ICARDA Caravan

Issue No. 18/19, June/December 2003

Review of agriculture in the dry areas

In this Special Issue on Rebuilding Agriculture in Countries Affected by Conflict and Drought:

From the Director General

When ICARDA's founding fathers wrote its charter, they saw the Center playing an important role in alleviating hunger and poverty in the dry areas in peaceful times. But, ICARDA, since its inception, has had to respond to the need to rebuild agriculture in countries affected by war, conflict, and natural disasters. This important dimension of the Center's work has remained much less known.

In the Central and West Asia and North Africa (CWANA) region, which constitutes the bulk of ICARDA's geographic mandate area, conflicts have taken place in Afghanistan, Palestine, Lebanon, Algeria, Kuwait, Jordan, Iraq, Sudan, Ethiopia, Eritrea, Cyprus, Yemen, Georgia, Azerbaijan, Armenia, and Tajikistan in the last 25 years. Several of these countries have been hit by drought during the same period.

Besides taking lives, war destroys food and water supply sources. Biodiversity and seed systems are damaged or destroyed. Shortage of seed after war can cause widespread starvation. In addition to the direct and indirect disruptive effects on agriculture, longer term environmental effects may linger from land mining, deliberate flooding, and the degradation of soil from chemical warfare.

It is a massive task to rebuild agriculture in countries affected by conflict and/or natural disasters. This is largely because agriculture is not just growing crops; it is interlinked with several other sectors, such as transport, marketing, pesticide, fertilizer and irrigation equipment industries, infrastructure and human resource development, farmers' cooperatives, policy and property rights, and others. Although ICARDA's mandate is research and training, rebuilding goes beyond this to development. This is where complementary activities with partners who address the link between research and development are very important.

Our rehabilitation strategy is, therefore, built around three key elements: partnerships and networking, rapid needs assessment surveys, and program development for the medium and longer term. ICARDA's approach to partnership is to provide a broad platform and create an enabling environment for a variety of actors to play their roles.

This issue of *Caravan* provides examples of activities undertaken by ICARDA and its partners to address challenges of rebuilding agriculture in the aftermath of conflicts and natural disasters,

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***Cover**: Top four pictures: Rebuilding agriculture in Afghanistan after war and drought. Next two pictures: Rebuilding agriculture in Palestine in the midst of ongoing destruction. Bottom left: Putting in place an efficient seed supply system in Sudan to fight drought. Bottom right: A feed-blocks manufacturing facility in Iraq (see story on page 28).*

News

Afghanistan

particularly in Afghanistan, Palestine, Iraq, Eritrea, Sudan, and Ethiopia.

The cycle of conflict, poverty, hunger and drought can be broken with application of cutting-edge science to ensure nutritional and food security. ICARDA is playing a vital role in encouraging advanced research institutions to collaborate in technology development, capacity building, technology transfer and policy research that will provide livelihood options for the millions caught in the consuming web of poverty and conflict.

International donors have been supporting these efforts, but rebuilding agriculture requires a substantial increase in donor support. I hope the highlights of some key achievements presented in this issue will be useful in gauging the value of efforts and investments in the massive task of rebuilding agriculture after conflict and natural disasters.

Prof. Dr Adel El-Beltagy
Director General

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 at 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 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.

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 Technical Advisory Committee, with its Secretariat at FAO in Rome, assists the System in the development of its research program.

Note to Readers

Since the articles in this issue were developed from contributions from a large number of researchers cooperating with ICARDA, as well as ICARDA's own staff members, they do not carry any author names. ICARDA is grateful to all those who contributed to these articles, and also provided pictures. Credit for pictures and articles should, therefore, be given to ICARDA by those who decide to use any material from this issue.

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ICARDA Participates in World Water Forum

Center-organized workshop a great success

Water scarcity and its potential adverse consequences for food security in dry areas was the key message delivered by ICARDA Director General Prof. Dr Adel El-Beltagy at the ministerial and other high-level meetings during the Third World Water Forum (WWF) in Kyoto, Japan, held on 16-23 March 2003 to develop global policies on water issues.

The Director General called for special attention to be given to the "serious water scarcity situation in the dry areas" to safeguard the food security of the one billion people who live in these areas and ensure "the sustainability of their ecological systems." He highlighted ICARDA's role in managing this scarce resource by improving water-use efficiency for sustainable food production. The WWF is held every three years.The Ministerial declaration of the forum reflected the urgency of dealing with water scarcity, adoption of new policies, and the use of cutting-edge science to address the problems. ■

The ICARDA-sponsored Workshop Panel at the Third World Water Forum. From left to right, Prof. Dr Adel El-Beltagy, Director General, ICARDA; Dr Margaret Catley-Carlson, Board Chair, ICARDA; H.E. Dr Mahmoud Abu-Zeid, Minister of Irrigation and Water Resources, Egypt; Dr Ismail Seralgeldin, Director, Bibliotheca Alexandrina, Egypt; Professor Theodor Hsiao, University of California, Davis; and Professor Iwao Kobori, Vice-Chair, United Nations University, Japan.

Australian Parliamentarians Visit ICARDA

Members of the Australian Parliament visited ICARDA on 11 November 2003. The delegation consisted of Mr Sandy Macdonald (Leader), Senator for New South Wales, National Party; Mr Kim Karr (Deputy Leader), Senator for Victoria, Australian Labor Party; Mr Phillip Barresi, Member for Deakin (Victoria), Liberal Party of Australia; Ms Joanna Gash, Member for Gilmore (NSW), Liberal Party of Australia; and Gellibrand (Victoria), Australian Labor Party. Ms Joanne Towner accompanied the group as Delegation Secretary. They were accompanied by H.E. Mr Robert Newton, Australian Ambassador to Egypt, Sudan, Syria and Tunisia; and Ms Suzanne Stein, First Secretary, Australian Embassy.

Dr Mohan C. Saxena, Assistant Director General (At-Large), received the distinguished visitors at ICARDA. They had a meeting with the Executive Management of ICARDA and Dr Ken Street, an Australian national and Associate Expert with ICARDA. Dr Street briefed the delegation on the genetic resources activities of the Center, including those recently initiated in Central Asia. He emphasized the importance of Australian support in the recent germplasm collection missions in Tajikistan, and the value of the germplasm accessions collected. The delegation also visited ICARDA laboratories and exchanged views with the scientists.■

Dr Michael Baum (right) briefing the delegation members on ICARDA's biotechnology research. Standing next to him is Mr Sandy Macdonald, Senator for New South Wales, National Party, and Leader of the Delegation.

Improved Public Perception Critical to Expanded Rural Development Effort

The public must be informed about the value of, and urgent need for, rural development if funding for research and development is to rise from its present low levels, participants agreed at ICARDA and World Bank-organized consultation workshops held in Cairo. The first consultation workshop for Central and West Asia and North Africa (CWANA) focused on the "World Bank Strategy for Rural Development: Reaching the Poor," and was held on 23-24 February. It was followed by a second workshop on the proposed "International Assessment of the Role of Agricultural Science and Technology in Reducing Hunger, Improving Rural Livelihoods, and Stimulating Economically Sustainable Growth," on 25-26 February.

At the joint opening session of the two workshops, His Excellency Prof. Dr Youssuf Wally, Deputy Prime Minister and Minister of Agriculture and Land Reclamation, Egypt, appreciated the initiative, "which would greatly help in the rural development efforts in the region," he said.

Dr M. Ayoub, Director, World Bank Country Department, Cairo, and ICARDA Director General Prof. Dr Adel El-Beltagy made opening statements. In his statement, Prof. Dr El-Beltagy emphasized that the development process was firmly in the hands of national programs and driven by them. The workshop should help in this effort.

H.E. Mr Sayed Hussain Anwari, Minister of Agriculture and Livestock, Afghanistan, was among those who participated in the workshop. Drs Kevin Cleaver, Latitia Obeng, and Csaba Csaki, from the World Bank, presented the latest strategy papers from the Bank.

"The workshop reinforced the commitment for rural development. However, there is a challenge to change the prevailing public perception in order to overcome the insufficient commitment from both the developed and developing countries," Prof. Dr El-Beltagy said.■

H.E. Prof. Dr Youssuf Wally (center), Deputy Prime Minister and Minister of Agriculture and Land Reclamation, Egypt, inaugurated the two workshops in a joint opening session. Present with him were Dr Mahmoud Ayoub (left), Director, World Bank Country Department, Cairo; Prof. Dr Adel El-Beltagy (second from left), Director General, ICARDA; H.E. Mr Sayed Hussain Anwari (second from right), Minister of Agriculture and Livestock, Afghanistan; and Dr Kevin Cleaver (right), Director, Rural Development Department, the World Bank.

International Conference on Dryland Development

Researchers and research administrators from 25 countries met at the Seventh International Conference on Development of Dry Lands, held in Tehran, Iran, 14-17 September 2003, to explore how technology can help ensure sustainable development in the world's dry areas.

The Conference, organized under the auspices of the International Drylands Development Commission (IDDC), was jointly sponsored by the Ministry of Jihad-e-Agriculture, Iran, and ICARDA. Additional support was provided by FAO (Food and Agriculture Organization of the United Nations) and COMSTEC (Committee for Scientific and Technological Cooperation).

Over 217 participants made 100 oral presentations and 80 poster displays, covering soil and water degradation and conservation, forage and range management, biodiversity conservation and utilization, stress physiology, biotechnology, development and transfer of new technologies for dry lands, and study and exploitation of indigenous knowledge and heritage.

The Conference was inaugurated by H.E. Eng. Mahmoud Hojjati, Minister of Jihad-e-Agriculture, Iran, and Prof. Dr Adel El-Beltagy, ICARDA Director General and Chair of IDDC. They both stressed the importance of the dry lands, and the need to devise and adopt sound technologies for their sustainable development.■

Prof. Dr Adel El-Beltagy, ICARDA DG, discussed the ongoing ICARDA-Iran collaboration with H.E. Eng. Mahmoud Hojjati (center), Minister of Jihad-e-Agriculture, and Dr Ali Ahoonmanesh (left), Deputy Minister for Agricultural Research and Education, Iran.

Strengthening Ties with Japan

United Nations University
ICARDA has forged a productive partnership with the United Nations University (UNU) over the years. On the invitation of the UNU Rector, Dr J.A. Hans van Ginkel, Prof. Dr Adel El-Beltagy, ICARDA Director General, visited the University on 14 March 2003. He presented the highlights of ICARDA's work in the dry areas to the faculty and management of UNU. Later, he signed with the Rector of UNU a "Twinning Agreement" for the establishment of a joint ICARDA-UNU platform for dry area agricultural research and human resource capacity building at ICARDA. Under this agreement, a training and research program will be implemented through exchange of visiting scientists and post-doctoral fellows; development of joint research projects for seeking donor support; joint training programs; and joint research supervision of post-graduate students from Central and West Asia and North Africa.

Japan International Cooperation Agency
The Japanese International Cooperation Agency (JICA) has been a strong supporter of ICARDA through its Overseas Volunteers Program, Experts Program, and the Program for Third Country Training. The DG visited JICA headquarters in Tokyo on 14 March with Prof. Iwao Kobori, former Member, ICARDA Board of Trustees. He was received by Mr Hisao Azuma, Senior Vice-President of JICA and Mr Hiroyuki Mori, Deputy Director, Middle East and Europe Division of JICA. JICA is in the

Prof. Dr Adel El-Beltagy (right), ICARDA DG, and Dr J.A. Hans van Ginkel, Rector of UNU, sign a "twinning agreement" for the establishment of a joint ICARDA-UNU platform for dry area agricultural research and human resource capacity building at ICARDA.

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Genebank Initiative Aims to Safeguard Plant Genetic Heritage of the Arab World

Representatives from regional research and development organizations met at ICARDA headquarters on 6-7 May 2003 to consider options for establishing a genebank to safeguard the plant genetic resources in the Arab World.

ICARDA Director General, Prof. Dr Adel El-Beltagy, welcomed the participants, emphasized the importance of cooperation in genetic resources conservation, and gave a brief review of the regional genebank initiative, which was first proposed formally about 10 years ago, after the signing of the international Convention on Biological Diversity (CBD).

The convention recognized each country's sovereign right to its biological diversity, but made clear that each country has a responsibility to conserve biodiversity and share it with other countries. The regional genebank approach was proposed to raise countries' capacity to conserve biodiversity and fulfill the obligations outlined in the CBD.

ICARDA Director General Prof. Dr Adel El-Beltagy (second from left) stresses the importance of regional cooperation in genetic resources conservation at a meeting to discuss a regional genebank initiative. The meeting was held at the Center's headquarters on 6-7 May 2003.

The United Nations Environment Programme Regional Office for West Asia (UNEP-ROWA) reinvigorated the initiative by funding a feasibility study conducted by ICARDA in 2002. UNEP-ROWA and ICARDA convened the meeting to consider three options arising from the study: 1) establish a network of existing national genebanks, 2) establish four subregional genebanks, and 3) set up a major, fully centralized genetic resources center to hold a duplicate set of the region's germplasm and cover all aspects of germplasm collection, conservation, and sharing.

The participants' recommendation will be considered by the League of Arab States.■

Strengthening Ties...
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process of revising its structure and protocols for deputing experts. The requests made by ICARDA for new volunteers and the progress in the JICA-supported training course on water management were reviewed and support for continuation of these programs was emphasized.

Japanese International Research Center for Agricultural Services

The Japanese International Research Center for Agricultural Services (JIRCAS), a premier research institution, based in Tsukuba, has been a long-time partner of ICARDA in agricultural research. On the invitation of Dr Takahiro Inoue, President of JIRCAS, Prof. Dr El-Beltagy visited JIRCAS on 12 March 2003, with Prof. Shinobu Inanaga, Director of the Arid Land Research Center of Tottori University and Member of ICARDA Board of Trustees.

