Pakistan	5
Armenia	2	Palestinian Territories	2
Egypt	15	Qatar	2
Ethiopia	1	Saudi Arabia	1
Georgia	2	Sudan	5
Iran	8	Syria	1
Iraq	3	Tajikistan	3
Jordan	3	Tunisia	7
Kazakhstan	2	Turkey	7
Kuwait	1	Turkmenistan	2
Kyrgyzstan	3	UAE	1
Lebanon	1	Uzbekistan	15
Morocco	8	Yemen	8
Oman	2	<b>Total</b>	<b>111</b>

The persons responding can be grouped as follows:

- Director of an Institute 65
- Programme Leader/  
Department Head 28
- Scientist 9
- University Professor 9

The replies and comments received are presented in the following.

1. What are the major areas of collaboration between your country/institute and ICARDA (number gives the frequency of reply received)

- cereal improvement 82
- food legume improvement 70
- forage improvement 36
- livestock production management 24
- cropping systems management 29
- soil and water management 45
- integrated resource management 37
- integrated pest management 38
- human resource development and institutional strengthening 73
- information management 50

Other areas listed by the respondents: biodiversity and conservation (Jordan), climate change (Jordan), using local seeds (Iraq 2x), animal feed (Iraq), crop/livestock integration (Iraq), genetic resources collection missions (Uzbekistan 7x), improvement of indigenous genetic resources of rangelands (Pakistan), biotechnology (Iran, Jordan, Tunisia, Turkey), management of Orobanche (Egypt), protected agriculture (Oman 2x), seed production (Kazakhstan 2x, Iran), meteorological data collection (Pakistan), protected agriculture (Oman), research management (Yemen), establishment of technical council at the Tashkent State Agricultural University (Uzbekistan), joint collection missions (Uzbekistan), distribution of publications from ICARDA's library (Uzbekistan 2x), agricultural mechanization (Uzbekistan), joint publications (Tunisia), meteorological data collection (Pakistan), greenhouse experiments (Qatar 2x), virus free fig plants, and development of transgenic fig plants (Egypt),

2. How do you evaluate the benefits of the collaboration with ICARDA to your country/institute

- excellent 41
- good 58
- average 11
- poor 0

In case you answered excellent or good, which areas of agricultural development did this relate to

- food production 74
- natural resource management 52
- human resources management 62

3. With respect to question 2, are documented examples of impact in your country available? If so, then we would like to receive examples or references of publications. The following topics

were mentioned and in most cases publications are available.

- release of chickpea and lentil varieties (Turkey, Tunisia, Iran),
- Mashreq-Maghreb documents (Jordan, Iraq, Tunisia),
- cost/benefit analysis for water harvesting techniques in marginal areas (Iraq, Jordan),
- various (joint) publications (Iraq, Egypt, Jordan, Yemen, Morocco, Pakistan, Kyrgyzstan, Uzbekistan 6x, Tajikistan 2x),
- National Research Strategy, Rapid Impact Programme (Yemen 2x),
- development of improved wheat and barley varieties (Sudan, Morocco 2x, Kazakhstan, Tunisia 3x, Iran),
- agro-biodiversity programme (Palestine Territories),
- integrated pest management (Egypt),
- soil management studies (Egypt),
- faba bean varieties released (Egypt),
- reports Nile Valley and Red Sea Regional Programme (Sudan),
- infrastructure development (Sudan),
- feed block production, range rehabilitation, and improved seed production (Uzbekistan),
- waste water use (Kazakhstan),
- analysis of micro and macro nutrients in plants, soil and water (Tajikistan),
- natural resource management (Turkmenistan),
- plant genetic resources conservation (Uzbekistan),
- small ruminant management (Turkmenistan),
- sustainable development of small scale farmers (Turkey),
- workshop handouts (Iran),
- proceedings of ICARDA/Iran collaborative research (Iran),
- publication on soil resources, soil management and conservation (Armenia),
- national action plan on desertification

(Armenia), and

- wheat gene pool and its importance for breeding (Armenia).
5. Which collaborative mechanisms are most suitable to your country's needs? In brackets the percentage distribution within each row.

