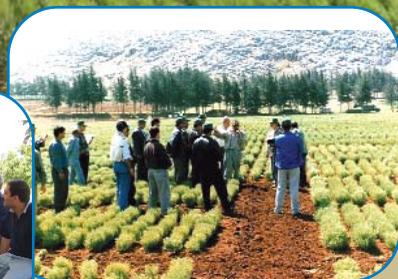


Lebanon and ICARDA

Ties That Bind



ICARDA

International Center for Agricultural Research
in the Dry Areas

About ICARDA and the CGIAR



ICARDA

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is one of 15 centers supported by the CGIAR. ICARDA's mission is to contribute to the improvement of livelihoods of the resource-poor in dry areas by enhancing food security and alleviating poverty through research and partnerships to achieve sustainable increases in agricultural productivity and income, while ensuring the efficient and more equitable use and conservation of natural resources.

ICARDA has a global mandate for the improvement of barley, lentil and faba bean, and serves the non-tropical dry areas for the improvement of on-farm water use efficiency, rangeland and small-ruminant production. In the Central and West Asia and North Africa (CWANA) region, ICARDA contributes to the improvement of bread and durum wheats, kabuli chickpea, pasture and forage legumes, and associated farming systems. It also works on improved land management, diversification of production systems, and value-added crop and livestock products. Social, economic and policy research is an integral component of ICARDA's research to better target poverty and to enhance the uptake and maximize impact of research outputs.



CGIAR

The Consultative Group on International Agricultural Research (CGIAR) is a strategic alliance of countries, international and regional organizations, and private foundations supporting 15 international agricultural Centers that work with national agricultural research systems and civil society organizations including the private sector. The alliance mobilizes agricultural science to reduce poverty, foster human well being, promote agricultural growth and protect the environment. The CGIAR generates global public goods that are available to all.

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 with a System Office in Washington, DC. A Science Council, with its Secretariat at FAO in Rome, assists the System in the development of its research program.

Lebanon and ICARDA

Ties that Bind

32 years of partnership for sustainable agriculture



ICARDA

**International Center for Agricultural Research
in the Dry Areas**

© 2009 International Center for Agricultural Research in the Dry Areas (ICARDA)
All rights reserved.

ICARDA encourages fair use of this material.
Proper citation is requested.

Citation:

ICARDA. 2009. Lebanon and ICARDA. Ties that Bind, No. 27. ICARDA, Aleppo, Syria. iv + 27 pp.

ISBN: 92-9127-225-6

Headquarters

International Center for Agricultural Research in the Dry Areas (ICARDA)
P.O. Box 5466, Aleppo, Syria
Tel: (+963) (21) 2213433, 2213477, 2225112, 2225012
Fax: (+963) (21) 2213490, 2225105, 5744622
E-mail: ICARDA@cgiar.org
Website: www.icarda.org

Terbol Station

Terbol, Beka'a Valley, Lebanon
Tel: +961-8-955127
Fax: +961-8-955128
E-mail: icarda-terbol@cgiar.org

ICARDA-Lebanon

PO Box 114/5055, Beirut 1108-2010, Lebanon
Tel: +961-1-813303
Fax: +961-1-804071
Email: icarda-beirut@cgiar.org

Foreword

The International Center for Agricultural Research in the Dry Areas (ICARDA) and the Republic of Lebanon have been closely bound together since 1977, when ICARDA was established with the signing of an agreement between the Government of Lebanon and the Consultative Group on International Agricultural Research (CGIAR).

ICARDA emerged from, and expanded, the former Arid Land Agricultural Development (ALAD) Program of the Ford Foundation that operated in Lebanon in the 1960s and 1970s. The objectives of that program remain valid today; to make the best use of limited water resources, to improve production of staple food crops in a region of major food gaps, and to address the complex integration of crop and livestock production in the dry areas.

Despite disruptions for various reasons in Lebanon and throughout the region that ICARDA serves, ICARDA and the Lebanese national research program have worked together in areas of mutual interest for more than 30 years. This collaboration has proved to be an enduring and successful partnership that has resulted in clear impact on farming households. This booklet presents highlights of the collaborative projects and activities undertaken over that time.

ICARDA works closely with the Lebanese Agricultural Research Institute (LARI) to strengthen agricultural research in Lebanon. In addition, LARI's Terbol and Kfardan research stations, seconded to ICARDA, provide important research sites that complement the crop improvement research and germplasm testing at ICARDA's principle research station at Tel Hadya near Aleppo, Syria. These sites represent agro-ecological conditions not available at Tel Hadya, also providing the Center with off-season sites to advance breeding of segregating generations, multiply seeds of promising breeding lines, and screen for specific diseases for which conditions at Terbol conducive.

Building on past cooperation, ICARDA looks forward to future collaboration with the Republic of Lebanon in addressing the emerging challenges facing sustainable agricultural development in the region.

Mahmoud Solh
Director General, ICARDA

Contents

| | |
|---|----|
| Agriculture in Lebanon - an overview | 1 |
| ICARDA and Lebanon | 2 |
| Terbol research station | 4 |
| Conserving genetic resources | 7 |
| New crop varieties | 9 |
| Seed increase and the regional seed network | 11 |
| Crop disease surveys | 12 |
| Livestock production and crop-livestock integration | 13 |
| Natural resource management | 16 |
| Socio-economic and policy research | 17 |
| Gender analysis | 18 |
| Capacity building | 19 |
| Publications and information | 22 |
| Appendices | 23 |
| Selected ICARDA events in Lebanon | 23 |
| Memoranda of Understanding | 24 |
| Selected publications (1999-2009) | 24 |

Agriculture in Lebanon - an overview

The Republic of Lebanon is part of the Fertile Crescent region, where most of the world's significant crops, such as wheat, barley, lentils and many fruit tree species were domesticated over the last 10,000 years.

The climate is typically Mediterranean, a predominance of arid and semi-arid areas, and mountain ecosystems making up three-quarters of Lebanon's surface area of 10,400 km². Agriculture is the major activity for more than 30% of the total population of 4 million people, and this sector contributes around 12% to the national Gross Domestic Product.