Prof. Dr El-Beltagy was received by President Dr Inoue, Vice-President Dr Yoshi Morooka, Executive Director Dr Akinori Koyama, and Director of Biological Resources Division Dr Ryoichi Ikeda. He made a formal presentation to JIRCAS scientists and management team on ICARDA research and training activities and reflected on current collaboration. He also visited several important laboratories and held discussions with scientists, including Dr Shinozaki, with whom ICARDA is collaborating on DREB genes to transform ICARDA mandate crops to enhance resistance/tolerance to abiotic stresses, such as drought and heat.

To help expand collaboration with JIRCAS, it was agreed that the joint agreement signed several years ago would be revised. It was also agreed that JIRCAS would soon send Dr Masanori Inagaki, International Research Coordinator, to ICARDA to prepare a new joint project. Under this project, ICARDA will host Dr Inagaki for several years to implement the project in collaboration with plant breeders and molecular biologists in the Center's Germplasm Program.

Drs. Inoue and Morooka showed great interest in expanding collaboration with ICARDA in Central Asia.■

ICARDA, ESCWA Sign Memorandum of Understanding

Dr Mervat Tallawy, Under-Secretary General and Executive Secretary, ESCWA, and ICARDA Director General Prof. Dr Adel El-Beltagy signed a Memorandum of Understanding at the Center headquarters on 27 May 2003.

ICARDA and the United Nations Economic and Social Commission for Western Asia (ESCWA), based in Lebanon, have formalized their cooperative relationship in a Memorandum of Understanding that should spur exchange of information, research, capacity building, and joint projects.

Dr Mervat Tallawy, Under-Secretary General and Executive Secretary, ESCWA, and ICARDA Director General, Prof. Dr Adel El-Beltagy, signed the document at Center headquarters on 27 May 2003.

"This Center has enjoyed many years of productive cooperation with ESCWA. This memorandum recognizes this relationship officially, and points to specific areas of mutual interest where we hope to expand and enhance our collaboration for the good of farmers and farm communities in the dry areas of West Asia," said Prof. Dr Adel El-Beltagy.■

Five Hessian Fly Resistant Durum Varieties Released in Morocco

Five durum wheat varieties (INRA 1804, 1805, 1807, 1808, and 1809) combining resistance to Hessian fly and tolerance to drought were released in Morocco in 2003. Hessian fly (*Mayetiola destructor*) is an insect pest of durum and bread wheat responsible for severe reductions in production. In Morocco, the crop losses from Hessian fly infestations in the 2002/03 cropping season were estimated to reach as much as US$200 million. The release and subsequent adoption of these Hessian fly resistant varieties is key to breaking the drought-Hessian fly cycle prevailing in many rainfed areas, and preventing crop failure.

Left: A durum field planted to a susceptible variety heavily damaged by Hessian fly. Right: A field planted to a new Hessian fly resistant variety being currently promoted for cultivation in farmers' fields.

Durum wheat is known for its susceptibility to Hessian fly, especially in the Mediterranean region. Pioneering research in durum wheat improvement in the region led to the discovery of genetic resistance to Hessian fly that was successfully incorporated into durum germplasm along with drought resistance. The release of these varieties by the Moroccan national program will significantly boost durum production in the region.■

AGM03: Designing Agricultural Research Strategies in a Changing World

The 2003 Annual General Meeting (AGM03) of the CGIAR was held in Nairobi, Kenya, 29-30 October 2003. H.E. Mr Moody Awori, Vice-President, Republic of Kenya, inaugurated the meeting.

In his statement, the CGIAR Chair, Mr Ian Johnson, said that the Kenya-CGIAR partnership is a strong and enduring example of the benefits of mobilizing science for achieving balanced development in Africa.

Following the inaugural session, Prof. El-Beltagy, in his capacity as Chair of the Center Directors Committee (CDC), made a comprehensive presentation on "CGIAR Contributions to Meeting the Millennium Development Goals." He summarized the contributions made by the CGIAR centers to meeting the millennium goals in (i) natural resource management, (ii) information technology, and (iii) rebuilding agriculture after conflicts/natural disasters.

October 27 was designated as CGIAR Members' Day, and devoted to bilateral and multi-center meetings and discussions among CGIAR members and centers in the lead up to the opening of the AGM03.

The centers made presentations on specific topics, and the members chose to attend those of their interest. The ICARDA presentation on "Combating Water Poverty," jointly made by Prof. Dr Adel El-Beltagy and Dr William Erskine, ADG (Research), was chaired by Dr Margaret Catley-Carlson. A large number of CGIAR members were present.

The presentation generated much interest in the donor community and figured in the discussions that followed with various donor representatives.■

Centers' Forum co-chaired by Dr J. de Hass (second from right), from Germany, and Dr F. Moore (third from right) from USA. Prof. Dr Adel El-Beltagy (second from left), ICARDA DG and CDC Chair, and Dr Kanayo Nawanze (left) WARDA DG and in-coming CDC Chair (from January 2004), made presentations.

On Members' Day, Prof. Dr Adel El-Beltagy, ICARDA DG, made a presentation on "Combating Water Poverty."

ICARDA Opens Office in Algiers

In 2003, the ribbon was cut on a new ICARDA liaison office at the Institut National de la Recherche Agronomique d'Algérie (INRAA) that is expected to strengthen cooperation and improve communication between the Center and Algeria's national program.

The ceremony was held on the first day of the annual ICARDA-Algeria agricultural research coordination meeting, on 11-12 October 2003, in Algiers, which brought together more than 60 national scientists and science managers from 14 institutes and centers of the Ministry of Agriculture and Rural Development (MARD).

At the meeting's inaugural session, INRAA Director General Dr Kamel Feliachi said the past year saw major events that will form strong basis for renewed partnership with ICARDA. Among them:

- Algeria's interest to join the Consultative Group on International Agricultural Research
- Establishment of a consortium linking all institutes and centers of the Ministry
- ICARDA's decision to open a liaison office at INRAA, and
- Signing of a memorandum of understanding between the Ministry and ICARDA to backstop the activities of the National Plan for Agricultural and Rural Development.

These initiatives will boost collaboration with ICARDA and provide excellent backstopping to agricultural research and development in Algeria, Dr Feliachi told the participants. He thanked ICARDA for its continuous support to agricultural research in Algeria.■

Dr Kamel Feliachi (left), INRAA Director General, and Dr Mohammed El-Mourid, Coordinator of ICARDA's North Africa Regional Program, cut the ribbon on a new ICARDA liaison office at INRAA in Algiers.

Future Harvest Consortium to Rebuild Agriculture in Afghanistan

Agriculture is the largest and most important sector of the economy in Afghanistan, a country of about 22 million people. But war and drought have devastated Afghanistan's food-production capabilities and depleted critical seed stocks, leaving the nation heavily dependent upon food aid from international donors. To rebuild Afghanistan's agriculture, ICARDA took the lead by bringing together research institutes, relief and development organizations, universities, and aid agencies at a meeting in Tashkent in January 2002. The result was the launching of the "Future Harvest Consortium to Rebuild Agriculture in Afghanistan," a multi-million dollar global effort to revive Afghanistan's once-thriving farming sector by harnessing the best of agricultural research and the power of partnerships.

In October 2001, at the Annual General Meeting of the Consultative Group on International Agricultural Research (CGIAR) held in Washington, DC, ICARDA proposed an initiative to help Afghanistan rebuild its agriculture. Following discussions with the United States Agency for International Development (USAID), ICARDA convened a meeting on 20-21 January 2002 in Tashkent, which brought together 74 participants from 34 organizations, including 10 of the 16 Future Harvest Centers* of the CGIAR, non-governmental organizations (NGOs), United Nations agencies, United States institutions, various international agencies, and donors, including the Department for International Development (DFID), U.K., the International Development Research Centre (IDRC), Canada, USAID, and others. The meeting resulted in the launch of the "Future Harvest Consortium to Rebuild Agriculture in Afghanistan." USAID and IDRC pledged support for implementation of the work plans of the Consortium. The Consortium membership has since been expanding (http://www.icarda.cgiar.org/Afghanistan/Members.htm).

The immediate aim of the Consortium was to develop a work plan to establish efficient seed systems, and develop a framework for long-term activities in seeds and crop improvement; soil and water management; livestock, feed, and rangeland improvement; and horticulture. A common theme in all work plans was to involve Afghan partners closely to create ownership, strengthen their capabilities, and ensure that the realities of the Afghan situation are reflected in all efforts. The key objectives included the following:

- Multiply and deliver quality seed of adapted varieties through effective delivery systems to reach affected farmers in time, and to build, with Afghan partners, an effective regulatory system that enforces standards and promotes the use of high quality seed and varieties.
- Establish a framework and strategy for CGIAR technical assistance, in cooperation with partners, for the development of seed systems and sustainable agricultural production systems in Afghanistan at the central, regional, and local levels.
- Rehabilitate the irrigation systems because, in the short term, it is the irrigated sector, rather than the rainfed system, that can put agriculture back into production.
- Reinstate the market economy since there is already a cash economy. Afghanistan has resilient farmers who follow good agronomic practices, and they can work collectively and make collective decisions.
- Restore an enabling environment through capacity building.

Since its establishment, the Consortium has made excellent progress, reported in the pages that follow. ■

Seventy-four representatives from 34 organizations gathered in January 2002 in Tashkent, Uzbekistan, to help plan the rehabilitation of Afghanistan's agriculture sector. The meeting was organized by ICARDA and supported by the United States Agency for International Development.

* International Center for Tropical Agriculture (CIAT); International Center for Maize and Wheat Improvement (CIMMYT); International Potato Center (CIP); International Center for Agricultural Research in the Dry Areas (ICARDA); International Crops Research Institute for the Semi-arid Tropics (ICRISAT); International Food Policy Research Institute (IFPRI); International Livestock Research Institute (ILRI); International Plant Genetic Resources Institute (IPGRI); International Service for National Agricultural Research (ISNAR); and the International Water Management Institute (IWMI).

Needs Assessments in Support of Agricultural Rehabilitation in Afghanistan

With emergency seed distributions in progress, the Future Harvest Consortium shifted its focus to the long-term needs of Afghanistan's agricultural sector. Needs assessments were commissioned covering four main areas: soil and water management; livestock, feed and rangelands; seed systems and crop improvement; and horticulture.

Afghan farmers participating in the livestock and rangelands needs assessment.

Impassable roads and checkpoints are just a few of the barriers to conducting needs assessments in Afghanistan. Commanders retain varying degrees of control over their regions. Remote villages remain suspicious of strangers.

Armed only with penetrating questionnaires, survey teams and Consortium scientists covered every province in Afghanistan. They passed the impassable and achieved the nearly impossible to get the information needed to guide rehabilitation efforts. Thousands of farmers answered questions about agriculture, providing a clearer picture of their situation. Tea also appeared to have played a pivotal role.

When asked if Afghan farmers were reticent or suspicious about the questions, Joachim Mueller, a needs assessment team member from one of the Future Harvest centers said, "After a short period and with the aid of abundant tea, in all cases we achieved good participation."

Even more difficult than crossing checkpoints and cratered roads, the survey teams listened to stories of deprivation and heartbreak. Every family seems to have lost members to the war. The drought brought agriculture to a state of collapse. In the Pashtoon Zerghoon district of Herat, Ibrahim of Dar Gharas told survey team member Raz Muhammad Fidai that he had planted 400 kg of wheat, 200 kg of barley, and 100 kg of chickpea. But because of drought, the crops failed. Other villagers reported that lack of sufficient food caused entire communities to be close to starvation.

The hard-won information by the needs assessment teams was considered by representatives from the Afghanistan Ministry of Agriculture and Livestock (MOAL), United States universities, NGOs, the Food and Agriculture Organization of the United Nations, the private sector, and the CGIAR centers, who gathered at ICARDA on 18-20 November 2002. All four needs assessment reports can be found at www.icarda.org.

The soil and water needs assessment pointed out some potential for expanding irrigated crop land. Afghan farmers need more information on effective management of water resources and use of fertilizer, which dropped off precipitously in the 1980s. The greatest constraints listed by the soil and water assessment team were the lack of credit for farmers, nutrient deficiency, seeds, and water. The farmers also expressed great concern over locusts, which hit in the following growing season.

The crop improvement and seed survey report stated that under normal conditions Afghan households were able to produce about 86% of their own food needs, but that drought had caused a considerable shortfall in meeting household food requirements. Debt insecurity averaged about US$800 per household, with very little capacity for repayment. Increased crop productivity at the household level would considerably reduce rural poverty and hunger on a lasting basis.

The livestock, feed and rangelands assessment recommended six "project ideas" with potential for short- and long-term impact in war-torn, drought-stricken Afghanistan. The ideas include work in institutional strengthening; human capacity building; improved dairy production; integrated small-ruminant production; integrated animal health management; animal power for tillage and transport; and village women's poultry production.

The horticulture and marketing assessment pointed out that in the past, horticulture provided 30-50% of Afghanistan's export earnings and presents the best potential for replacing poppy production. However, global competition is increasing for traditional Afghan horticultural crops, and global preferences are also changing, making many of the Afghan cultivars and practices unacceptable. The lack of roads, transportation, and storage facilities requires substantial investment. Efforts to restock Afghanistan's genebank and evaluate local varieties for development are already well underway.■

Germplasm Collections: Key to Rehabilitation of Agriculture in Afghanistan

Afghanistan is the center of diversity for a number of important crops, but years of turmoil has placed the country's priceless genetic heritage at risk. With help from ICARDA and its Future Harvest Consortium partners, Afghanistan has regained much of its lost germplasm, and is now moving ahead with its plans for crop improvement and income generation.

ICARDA and Future Harvest Consortium partners have long experience in utilizing cutting-edge science to assess, preserve, and protect genetic resources. Unique and diverse genetic resources are key to developing improved crop varieties, and they can help fill new market niches for increased farm family income.