	Useful	Medium	Poor
Coordination/planning meetings	74 (78)	17 (18)	4 (4)
Workshops/training	81 (85)	13 (14)	1 (1)
Research networks	77 (77)	21 (21)	2 (2)
Joint projects	82 (81)	17 (17)	2 (2)
ICARDA staff posted in-country	50 (58)	25 (29)	11 (13)
Appointment of national staff as ICARDA affiliates	58 (62)	26 (28)	9 (10)

6. Which areas of collaboration you feel should be strengthened in the future?

- cereal improvement 64
- food legume improvement 57
- forage improvement 46
- livestock production management 41
- cropping systems management 45
- soil and water management 60
- integrated resource management 66
- human resource development and institutional strengthening 71
- information management 66
- other areas: olive production, socio-economics 2x, biotechnology 5x, GIS and remote sensing, seed production, agricultural mechanization, greenhouse experiments, and date palm development.

7. Is your national programme willing and able to share the costs of collaborative projects with ICARDA?

Yes	83
No	19

In case of yes, would such a contribution be:

In kind	68
Direct financing	16

## Annex IV. Examples of Technology Transfer Activities and Impact of the Outreach Programme

The headquarters and field research activities constitute one overall programme and, consequently, it may seem difficult to appraise the technology transfer and impact of the outreach activities separately. However, there are many useful examples which would not have occurred without the additional research activities funded through special projects and implemented under the outreach programme. For different sub-regions a number of these are presented in the following. The information has been summarized from reports mostly provided by the Regional Coordinators. Detailed impact studies have not always been carried out but, in cases where this has been done; the excellent results obtained have been clearly demonstrated. There is no doubt that similar results would be achieved if economic on-farm surveys could be carried out to determine the impact of the work undertaken under all the regional programmes.

### Activities in Central Asia and the Caucasus

One of the great benefits of the ICARDA coordinated programme for Central Asia and the Caucasus (CAC) is that it has for the first time since 1991 provided a neutral forum for an active interface among NARS leaders and scientists from the eight countries of the CAC region. ICARDA was the first Centre of the CGIAR to establish a regional programme in the region and has posted staff in the Tashkent office since 1998.

Under this regional programme NARS

are being strengthened to become more efficient and responsive to the new emerging challenges in the region. So far, over 2500 scientists have either been trained or given an opportunity for participation in various meetings, workshops and conferences. To improve communication opportunities special efforts have also been made to impart English language training to around 300 young scientists. Infrastructure has been upgraded and ICT networking through e-mail and Internet access has been established. Notwithstanding the fact that this regional program is rather young significant progress has been made in a number of research areas. This was mainly possible because of the availability of a large pool a well qualified staff which, however, was working mostly in isolation and lacked the means to carry out the necessary research since 1991.

### *Plant Genetic Resources and Germplasm Development*

In cooperation with IPGRI, plant genetic resources units have been established in each of the eight CAC countries. Collection missions have been undertaken and in total over 1800 accessions of different crops have been collected and added to the genebanks.

Based on material sent from the joint CIMMYT/ICARDA/Turkey Programme on Winter Wheat Improvement new varieties have been developed and currently ten of them or in the final approval stage by the State Variety Testing Commissions (STVC) in the various countries. Two winter wheat varieties emanating from the introduced materials have already been released, one under the name of Dostlik (which means friendship) in Uzbekistan and Mtskhetis in Georgia. In field experiments Dostlik, which in

2003 is multiplied on 300 ha, shows significant yield advantages over the varieties currently grown; it has good resistance to yellow rust and some tolerance to salinity.

Three winter barley varieties and one spring barley variety have been submitted to the STVCs in Kyrgyzstan, Azerbaijan, Uzbekistan and Kazakhstan. One improved chickpea variety will soon be ready for release in Azerbaijan, and one is already grown by farmers in Georgia. An improved lentil variety has been released in Georgia, and one has been submitted for testing to the STVC in Uzbekistan.

### *Natural Resource Management*

Very encouraging progress has already been made with the introduction and adoption of improved soil and water management technologies. This has been achieved under the project on Soil and Water Management initiated in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, and financed by the Asian Development Bank from 2000 onwards. While considering the following examples it should be noted that under the former USSR regime, these countries applied standardized production practices, including mono-cropping, high dosages of fertilizers, and deep ploughing; all aimed at producing maximum quantities of cotton and wheat.