Arable land in Lebanon occupies approximately 250,000 hectares, or almost a quarter of the total land area of the country. Of this cultivated land, 42% is under irrigation and a similar percentage is on mountain slopes. Of the remaining land, rangelands make up over half of Lebanon, with 515,000 ha, and forests cover some 135,000 ha. Land use on cultivated land is diverse, with olive trees covering 20%, other fruit trees 23%, cereals 20%, vegetables 17%, industrial and oil crops 8% and legumes on 2.5% of the area.

Farm size is generally very small, averaging only 1.27 ha, three quarters of all farmers have less than 0.5 ha, and 37% of all farms produce only for home and family consumption. Land ownership is 85% private, 12% 'Amiri', 1% public, 1% Waqf and 1% collectively owned.

Regarding livestock, there are an estimated 436,000 goats, 378,000 sheep and 76,000 cattle. The Beka'a valley is the most fertile area in Lebanon, covering 102,481 ha (42% of the total arable land). Here, most of the country's food is grown; 60% of all Lebanon's cereals, 62% of its industrial crops, 57% of its vegetables, and 37% of all its fruit trees.

However, Lebanese agriculture is facing challenges linked to rapid degradation of the resource-base, difficulties in marketing agricultural products, high production costs and slow adoption of improved technologies and practices due to limited extension efforts. These intensive agricultural systems are also characterized by excessive use of fertilizers and pesticides.

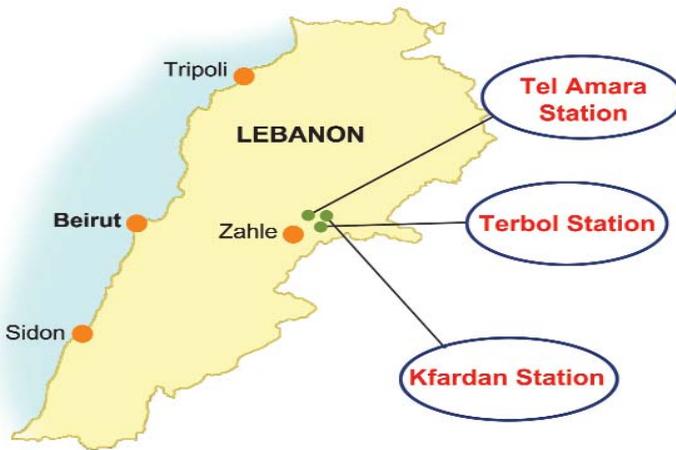
The civil war (1975-1991) significantly slowed government and private research efforts to develop agricultural production, though ICARDA's work continued regardless. It has played then, and continues to play, an important role in serving Lebanese agricultural development throughout the last 32 years.

ICARDA and Lebanon

The International Center for Agricultural Research in the Dry Areas (ICARDA) was born in Lebanon. The concept of establishing an international center for dryland crops in the region emerged from the Arid Land Agricultural Development (ALAD) program which was operating in Lebanon in cooperation with the Lebanese Agricultural Research Institute (LARI), from the mid 1960s to 1976.

ICARDA was first established in Lebanon on 1 January 1977. The first office was in Rayack, on the road between Tel Amara and Terbol, and the first field trials were at Tel Amara during the 1976-1977 and 1977-1978 seasons.

The nascent ICARDA and the Lebanese government signed Decree No.124 on 20 June 1977, which was released by HE the President of



the Republic of Lebanon Mr Elias Sarkis, and HE the Lebanese Prime Minister Dr Salim El-Hoss. This was followed by the signing of an official agreement on 6 July 1977, in which ICARDA leased both Terbol and Kfardan research stations from the Lebanese Agricultural Research Institute. ICARDA has since played a major role in conducting agricultural research on field crop improvement and natural resources management, in close collaboration with LARI and other organizations.

During the 1978-1979 growing season, research work was transferred to Terbol station, in the heart of the Beka'a valley, when construction started on fencing, store buildings, workshop and office. The office was moved to Terbol in 1979, moving into a new building in 1981.

Since that time, and despite the difficulties and the uncertain conditions in Lebanon, ICARDA has continued its support of research in Lebanon. ICARDA was the only institution that ensured the continuation of agricultural research activities throughout the Lebanese Civil war, hence preserving a wealth of research materials and resources, and improved technologies, which at the end of the war became the cornerstone for the resumption of dryland agricultural research.

ICARDA works in partnership with government, non-government and local institutions. It has also developed strong links with local communities and other agencies either directly or through joint projects.

Examples include:

- Government institutes: the Ministry of Agriculture, the Ministry of Environment, the Council of Development and Reconstruction.
- Universities: Lebanese University, American University of Beirut (AUB), Jesuit University, Saint Esprit University (Kasslik).
- International organizations: United Nations Development Programme (UNDP) and the Global Environment Facility (GEF), United Nations Economic and Social Commission for Western Asia (ESCWEA), Food and Agriculture Organization (FAO).
- National/regional organizations: European Union, GTZ.
- Non-governmental organizations: Save The Children Fund, World Vision, Green Line, Friends of Nature, The Mouawad Foundation, Wedge Foundation, Jihad El-Bina' Foundation, Aarsal Rural Development Association, Agricultural Cooperatives (Aasal herders cooperative, Deir El-Ahmar Cooperative, Ham and Maaraboun cooperatives).



ICARDA's Director General in a meeting with HE the Prime Minister of Lebanon

Lebanon is part of ICARDA's West Asia Regional Program (WARP), which coordinates ICARDA's agricultural research for development activities in Cyprus, Iraq, Jordan, Lebanon, the Palestinian Authority, Syria and lowland Turkey. With its head office in Amman, Jordan, the program plays a key role in joint bilateral and regional initiatives, as well as in many national projects.

Terbol research station

ICARDA has permanent research stations in Syria and Lebanon, where technologies are developed for further evaluation in partner countries and on farmers' fields. Terbol is the main station in Lebanon, with an outreach station at Kfardan, which complement ICARDA's main research station at Tel Hadya, near Aleppo, Syria. Terbol and Kfardan stations are nominally rented from the Lebanese Agricultural Research Institute (LARI) in an arrangement that dates back over 30 years. These represent two different agro-climatological zones, and are very well suited for screening crops for tolerance to mild cold, drought and heat stresses and resistance to important crop diseases and insect pests. ICARDA's work at Terbol and Kfardan stations in Lebanon exploits the complementarity in research, of ICARDA, in generating and testing germplasm and improved production technologies of mandate crops, in adaptive testing and dissemination of seeds and

new technologies to farmers, on the conservation and sustainable use of the natural resources, and on building the capacity of the national institutions.