In post-conflict situations, ICARDA can help by restoring functional, cost-effective, cold storage facilities to hold national germplasm collections, and help repatriate duplicate accessions being held at international facilities. Using a community-based participatory approach that focuses on adding value to indigenous plant products, the Center also promotes on-farm (*in situ*) conservation of valuable agrobiodiversity.

The indigenous varieties of any country evolve with genetic adaptations specific to their environment. These genetic resources form the raw material from which new crop species are derived, and they form a pool from which all species draw traits that allow them to adapt to stresses, such as diseases and pests. The ICARDA mandate region has the distinction of being the birthplace of agriculture and a center of genetic diversity. Afghanistan, for example, is the center of diversity for several species of global significance: carrot, radish, cherry, plum, apricot, peach, pear, apple, walnut, pistachio, fig, grape, pomegranate, melon, and almond.

A view of ICARDA's genebank where 2217 accessions of wheat, barley, lentil, chickpea and forage legumes, collected in Afghanistan, are preserved. Of these, 271 accessions were repatriated to Afghanistan in 2002. ICARDA holds a total of 131,000 accessions in it genebank and freely shares them with partners all over the world.

An unusually large wild population of Lens odemensis, Sweda Province, Syria.

In September 2002, the international media reported that looters had destroyed Afghanistan's largest crop seed collection. The seed was dumped so that looters could take the plastic containers in which it was stored. The Future Harvest Consortium recovered seed from duplicate collections around the world for repatriation to Afghanistan.

Many varieties in Afghanistan lost in the looting are being re-collected. For example, some 60 varieties of almond have already been collected. Other collection efforts are planned aimed at replacing lost seed, landraces, and wild relatives of important crop species. Upon return to ICARDA headquarters in Syria, collected material is planted to increase the seed quantity and then placed in the Center's genebank. Most importantly, the material is made readily available to broaden the genetic base for crop breeding efforts in Afghanistan. ■

Afghan germplasm preserved in the genebank of the Consortium members of the CGIAR.

Centers	Crop collections	Number of accessions
CIAT	Beans	73
CIMMYT	Maize, wheat	21
ICARDA	Genetic resources collection, wheat, barley, lentil, chickpea, forage legumes	2217
ICRISAT	Chickpea, small millets, sorghum	723
IITA	Genetic resources collection	77
ILRI	Genetic resources collection	23
IRRI	Rice collection	69

CIAT: Centro Internacional de Agricultura Tropical; CIMMYT: Centro Internacional de Mejoramiento de Maiz y Trigo; ICARDA: International Center for Agricultural Research in the Dry Areas; ICRISAT: International Crops Research Institute for the Semi-Arid Tropics; IITA: International Institute of Tropical Agriculture; ILRI: International Livestock Research Institute; IRRI: International Rice Research Institute.

Timely Seed Supply Averts Starvation in Afghanistan

In late 2001 and early 2002, the world worried over the threat of starvation in Afghanistan because of lack of seeds for growing food crops. Emergency relief was needed, and fast. Famine was averted with timely shipments of quality seed, and the relief effort quickly evolved into a broad-based program aimed at delivering food self-sufficiency.

Emergency Wheat Seed Distribution

Above: Improved wheat seed provided by the Consortium being unloaded in Kabul.
Left: Over 70,000 farm families benefited from the Consortium-provided seed for spring 2002 planting.

April 2002

Afghan farmers needed wheat seed for spring planting from mid-April to the beginning of May. Time was running out, but through determined effort a total of 3500 tonnes of improved wheat seed was delivered by 10 April to anxious farmers through NGOs and village *shurahs* (community leadership).

Wheat is the most important crop in Afghanistan, covering 80–85% of the arable land, or about 4 to 8 million hectares annually. The average Afghan consumes half a kilogram of wheat daily. The seed selected by ICARDA scientists was ensured to be high yielding and adapted to the agroecology of Afghanistan. The seed was procured in Pakistan and transported by the United Nations World Food Programme via Peshawar and Kabul to NGOs in the provinces. Over 70,000 farm families in the provinces of Badakhshan, Bamyan, Ghazni, Lowgar, Kapisa, Parwan, Wardak, and Uruzgan received seed. This remarkable result was achieved through the diligence of Afghan partners who worked around the clock and knew where to find those families most in need. The World Food Program, a United Nations (UN) agency, arranged the transport of seed to Kabul, and the Food and Agriculture Organization (FAO) of the UN–along with non-governmental organizations (NGOS) and local authorities–helped distribute the seed. NGO participants included the International Medica Corps, Helping Afghan Farmers organization (HAFO), Agricultural Development of Afghanistan (ADA), International Mercy Corps (IMC), SOLIDARITES, FOCUS, and ACTED.

September 2002

During the spring distribution, planning began for the fall 2002 wheat seed campaign. The Future Harvest Consortium addressed food security in Afghanistan by combining relief with research and development.

Instead of shipping in wheat seed from other countries, ICARDA staff provided training in seed production and contracted Afghan farmers to produce the seed for the fall distribution. A rigorous program to ensure quality was put in place, which included field inspections, removal of off-type plants, post-harvest treatment against disease, and proper packaging. Farmers benefited from internal investment,

Seed cleaning provided a critical source of cash income for farm families, particularly war widows.

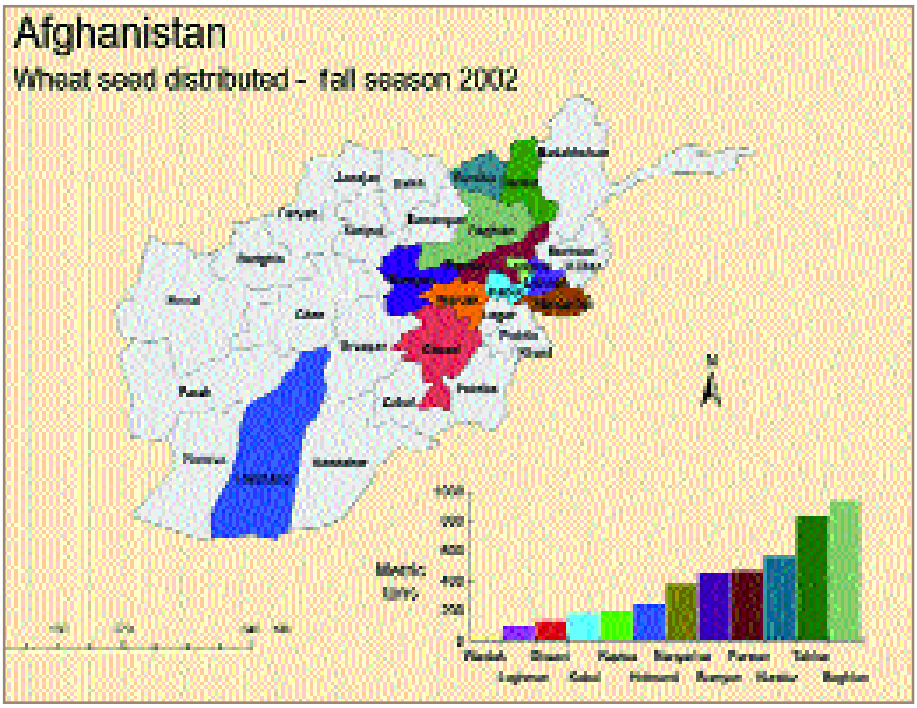
Foundation wheat seed production at ICARDA's main research station for distribution to Afghanistan farmers.

training, access to high quality seed, and a reduced risk of importing unwanted pests.

To remove chaff, weed seeds and other impurities, the seed was cleaned manually, using methods that go back thousands of years. The wheat was hand sifted, then shoveled into the air. The sifting removed the chaff and the wind blew away the smaller and lighter weed seeds. The seed was then treated against pests and pathogens.

The seed cleaning facilities were essential sources of income for Afghans living in surrounding villages. Over 300 female heads-of-household were employed in the cleaning and distribution process, which injected over one million dollars into the Afghan economy.

The fall 2002 Future Harvest Consortium wheat seed campaign distributed nearly 5000 tonnes of improved wheat seed to more than



Farmers collected seed from local seed distribution outlets.

90,000 farmers in 11 provinces. This distribution of high quality, disease resistant wheat seed yielded upwards of 100,000 tonnes in 2003.

The 2002 short-term emergency measures were just the first step in developing sustainable agricultural production systems in Afghanistan. As part of the Consortium's activities, many varieties of wheat, barley, lentil, chickpea, and vetch have been provided for evaluation and multiplication in cooperation with farmers. Included were Afghan landraces that had been safeguarded in ICARDA's genebank. These varieties and landraces will provide farmers with a broader range of production options far into the future.■

Developing National Policy: The Seed System Code of Conduct in Afghanistan

Quality seed production is a complex process. Countries rely on detailed policies and regulations to ensure the availability and use of clean, high-quality seed. Like its physical infrastructure, Afghanistan's administrative structures have also seriously suffered, and policy guidelines are sorely lacking. Now, thanks to assistance from the Future Harvest Consortium, the country has a framework that will help the seed sector boost agricultural productivity while protecting farmers from using poor-quality seed.

H.E. Mr Sayed Hussain Anwari (front, right), Minister of Agriculture and Livestock, Afghanistan, opened the workshop. Seated behind from left to right are: Mr Ismet Hakim of UN-FAO; H.E. Mr Mohammad Sherif, Deputy Minister of Agriculture and Livestock, Afghanistan; Dr William Erskine, ADG (Research), ICARDA; and Dr Ray Morton of USAID.

The use of unsuitable, imported varieties and poor-quality seed that fails to germinate has negatively impacted Afghan farmers. There was a clear need to coordinate activities and to formulate some regulatory guidelines in three key areas of seed and planting materials: production, import, and distribution.

To create a National Seed Code of Conduct, ICARDA organized a workshop in collaboration with the Afghan Ministry of Agriculture and Livestock in May 2002. Some 80 participants helped create and define standards and procedures affecting seed systems. The organizations represented at the workshop included USAID, ICARDA, FAO, CIMMYT, CIP, ICRISAT, ODI, IFDC, two US land grant universities, as well as several international and local NGOs, including Acted, Afghanaid, Concern Worldwide, Catholic Relief Services, DACAAR, GRSP, Focus, IMC, ISRA, MADERA, MC, and SOLIDARITE. H.E. Mr Syed Hussain Anwary, Minister of Agriculture and Livestock, Afghanistan, opened the workshop. Workshop participants also visited wheat fields in Logar Province, about 60 km south of Kabul, where they met growers, community groups, and members of farmer cooperatives. Discussions covered a wide range of issues, including variety maintenance, pests and diseases, and agronomic and seed production practices.

Participants discuss standards and definitions for the development of a Seed Code of Conduct for Afghanistan.

Afghanistan's Acting Interim Government adopted the Code of Conduct developed at this workshop as the national seed policy and regulatory framework for the country.

Both policies take into account Afghanistan's specific conditions, which might require a unique approach, while urging the nation to participate in the developments in the seed industry taking place around the world. The FAO has agreed to finalize these documents through the services of a legal consultant.

These guiding principles are an important tool for creating new businesses, developing consumer confidence, and protecting Afghan farmers as the country moves from dependence on emergency assistance to sustainable agricultural production.

Improved Wheat Production through Integrated Pest Management in Afghanistan

Members of the Future Harvest Consortium are researching and promoting an integrated approach to crop pest and disease management in Afghanistan. The strategy has already paid off in one Afghan province threatened by Sunn pest, and more success can be expected now that extension and farmer training are well under way.

Wheat Crop Saved in Helmand, Afghanistan

In summer 2002, wheat production on about 200,000 hectares in Afghanistan was rendered useless due to infestation by *Eurygaster integriceps,* an insect known as Sunn pest. It would have happened again in spring 2003, but the effort of the Central Asian Development Group (CADG) saved the crop. The organization, a member of the Future Harvest Consortium, was able to save 12.8 million dollars worth of wheat in Helmand Province using Sunn pest management information provided by the International Center for Agricultural Research in the Dry Areas (ICARDA).

"We launched an emergency program with our extension workers supported by community volunteers, and our program covered 32,000 acres in around seven days," reported Mr Steve Shaulis, CADG Director. The Sunn pest infestation was brought under control, and the saved crops represent enough wheat to feed 300,000 Afghans for one year.

The site of evolution of many of the world's most important crops, West Asia is also host to many of wheat and barley's most damaging pests. Sunn pest, for example, causes damage as it feeds on plants, but also injects chemicals that cause grain gluten to break down. If as little as 2% of the grain in a crop is affected, the entire grain harvest is rendered unsuitable for baking.

For long-term management solutions, ICARDA, in partnership with the University of Vermont, is providing training in integrated pest management (IPM). The training covers biological and behavioral knowledge of the Sunn pest, its natural enemies, farming practices, host plant resistance, entomopathogenic fungi, and use of conventional pesticides. Using this integrated, broad-based approach, scientists hope to more effectively control infestations and decrease dependence on expensive and environmentally harmful chemicals that might also lead to resistance in the insect population.

The Integrated Pest Management Approach

Twenty Afghan agronomists, including representatives from CADG, were selected for integrated pest management (IPM) training in the summer of 2002. Trainees learnt how to conduct field assessments necessary to reveal the degree of infestation and overwintering sites where Sunn pest can be controlled before migrating to crop areas in the spring. Trained farmers were able to identify these sites, calculate the likelihood of infestation, and determine the economic threshold for application of pesticides, as well as utilize other methods for controlling insect numbers.

Sunn pest infected with* Beauveria bassiana *fungus.

Heavy Sunn pest infestation on a wheat spike.

An option under development is the use of the fungus species *Beauveria bassiana* as a biocontrol agent. Scientists have determined that this fungus is highly toxic to Sunn pest in the egg and larval stages. If mass-produced on cereal grain and applied by farmers on overwintering sites, this fungal formulation could provide a low-cost, simple means of controlling the pest.