- Improved irrigation technologies, developed and tested on-farm, increased average yield of winter wheat by more than 40%, reduced soil erosion by almost 60%, and increased water use efficiency by 50 - 100%. These technologies are now ready for adoption on approximately 1.4 million ha of sloping land in Uzbekistan.
- In southern Kazakhstan, the introduction of improved irrigation technologies, led to about 30% of water saving compared to traditional furrow irrigation. It also reduced the pressure on the drainage system by 40%.
- Experiments using treated wastewater for irrigation of fodder and industrial crops and tree plantations in Kazakhstan and Tajikistan led to promising results with respect to the potential reduction in use of scarce water resources.
- Under rain-fed semi-arid conditions of northern Kazakhstan, minimum and zero tillage resulted in 15% higher grain yields compared to the general practice of deep ploughing. Currently, zero tillage has already been adopted by farmers on approximately 10,000 ha.
- Reduced tillage has also led to promising results in Turkmenistan; water productivity increased by 25% compared to the traditional deep ploughing practices.
- In Uzbekistan and Tajikistan, cotton planted as a double crop after winter wheat gave similar yield under no-tillage compared to traditional deep ploughing and mono-cropping. The no-tillage practice has now been introduced on about 4,000 ha in these two countries.
- Crop diversification has been promoted through the introduction of chickpea, safflower, soybean, common bean, mungbean and groundnut. Chickpea, earlier an unknown crop, is now grown on about 3,000 ha in northern Kazakhstan, while in southern Kazakhstan, safflower is produced under rain-fed conditions on some 70,000 ha and soybean on 2,000 ha. In Kyrgyzstan, common bean (*Phaseolus vulgaris*) now occupies some 2,500 ha, and rain-fed chickpea some 3,000 ha.

- Double cropping of cotton after winter wheat has been introduced in Uzbekistan on 5,000 ha. In Tajikistan, double cropping has been practiced using different crops after winter wheat such as cotton on 5,000 ha, buckwheat on 3,000 ha, tobacco on 1,000 ha and rice on 1,000 ha.
- Wheat-cotton rotation is now getting popular due to the introduction of conservation tillage, varietal adjustments and alternate furrow irrigation technologies. It is expected that the area under cotton-wheat rotation in the CAC Region will increase to about 200,000 ha in the next two to three years.

### *Crop/Livestock Integration*

The project on Integrated Feed and Livestock Production in Steppes of Central Asia undertaken in Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan with support of IFAD since 1999, has led to the following outputs.

- Research on socio-economic and public policy matters identified the main livestock production constraints; described the different types of farming units and marketing channels, and determined the access to rangelands, and community property rights.
- For range rehabilitation promising results were obtained in the steppes of Kazakhstan, Turkmenistan, and Uzbekistan, by using various native shrubs.
- Intensive forage production technologies using a rotation of triticale, oats and fodder pea, followed by maize gave dry matter yields of about 14 t/ha under irrigated conditions in Uzbekistan and Turkmenistan.
- Feed block technology for sheep feeding is increasingly adopted in Uzbekistan and is being tested by a number of farmers in other countries.
- Improved livestock management technologies, such as early weaning, early lambing and market oriented lamb fattening, allowed farmers to generate more income in all the Central Asian countries.
- Farmers in the region, who never practiced milking of sheep before, are now getting interested to adopt this practice, to increase their income.

### **Iran/ICARDA Collaborative Agricultural Research Programme**

The Iran/ICARDA Project on Strengthening Agricultural Research for Dryland Farming in the Highlands of Iran started in 1990 and has continued to constitute the base for research collaboration on:

- germplasm enhancement of various food and feed crop species for dry-land conditions,
- the development of rain-fed crop production technologies,
- research on the integration of crop and livestock systems, and
- study of socio-economic factors limiting agricultural production in rain-fed highland areas.

The project has led to the establishment in 1993 of the Dryland Agricultural Research Institute (DARI) at Maragheh, with three major research stations at Maragheh, representing the cold-winter areas, at Kermanshah representing the cool-winter areas, and at Gachsaran, representing the mild-warm winter areas.

ICARDA provides annually about 1000 kg of germplasm seed representing more than 6000 entries/genotypes of different crops to researchers from DARI and the

Seed and Plant Improvement Institute (SPII). Special emphasis is placed on germplasm with specific attributes suitable for growing in Iran, in particular, adaptation to drought, heat, cold, salinity, and tolerance to diseases and insect pests. Iranian researchers have evaluated and used this germplasm in their breeding programmes, which has led to the release of a number of cultivars. This included seven wheat cultivars, five barley cultivars, two chickpea cultivars and one lentil cultivar. A number of advanced breeding lines of wheat, barley, chickpea and lentil with superior performance are being retested during 2003 in multi-location on-farm sites, before a final decision is taken on their possible release.