View of the experimental fields in Terbol Station

Agroecology

Terbol offers conditions that are typically Mediterranean, though with some differences to ICARDA's main station at Tel Hadya. It is cooler in summer, but relatively more humid in winter, with a higher mean annual rainfall of 539 mm. There is frequent snow in the winter, when temperatures can fall to as low as -16°C . The outreach station at Kfardan is colder still in winter and warmer in summer. The soil is a deep and rich clay loam. ICARDA exploits these differences in its research activities, conducting experiments on both stations to test and screen germplasm for different physiological aspects, and obtaining results representative of more than one zone relevant to the world's non-tropical drylands.

Resources

Terbol research station occupies almost 50 ha, of which 30 ha is used by ICARDA for cropping, with the remainder used by LARI or occupied by buildings and roads. ICARDA uses around 16 ha for winter crops, 2 ha for spring chickpeas and 12 ha for summer crops. The station also has an automatic weather station and other manually recorded gauges. Daily weather data collected by ICARDA at Terbol and

Kfardan stations is provided to many national research and educational institutions upon request.

Activities

Terbol contributes significantly to crossing activities for plant breeding in cereals and legumes. With its relatively mild summers, two generations can be grown per year, which speeds up the breeding process considerably. The climate also permits trials for cold nurseries and off-season summer nurseries of cereals and legumes, not possible at any other of ICARDA's research stations. It has proven to be an excellent site for disease screening, mainly for durum and bread wheat as well as food legumes. These stations also provide most of the seeds of newly released varieties distributed to farmers in Lebanon, seeds used in farmers' verification and demonstration trials, and security seed to programs at ICARDA's headquarters and at LARI.

All the major crops can be grown in the off-season, bread wheat, durum wheat, barley, chickpea, lentil and faba bean, with good yields. Since 1980, good relationships have been developed with most of the agricultural centers in the Beka'a and in Lebanon as a whole, as well as with many universities. The Lebanese Agricultural Research Institute also started formal on-farm trials in 1981, enhanced by closer cooperation between ICARDA and LARI staff. This work resulted in many of the improved crop varieties since released in Lebanon and which are now planted in large areas of the country. These include bread wheat (4 varieties), durum wheat (4), barley (3), chickpea (4), faba bean (1) and 3 varieties of forage legumes.

Many farmers' field days were organized not only in Terbol, Kfardan and Tel Amara, but throughout the country, where technologies were demonstrated to hundreds of farmers. Terbol also hosts many visiting scientists, and many university students undertake fieldwork for their graduate research at these research stations.

ICARDA, in addition to its continuous research work at Terbol and Kfardan stations and demonstration trials throughout the country, has executed a number of bilateral and regional projects that have furthered the development of strong collaboration and networking with national institutions and with other NARS in CWANA region.



A joint LARI-ICARDA farmers' field day

Conserving genetic resources

ICARDA plays a central role in collecting and safeguarding genetic resources, and a critical role in conserving the valuable agro-biodiversity in this part of the Fertile Crescent, a mega-center of diversity and of origin of species of global significance. Since 1977, ICARDA has organized 13 missions leading to the collection of a total of 883 accessions of crop landraces and wild relatives, including cereals (345 accessions from six collection missions in 1988, 1992, 1993, 1994 and 2003), food legumes (24 accessions from two collection missions in 1992 and 1994), and forage legumes and rangeland species (541 accessions from five missions in 1977, 1980, 1992 and 2003).

The ICARDA genebank now holds 1453 accessions of its mandated crops and wild relatives, as well as more than 60 medicinal and herbal species collected during the agro-biodiversity project. Of the main crops, these include durum wheat (70 accessions), bread wheat (30), barley (17), lentil (82), faba bean (35) and chickpea (28). Of crop wild relatives, there are 208 accessions of *Aegilops*, wild wheat (58), wild barley (36), wild lentil (19) and wild chickpea (18); and of forage legumes there are *Medicago* (328), *Trifolium* (278), *Vicia* (81), and 138 accessions of other range forage species.

More than 320 of these accessions have been shared with national research institutions for research and education purposes, in addition to thousands of accessions provided for field screening and molecular markers analysis. ICARDA-Lebanon is also increasing the seeds of the medicinal and herbal species for distribution to local communities and NGOs and for conservation. Also, during 2004-2006, 1306 accessions were repatriated to Lebanon to the newly established National Genebank at the American University of Beirut, and the genebank is using the database developed at ICARDA.

Conservation and sustainable use of dryland agrobiodiversity

ICARDA coordinated the regional GEF-UNDP funded project, 'Conservation and sustainable use of dryland agrobiodiversity in Jordan, Lebanon, Palestine and Syria', which was implemented in Lebanon in collaboration with LARI from 1999 to 2005. The project promoted in situ/on-farm conservation of landraces and wild relatives of cereals, food legumes, feed legumes and fruit trees originating from the Fertile Crescent. Field activities were undertaken with local communities of Aarsal, Ham/Maaraboun and Nabha. The project assessed the status of landraces and wild relatives and major threats to local agrobiodiversity. Landraces and wild relatives along with more than 45 medicinal plant species were collected and two field genebanks of grapes and figs were established at LARI. The project was successful in demonstrating the benefits of water harvesting techniques in enhancing rangelands, forests and orchards using mainly native species. A community nursery was established in Aarsal which supplied wild relatives of fruit trees, the government agreed to use the same for their own reforestation efforts and many developmental projects followed suit. The project demonstrated several alternative income sources and value-addition for improving the livelihoods of custodians of local agrobiodiversity of global significance, including training on fruit processing, eco-tourism, markets links and participation in fairs that increased the interest in local agrobiodiversity. The project increased public awareness through use of various media and the introduction of biodiversity in school curricula, and the public awareness unit established at LARI is continuing these activities. The project also helped in drafting elements for the national agrobiodiversity strategy and national Plant Genetic Resources for food and Agriculture (PGRFA) legislation. Consequently, Lebanon signed the International Treaty on Plant Genetic Resources and the Memorandum of Understanding with Jordan, Syria and Palestine for a regional alliance to conserve agrobiodiversity and facilitate the exchange of genetic resources. The project supported eight graduate and post-graduate students, and provided training for more than 300 people including 135 women.