And ICARDA scientists have discovered a source of resistance to Sunn pest in a wild relative of wheat. Plant breeders are crossing these lines with Afghanistan-adapted bread wheat varieties to develop pest-resistant crops for release to farmers.

With training in IPM, farmers can turn to cheaper and environmently safer ways to control this destructive crop pest. In the future, dependence on government subsidized pesticides will diminish along with the damage caused to the environment. Farmers will soon have access to safer, and more effective means of protecting their crops.■

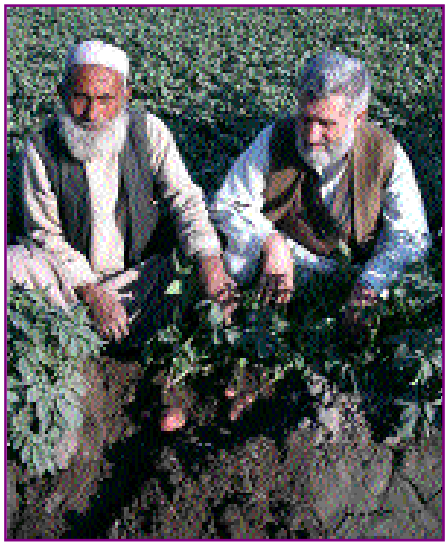
Crop Diversity for Improved Nutrition, New Markets, and Higher Income in Afghanistan

Bread made from wheat is the major constituent of Afghan diet, but wheat prices are low—an unhappy by-product of successful relief efforts that discourages farmers from growing wheat. Crop diversity is the answer, not only for improved income, but also improved nutrition, especially for mothers and children.

Expanded production of fruits, nuts, vegetables, food legumes, forages and feedgrains is needed to support food, dairy, meat and hide production in Afghanistan. These so-called alternative crops and related crop/livestock systems have potential to create employment and market opportunities that the major commodities are unable to provide.

Vegetable seed production at six agricultural research stations rehabilitated by ICARDA includes carrots, onions, turnips, tomatoes, and okra. The grain and legume crops at these stations include barley, wheat, faba bean, chickpea, and mung bean.

Horticultural products once accounted for more than 40% of Afghanistan's exports. Horticultural nurseries have been established to plant hundreds of hectares of grape, fig, olive, pomegranate, almond, mulberry, apricot, peach, orange, lemon, and walnut. Fruits and nuts add important nutrients to Afghan diets and hold the potential for added-value products for sale in regional and global markets. These nurseries will be self-sustaining through the sale of seed and saplings to farmers.



Examining potato yields in Jalalabad.

Improved potato varieties and production practices, the result of work led by the Peru-based International Potato Center (CIP), also a member of the Future Harvest Consortium, are an important addition to the Afghan agricultural sector. Farmers improve their operations and income by either producing virus-free seed for sale to other farmers or by purchasing the improved seed and obtaining much higher yields. More than 750 Afghan farmers and agronomists have been trained in virus-free seed production.

Controlling aphids is an important component of potato production training. Aphids carry viruses from plant to plant enabling diseases like potato leaf roll virus (PLRV) and mosaic virus in becoming epidemic. Farmers received field training on the visual identification of major potato diseases and off-type plant identification and control. Research has shown that it is effective to grow potatoes as a spring crop in high mountain valleys where aphids are few and to use those potatoes as the fall planting material for the lowland farmers.

The seed testing laboratories being built by the Consortium are invaluable to the creation of a commercialized potato seed industry. Consortium members are working with farmers to develop a certification process that will be recognized by potato seed purchasers nationwide. This will enable the creation of new markets associated with the production and sale of guaranteed virus-free seed and build farmer confidence in its yield and health. As a high-yield cash crop for smallholding farmers, the CIP potato program represents a significant improvement in Afghanistan's agricultural future.

Crop Diversification to Replace Poppy

Following the departure of the Taliban, poppy production in Afghanistan has rebounded to levels that reestablish the country as a leading producer of opium for the illegal drug trade. A recent report released by the United Nations Drugs Control Program indicates that opium production in Afghanistan is estimated at 3,400 metric tons. Poppies are estimated to earn approximately eight times more income per hectare than wheat, with less water and fewer inputs.

The cultivation of opium poppies is concentrated in the southwest, particularly in Helmand Province, although it is also fairly common in Nangahar and Badakhshan. Poppy has been a source of credit to offset the losses caused by drought and to support farming operations. The high value of the crop allows farmers, particularly returning refugees, to raise capital for buying livestock and other farming inputs.

Fruits and nuts hold considerable potential for improving the nutrition and incomes of farm households, and could provide an alternative to poppy cultivation in the future. For example, Afghanistan is the country of origin for

over 60 varieties of almonds. There may be considerable value in protecting and developing these unique almond varieties for international markets.

However, many of the Afghan horticultural operations no longer exist. Entire orchards have dried due to lack of water and trees have been felled for fuel. Nurseries are needed to develop saplings of native varieties. Training on advanced horticultural practices and techniques is necessary. All of this depends on better water management, and building efficient irrigation systems. Even after new trees become established, considerable investment is needed for storage facilities, transportation, and marketing.

Badakshan farmer extracts resin from poppies. Economic alternatives are being explored to replace poppy.

Efforts continue to enhance the diversification of crop production as a means of dealing with the opium problem. ICARDA provided more than 3500 tonnes of improved, high-quality wheat seed to farmers in time for spring planting in 2002, and local growers were contracted to produce 5000 tonnes of seed for the fall planting. Still more seed of other crops, including native Afghan crop varieties lost during the drought, was repatriated from ICARDA's germplasm collection and is being evaluated by Afghan crop scientists for potential release to farmers.

While poppy remains a challenge to Afghan agriculture, rebuilding the agricultural infrastructure has the potential to provide economic alternatives for farmers.■

Improving Feeds, Rangelands, and Livestock Production in Afghanistan

Afghanistan runs on animal power. What's more, small-ruminant production is an important source of income and nutrition. Years of drought, however, have taken their toll on animal herds and the feed sources that sustain them. Now, the Future Harvest Consortium, led by ICARDA, is pooling its experience with that of its partners to help improve rangeland productivity and animal health and production in Afghanistan.

In the mid-1970s, the agricultural sector (including livestock and forestry) accounted for about half of Afghanistan's GNP. About a quarter of the latter was made up of livestock and related value-added products. Livestock exports accounted for about 25 percent (US$65.5 million each year) of all exports. These comprised carpets and rugs (39 percent), Karakul pelts (30 percent), hides and skins (17 percent) and wool and hair (14 percent). There were also said to be unreported exports of live sheep to Iran worth US$33 million. Returning to these levels of production by 2010 should be an achievable goal. This is well below the rate at which annual cereal production is apparently recovering to pre-drought levels.

Plowing the fields in Baghlan Province.

Equally important as exports but less obvious is the contribution livestock make to the livelihoods and food security of much of the rural, as well as to some of the urban, populations. They supply high-quality, edible products which are essential constituents of the diets of children and pregnant and nursing mothers, particularly among the most vulnerable families who grow no crops. They also provide raw materials that can be processed to add value and when sold or bartered, generate income for their owners. Development assistance should therefore not only give attention to improving livestock productivity, but also to restoring marketing structures and to encouraging the export of goods such as carpets, for which Afghanistan has a comparative advantage.

At its meeting in Tashkent in January 2002, the Future Harvest Consortium to Rebuild Agriculture in Afghanistan identified four needs assessments (NA), one of which would be on feeds, livestock and rangelands. It was conducted by ICARDA and involved several US Land Grant Universities, the Ministry of Agriculture and Livestock (MOAL) and NGOs under the auspices of the Livestock Working Group of the Future Harvest Consortium. The USAID provided generous support to ICARDA to conduct the NA.

A wrap-up workshop was held in Aleppo, Syria, in mid-July 2002 to develop project ideas. Participants came from the MOAL, the Faculty of Agriculture at the University of Kabul, US Land Grant universities (University of California, Davis; University of Purdue; University of Wisconsin-Madison, Texas A&M), the Department

for International Development (UK), the Macaulay Institute (UK), the International Livestock Research Institute (ILRI), the FAO livestock project in Afghanistan and from the host institution, ICARDA. Private consultants on gender issues, animal traction and small ruminant production and genetics also attended the workshop by invitation. The six project ideas developed by the workshop participants were:

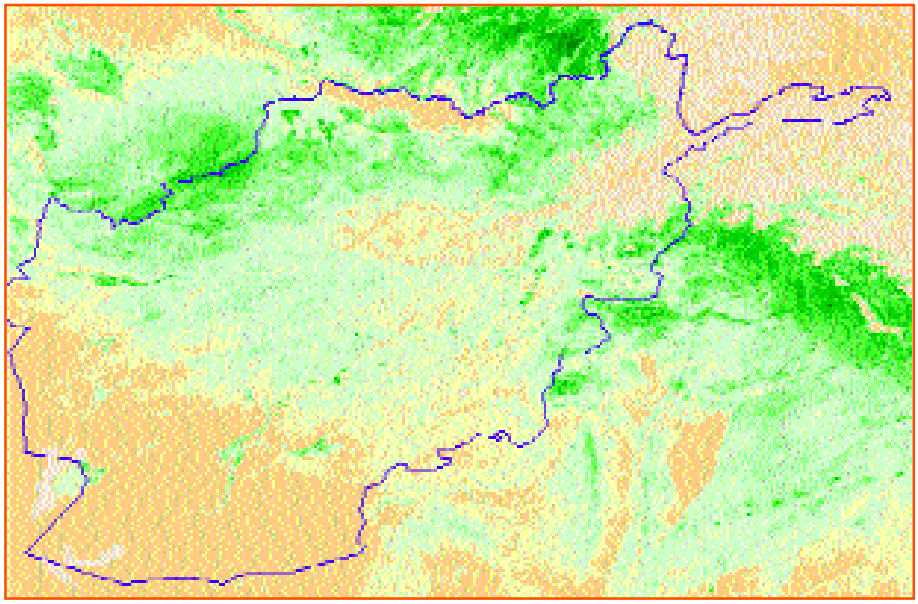
- Institutional strengthening/human capacity building
- Dairy production
- Integrated small ruminant production
- Integrated animal health management
- Animal power for tillage and transport
- Village women's poultry production.

ICARDA has long experience in improving livestock management and production, which it is putting to effective use to rebuild Afghan agriculture.

Some of the Center's successes in dry-area countries around the world have included:

- introduction of high-yielding, drought-resistant barley
- introduction of forage legumes for better ewe milk production
- vetch/barley hay mixtures for increased animal feed production
- better ram selection for improved breeding stock
- increased lambing rates
- urea treatment of straw for enhanced ewe performance
- feed-block production for better nutrition to meet feed shortages
- field advisory training.

In some areas, new forage mixtures and feed-block production systems have been used to dramatically improve sheep production. Feed-blocks are easily manufactured from agro-industrial by-products, and use their results in increased herd body weight and fertility. They are also a low-cost, effective means to augment seasonal feed supply in low rainfall areas. They have also spawned small and medium size production enterprises, especially in Iraq. They might hold similar potential in parts of Afghanistan.



Spot-4 satellite image of the vegetation cover of Afghanistan in May 1998. (Source: FAO/GIEWS 2002)

Satellites used to guide range management

Satellite remote sensing and geographic information system (GIS) technology are being used in Afghanistan by ICARDA and Michigan State University, a Future Harvest Consortium member, to produce information to assist farmers in managing their rangelands for better forage production. Farmers are provided with maps and the training needed to correctly interpret and use them. The objective of the project is to produce a suite of rangeland information products to assist villagers and rangeland managers to efficiently manage their resources for better forage production. Landsat and MODIS images and existing GIS are used to determine and display grass cover, height, and total forage amounts in grass-dominant rangelands in the country. These products will be delivered both in map format and on CDs.

A full report of the needs assessment on feeds, livestock and rangelands in Afghanistan is available on http://www.icarda.cgiar.org/Afghanistan/Need.htm.

Agricultural Research Stations Refurbished in Afghanistan

In the early 1970s, there were 22 agricultural research stations in Afghanistan. Over the past two decades, most of them have been abandoned, bombed, looted or confiscated by warlords. ICARDA, with support from USAID, has so far refurbished six stations in five provinces. These stations connect farmers to new crops, markets, and training opportunities. The bottom line is higher income and improved nutrition.

As the lead Center of the Future Harvest Consortium, financially supported by USAID, ICARDA rebuilt six agricultural stations in five provinces in little more than a year: Kabul, Baghlan, Kunduz, Takhar, and Nangahar. They represent an important step toward a brighter future for Afghanistan's agricultural economy.

The stations develop, test and evaluate new crop genotypes for distribution throughout the region.

Ruined station in Baghlan Province.

Farmers frequently visit Badam Bagh station, Kabul, to seek information and advice and to select crop lines suited to their field conditions.

Farmers visit the stations to examine and select lines that would perform best in their climate. They also gain information on best practices for fertilizer and pesticide application, new farming methods, and water management. The stations provide a flow of improved lines of barley, spring bread wheat, durum wheat, lentil, faba bean, chickpea and forage legumes, derived from indigenous species and better suited to the regional agroecologies. Improved crop seed is multiplied for transfer to farmers and seed supply entrepreneurs.

A seed health and testing laboratory is being re-installed at each station along with meteorological equipment to provide accurate weather data. The Badam Bagh station in Kabul is now fully equipped with seed health and quality testing facilities. It will serve as Afghanistan's national seed testing and seed health laboratory. According to the Code of Conduct for Seed, coordinated by the Consortium, USAID and FAO, and adopted by the Government of Afghanistan, all seed imported into the country must meet certain standards to be certified. The seed should be accurately labeled and be free of pests and pathogens. This laboratory will assure farmers and agricultural officials that the standards of certification are met and pave the way toward re-entering a global economy.