In addition to these breeding successes, production technology packages have been developed by DARI researchers working jointly with ICARDA scientists for the major agro-ecologies of Iran. This included adoption of appropriate varieties, time of planting, seed rate, fertilizer rate and placement, drill sowing, and weed control. Farmers using the improved technologies in rain-fed areas have seen their yields increased by 10-50% for wheat crops, and 100-300% for chickpea, despite the severe drought that prevailed during the past four years. These successes have been demonstrated in field days to farmers who expressed a keen desire to adopt the new technologies, and these were applied in 2002 on some 4,000 ha of demonstration-cum-adoption fields in four provinces within Iran during 2002. During 2003 the improved production package is used on 55,000 ha.

ICARDA contributed to a major effort on the introduction, development and production of oilseed crops, particularly

rapeseed. Three oilseed consultants were seconded to SPII and DARI in 1999. As a result of this, promising varieties and proper production technologies have been identified and are adopted by farmers, mostly in irrigated areas. However, there is also a real potential for oilseed crops, both rapeseed and safflower, in rain-fed areas of Iran. Grain yield of rapeseed is 4-5 t/ha on properly irrigated farms, and about 1 t/ha on rain-fed farms. The area grown to rapeseed has increased from 11,000 ha in 1999 to 48,000 ha in 2002.

During the period 1990-2001, a total of 737 scientists and technicians have been trained through ICARDA-organized courses either in-country, or outside Iran. In addition, 60 scientists have been sponsored by the project for PhD degree training at foreign universities. While 10 of these researchers are still pursuing their studies, most of the others have returned to Iran and are contributing effectively to the enhancement of the research capacity of their respective institutes.

In conformity with its strategy of encouraging or establishing collaboration in agricultural research among countries of CWANA, ICARDA, through its Tehran Office, has conducted a number of regional activities, with a strong backing from the Agricultural Research and Education Organization (AREO) and with the participation of a large number of Iranian scientists.

### **Activities undertaken under the West Asia Regional Programme**

Results obtained in the Marhreq region under the Masheq and Maghreb Project offer a useful example of new technologies developed and adopted as part of the outreach programme. The Mashreq-

Maghreb Project has developed and introduced several improved crop and livestock technologies into the farming systems of Iraq, Jordan, Lebanon, and Syria. The adoption of these technologies has been determined through on-farm surveys. In depth economic analysis have been carried out to determine the benefits of the use of improved barley varieties, the adoption of feed blocks, the introduction of vetch in barley rotations, planting of cactus, and early weaning of lambs. It has been clearly proven that the Mashreq and Maghreb project has contributed significantly to the welfare of farmers in the dry areas of West Asia.

Results demonstrate that improved barley varieties fitted well into the prevailing production systems; the rate of adoption, i.e. the percentage of farmers adopting the new technology, was over 50% in Iraq, Lebanon and Jordan, and 32% in Syria. Planted areas to newly developed barley varieties constituted 54% of the total barley growing area in Iraq, 67% in Jordan and 21% in Syria. The high adoption rate is attributed to better productivity, improved disease and lodging resistance and in some areas to distinctively higher returns.

The feed block technology has been expanding rapidly among sheep owners in countries in West Asia. In Iraq, the collected information revealed that sheep owners are routinely supplementing the feeding of their sheep with feed blocks. In other countries, the feed block technology is also gaining grounds, for example its adoption rate was 21% in Jordan.

Cactus planting and subsequent use in animal feeding is expanding in the West Asia region. However, expansion to new environments is mostly by government

decisions. Several other technologies contributed to increased welfare of the rural poor in selected zones of the region. *Vetch* introduction in barley rotations and early weaning of lambs showed adoption rates of respectively 28.5 and 28.8% in Syria, and influenced in a positive manner sheep production and related economic returns.

Farm size, land tenure and type of farming systems influenced in many situations the level of adoption of a given technology. In Jordan, for example, mixed crop and livestock production systems had the highest adoption rate for all technologies. Similarly in Syria, adoption was highest for farmers practicing livestock, or mixed crop/livestock production systems. Land tenure had a noticeable positive impact on the adoption of improved barley varieties and vetch introduction and growing in Jordan.