New crop varieties

ICARDA is the main source of experimental and released germplasm of cereals and legumes in Lebanon. It provides national agricultural research institutions with the basic genetic material for their breeding programs, as well as new improved varieties for release to Lebanese farmers.

Research experiments conducted in Terbol and Kfardan stations since 1978-1979 have helped to select suitable material and promising varieties that were transferred to farmers fields, in collaboration with LARI, for preliminary verification through Farm Verification Trials (FVTs), initially covering the Beka'a plain and later extended to the other regions including southern Lebanon.

The outcome of this cooperative work was the release of 23 high yielding varieties of cereals and food and forage legumes over a twelve year period between 1992 and 2004.



Improved wheat varieties demonstrated in farmers fields jointly by LARI and ICARDA, 2009



Improved lentil varieties demonstrated in farmers fields jointly by LARI and ICARDA, 2009

Varieties released in Lebanon, developed from ICARDA germplasm

| Crop | Variety Name | Year of Release |
|----------------|-------------------------|-----------------|
| Durum wheat | Masarra | 2000 |
| | Waha | 1993 |
| | Lahn | 1992 |
| | Sebou | 1988 |
| Bread wheat | Tannour (Memouf-22) | 2000 |
| | Towpe | 1998 |
| | Nesser (Cham 6) | 1992 |
| | Seri 82 | 1988 |
| Barley | Faiz | 1997 |
| | Assi | 1997 |
| | Rihane 03 | 1984 |
| Lentil | Hala | 2002 |
| | Rachayya (FL 87-56) | 2000 |
| | Talia-2 | 1988 |
| | Toula | 1995 |
| Chickpea | Al-wady (FL 86-6) | 1998 |
| | Balila (FL 85-5) | 1995 |
| | Janta-2 (ILC 482) | 1988 |
| | Balila-2 | 2004 |
| Faba bean | Elisar | 1995 |
| Forage legumes | Jaboula | |
| | (Lathyrus cicera) | 1997 |
| | Ammara (Vicia ervillia) | 1997 |
| | Baraka (Vicia sativa) | 1997 |

In addition, a further three promising varieties of chickpea (Flip 86-5, Flip 82-150 and Flip 88-85) and one barley variety (Pamir 35) are at the pre-release phase. Many other lines continue to be developed and tested in order to have replacements at hand and to cover other agro-climatic zones in the country, such as southern Lebanon.



An improved durum wheat variety released in Lebanon, developed from ICARDA material

Seed increase and the regional seed network

ICARDA continues to assist the national seed program through seed multiplication conducted at its Terbol station.

Lebanon is among the founding and one of the most active members of the West Asia and North Africa (WANA) Seed Network, and has been a member of its Steering Committee since 1995. In 2000, Lebanon hosted the steering committee meeting of the Network which led to the organization of a round table discussion of the Lebanese seed sector, attended by public and private sector representatives. The role of policy and liberalization of the seed sector was presented and experiences exchanged with leaders of the national seed programs from other countries in the region. The Country Representative of Lebanon also attended the plant variety protection workshop organized by ICARDA's Seed Unit and the International Union for Protection of the New Plant Varieties (UPOV) held in Cairo in 1999 following the Third Network Council.

The Country Representative of Lebanon is responsible for compiling a comprehensive list of seed-related literature on policy, regulatory and technical issues in member countries of the network. The ICARDA Seed Unit featured the profile of the Lebanese seed industry in a special issue on Seed Programs. Many Lebanese nationals from the Lebanese Agricultural Research Institute and from seed production organization as well as staff from the American University of Beirut benefited from training conducted in Syria and Jordan organized by ICARDA's Seed Unit.

Crop disease surveys

ICARDA's Biodiversity and Integrated Gene Management (BIGM) Program has also been very active in surveying major crop diseases, including four important surveys conducted between 1991 and 1994. These include a survey of bread wheat yellow rust in the Beka'a valley following a request from HE the Minister of Agriculture, Dr Adel Cortas, after an epidemic outbreak of this disease. In addition, there were surveys on legume nematodes, legume viruses, and chickpea and lentil viruses specifically. A survey of Barley yellow striate mosaic virus (BYSMV) affecting cereals was also undertaken in 2001-2002.



Researchers in Terbol station record their observations

Following the 1994 yellow rust epidemics and the results of the survey, ICARDA established permanent monitoring nurseries for the pathotyping of cereal rusts and also blotch diseases of wheat and barley. Monitoring of yellow rust races in Lebanon has included targeted screening of wheat germplasm, and resistant varieties have been released and others are at a pre-release stage. Despite the presence of highly virulent races of yellow rust, ICARDA, in collaboration with the national program, were pivotal in assisting Lebanese farmers to avoid crop losses resulting from occurrence of disease epidemics over the past 10 years. This was possible through an intensive screening program established at Terbol that identifies and discards susceptible advanced material before release, and eliminates varieties that have lost their resistance due to new races of the rust diseases.

Livestock production and crop-livestock integration

The rapidly expanding sheep and goat sector in Lebanon is facing major production constraints, due to shortages in natural rangeland forage availability and cultivated fodder. Farmers are increasingly reliant on expensive purchased feed, which increases production cost and makes the Lebanese animal production sector uncompetitive with those of neighboring countries. Also, continued overgrazing for many years has resulted in rangeland degradation. In order to assess the problem in the Beka'a valley, a survey of the livestock system was undertaken in 1993, in collaboration with LARI, AUB, the Lebanese University and the Ministry of Agriculture.