The refurbished agricultural stations serve as launching points for hundreds of village seed enterprises (VSEs) throughout Afghanistan. VSEs provide the means for small business development, new markets, crop improvement, technology transfer, training and educational opportunities for Afghan farmers. The stations are also essential components in the development of crop diversification.

Training courses for Afghan men and women are being conducted to ensure that the stations have skilled and qualified staff now and for the future. ICARDA organized two training courses at the Badam Bagh station in Kabul in

Continued on page 22

Badambagh research station, near Kabul— before (left) and after refurbishing (right).

Short-term, High-impact Projects to Rebuild Agriculture in Afghanistan

The goals were lofty and the deadline tight. Nevertheless, the researchers who received grants from the United States Agency for International Development (USAID) were able to carry out short-term, high-impact projects to complement the ongoing efforts to rebuild Afghanistan's agricultural system and begin the nation's transition from emergency relief to an economically productive, sustainable, and diverse rural economy. The Future Harvest Consortium brought together partners with diverse expertise to deal with the challenge.

Researchers devised projects that addressed basic issues such as the inadequate supply of quality seed, the lack of trained professionals, the rampant pest infestations, the water shortage after four years of drought, the neglected irrigation systems and the shortage of forage for the remaining livestock. The Future Harvest Consortium to Rebuild Agriculture in Afghanistan, FHCRAA/USAID, awarded a total of $1.25 million to eight short-term, high-impact projects and ICARDA managed this grants program. Each project was completed by the end of August 2003.

Potato Seed Production and Multiplication

The International Potato Centre (CIP), based in Peru, contributed to increasing the supply of virus-free potato seed in Afghanistan for local needs as well as future export to neighboring countries, by developing a farmer-based seed multiplication system. The successful training of farmers and the testing of new varieties expanded from Jalalabad to Kabul and Bamyan districts. For example, Bamyan used virus-free seed produced in Jalalabad for the summer 2003 harvest. The new farmer candidates began their training and the necessary equipment was on its way.

Sustainable Maize Systems: Seeds for Peace

The International Center for Wheat and Maize Improvement (CIMMYT) scientists implemented an open-pollinated maize improvement program. Researchers identified candidates for training and chose twenty locations for nurseries around Afghanistan. CIMMYT distributed seeds to the nurseries and arranged the planting of these experiments near key villages. Farmer survey documents were prepared, and translators produced a manual in Pashto and Dari for farmers and extension agents. After training, farmer-cooperators were able to observe production problems and to identify maize populations for on-farm commercialization.

Human Resource Capacity Building in Afghanistan

CIMMYT contributed to building human resource capacity by training around 30 scientists. Five Afghan scientists participated in the wheat improvement training course, and two attended the advanced agronomy course in Mexico. One maize breeder attended the advanced maize improvement course and two wheat scientists joined the CIMMYT-Turkey office for training. An in-country training course was held for twenty Afghan scientists.

Rangeland Information Products from Remotely Sensed Imagery in Afghanistan

Michigan State University utilized satellite remote sensing and GIS technology to create detailed maps that will improve rangeland management. GIS experts accessed and overlaid MODIS imagery and DEM data layers and integrated the information from Landsat images for all of Afghanistan for the period May 2002 to the present. The on-ground data validation study began in June, and despite enormous security and logistical problems, was a success. The crew traveled around the rainfed regions of Afghanistan with GPS, video and computing equipment to compare and validate on-ground forage productivity with landsat-based estimates. The resulting maps were provided to farmers and agricultural professionals at the MSU website http://35.8.163.126/research/ along with training in interpretation and utilization of the data for improved rangeland management.

Agricultural Production on Degraded/Saline Land

Drought has reduced surface water supplies and the bulk of the irrigation systems, which produced over 80% of Afghanistan's food supply. The International Center for Biosaline Agriculture (ICBA), based in the United Arab Emirates, provided apprenticeships for extension agents to improve their basic skills in designing and operating improved irrigation systems suitable for saline soils and water. Three student-trainees worked at ICBA for six weeks and attended a two-month water and soil management course at ICARDA.

Farm Water Management and Irrigation

Groundwater resources have been overexploited and the water tables have dropped significantly over large areas of Afghanistan causing wells to go dry. Soil salinization and degradation is a priority issue in five provinces-Helmand, Ghazni, Faryab, Shaberghan, and Khandahar. The Danish Committee

Continued on page 22

Raising Crops by Raising Skills: Building Human Capacity for Sustainable Production

As the conflict in Afghanistan continued to span decades, the most basic component necessary for human progress-the ability to increase and convey knowledge-was eroded: children were separated from the wisdom of their ancestors; professionals left to find jobs in other countries, while those that remained were isolated from peers and progress. As international agriculture advanced to meet the demands of the global marketplace, Afghans fell further and further behind. The Future Harvest Consortium is addressing this issue.

To build sustainable agricultural production systems and improve operations and incomes, scientists, researchers, technicians, professors and farmers need access to the latest information and instruction in new skills and technologies. This is why the Future Harvest Consortium has built a training component into every project.

Water and soils course in Kabul conducted by scientists from Cornell University.

Upgrading Afghan Professional Expertise

As the central government and its institutions struggle to gain the confidence of the Afghan people, the Consortium is upgrading the skills of the Afghan researchers and agricultural university faculty members. The topics covered during training include: all aspects of seed systems, seed production and seed enterprise development, variety management, potato seed multiplication, integrated pest management, operation and management of experimental stations, use of field equipment, fertilizer and pesticide application, meteorological equipment/station operation, management of water resources and improvement of water-use efficiency, advanced radio production, format development and audio-editing, agricultural journalism, digital audio recording and editing, and computer training.

ICARDA has rebuilt agricultural stations in five provinces to facilitate farmer outreach. Consortium staff members are partnered with staff from the Ministry of Agriculture and Livestock (MOAL), with whom they work closely to rebuild infrastructure and restart research and extension activities. CIMMYT (International Center for Maize and Wheat Improvement), a Future Harvest partner offered unique training courses in wheat and maize improvement, specifically targeted toward scientists. The cultivars have shown excellent results in yield trials that are taking place at research stations where farmers have access to state-of-the-art technology, new varieties, and comprehensive training.

Afghanistan researches participate in the water management training course at ICARDA.

Working Directly with Farmers

Farmers were invited to learn about the production of virus-free potato seed in Jalalabad in a course conducted by the International Potato Center (CIP). The production of virus-free seed can be a business enterprise in itself, or a valuable tool in dramatically increasing yields. This training was repeated for over 725 Afghans in eight provinces.

Cooperation with NGOs

Water scarcity remains a critical barrier to agricultural production in Afghanistan. More than 100 Afghans have been trained in water management technologies by Cornell University, the International Center for Biosaline Agriculture (ICBA), the Danish Committee for Aid to Afghan Refugees (DACAAR), and ICARDA. Those candidates recommended by DACAAR will return to Afghanistan to be integrated into the agency's rebuilding strategy based on 'integrated agricultural development' activities.

Preparing for a Market Based Economy

The Consortium's focus on training has created qualified, skilled workers for both existing jobs and those that will be created as Afghanistan's economy improves. For example, the six seed health and quality testing laboratories being installed at the agricultural research stations, and the related training, are essential to build food security and to meet the high standards required for Afghanistan to compete in the global marketplace. Seed entering the country is tested for pests and pathogens, thus safeguarding the existing agricultural production. Seed being offered for sale by farmer entrepreneurs can be quality tested and labeled to build consumer confidence. This service calls for qualified Afghans to staff the labs.

Thoughtful and strategic training conducted along with other rebuilding efforts is raising the capacity of Afghans. The Future Harvest Consortium is striving to enable Afghans to generate agricultural technologies that address the unique needs of their country and to achieve self-sufficiency. Provided that there is security and stability in the country, the effects will be felt for generations to come.

Agricultural Research Stations ...

Continued from page 19

June 2003 for 24 newly recruited quality assurance personnel from various provinces in Afghanistan. H.E. Mohammed Sharif, Deputy Minister of Agriculture and Livestock (MOAL), Afghanistan, opened the courses. The courses included the start-up and calibration of seed quality testing and seed health testing facilities and

Participants work through a group exercise on seed testing.

equipment. The participants received practical training in seed testing for quality control and seed health, working in small groups according to their background and future assignments at various laboratories in the country. Another Consortium member, the International Potato Center (CIP), based in Peru, has trained farmers at Badam Bagh and Nangahar stations in the production of virus-free potato seed for improved yields.

Short-term, High-impact...

Continued from page 20

for Aid to Afghan Refugees (DACAAR) worked to introduce best management practices for farm water management and irrigation. Their project commitment was fulfilled by training eight Afghan scientists in best water management practices at the water and soil management course at ICARDA headquarters.

Best Management Practices for Water and Soil

A team from Cornell University in Ithaca, New York held a workshop on "Best Management Practices for Water and Soil" at the College of Agriculture in Kabul. Seventy-four Afghans attended the first day's course on water management and approximately 200 attended the second day's for training in crop and soil management. The researchers also organized a traveling workshop for 35 participants on 12-15 May 2003. The participants visited irrigation systems and farms in Baghlan and Balkh provinces, and toured the Parwan irrigation project. During the workshop, the investigators conducted field schools to help farmers better understand water and nutrient management principles. Handouts in the local languages on key factors in wheat production, soil nutrient deficiencies, wheat diseases and water management were distributed at the workshop.

Building Capacity to Control Sunn Pest Infestations

The number one biological constraint to wheat production in Afghanistan is the insect known as "Sunn Pest." The indiscriminate use of pesticides has created resistance in, and killed the natural enemies of, this destructive insect. Wheat yield losses ranged from 50% to 90% in 2002. ICARDA and the University of Vermont, USA, addressed the Sunn Pest problem by training and providing information to growers and NGOs. ICARDA trained 10 Afghan scientists in IPM techniques for Sunn Pest management that included methods for mass rearing important natural enemies. ICARDA also conducted an in-country training course in August 2003. Crop production guides on insect management were translated into Dari and Pashto. The group also delivered a Sunn Pest Management Guide to the Central Asian Development Group (CADG) in March that enabled local farmers to save 32,000 ha of irrigated wheat production. Researchers also reestablished the Kabul University Entomology Laboratory, furnished with equipment purchased through this grant.

The USAID-funded, ICARDA-managed Short-Term High-Impact grants program made a difference in Afghanistan by providing improved potato and maize germplasm, better understanding of national forage productivity, and training plant breeders, agronomists, water and crop pest management researchers.

Spreading the Message

Communication is the key to the implementation of new ideas and research methods. The latest challenge has been in Afghanistan. Experienced ICARDA communications staff traveled to the country to gather first-hand information and images as well as to implement communications projects in the country, such as the Afghan Radio Project.

The ICARDA communications center is a bilingual facility possessing a full complement of technology and staff expertise for a wide array of media activities. Regular publications in Arabic and English include "The Week at ICARDA," "ICARDA Annual Report," "Caravan: Review of Agriculture in the Dry Areas," internal documents, scientific papers, feature articles and numerous press releases. Many documents are produced entirely in-house, from translation and typesetting to printing and binding. Publications are distributed in both hard copy and electronically to media agencies throughout the world. The Center maintains an information-rich website (www.icarda.org), which includes a sub-site specifically devoted to Afghanistan.

Communications activities of the Future Harvest Consortium to Rebuild Agriculture in Afghanistan have included regular reports to USAID, photographs, press releases, posters, brochures, radio programs, videos, contacts with media outlets in Kabul, articles in "The Week," and "Caravan," multi-media presentations, and websites, all using up-to-date digital technology.

Agriculture Minister H.E. Mr Sayed Hussain Anwari (right) is interviewed by Mr Enayat Safi in the Ministry's refurbished studio. Mr Safi produces a weekly radio program for farmers, funded by the ICARDA-led Future Harvest Consortium.

Ag Radio Reaches Out to Afghan Farming Families

Under the Taliban, radio broadcasts were limited to "the Voice of Shariat." There was no music and not much opportunity for independent, creative programming that responded to the needs of the audience. Partly due to the low literacy rate of only 31%, Afghans mostly depend on the radio for information, entertainment and their connection to other provinces and the central government. Radio remains the most popular and effective media in the country.

Two decades of conflict have left Afghan farmers far behind the rest of the world when it comes to new technologies, improved crop varieties, and agronomic methods. Farming families need the latest information on how to improve their operations. To address this need, communications experts organized a five day workshop in Kabul on Agricultural Journalism. Radio reporters from 13 provinces visited agricultural research stations along with progressive local producers of vegetables, poultry and dairy projects. Instruction was provided in basic journalism, interview techniques, and creative production. ICARDA/Kabul staff provided agricultural expertise along with representatives from the Afghanistan Ministry of Agriculture and Livestock. Topics ranged from water management to fertilizer application and genetics.

Each participant selected a specific topic, conducted interviews with appropriate agricultural resource people and wrote a 3-minute script that was recorded on CDs. At the conclusion of the workshop, the reporters were presented with 17 broadcast-ready programs to take back to their home radio stations. The programs, recorded in Dari and Pashto, were entitled "Dialogue in Agriculture."

Reporters upgraded their knowledge of agriculture and quality standards for production. As the media becomes more self-confident, reporters will be able to practice journalistic values and raise standards and audience development. Farmers will also benefit from increased access to useful information on agriculture to improve their crop yields.

Afghan Minister of Agriculture and Livestock (MOAL), H.E. Mr Sayed Hussain Anwari, cuts the ribbon on the Ministry's refurbished recording studio, assisted by Dr Nasrat Wassimi (right), Executive Manager of ICARDA's Kabul office, and Mr Amir Muhammad Safi (left), head, MOAL communication section, on 11 September 2003 in Kabul.

Farmers being interviewed for "Dialogue in Agriculture" radio program in Kabul.