### *Examples of economic impact*

Performance indicators and relevant methodologies have been used to assess technology impact on farm income and its distribution, and on household food/feed security and productivity. Benefits and costs associated with each technology have been assessed to calculate the internal rate of return (IRR) and the benefit-cost ratio.

The impact of improved varieties on barley productivity is evident in Iraq; the net benefit was 19%. Similarly in Syria it has been shown that planting of both improved and local varieties at the same input levels will result in a yield gain of 20% from the improved variety. These varieties increased the household food security, measured in kg of barley grain/household/year, by 14% compared to local varieties.

The use of feed blocks increased sheep production efficiency by 32% in Iraq as a result of the increased number of lambs born. Results also show that increased meat production of 4.09 kg/ewe/year may be attributed to the use of feed blocks. Similarly, increased milk production of 8.28 kg/ewe/year is obtained following the use of feed blocks. The calculated benefit/cost ratio was 1.56 and the IRR 87%. Comparing the IRR of 87% with the effective rate of interest of 10% indicates that investment in feed blocks for sheep feeding is paying high dividends.

Economical analysis of the introduction of forage legumes in Iraq showed that the rotations of barley/vicia, barley/vicia-barley mixture and barley/fallow are more profitable than other alternatives. For farmers with mixed crop-livestock enterprises, the rotation of barley/vicia and barley/vicia-barley mixture have been recommended as they serve better the goal of crop/livestock integration. These case studies showed that the introduced technologies were economically attractive, regardless of government subsidies. However, government incentives are important at the early stages of technology adoption to secure widespread dissemination.

In recent years ICARDA is coordinating a regional project on the conservation and sustainable use of dry-land agro-biodiversity, which is implemented in Jordan, Lebanon, Palestinian Authority and Syria. The preliminary impact of the project is the increased awareness of local communities and major decision makers of the importance of the local agro-biodiversity. The relevant Agricultural Research Institutions and Forestry Departments have now developed biodiversity units to promote *in situ* and *ex-situ* conservation.

The governments and local communities are increasingly using local wild fruit trees in reforestation efforts. In Syria, the number of wild fruit tree seedlings planted has increased from 30,000 to more than 600,000 in three years. So far twelve *in situ* conservation sites have been created in the participating countries.

### Activities in the Arabian Peninsula

The Arabian Peninsula is characterised by low and erratic rainfall, high evaporation rates and very high temperatures. The countries in this sub-region, Bahrain, Emirates, Kuwait, Oman, Qatar, Saudi Arabia and Yemen, face the challenges of developing sustainable agricultural production systems, in particular, making more efficient use of their scarce water resources and preserving the environment and biological heritage. Three main research themes are pursued by the Arabian Peninsula Regional Programme (APRP) with, at the same time, strong emphasis on strengthening the national institutional and human resource capacities. These themes are:

- on-farm water use and irrigation;
- rangeland, shrubs, irrigated forages and livestock; and
- protected agriculture.

Examples of activities undertaken in recent years and achievements include the following.

### *On-farm Water Use and Irrigation Management*

- Specialized equipment has been introduced in the UAE to obtain more accurate measurements of water use efficiency.
- The establishment of a weather stations network for the Arabian Peninsula has

been initiated with the distribution of eleven automatic weather stations. The objective is to link the weather stations to the ICARDA-APRP Internet website to make data available to the end-users to estimate near real time crop water requirement as an input to more efficient irrigation water management.

### **Rangeland, Shrubs, Irrigated Forages and Livestock**

- A potential solution to water shortage and rangeland problems is the development of production systems based on indigenous species with relatively low water requirements. Plant and seed collection missions have been carried out in all countries of the Arabian Peninsula. From the species collected, a total of 27, including 10 grasses and 15 shrubs/trees, were identified as high priority according to various criteria. Feed quality of some of these has been determined with initial results showing their nutritional value to be as high as that of introduced material.
- Rehabilitation of heavily degraded rangeland in Saudi Arabia and Yemen through the seeding and transplanting of drought tolerant indigenous shrubs and trees and proper grazing management has been very successful.
- A preliminary study on water use efficiency was initiated in UAE comparing two native grasses (*Cenchrus ciliaris* and *Lasiurus scindicus*) and one exotic species (*Chloris gayana*). A more comprehensive study is now undertaken in UAE comparing the above species with *Panicum turgidum*, *Coelachyrum piercei* and *Medicago sativa* for their water use under drip irrigation.
- Bulk seed production of priority species is pursued in all countries and samples of *Cenchrus ciliaris*,

*Coelachyrum piercei* and *Lasiurus scindicus* were collected from a natural reserve in UAE. The material has provided an opportunity to test seed scarification and cleaning equipment.