After over 15 years of surveys, selection, experimentation and seed multiplication, ICARDA and LARI have together developed the methodologies needed for rehabilitating degraded natural pastures. These have included reseeding with 18 native wild annual plants species of the genera; *Astragalus*, *Hymenocarpus*, *Hypocrepis*, *Medicago*, *Trifolium*, *Trigonella* and *Scorpioris*. Also, native and introduced perennial shrubs have been planted as part of rangeland rehabilitation, including species of *Atriplex* and *Salsola* for dry zones, and *Medicago arborea* and *Butiminarea* for higher elevations.

The Smallholder Livestock Rehabilitation Program (1991-2002) was the first IFAD assistance to Lebanon. The project, designed as a post-con-

flict intervention, started at a time when the country was emerging from 17 years of civil war and lasted over ten years. It was designed with the ultimate aim of addressing the needs of the poor and disadvantaged in the post-conflict reconstruction of the project area. The main impacts were the provision of a stimulus to re-establish smallholders' livestock production in the Beka'a Valley, replenishing smallholders' lost stock in the project area, providing the basis for sustainable development in the livestock sector and increasing the income of poor farm families and women who derive most of their income from livestock, and the development of agricultural support services.



Farmers in Lebanon participated in the preparation of Community Development Plans through the Mashreq / Maghreb project

The Regional program for integrated crop-livestock production (the Mashreq/ Maghreb project) has had the most significant impacts. First funded by IFAD, the Arab Fund and IDRC funded two phases from 1996 to 2003, with a third and final phase funded by IFAD and the Arab Fund which ended in 2008. This project developed means for technology transfer and a community approach for undertaking adaptive research, and developing and evaluating technology, as well as generating technical, institutional and policy options (TIPOs).

ICARDA and NARS worked within selected communities on improving of feed resources, improving rangeland management and rehabilitation, increasing the productivity of small ruminants through improved fertility and nutrition and the development of alternative feed sources, monitoring of technology transfer, adoption and impact, and on policy and institutional research.

Terbol station has also played an important role in multiplying seeds of native forage species, and has produced adequate amounts to initiate rehabilitation projects and conducted on-site research in the Beka'a (Sa'aideh, Brital, Shlifa, Beshouat, Zabboud, Aarsal, Amiq and Bednayel) in collaboration with LARI, the American University of Beirut (AUB) and local communities. In Haoush Sneid, ICARDA and AUB began a long-term rotational trial on the integration of pasture forages, barley and livestock, in 1994. ICARDA-Terbol was also subcontracted to contribute to rangeland rehabilitation, as part of the national action plan to combat desertification. Research was undertaken on reseeding with native species, establishing fodder shrub plantations, and the introduction of intercropping with vetch in cherry orchards in northern Beka'a.



Trials on supplemental irrigation of wheat conducted with LARI at Kfardan and Tal Amara stations, to optimize irrigation scheduling for improved water use efficiency.

Natural resource management

Trials on supplemental irrigation and fertilization of wheat have been conducted with LARI over 5 years at Kfardan and Tal Amara stations. The trials aimed at optimizing supplemental irrigation in conjunction with rainfall and determining the appropriate amount of fertilizer application for improved water and nitrogen productivity in rainfed systems. The research has shown that small amounts of supplemental irrigation can substantially increase rainfed yields and combined with use of nitrogen, results in higher water productivity.

ICARDA with the Economic and Social Commission for West Asia (ESCWA), has conducted several surveys and studies to assess the economic and technical feasibilities of on-farm water management options. The research modeled and evaluated water use efficiency in farmers fields and determined the constraints to improved efficiency with similar studies conducted in Egypt, Iraq, Jordan and Syria.



Farmers construct soil conservation structures within the UNCCD Sub-regional Action Program (SRAP)

Work has also been undertaken on combating land degradation in the mountainous areas of the Baka'a area. The project included the development and implementation of sustainable water, land and vegetation management options. The Integrated Natural Resources Management project to combat desertification in Lebanon and

Jordan (2003-2006) was funded by the OPEC Fund for International Development (OFID) through the Global Mechanism and the UNCCD Sub-regional Action Program for West Asia (SRAP), and was conducted together with the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD). In Lebanon, the project was implemented by communities in Yemouneh and Dier El Ahmar. Important measures to combat degradation considered by the communities and other stakeholders in the planning workshop included the rehabilitation of vegetation cover on slopes by water harvesting, and runoff management that improved productivity and reduced soil erosion. Design of potential water harvesting techniques was developed and trees and shrubs were planted. Capacity of the communities and national institution were also enhanced.

Socio-economic and policy research

Socio-economic analyses are an important part of ICARDA's activities. An IDRC-funded project entitled 'Changing rural livelihoods and land degradation in the Bekaa valley' which ended in 2000, looked specifically at these aspects leading to a detailed report that assessed the current situation and identified areas where further work was needed.



A farmer consultation meeting to introduce a new joint LARI-ICARDA project

A detailed analysis of the impact of improved barley varieties was also undertaken in two communities in Baalbeck Province by LARI scientists as part of the Maghreb/ Mashreq project (for the full paper, see Naddaf et al., 2005). In Aarsal, 30% of the sampled farms had adopted the improved varieties, and had planted an average of 35% of their barley fields with improved varieties. Farm size influenced adoption, with smaller farms much more likely to adopt the new varieties, though they planted less of their land with improved varieties. Adoption also varied, as would be expected, depending on farmers' participation in project activities, with the highest adoption rate seen with by farmers who had hosted demonstrations, followed by field day attendees, and non-participants having the lowest adoption rates. Similar but less marked trends were observed in Deir El Ahmar, though here, land tenure was a critical factor for the adoption of improved barley. The net revenues of adopters and non-adopters were similar in Aarsal, but in Deir El Ahmar, adopters of the new barley technologies increased their net revenues by 30%.

In addition, the GEF-funded Agrobiodiversity project on biodiversity conservation and utilization, analysed the socio-economic situation of communities in Aarsal, and of Nabha and Ham in Baalback, and compared these with identical studies in communities from Jordan, Palestine and Syria. The study found that the average income of those households that were involved in the project was higher than those that did not, in all four countries. The highest increase in income was seen in Lebanon, with an estimated annual increase of US\$1914 resulting from increased agrobiodiversity conservation and utilization.