Ethiopia Prepares to Prevent Recurrence of Famine

In the early 1980s, sub-Saharan Africa suffered a severe drought which led to the starvation of millions of people, especially in Ethiopia where it was made worse by war. Since 1984, ICARDA has been working with Ethiopian researchers to improve the nutrition, income, and well-being of farm families and the rural poor in the country. This is being achieved through development of improved crop varieties and production technologies suitable for the agroclimatic conditions in the country, and through training, information exchange, and institutional capacity building. Ethiopia now stands better prepared to successfully manage famine, if it were to threaten again.

Ethiopia's famine of the early 1980s was the worst drought-related disaster in recent times. Over 300,000 people died, while nearly 15 million were either displaced or diseased. The country is most vulnerable to harsh drought conditions that lead to famine in sub-Saharan Africa. There are several reasons for Ethiopia's vulnerability. The population growth is over 3 percent per year, the country has gone through times of civil conflict, erosion has denuded the country's highlands, and deforestation has reduced the country's forests to one percent of the land area.

Ethiopia has undertaken great efforts to modernize its agriculture. Its efforts have been bolstered by the support of international agricultural research centers, including ICARDA. Young Ethiopian scientists have been trained to take the lead in carrying out research to help millions of resource-poor farmers. ICARDA's research support has been on some of the most important crops in Ethiopia including pulses and barley.

Research and development cooperation can help ensure a safe, green, and prosperous future for the children of Ethiopia.

Pulses—a Key Source of Protein

In 1983, Ethiopia's production of pulses was 799,000 tons. In 1985, when the famine gripped the nation, it dropped to 539,000 tons. Faba bean, lentil, field pea, chickpea, and grasspea are key sources of protein for Ethiopia's 60 million people. Pulses are also an important part of the cropping system. Grown in rotation with cereals, pulses maintain soil health, nitrogen balance, and cropping system sustainability. ICARDA has so far provided the Ethiopian national agricultural research system with a large number of breeding lines of faba bean (2039), lentil (894), chickpea (183), and field pea (92).

Faba Bean

Faba bean is ranked first among highland cool-season food legumes in Ethiopia. Major constraints to increased faba bean production are chocolate spot (*Botrytis fabae*), ascochyta blight, rust, soilborne diseases, water-logging, cold, and drought.

The collaborative research on faba bean improvement started after Ethiopia joined the ICARDA/IFAD Nile Valley Project in 1985. The early use of genetic resources resistant to chocolate spot, resulted in the release of two high-yielding varieties, 'Shallo', and 'BPL 18021-2' with improved levels of resistance to chocolate spot and rust. The project further delivered improved cultural practices and faba bean lines, such as 'CS 20 DK' for high altitudes and 'NC 58' for intermediate altitudes. Improved faba bean germplasm provided average yield advantages of 0.62 t/ha (86%) and 0.57 t/ha (74%) in high and intermediate altitudes, respectively, leading to an average income improvement of 63%. In large-scale demonstration fields in 1989 and 1990, an average yield advantage of 0.68 t/ha (64%) was recorded, corresponding to about 60%

improvement in farmers' incomes. A survey conducted in Shewa region has shown that, from the faba bean package made available, 52% of the farmers adopted the improved cultivars, while 56% adopted management practices. Only 8% farmers adopted the fertilizer recommendations.

Lentil

Lentil is an important pulse in Ethiopia, used in many recipes, including *wot*, a popular soup. Lentil productivity in Ethiopia remains low mainly due to cultivation of low-yielding, disease susceptible landraces. The most important lentil diseases in Ethiopia are rust, caused by *Uromyces fabae*, and the wilt/root-rot complex. Water-logging, drought, poor agronomic management, and lack of improved technology also limit lentil production.

Rust devastated lentil in Ethiopia in 1996/97, but the improved rust-resistant cultivar 'Adaa' (left) stayed green and healthy.

The lentil improvement program of the Ethiopian Agricultural Research Organization (EARO) has benefited from fruitful collaboration with ICARDA since the early 1980s, and has released seven lentil varieties, five of which were derived from ICARDA-supplied material. The varieties are: 'Chalew' (ILL 358), 'Chekol' (ILL 2704), 'Adaa' (ILL 6027), 'Gudo' (ILL5748), and 'Alemaya' (ILL 6821). 'Adaa' and 'Alemaya' are highly resistant to the wilt root-rot complex. In addition, 'Alemaya' exhibits developmental and phenological plasticity, which has led to its adoption in diverse agroclimatic conditions. These varieties have a yield potential of up to 2.6 t/ha.

Chickpea

Chickpea is an important cool-season food legume in Ethiopia, but its productivity is low due to various biotic and abiotic stresses. Varieties grown by farmers are susceptible to several diseases (ascochyta blight, rust, fusarium wilt) and insect pests. There is a lack of improved varieties and the diffusion of appropriate production technologies has been slow.

ICARDA chickpea breeding material has been shared with the Ethiopian national program and jointly evaluated for stress resistance. The research work undertaken in various disciplines has focused on release of improved cultivars and the development of improved production packages. The achievements under the Nile Valley Regional Program include the release of lines received from the International Crops Research Institute for the Sem-Arid Tropics (ICRISAT), based in India, or developed locally: ICCL-820104/85-DZ/16-2, ICCL-84218, ICCL-84239, and DZ-10-9-2. These lines are resistant to wilt, and are adapted for mid-altitude areas. In 2000, two more varieties of kabuli chickpea were released for midlands and highlands; 'Areti,' resistant to fusarium wilt and ascochyta blight, and 'Shasho,' resistant to fusarium wilt. A high-yielding and ascochyta blight-resistant desi chickpea variety (ICCV 922219) was also identified for the country's highlands. Consequently, chickpea area increased from 127,000 ha in 1989-91 to 168,000 ha in 1999, with an increase in productivity from 800 kg/ha to 828 kg/ha.

Screening chickpea lines for resistance to Fusarium wilt in a wilt-sick plot in Ethiopia. The susceptible control, middle, wilted and turned yellow, while the resistant lines planted left and right faired much better.

Grasspea

Grasspea has been cultivated in Ethiopia for more than 2500 years. Today, the crop is grown on about 110,000 ha, producing 0.8-1.0 million tonnes annually. Although grasspea seed is a tasty source of high-quality protein (often exceeding 30%), over-consumption for a prolonged period can result in paralysis of the legs (lathyrism), caused by the neurotoxin B-n-Oxalyl-L-2,3 diaminopropionic acid (B-ODAP) found in its seed.

Recognizing the importance of the crop, ICARDA and EARO scientists undertook a joint project financed by the Department for International Development (DFID), UK, to develop cultivars with low (less than 0.2%) B-ODAP, improve management strategies, agronomic performance and yield. Lines with low B-ODAP and high yield potential were developed and tested in Debre Zeit. The study revealed that B-ODAP concentration in the seeds increases with reduced soil moisture. Thus, a combination of low B-ODAP lines and early sowing to avoid moisture stress can keep the neurotoxin at levels safe for human consumption.

New low-neurotoxin grasspea lines, jointly developed by ICARDA and Ethiopian researchers, being evaluated at Debre Zeit Research Center. The performance of these lines has renewed the interest in grasspea improvement research in Ethiopia.

Grass pea is known for its ability to withstand harsh growing conditions, particularly water stress. Under conditions of extreme drought, grass pea could be the only crop producing yield, whereas other crops would fail.

Barley

Barley is one of the most important staple food crops in the highlands of Ethiopia. It is cultivated on more than 800,000 ha and total annual production is around 800,000 tonnes. The most important factors that reduce yield of barley in Ethiopia are poor soil fertility, water-logging, drought, frost, soil acidity, diseases, insects, weeds, and poor-yielding varieties.

A Barley Traveling Workshop held in Ethiopia brought together researchers from Egypt and Ethiopia to review on-farm trials.

ICARDA is working with Ethiopian scientists to improve the productivity of barley. Two improved barley varieties, 'HB-42' and 'Shege' were released in 1986 and 1996, respectively, and promoted for use by farmers in western and northwest Shewa. 'Shege' yielded 2.89 t/ha compared with 1.78 t/ha produced by local varieties, showing a grain yield advantage of 63%. At Degem, 'Shege' yielded 3.87 t/ha, compared with 1.73 t/ha from local varieties, providing a 134% grain yield increase. At Alem Gena, 'HB-42' yielded 2.99 t/ha resulting in a yield advantage of 71%. The National Committee for Variety Release officially released two barley varieties in 2001, one for food (3369-19) and the other for malting (HB-52).

Seed Production

During 1995, ICARDA initiated a project nicknamed the "Seed Safety Net" designed to reduce the risk of famine and to speed recovery if seed stocks were lost. The project was led by Ethiopia and included Eritrea, Sudan, and Yemen. It coordinated national seed programs, collected information on varieties used, and kept track of seed stocks. The project worked through the West Asia and North Africa (WANA) Seed Network, a network of national seed programs in the region, with its secretariat at ICARDA headquarters.

Despite the availability of improved and well-adapted varieties of barley and tef, the adoption was lagging due to weak seed supply systems. Production of enough quality barley and tef seed is a challenge for the national seed program. Therefore, the Ethiopian Seed Enterprise (ESE) adopted an innovative approach of contracting smallholders to produce certified seeds. The pilot scheme generates income for peasants in the rural areas, creates a community of seed producers, and helps develop effective distribution mechanisms that could spread improved cultivars through farmer-to-farmer exchange. This helps to build a sustainable seed-supply system that strengthens the informal sector and links it well to the formal sector, while enhancing indigenous capability in quality seed production. A positive evaluation report by ICARDA has encouraged ESE to extend the scheme to food barley.

A grower, Ato Zerfu Woldegiorgis (third from right), explains to workshop participants the construction of a local seed storage facility during a field visit to Hitosa in the Arsi zone.

Information Technology

Information sharing is critical to the success of agricultural research and development, so ICARDA is playing an active role in developing the capacities of NARS in the use of information technologies. During 1998, scientists and technical staff from ICARDA carried out a detailed study at EARO's headquarters and its various research stations, and proposed an Information Technology Strategy for 1999-2003. ICARDA technical staff supported the implementation of the study recommendations at EARO.

Human Resource Development

ICARDA provides training through specialized short courses covering a wide range of disciplines. These are organized in the Nile Valley region, in Ethiopia, and at ICARDA headquarters in Syria. National scientists are also sent to other countries on traveling workshops to review on-station and on-farm researches, make joint line/variety selections, and compare research methods. So far (1977-2003), over 601 Ethiopian researchers have benefited from the training courses organized by ICARDA, in addition to graduate students who have worked at the Center for their MSc/PhD degrees.

Regional Cooperation

Since the establishment of the Nile Valley Project in 1979, informal networking has been taking place between the national agricultural research systems of the participating countries, initially Egypt and Sudan, and, since 1985, Ethiopia. Informal networks were created for sharing improved germplasm and conducting study visits, training courses, and traveling workshops. In September 1995, a Regional Networks Project was established to find solutions to the major biotic and abiotic stresses constraining production of the five cool-season cereal and food legume crops important in the region. The networks are still operational thanks to support from the International Fund for Agricultural Development (IFAD).■

Eritrea's Rough Road to Food Security

Eritrea gained independence in 1993 and was in the process of putting in place its plans for promoting agricultural research and development. But the restart of a devastating war in 1998 and prolonged drought conditions have led to displacement and food insecurity for nearly two-thirds of the population. Since the end of the war in 2000, Eritrea is trying to rebuild its economy and ensure food security for its 3.5 million people. The country needs increased international support in its efforts to feed its population.

An Eritrean researcher (left) from the Department of Agriculture Research, notes farmer opinion on new barley varieties that may eventually form part of a disease-breaking **Hanfetse** *mixture (above).*

Eritrea's per capita GDP is about US$ 200. Although agriculture is a vital sector of the economy, and it employs the vast majority of the population, its contribution to GDP is just about 16%. Only 15% of the 3.2 million hectares of arable land is normally cultivated. More than 95% of the arable land is rainfed, but the rains vary in quantity and distribution. The country's farmers mainly grow cereals, with barley, wheat and tef grown in the highlands. Lack of improved varieties and technologies, and inadequate inputs, are additional constraints to productive agriculture. The country, therefore, depends largely on imported food to satisfy the needs of its population.

ICARDA is working with scientists in Eritrea to promote agricultural research and increase food production in the country. Major areas of collaboration include disease control in cereals, promotion of conducive seed polices, and building capacities of Eritrean agricultural scientists. Eritrea is one of the countries participating in ICARDA's Nile Valley and Red Sea Regional Program (NVRSRP) which aims at increasing the incomes of smallholder farmers through the improvement of productivity and sustainability of the agricultural production systems, while conserving natural resources, and enhancing the research capacity of national scientists. Other countries in the NVRSRP program are Egypt, Ethiopia, Sudan and Yemen.

Cereals

Cereal crops account for 95% of the cultivated area. Despite their importance, productivity remains very low, less than 1 t/ha. This is due to various biotic and abiotic stresses, and poor production practices. Diseases are among the main limiting factors. Because there is a wide range of virulent rust pathotypes, disease resistance in wheat breaks down easily, giving rise to the need to develop new, disease-resistant varieties speedily. In barley, a wide spectrum of leaf blotch diseases are known to have spread to epidemic levels.

To alleviate the impact of diseases, such as the rusts on wheat and the leaf blotch diseases on barley, farmers plant mixtures of wheat and barley seed. The mixture is known as *hanfetse*, and the practice is common in many cereal producing areas. Disease incidence in both wheat and barley can be reduced, but the potential benefits of this practice are often lost due to the difference between wheat and barley in their maturity range.

The inherent variability of cereal diseases in Eritrea requires a broader based, integrated management strategy that enhances durability of disease resistance through an appropriate gene management system, complimented by other control methods, such as cultural practices, safe chemicals, and biological control. ICARDA is working with Eritrea's national agricultural research system on a project aimed at developing an integrated disease management strategy that will contribute to improved production and income. The objective is to control cereal diseases and to reduce their spread. The project is funded by the Danish Agency for International Development (DANIDA).