- A seed technology unit has been established in UAE to enhance quality seed production of indigenous forage species. A similar unit is being established in the Sultanate of Oman.
- In UAE four grasses have been multiplied at two locations of 5 ha each. Similar activities are ongoing in the Sultanate of Oman, Qatar, Saudi Arabia and Yemen.
- Suitable fodder shrub species have been identified in the northern part of Saudi Arabia. These include: *Atriplex leaucoglada*, *Salsola velosa*, *Salsola tetrandra*, *Atriplex halimus* and *Tragnum nudatum*.

### **Protected Agriculture**

- To increase farmer's income in the mountain terraces of Yemen, cultivation of cash crops in greenhouses has been introduced. The use of drip irrigation in plastic houses proved of interest to farmers because of more efficient water use. Cost/benefit analysis revealed that total costs can be recovered in three seasons.
- Integrated Production and Protection Management (IPPM) practices have been developed to provide greenhouse growers with simple applicable techniques for crop protection instead of relying mainly on pesticides. IPPM has been used successfully by both research stations and private growers in all the Arabian Peninsula Countries.
- Solarization techniques for the control of soil-borne diseases have been introduced on research stations and private farms with excellent results. It elimi-

nated the use of hazardous pesticides. Training has been provided and a guide book has been made available to growers and extension agents in the region. The technique has been successfully adopted by many growers in the countries of the Arabian Peninsula.

- To increase quality and quantity of yield per unit of water, area and manpower, soil-less growing techniques have been introduced for vegetable and strawberry production. Economic analysis showed significant returns on the investment with major savings in water, fertilizers and labour, in addition to reduced salt accumulation and infestations by soil-born pathogens. Soil-less production has been adopted by many growers in different countries.
- Positive results have been obtained in experiments testing new designs of greenhouses and cooling systems. These provided extra crop protection and improved cooling, with possibilities to recover fresh water from the enclosed area.

An Information Technology System for Agriculture and Natural Resources Development in the Arabian Peninsula has been introduced in collaboration with research institutes in Egypt. An Internet based expert system for cucumber production under protected agriculture has been developed and placed on the Internet. This allows growers, extension personnel and researchers to take the right decisions for cucumber production. ([www.icarda.cgiar.org/aprp/it.htm](http://www.icarda.cgiar.org/aprp/it.htm)). Over the last four years more than 120 researchers and scientists from the sub-region have been trained by ICARDA. A Seed Technology Unit has been established at the Dhaid Research Station in UAE.

## Activities in North Africa

The North Africa Regional Programme (NARP) has evolved from a commodity focus, emphasizing technology testing/demonstration at the farm level, to a community and participatory based approach, addressing technical, socio-economic, institutional, and policy dimensions. Strengthening of NARS' capacities has been an integral part of most of the project activities undertaken. Activities aimed at assessing women's role in food production and household food security, such as durum wheat and wool processing, have been initiated throughout the region. Regional networks and meetings have significantly fostered cross-fertilization of experiences among NARS' scientists. Special efforts have been undertaken to forge linkages with development projects to enhance the dissemination of new technologies and speed up their adoption by farmers. Various on-farm surveys have been undertaken to determine the adoption of improved technologies.

## Crop improvement

Since 1980 the national programmes of Algeria, Morocco, and Tunisia, in collaboration with ICARDA and CIMMYT, have succeeded in generating several new varieties. For cereals some 100 improved varieties have been released between 1980 and 1999. The main feature of later generation varieties is their ability to perform well, even under the prevailing abiotic and biotic stresses. A large proportion of farmers' fields are now planted with new cereal varieties, and in particular the adoption of improved wheat varieties is widespread across the region. Improved barley varieties are now grown on 40% of the cultivated area in Morocco resulting in a 35% increase of productivity. The

development of lentil varieties with good standing ability, well adapted to mechanical harvesting, has significantly enhanced adoption of new materials and mechanical harvesting. Moreover, the winter chickpea technology is making headway, especially in Morocco. Surveys show that the average yield advantage of improved varieties of cereals and food legumes ranges from 20 and 50%.