ICARDA conducted nationwide surveys on wheat production in 1992 and on food legume production in 1994. Work has also been conducted on developing more sustainable and diversified farming systems in the Beka'a Valley, including the introduction of alternative crops such as cumin, black cumin, safflower and anise.

Gender analysis

The important role of gender was well acknowledged and assessed in detail as part of the UNDP/GEF agrobiodiversity project. The results confirmed the different roles of men and women in the conservation and sustainable use of biodiversity.

ICARDA also began a ground breaking project in 2009, funded by IDRC, entitled "Because gender matters: strengthening social and gender analysis in environmental and natural resource management Environmental and Natural Resource Management (ENRM) in the Middle East and North Africa". The goal is to build capacity and generate innovative practices and methods that demonstrate the value-added of social and gender analysis ('SAGA') methods in action-oriented and transformative research. This four-year project will build a stronger base of researchers in the region implementing SAGA in ENRM research, while also improving the livelihoods of women and men in the study areas and beyond. Through wide communication of research results and lessons learnt, researchers, research managers, donors, policy makers and civil society will have a stronger understanding of the critical importance and value addition from SAGA research.

The first of four specific objectives is to identify and conduct applied research projects on gender and social analysis to generate new knowledge on key challenges of gender, poverty and ENRM. One of these is from Lebanon. The Collective for Research and Training for Development - Action (CRTD.A) will implement a project "Challenges of rural women cooperatives in accessing internal and external markets: a study of threats and opportunities created by globalization trends and traditional women's know-how, skills and expertise".

Capacity building

ICARDA's training activities are designed to improve the capabilities of scientists and technicians in the national agricultural research programs in developing countries to conduct research independently. These activities also foster the transfer of technology and address issues related to farmers' decisions in adopting or rejecting new technologies.

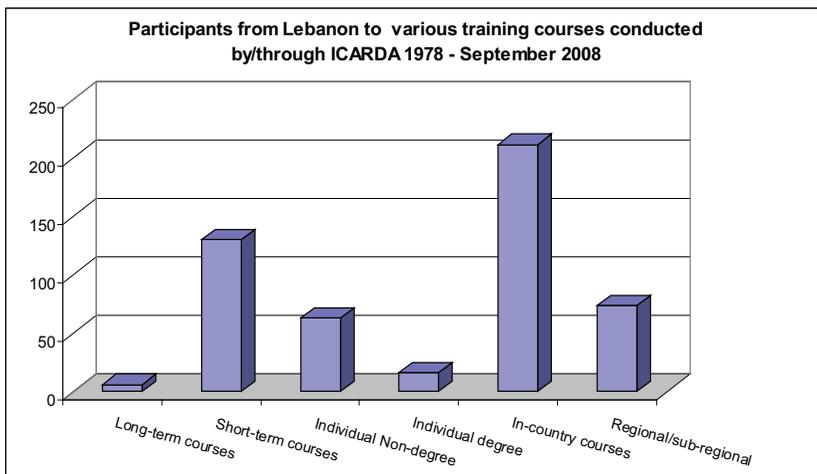
Since 1978, ICARDA has provided training opportunities for many thousand individuals from over 50 countries in the region, and Lebanon has benefitted from this training. To date, formal training has been provided to 501 scientists, technicians and students from LARI, the Ministry of Agriculture, AUB, the Lebanese University, St. Joseph University, and to farmers and NGOs.

ICARDA was also a pioneer in providing training to Lebanese farmers in collaboration with LARI and the Lebanese University. Three of the first such training courses were conducted in 1992-1993, each with over 30 participants and each covering different parts of the country, the Beka'a in Zahle in May 1992, southern Lebanon in Saida in May 1993, and north Lebanon in Tripoli in June 1993. These were complemented by demonstrations, such as those on mechanical harvesting of chickpea and lentil and similar technologies.



Participants of a workshop in Deir El Ahmar

Over 30 years, a total of 501 Lebanese, scientists, extensions or farmers, have received training from ICARDA-organized programs. From these, 212 have participated in in-country courses and 74 in regional courses. Six have received specific long-term (2-6 month) training and 130 have received specific short-term (2-6 week) training. In addition, 16 others having been co-supervised by ICARDA in graduate degree training and 63 have undertaken long-term training at ICARDA.



Some examples of the topics covered in specific training include courses on: legume breeding methodology, legume crossing techniques, statistical analysis and experimental design, long term rotational trial regional training and farm verification trials and demonstration of new varieties training. These were complemented by seminars, such as those given on rangeland management and crop/livestock integration.

Aside from general training activities, Terbol station provided its facilities to assist students in undergraduate, graduate and postgraduate academic research. Students from the Lebanese University, AUB and Saint Joseph University visit the station on a regular basis to become acquainted with different research and farm operation activities conducted at the station. Thirteen students have so far conducted their MSc thesis research work at Terbol station, seven from Saint Joseph University, three from the Lebanese University and three from AUB. A number of students from Lebanese universities carried out their graduation/post graduation projects at the headquarters under joint supervision.

Publications and information

ICARDA's Communication, Documentation and Information Unit (CODIS) sends its publications to more than 100 different addresses in Lebanon. Its library provides information services, e.g., literature searches, table of contents and document delivery to many Lebanese institutions, scientists and students.

Selected publications (1999-2009) that arose from collaboration between ICARDA and scientists from Lebanon (LARI, AUB, Lebanese University, Al-Manar University and others), or were sponsored by ICARDA, are listed in the appendices,

In addition to these, however, ICARDA has published a range of additional materials, including extension leaflets and booklets, posters and training manuals.