Seed Security

Food security in Africa depends on seed security, but in many countries seed supply is precarious. The Seed

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Rebuilding Agriculture in Iraq: The Role of ICARDA

In the face of wars and drought, Iraqi agriculture is under increasing pressure to feed an estimated population of 26 million that is growing at an annual rate of more than 2.8%. It is estimated that Iraq will need US$ 3.5 billion to import basic food to meet the annual shortages during the next decade. Like other countries in the region, Iraq faces the limitation of natural resources, particularly arable land and water. Climatic features, especially the low and highly variable rainfall, along with soil salinity buildup, limit the options available to farmers. ICARDA, with other international research agencies, is working on programs to revitalize the agricultural sector in Iraq.

Agriculture in Iraq has suffered because of wars, drought, economic sanctions, and other internal and external factors. Agricultural production in Iraq also remains constrained by lack of quality seed, herbicides, insecticides, fertilizers, animal vaccines, machinery, irrigation equipment and spare parts. Land degradation, salinization, and declining crop yields due to land degradation and lack of inputs are serious problems, especially in the irrigated lands.

Estimates of cultivable land areas vary from 5 to 8 million ha. The demographic pressure on the land, combined with the need to produce more food from a shrinking resource base of land and water, are forcing farmers to follow exploitative production practices that maximize short-term returns at the expense of long-term sustainability.

Renewable fresh water resources are estimated at about 2000 m3/person/year, originating mainly from the Tigris and Euphrates rivers; however, Iraq faces huge water problems caused by geographic, topographic and management factors. Decreasing water resources and deterioration of irrigation systems call for a structural readjustment of the agricultural sector.

In the drier areas, rural livelihoods are based on agropastoral systems of production, in which small ruminants (sheep and goats) represent the principal source of income. A generation ago, natural pastures met a large proportion of the feed needs of the small ruminants. Feed resources, however, have been reduced by overgrazing, cultivation of rangelands for crop and tree production, removal of vegetation for fuel wood, and the resulting soil erosion. Today, a large proportion of the feed needs must be met by grain, crop residues, and supplemental feeding of concentrates. The livestock sector has also suffered because of shortages of veterinary services and vaccines. The number of farm animals declined and meat and milk production dropped by 24% during the late 1980s as compared with the 1970s.

Innovations being exploited in Iraq include the high-yielding barley variety Rihane-03 (top). Awassi sheep (center) have also been the focus of a ram improvement program to produce higher quality breeding stock in collabroration with the IPA Agricultural Research Center. Ewe milk production has been increased by the introduction of forage legumes such as* Vicia sativa *(bottom), either into continuous barley cropping systems or to replace fallow.

Iraq is within ICARDA's ecoregional and geographical mandate region, and, despite the difficult conditions, the Iraq/ICARDA cooperation has been strong since ICARDA's foundation in 1977. The focal points of the collaboration have been the Ministry of Agriculture and the IPA Agricultural Research Center, Abu Ghraib, Baghdad. The collaboration involves joint research, plant genetic resource conservation, and human resource capacity building, in partnership with IPA scientists and the agricultural universities in Baghdad and Mosul.

Crop Biodiversity

Iraq lies at the eastern end of the Fertile Crescent, which encompasses an area of mega-diversity of important food crop and pasture species. It is one of the nuclear centers where numerous species of temperate-zone agriculture originated. These crops provide some 38% of the human diet globally. Their wild relatives and landraces of enormous genetic diversity are found even today, representing a key resource not only for Iraq but also for the world for breeding improved crop varieties.

To conserve its genetic resource collections, the national program of Iraq sent hundreds of accessions of different

crops during the 1990s to ICARDA for safe deposit in its genebank. The number of Iraqi accessions held in major genebanks outside Iraq is limited; the largest collection is at USDA (1113 accessions): ICARDA holds 1003 accessions (Table 1), and VIR (N.I. Vavilov Scientific Research Institute of Plant Genetic Resources) in Russia has 403 accessions. The holdings of Iraqi accessions in other CG Center genebanks are: CIMMYT, 2 accessions; ICRISAT, 23; ILRI, 2; and IRRI, 15. ICARDA has made three joint collection missions in Iraq in the last decade, and distributed 1501 germplasm accessions from its genebank holdings to Iraq for use in crop improvement programs.

Iraq is among the few countries that did not sign the Convention on Biological Diversity (CBD). There is, therefore, an urgent need to develop a national biodiversity strategy and action plan, and national legislation for access to plant genetic resources.

Table 1. Accessions from Iraq conserved in ICARDA's genebank.

Crop	No. of accessions
Aegilops (wild wheat)	64
Barley	172
Bread wheat	129
Chickpea	37
Durum wheat	135
Faba bean	86
Forage and range species	26
Lathyrus (grasspea)	10
Lentil	32
Medicago (alfalfa)	144
Pisum (peas)	3
Trifolium (clovers)	72
Vicia (vetches)	16
Wild barley (*Hordeum* spp.)	22
Wild wheat (*Triticum* spp.)	55
Total	1003

Crop Improvement

Over the years, ICARDA has distributed a wide range of improved genetic material of barley, bread wheat and durum wheat, lentil, faba bean, chickpea, and vetches to breeding programs in Iraq. Additionally, ICARDA supplied germplasm nurseries to the northern Kurdish area under the FAO 'Oil for Food' Program. As a result, improved varieties of barley, spring bread wheat, durum wheat, lentil, and chickpea have been released to Iraqi farmers (Table 2) and are being grown on large areas. For example, the improved barley variety 'Rihane 03' is estimated to be grown on about 250,000 hectares in rainfed areas in northern Iraq, representing about 18% of the total (1.4 million ha) area sown to barley annually. The variety proved popular because of the white color of its seed (compared with the black seed of local varieties), which made it suitable for mixing with wheat in bread-making. Another variety 'Zanbaka,' selected from a local Syrian landrace, is better adapted to the drier environments and is also proving popular with farmers.

Responding to the need for maximizing production from the limited water resources available, recent joint research in northern Iraq has revealed that, in dry years, supplementary irrigation during critical drought periods can increase wheat yields by up to 100%.

Integrated Crop and Livestock Production

Iraq participates in a regional adaptive research program-"Development of Integrated Crop/Livestock Production in Low Rainfall Areas of WANA (the "Mashreq/Maghreb Project")"--coordinated by ICARDA from its West Asia Regional Program in Jordan. The Mashreq/ Maghreb project has developed a community approach that has helped to produce, with the participation of community members and other stakeholders, packages of "best-bet" technical, institutional, and policy options to support livestock production in dry areas. The community approach has also focused on strengthening appropriate local institutional support for community development plans. The policy options were researched jointly with the International Food Policy Research Institute (IFPRI).

Considerable progress has been made in the development and delivery of technological packages related to on-farm feed production, alternative feed sources, and improvement and management of small ruminants. New varieties of barley, oat, vetch and triticale adapted to harsh environments have been tested and adopted by farmers. Fodder shrubs and cactus are widely used to augment feed resources. Feed-blocks made from agro-industrial by-products have become an integral part of the feed calendar of small ruminants in Iraq, and are produced entirely by the private sector. Small-ruminant management practices, including the introduction of improved breeding stock, practices to enhance fertility and lambing rates, and early weaning, have become popular with farmers. Rangeland rehabilitation has focused mainly on the plantation of fodder shrubs (e.g. *Atriplex*) and cactus on private lands. Farmers have started

Table 2. Improved crop varieties released in Iraq using ICARDA-supplied germplasm.

Crop Name	Year	Variety	Other name
Barley			
	1993	Rihane03	
	1994	IPA 265	
	1994	IPA 9	
	1994	IPA 7	
Chickpea			
	1992	Rafidain	ILC 482
	1992	Dijla	ILC 3279
	2000	IPA 510	FLIP 86-5C
Durum wheat			
	1994	Waha Iraq	CM17904-B-3M-1Y-1Y-0 SK-0AP
	1997	Korifla	
Lentil			
	1992	Baraka	ILL 5582
	1998	IPA 98	ILL 5883
Spring Bread Wheat			
	1989	Es14	
	1994	Hamra	
	1994	Adnanya	
	1994	Abu Ghraib	
	1997	IPA 99	
	1998	Vee 'S'	

Feed-blocks ready for distribution in Iraq. There is nothing new in using crop residues for feed, but this project should take it a long step further.

planting these fodder crops in their own fields.

Human Resource and Capacity Building

Iraq has a well-trained cadre of agricultural scientists, many with PhDs from Europe and USA, who have been ICARDA's principal partners in collaborative research activities. Since 1979, ICARDA has trained a total of 347 Iraqi scientists in various training courses ranging from group, long- and short-term courses, to individual non-degree and degree training at ICARDA headquarters and outside Syria, in close collaboration with advanced national, regional, and international institutions. More recently, ICARDA has trained Iraqi scientists in the application of biotechnology, expert systems, GIS and remote sensing for crop improvement, and natural resource management. Seven Iraqi scientists have been assisted to complete their PhD research, and two for MSc, in collaboration with appropriate agricultural universities in both developed and developing countries. ICARDA is also working with the University of Hawaii within the framework of the USAID-funded Partnership for Revitalizing Agricultural Higher Education and Development (HEAD) in Iraq. In addition to field research opportunities, students and scientists have access to ICARDA's large scientific databases.

ICARDA, in collaboration with the International Food Policy Research Institute (IFPRI), organized a training workshop for Iraqi researchers on policy and property rights in 1999/2000. Standing third from the right is Dr Kamil Shideed, National Research Coordinator of the Iraq/ICARDA collaborative program.

Database of Professionals for Reconstruction of Iraq

To accelerate the pace of reconstruction, Iraq needs qualified experts to undertake key tasks in various fields. The challenge is to identify qualified Iraqis and other nationals for the available jobs and consultancies in government, NGOs, the private sector and other agencies working in Iraq. With support from the Economic and Social Committee for West Asia of the United Nations (ESCWA), ICARDA has set up an electronic database which has information on some Iraqi nationals, their qualifications and experience, and where they are based in the world. The database can be accessed at http:// www.escwa.org.lb/information/iraq/IPR/background.html. Iraqi nationals can register into the database to help research and development agencies contact them for consultancies and full-time positions in Iraq.

Future Iraq/ICARDA Cooperation

ICARDA held its ninth biennial coordination meeting with Iraq in November 2003, in which scientists from Iraq and ICARDA reviewed the immediate actions that need to be taken to restart agricultural research and rehabilitate the agricultural sector in the country. Priority actions will include the following: (i) immediately multiply and deliver high-quality seed of adapted varieties, (ii) provide technical assistance in the development of sustainable agriculture in the longer term, and (iii) develop a strategy that will ensure a close integration of relief, rehabilitation and development projects. Within the framework of these plans, ICARDA worked with Iraqi colleagues to develop a program of large-scale on-farm demonstrations with improved varieties of barley, wheat, chickpea, lentil and vetches under different agroecological conditions in the 2003/2004 cropping season, to be implemented with support from USAID. For this program, ICARDA provided, in December 2003, over 20 tonnes of improved seeds of cereal and legume varieties known to be adapted to Iraq's environmental conditions. The seeds have also become the basis for a farm-based seed multiplication program in Iraq. Furthermore, ICARDA scientists have worked with Iraqi colleagues on measures to kick-start the seed program.

Participants of the ninth Iraq/ICARDA Coordination Meeting, held in Amman, Jordan, 16-17 November 2003.

ICARDA will adopt a consortium approach to support Iraq. To date, CIMMYT, CIP, IRRI, IPGRI, IFPRI and ILRI, among the CGIAR Centers, have already consented to be partners. But an effective program for rebuilding agriculture in Iraq calls for the participation of several other players including local institutions and NGOs, UN agencies, other international research institutes, and donors. The country is in need of substantial humanitarian, rehabilitation, and reconstruction assistance to regain its food security and infrastructure development.■

Supporting Agricultural Development in Palestine

Palestine lies within the Fertile Crescent, the birthplace of agriculture. The total agricultural land, approximately 183,400 hectares in the Palestinian territories (83% in West Bank and 17% in Gaza Strip), is dominated by rainfed agriculture and small holdings. However, pressure on the land, water scarcity, a limited market for local products, and the Israeli occupation are major constraints to the development of the agricultural sector in Palestine. ICARDA is working with local scientists to provide improved germplasm for cereals, legumes and forages, and to build the capacities of research institutions to improve agricultural production.

The Agricultural Sector in Palestine

Agriculture plays an important role in the Palestinian economy by significantly contributing to food requirements and providing jobs to more than 50% of the population. Livestock production contributes roughly 40% of the agricultural income in the West Bank and 25% in Gaza. But the political situation is impacting the agricultural sector. Only 33% of the rangelands are accessed by an estimated 770,000 head of sheep and goats, due to Israeli restrictions and settlements. While most of the agricultural production is for domestic use, it is also subjected to high competition from Israeli products that have free access to Palestinian markets.

A view of ongoing destruction in Palestine.

The National Agricultural Strategy and the National Research and Extension Policy recommended intensifying investment in agriculture to guarantee food security and increase the competitiveness of local products, despite the prevailing political situation. The capacities of agriculture-related agencies and departments (the National Agricultural Research Center—NARC—and the Directorate of Extension and Research) are limited. Many international organizations and NGOs, including the International Center for Agricultural Research in the Dry Areas (ICARDA), are working towards the rehabilitation and sustainable development of the Palestinian agricultural sector.

Training Palestinian farmers in water harvesting techniques to enhance agrobiodiversity.