### *Natural Resource Management*

Research and development efforts on sustainable crop and livestock systems have been initiated through projects such as the Mashreq-Maghreb project. As part of this a bio-economic model has been developed and validated, in particular in Morocco and Tunisia. This model provides valuable insights into the effect of macro-economic reforms on farmers' production strategies at the community level. It is a major tool for policymakers and researchers alike to better assess the implications of policy and institutional reforms on technology uptake.

For rangeland development encouraging results have been obtained through the introduction of new plant species, in particular *Lathyrus*, *Medicago*, and vetch, as well as fodder shrubs, for example, *Acacia* and *Atriplex*, and spineless cactus varieties. Due to the increasing feed demand the area devoted to forage crops is gradually increasing. The sustainability of pasture development, however, strongly depends on appropriate grazing management with stocking rates tailored to the nature and state of the vegetation and the availability of other feed resources. NARP activities have therefore emphasized the implementation of a multifaceted approach including rangeland development, crop rotations with a larger share of

forage crops, especially legumes, and the development of low-cost feed alternatives such as feed blocks and straw treatment.

Studies on the effect of land ownership on smallholders' investment behaviour showed that regardless of the land ownership rights, complete or partial, most farmers do invest in soil improvement operations such as de-stoning, tree planting, and well digging. However, land fragmentation, small plot size and remoteness negatively affect investment in land improvement. With regard to common pastures, the mechanisms currently in place, governing access and use, do not provide a satisfactory balance between individual and social interests enabling optimal use and sustainable management.

### *Small ruminant production*

Throughout the region, livestock represents a major component of the farming systems. Quantity and quality of feed is by far the most limiting factor to livestock production in the region. Due to its extensive nature, livestock production relies mainly upon grazing on communal lands that provide barely the minimum nutrient requirements because of degradation. NARP has been developing viable options to improve livestock production, especially through improved feed production. For example, barley-*Atriplex* intercropping has been promoted as a viable alternative to barley mono-cropping. The success of this approach is demonstrated by the fact that *Atriplex* is now also intercropped with other forage crops such as oats, while other forage mixtures, for example, barley/fodder pea and/or oats/vetch mixtures are increasingly used by the farmers.

The feed block technology has been identified as a breakthrough in overcoming the increasing shortage of feed in the region. The technology is simple, cost-effective, and its adoption by livestock owners was virtually instantaneous and has spread throughout most countries of the region. It has led to the development of a private feed industry, which has the additional advantage of providing important employment opportunities to rural labourers. The feed block technology greatly reduced feeding cost in Tunisia. The estimated IRR of 57% clearly explains why the technology is being widely used to substitute expensive feed resources, such as barley grain and wheat bran, while maintaining the same weights for small ruminants.

Another technology developed/revived to overcome feed shortages has been cactus, *Opuntia* spp., production. It is particularly well adapted to the harsh conditions of the dry areas, and is an important alternative source of feed as well as a means to control erosion and desert encroachment. In parallel to the development of new feed alternatives, ewes' fertility and reproductive capacity has been improved through the introduction of rams and the utilization of hormone treatment. Improved rams with a genetic potential to improve milk production and lamb growth have been identified and distributed to sheep owners for the genetic improvement of their flocks.

The IRR for cactus in marginal cereal production areas in Tunisia ranged from 61-66 %; while for cactus growing in the form of alley cropping with barley the IRR was between 81-89%. This increase in the IRR under alley cropping is solely attributable to the barley planted with cactus. Likewise the estimated IRR of

combining *Atriplex* with barley through alley cropping in Morocco is 79%, indicating the efficiency of research investment in this technology. The IRR for barley cropping alone is 59%.

### **Nile Valley and Red Sea Regional Programme**

The Nile Valley and Red Sea Regional Programme has had a strong impact on agricultural development in Egypt, Ethiopia and Sudan. Until 1995 the total number of improved cultivars released was 17 for faba bean, 6 for chickpea, 7 for lentil, 5 for field pea, 8 for wheat and 3 for barley. In addition improved production practices have been developed and transferred to farmers. These varieties and improved practices have been widely adopted and have resulted in significant production increases. In the following the results of the Matrouh Resource Management Project in Egypt are taken as an example, because an in-depth impact analysis has been carried out at the end of the project in 2001.