Appendices

Selected ICARDA events in Lebanon

- 10-12 December 1991. A research conference on crop production in Lebanon held in Shtaura, organized by ICARDA. Dr MANour (DG) in the presence of HE Dr M Durnika, Minister of Agriculture, with the participation of different Agriculture Institutes in Lebanon and ICARDA scientists and Terbol staff.
- 14-18 September 1992. A legume course held with the cooperation of Lebanese university conducted in Lebanon in Zahleh, scientists from the head quarter share with the course.
- 20-22 May 1993. Workshop in Saida, southern Lebanon on Techniques of Agriculture Products for the farmers.
- 28-30 May 1993. Travelling workshop in Bekaa valley for all the Agriculture Institutes and with participation of scientist from Aleppo, Dr. M.C.Saxena and others.
- 17-19 June 1993. Training course in North Lebanon Tripoli, the group visited Terbol on and the course was closed in the presence of HE Dr Adel Kortas and Dr. Nasrat Fadda (DG).
- 18 October 1993. LARI/ICARDA Coordination meeting held in Tel Amara.
- 16 May 1994. Traveling workshop in Bekaa, ICARDA and all the (5) Agricultural Universities in Lebanon.
- 11 October 1994. Coordination meeting between ICARDA and Lebanese Institutions held in LARI (Fanar), in the presence of HE Dr Adel Kortas and Dr Nasrat Fadda (DG).
- 16 May 1995. Traveling workshop in Beka'a North from AREC and finished in Terbol.
- 20 September 1995. Coordination meeting ICARDA and all Lebanese agricultural institutes.
- 13-16 May 1996, Traveling workshop ICARDA/LARI/Mashreq and Maghreb Project.
- 13-14 October 1996. ICARDA/LARI Coordination meeting (in Aleppo).
- 19-20 June 2000. Coordination meeting Lebanon/ICARDA (Tel Amara).
- 9-10 October 2002. Coordination meeting Lebanon/ICARDA (Tel Amara).
- 6-7 October 2006. Coordination meeting LARI/ICARDA (Tel Amara) in the presence of HE Minister of Agriculture and Dr Mahmoud Solh (DG).
- 21 October 2008. 10th Coordination meeting Lebanon/ICARDA in the presence of Dr Mahmoud Solh (DG) and undersigning the agreement between ICARDA and LARI.

Memoranda of Understanding

- Agreement between the Government of the Republic of the Lebanon and the International Development Research Centre (IDRC) - acting as executing agency on behalf of the Consultative Group for International Agricultural Research - for the establishment of the International Center for Agricultural Research in the Dry Areas - ICARDA. 22 p. Agreements. Lebanon Agreement ICARDA: LB 6 July 1977.
- Memorandum of agreement between the Agricultural Research Institute - LARI, Lebanon and ICARDA. 1 p. Agreements. Lebanon Agreement ICARDA: LB 25 March 1978.
- Agreement between the Lebanese University, Faculty of Agricultural Sciences, Beirut, Lebanon and ICARDA. 4 p. Agreements. Lebanon Agreement ICARDA: LB 28 April 1994.
- Agreement of cooperation between the American University of Beirut, Lebanon and ICARDA. 4 p. Agreements. Lebanon Agreement ICARDA: LB 12 April 1991.
- Agreement between the American University of Beirut (AUB), Lebanon and ICARDA. 4 p. Agreements. Lebanon Agreement ICARDA: LB 14 February 1999.
- Explanatory memorandum between the Agricultural Research Institute (LARI) and ICARDA. 3 p. Agreements. Lebanon Agreement ICARDA: LB 21 October 2008.

Selected publications (1999-2009)

Books

Ben Salem H, Al Jawharie N, Daba MA, Chriyaa A, Haj Hassan S, Dehimi ML, Masri MY, 2005. **Feed Block Technology in West Asia and North Africa**. ICARDA, Tunis, Tunisia. 112pp.

Mazid A, Shideed KH, Amri A, Ajlouni M, Assaf A, Assi R, Monzer M, Chihabulddin H, Sbeih Y, Al-Atawneh N, Saad A, Khnifes A, 2008. **On-Farm Agrobiodiversity in West Asia: Status, Threats and Impact on Rural Livelihoods**. ICARDA, Aleppo, Syria. 60pp.

Shideed Kamil H. and Mohammed El Mourid (eds). 2005. **Adoption and Impact Assessment of Improved Technologies in Crop and Livestock Production Systems in the WANA Region**. viii + 160pp. ISBN: 92-9127-180-3.

Selected scientific journal papers

Kabengi NJ, Zurayk RA, Baalbaki RZ, Ryan J, 2003. Phosphorus dynamics and characterization under long-term rotation trial. *Communications in Soil Science and Plant Analysis* 34(3/4): 375-392.

Larbi A, El Moneim AA, Atallah T, Umello R, 2005. Grasspea as a food/feed crop. *Journal of Food, Agriculture and Environment* 3(2): 345-354.

Larbi A, Khatib-Salkini A, Polus P, Iniguez L, 2009. Shrub yield and fodder quality variations in a non-tropical dryland environment in West Asia. *Agroforestry Systems* 75(2): 147-155.

Martini MA, Amri A, Ajlouni M, Assi R, Sbeih Y, Khnifes A, 2008. Gender dimension in the conservation and sustainable use of agro-biodiversity in West Asia. *The Journal of Socio-Economics* 37(1): 365-383.

Ryan J, Hasbany R, Atallah T, 2003. Factors affecting nitrogen mineralization under laboratory conditions with soils from a wheat-based rotation trial. *Lebanese Science Journal* 4(2): 3-12.

Smriga M, Ghosh S, Mouneimne Y, Pellett PL, Scrimshaw N, 2004. Lysine fortification reduces anxiety and lessens stress in family members in economically weak communities in Northwest Syria. *Applied Biological Sciences* 101(22): 8285-8288.

Talhok AS, Makkouk KM, 2000. Aphids as pests and vectors of virus diseases affecting agricultural crops in Lebanon and Syria. *Lebanese Science Journal* 1(2): 123-137.

Tambal HAA, Erskine W, Baalbaki R, Zaiter H, 2000. Relationship of flower and pod numbers per inflorescence with seed yield in lentil. *Experimental Agriculture* 36: 369-378.

Yahyaoui AH, Hakim MS, El-Naimi M, Rbeiz N, 2002. Evolution of physiologic races and virulence of *Puccinia striiformis* on wheat in Syria and Lebanon. *Plant Disease* 86: 499-504.

Yau SK, 2002. Comparison of European with West Asian and North African winter barleys in tolerance to boron toxicity. *Euphytica* 123(3): 307-314.

Yau SK, Erskine W, 2000. Diversity of boron-toxicity tolerance in lentil growth and yield. *Genetic Resources and Crop Evolution* 47(1): 55-61.

Yau SK, Ryan J, 2008. Boron toxicity tolerance in crops: a viable alternative to soil amelioration. *Crop Science* 48(3): 854-865.

Yau SK, Machlab H, Kiwan P, 2001. Grain legumes and their uses in Lebanon. *Grain Legumes* 34(4): 25-26.

Yau SK, Bounejmate M, Ryan J, Baalbaki R, Nassar A, Maacaroun R, 2003. Barley-legumes rotations for semi-arid areas of Lebanon. *European Journal of Agronomy* 19: 599-610.

Selected book chapters

Amri A, Valkoun J, Ajlouni M, Assi R, Sbeih Y, Saad A, 2005. Promotion of in situ conservation of dryland agrobiodiversity in West Asia. In: El Beltagy A, Saxena MC (eds.), *Sustainable Development and Management of Dry Lands in the 21st Century*. ICARDA, Aleppo, Syria. pp270-275.

Chabane K, Kassis R, Valkoun J, 2002. Genetic diversity of Lebanese wild wheat populations: RAPD and AFLP fingerprinting. In: Ryan J (ed.), *Desert and Dryland Development, Challenges and Potential in the New Millennium*. ICARDA, Aleppo, Syria. pp293-297.

Hamadeh S, Shomo F, Hammad RM, Nordblom T, Goodchild AV, Darwish R, Barbour E, Gintzburger G, 1999. Survey of small ruminant systems in Lebanon. In: Haddad N, Tutwiler R, Thomson E (eds.), *Improvement of Crop-Livestock Integration Systems in West Asia and North Africa*. ICARDA, Aleppo, Syria. pp362-371.

Kumari SG, Makkouk KM, Abou-Jawdah Y, 2008. Diagnosis of plant viruses. In: Makkouk KM, Fegla G, Kumari SG (eds.), *Virus Diseases of Important Agricultural Crops in the Arab Region*. Arab Society for Plant Protection, Beirut, Lebanon. pp 45-76.

Larbi A, Khatib A, Bolus P, Tiedeman J, Iniguez L, 2007. Forage potential of non-leguminous and leguminous fodder shrubs in the dry areas of Central and West Asia and North Africa. In: El-Beltagy A, Saxena MC, Tao W (eds.), *Human and Nature - Working Together for Sustainable Development in Dry Lands*. ICARDA, Aleppo, Syria. pp 468-477.

Naddaf F, Hajj Hassan S, Skaff S, 2005. Impact of improved barley varieties in Lebanon. In: Shideed KH, El Mourid M (eds.), *Adoption and Impact Assessment of Improved Technologies in Crop and Livestock Production Systems in the WANA Region*. ICARDA, Aleppo, Syria. pp97-106.

Ngaido T, Abbassi M, Baalbaki A, Bashta,MS, Boughlala M, Hazell P, Khnefiss A, Malki M, Nassif F, Nasser C, Neshiewat K, Nordblom T, Redjel N, 1999. Land improvements and sources of income in low rainfall areas of the Mashreq and Maghreb region: do property rights matter? In: Chaherli N, Hazell P, Ngaido T, Nordblom T, Oram P (eds.), *Agricultural Growth, Sustainable Resource Management, and Poverty Alleviation in the Low Rainfall Areas of West Asia and North Africa*. ZEL, Feldafing, Germany, pp101-138.

Osman AE, Nassar A, Hassan SH, 1999. Grassland improvement by reseeding native legumes and protection from grazing in the Bekaa Valley, Lebanon. In: *Dynamics and Sustainability of Mediterranean Pastoral Systems. Options Mediterraneennes 39*, CIHEAM, Zaragoza, Spain. pp147-149.

Yau SK, Bounejmate M, Ryan J, Nassar A, 2004. Sustainable barley-legume rotations for semi-arid areas of Lebanon. In: Rao SC, Ryan J (eds.), *Challenges and Strategies for Dryland Agriculture*. ASA Special Publication 32. American Society of Agronomy, Madison, USA. pp 219-227.

Selected articles

Ali A, Bulad A, Kozah A, Oweis T, Bruggeman A, 2006. Fighting desertification in Jordan and Lebanon. *Caravan* 23: 10-12.

Bishaw Z, Machlab H, Van Gastel T, 2005. The WANA seed network. *Agrotica* 54: 32-33.

Shomo F, Hamadeh SK, Faour KY, Darwish R, Nordblom T, 1999. Methodological aspects of the economic analysis of integrated crop-livestock production in the Beka'a Valley of Lebanon. *Review of Agriculture in ESCWA Member Countries: Agriculture and Development in Western Asia* 20: 1-8.

Ties that Bind

Titles in this series

- The United States and ICARDA No. 1
- The SARC-NVRP Cool-Season Food Legume Program in Ethiopia No. 2
- Australia and ICARDA No. 3
- The Netherlands and ICARDA No. 4
- Japan and ICARDA (Eng, Jap) No. 5
- ICARDA and the Arab World (Eng, Ar) No. 6
- Morocco and ICARDA No. 7
- ICARDA: Serving the Highlands No. 8
- China and ICARDA No. 9
- Jordan and ICARDA No. 10
- Italy and ICARDA No. 11
- ICARDA in Central Asia and the Caucasus No. 12
- Germany and ICARDA No. 13
- Spain and ICARDA No. 14
- ICARDA and Syria (Ar) No. 15
- ICARDA and Ethiopia No. 16
- Sudan and ICARDA No. 17
- Libya and ICARDA No. 18
- IFAD and ICARDA No. 19
- Algeria and ICARDA No. 20
- Afghanistan and ICARDA No. 21
- Turkey and ICARDA No. 22
- GAP and ICARDA No. 23
- The Arab Fund and ICARDA No. 24
- Jordan and ICARDA (2nd ed.) No. 25
- Africa and ICARDA No. 26

Single copies of these titles are available free of charge from:
Communication, Documentation and Information Services, ICARDA,
P.O. Box 5466, Aleppo, Syria. E-mail: icarda@cgjar.org