The Matrouh Resource Management Project has been designed and implemented to break the cycle of natural resource degradation and alleviating poverty in the rain-fed areas of the north western coast of Egypt. The region has a semi-desert environment with an annual average rainfall of 150 mm, and water is the main constraint for agricultural development. The project has used holistic inter-disciplinary approaches to research and development in full participation with the local Bedouin community and technical support from ICARDA. It was designed to undertake the following activities to support the local communities.

- Natural resource development and conservation, including soil, water and vegetative cover;
- Adaptive research to improve agricultural production in relation to crops, rangeland and livestock;
- Extension, training and social development, including rural women development;
- Credit and rural finance for small income-generating projects; and
- Management, including monitoring and evaluation of performance and impact.

The holistic and participatory approaches addressed:

- The whole of the watershed as the physical development unit, ensuring resource sustainability and social equity;
- The whole farm as the agricultural development unit, ensuring optimum resource use efficiency and farmers' adoption of recommended technologies; and
- The local communities as a consolidated social development unit, in bottom up planning.

### *Resource development and conservation achievements*

- Design improvements were introduced for cistern and concrete reservoir constructions, improving water storage capacity and reducing costs by about 40%, and for dikes to improve their stability and more efficient functioning;
- New techniques such as micro-water harvesting systems, contour and semi-circular ridges, and gabions have been introduced;
- An integrated watershed planning approach has been implemented to sustain natural resource improvement,

and avoid disputes on property rights between resource users; and

- Awareness and skills of local communities were upgraded on improved cistern and reservoir construction, water purification techniques, and maintenance of structures.

### *Major areas of technology transfer*

- Crops: improving barley productivity through new varieties and cultural practices; cropping systems by introducing new crops, crop rotation, barley-vetch mixtures, and inter-planting of fodder shrubs.
- Horticulture: improving the productivity of figs, olives and vegetables mainly through cultural practices; introducing new species and varieties; rejuvenation of old and deteriorated orchards; and introducing greenhouse technology and drip irrigation.
- Range: improving the management of natural rangeland, identifying palatable local species, annuals and perennials, for multiplication and distribution to farmers; improved practices for seedling production of fodder shrubs, transplanting and management.
- Livestock: early-weaned lamb fattening; improved and more economical nutrition by using urea-treated straw; barley-vetch mixtures, fodder shrubs and olive cakes; rotating rams and cross-breeding with Damascus goats for germplasm improvement.
- Farming systems: characterization of farming systems for problem identification and orientation of research programmes; and evaluation of research findings and adoption of impact.

### *Impact*

- Water harvesting constructions increased water supply by 45%, and

water stored in cisterns and concrete reservoirs, and behind specially constructed dikes, was 280% and 110% of what was envisaged originally under the project outputs. Water harvesting had increased the net benefits of the overall farming systems by 88% on average for about half of the beneficiaries.

- More than 5.1 million fodder trees have been planted on more than 15,000 feddan (1 feddan = 0.42 ha), and perennials and annuals have been reseeded on more than 2,500 feddan. Productivity of barley has been increased by about 70% on 45% of the total barley growing area, increasing total production by 8,830 Mt and net returns by LE 7.8 million (1 US\$ = 5.9 LE), or LE 1,185 per adopter farm or household. In addition to this substantial increase in barley production, this represented also an increased feed supply recovering 20% of the total feed gap in the project area. Fodder shrub plantation has reduced concentrate use and feed expenses by 37% on average, varying from 29 - 75% for about 40% of the beneficiaries.
- Shelter belts have been planted on a total length of 64 km of sandy soils suffering from erosion and sand dune movements; 33% of farmers increased their orchard area, 19% adopted crop

rotation, and 16% inter-planted fodder shrubs with barley, all contributing to soil conservation. Fig and olive productivity increased by 60% and vegetables by 27%.

- Activities implemented by women such as home gardening and tree planting around the house, as well as women small-scale income-generating projects generated various benefits. In the case of poultry LE 367 per production cycle of 20 chickens.
- The beneficiary social pool was enlarged from 6,000 households at the time of the original project appraisal, to more than 18,600.
- Over 3,620 illiterate girls have been educated, and many thousands of women benefited from extension workshops and other activities to increase environmental, nutritional, and health awareness. New income sources and employment opportunities have been opened for women and men.

The Matrouh Resource Management Project provides an outstanding practical example on how to apply a holistic, community-based, approach for the development and introduction of sustainable agricultural production practices. The project results clearly demonstrate that this can be done successfully even under very harsh production conditions.