ICARDA's Support to Palestine in Agricultural Development

The collaboration between ICARDA and Palestine dates back to 1994, when a series of meetings were held with scientists from the Ministries of Agriculture and Environment and from many NGOs, including the Agricultural Research Institute, Jerusalem (ARIJ), to discuss potential areas of support for the development of well-coordinated, efficient research and extension systems that will ensure sustainability. Since then, ICARDA has signed Memoranda of Understanding with the Ministries of Agriculture and Environment, and the National Agricultural Research Center for the provision of improved cereal, legume and forage germplasm, for capacity building, and the implementation of joint projects. ICARDA has international nurseries of both food and forage crops to support breeding efforts in Palestine. Many Palestinian scientists have either been trained at ICARDA, or have participated in international conferences. The training and exchange visits have continued in spite of the difficult situation in the territories. In addition, ICARDA is coordinating two regional projects in collaboration with Palestine: the dryland management project and the GEF/UNDP funded project on conservation and sustainable use of dryland agrobiodiversity.

The Regional Dryland Management Project

The West Asia region is located in the arid and semi-arid zones characterized by high evaporation rates and low, erratic and unpredictable rainfall during the winter months. Overgrazing, wind and water erosion, poor irrigation and increased population are key contributors to land degradation. Within the framework of the multilateral working group for peace and the environment, sponsored by Japan, ICARDA is the facilitator for the regional initiative for dryland management. The project focuses on environmental protection, particularly combating desertification and optimizing marginal quality water-use, range management and human resource development.

This project promotes techniques to ensure more efficient water use in the Palestinian territories in order to increase agricultural production. Scientists first selected plant species that are tolerant to water stress, mature early (before harsh summer conditions start), are economically promising, and are preferred by the farmers. These plant species are: a local landrace olive (Baladi), a local landrace fig (Khdari), a local landrace of almond (Mokhmali, which may be marketed as fresh green fruits, or later as peeled almond), a local landrace of apricot (Mistikawi) and a promising peach.

Researchers then tested different water-harvesting techniques on the selected plant species after consulting with natural resource management experts and farmers. Target areas were selected in the southern part of the Hebron District, where annual rainfall ranges from 300 mm to 400 mm. Two techniques of water harvesting were selected: V-shaped micro-catchments, which is new to the farmers, and permeable rocks, which has been widely used for years.

The project has also conducted a study to determine the social and economic characteristics of dryland farming, opportunities, and challenges facing the farmers.

The Dryland Agrobiodiversity Project

The number of recorded plant species in West Asia ranges from 234 in Kuwait to about 3000 in Lebanon and Syria. There is a grave risk that much of the agrobiodiversity of West Asia will be lost unless a holistic approach is employed for the conservation of land, water and genetic resources.

The GEF/UNDP-funded project on conservation and sustainable use of dryland agrobiodiversity in West Asia is coordinated by ICARDA along with the International Plant Genetic Resources Institute (IPGRI) and the Arab Centre for Studies of the Arid Zones and Dry Lands (ACSAD). The project, which started in 1999, is implemented in Jordan, Lebanon, the Palestinian Authority, and Syria. It aims at building sustainable actions for conserving *in situ* and on-farm landraces and wild relatives of species of global significance originating from the Fertile Crescent (cereals, lentil, allium, annual forage legumes, olive, fig, pistachio, plum, and almond). The target areas in Palestine are Jenin and Al-Khalil, and its activities are executed by the Ministry of Agriculture and the UNDP/Programme of Assistance to Palestinian People (UNDP/PAPP). In the past four years, the project has been able to assess the status of local agrobiodiversity, the factors leading to its degradation, and has demonstrated technological options for improving productivity.

A field genebank at Beit Oad station where wild species of fruit trees are being planted.

For example, in 2002, the project distributed over 60,000 thyme, 6000 Silvia, and 12,000 chamomile seedlings to about 120 women farmers in the target sites. Also, over 1200 seedlings of targeted fruit trees were distributed to farmers in Sa'eer and Daheria. The project also provided cuttings of major fruit tree landraces to two private nurseries and to the Ministry of Agriculture nursery. Out of a rich collection of genetic resources, ICARDA holds 1006 accessions of *Aegilops*, barley, durum wheat, primitive wheat, wild *Hordeum* and wild *Triticum*, collected in Palestine. The Center is looking forward to repatriate this germplasm to rebuild a national genebank in Palestine for use in agricultural rehabilitation.

The project has also helped draft a national policy and legislation for agrobiodiversity conservation, increase public awareness and is working with the Ministry of Education to include biodiversity conservation in the school curriculum. The Palestinian project component was very active in enhancing regional integration and networking, and has succeeded in implementing most of the project activities. The positive contributions and progress of this project have been acknowledged by major stakeholders including the Ministry of Agriculture, UNDP/PAPP, local NGOs and farmers.

Training

Training young researchers in key areas and providing them with opportunities for higher studies is an important component of ICARDA's collaborative program with Palestine. Recently, 14 teachers from Sa'eer and Daheria took part in a training course in increasing awareness about the importance of conserving local agrobiodiversity. The course was organized jointly by ICARDA, the Palestinian Agricultural Research Center, NGOs, Ministry of Agriculture and the Ministry of Environment. To date, ICARDA has trained more than 80 researchers from Palestine. In addition, 42 scientists and extension personnel have benefited from courses covering the various aspects of *in situ* conservation and valuation of local agrobiodiversity, eight from a one-week course on scientific writing, and two from a two-day practicum.

Palestinian teachers receiving certificate of training in conserving agrobiodiversity.

Future Focus of the ICARDA-Palestine Program

ICARDA's long experience in dryland agricultural development will provide many opportunities to strengthen research and extension in Palestine. ICARDA will provide technical backstopping, training and appropriate technologies, and will also make available the expertise and technologies from regional institutions, and advanced research institutions worldwide. ICARDA will also play a major role in enhancing research efforts at the national level among the national research and extension institutions, NGOs, universities and local communities.■

How Sudan Fought the Aftermath of Drought

Since the terrible drought, which hit Northeast Africa in 1984/85 and caused mass starvation, agriculture in Sudan has improved considerably. Working closely with ICARDA, the country is now nearly self-sufficient in wheat, and has significantly improved its production of faba bean. This is a dream come true for Sudanese people and ICARDA.

In the early 1960s, Sudan was considered a potential breadbasket for Africa and the Middle East. The country has very extensive grazing areas, large areas of productive rainfed land, and enormous potential for irrigation from the Nile and its tributaries. But Sudan has often failed to produce enough food for its population, largely due to civil conflicts, periodically adverse climatic conditions and poor agricultural systems.

Agricultural research and development is helping to increase food self-sufficiency and improve the nutrition and income of the rural poor in Sudan.

ICARDA's cooperation with Sudan dates back to 1979 when the Nile Valley Project (NVP) was established. It is aimed at contributing to food security and increasing the incomes of smallholder farmers by improving crop yields and quality in Sudan. ICARDA works with Sudanese scientists to develop germplasm and improved technologies that enable Sudanese farmers to increase crop productivity and yield stability in a sustainable manner, and fosters human resource development through training. The Sudan/ICARDA collaborative program focuses on four important food crops: faba bean, lentil, chickpea, and wheat. ICARDA's backstopping has played a substantial role in the development of improved cultivars released by the Agricultural Research Corporation (ARC), Sudan. They include seven new cultivars of faba bean, eight of chickpea, three of lentil, and five of wheat.

Faba Bean

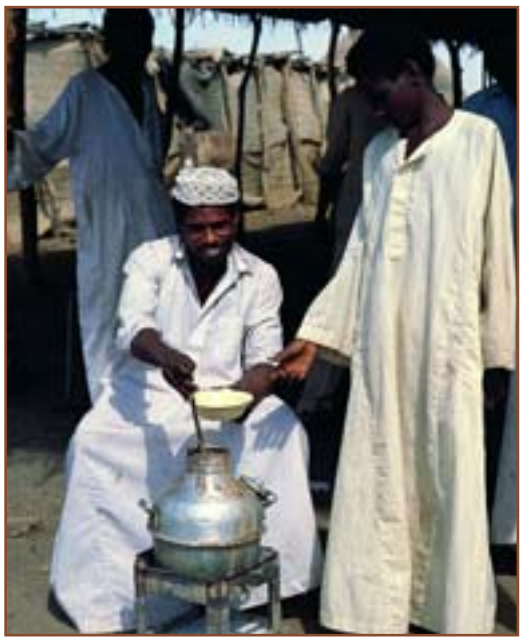
Suitable cultivars have been identified for different climatic conditions. Cultivar 'SM-L' is suitable for areas in the far north with milder temperatures. For northern Sudan, cultivars like 'Basabeer' and 'Hudeiba 93' that tolerate water shortage have been found suitable. An improved production package for faba bean (early sowing, frequent irrigation, insect pest control, and proper weed control) was developed by the Sudan/ICARDA program and has been demonstrated to farmers for several years. In addition, faba bean has been introduced as a cash crop in North Dar Fur region in the far west, where yields achieved are reasonably high (2.26-3.21 t/ha).

Lentil

Collaborative research with ICARDA has promoted lentil production in northern Sudan where farmers grew little of the crop before. To avoid paying a multi-million-dollar import bill, the government encouraged collaborative on-farm research to demonstrate production potential, facilitated farmers' access to credit to purchase inputs, and offered guaranteed prices. As a result, in the period 1989-93, production area increased from 420 to 10,000 hectares, yields improved from 0.8 to 1.4 t/ha, and total production increased from 340 to about 14,000 tonnes. This helped reduce lentil imports from over 9000 to about 700 tonnes.

There was a setback, however, in the following two years, possibly due to bad weather, constraints in institutional support, and change in policy emphasis. For example, lentil is traditionally grown in the Nile River Governorate, particularly in the Rubatab area. Its productivity increased by 31% during the period 1990-1995 as a result of the adoption of technology package. Due to several adverse factors, however, productivity had been sharply declining (0.4-0.5 t/ha) thereafter.

Research continues and hundreds of lentil accessions are being evaluated every year for adaptability and high yield. A new variety, named 'Nedi', was released in 1998 that achieved an average yield of 1.7 t/ha at Shendi and Hudeiba research stations.



Foul muddamis, ***the most common faba bean recipe, being sold on the roadside in Sudan. Underlying the challenge of increasing food production is the bigger challenge of access of the poor to sufficient food at prices they can afford.***

Chickpea

Over the past 15 years, Sudan and ICARDA have jointly made remarkable progress in chickpea improvement research and technology transfer, making use of germplasm provided by ICARDA and its sister center the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). Evaluation of improved lines at Hudeiba and Shendi stations in 1983/84-1986/87 led to the release of the kabuli variety 'Shendi-1' (line ILC 1335) for farmers in northern Sudan. On-farm evaluation of chickpea lines at Rubatab, Wad Hamid, and Jebel Marra in 1990/91-1992/93 led to the release of line ILC 915 under the name 'Jebel Marra-1'. Evaluation of large- and medium-seeded kabuli chickpea lines has led to the release of large-seeded lines FLIP 88-36C and FLIP 88-44C. On-station breeding at Hudeiba and Shendi resulted in many promising medium- and large-seeded genotypes with 50-100% higher grain yield than the checks ('Shendi-1' and 'Jebel Marra-1'). 'Atmor', 'Salawa', and 'Wad Hamid', which are resistant to wilt and root-rot diseases, were released in 1996; and 'Matama' was released in 1998. Apart from selection and breeding, researchers addressed major agronomic aspects of chickpea cultivation including optimum sowing time, crop establishment, nutrition, and irrigation.

Wheat

In collaboration with Sudan and other countries involved in the Nile Valley and Red Sea Regional Program, ICARDA has established a Thermo-Tolerance Network to enhance wheat productivity by improving its adaptation to high temperatures. Evaluation studies led to the identification of several high-yielding cultivars adapted to heat stress, including 'Seri 82', 'Anza', 'El Neilain', 'Condor's/Baladi #18', 'Attila', and 'Pfau/Vee #5'. In the short-winter zones of Sudan, wheat is now an attractive crop as it has few competitors for labor during the periods of peak demand and, in addition to generating cash, is a leading import-substitute crop at the national level.

Wheat self-sufficiency, which increased from 13% in the mid 1980s to over 60% in 2002, is a realistic possibility for Sudan. ICARDA is assisting Sudan in an extensive program of on-farm verification trials and demonstrations of production technologies.

Seed Security

Training of staff from national seed programs has been a key activity of ICARDA since 1995. Using a train-the-trainers approach, ICARDA has organized in-country courses on forage and pasture seed production and quality assurance in seed testing in collaboration with Sudan's Seed Administration and local seed companies. This has helped Sudan to improve forage and pasture seed production and to meet quality assurance standards set by the International Seed Testing Association.

Wheat Self-sufficiency is improving in Sudan, thanks to the development and adoption of improved varieties and production technologies.

An efficient seed-supply system can help ensure that the results of agricultural research, in the form of quality improved seed, are made available to farmers.

On-farm trials of lentil. The trials have helped in the development of locally-appropriate technology packages, and have been a major factor in Sudan's march towards self-sufficiency in this important crop.

Capacity Building and Institutional Development

Institutional development in support of agricultural research is critical. ICARDA is cooperating with ARC in a wide spectrum of human resource development efforts, such as training, development of linkages, strengthening of facilities for on-farm and on-station research, and access to publications. To improve the skills of a large number of researchers and technicians from Sudan, ICARDA has so far organized 33 degree, 121 group, 74 individual, 44 regional and 111 in country training courses. As of 2003, ICARDA had

Training of Sudanese scientists at ICARDA has helped improve the efficiency of the country's research efforts.

provided training opportunities to over 400 researchers from Sudan in key areas of agricultural research, including biotechnology, geographical information system and remote sensing, biometrics, information technology, and information management. Policy makers have also been involved through field visits and briefings on research results.

Training also covers cutting-edge science. For example, a Sudanese researcher, Imad Eujayl (seen in the picture on left), worked at ICARDA for his Ph.D. in biotechnology in collaboration with the University of Helsinki, Finland, and earned the degree in 1998. He succeeded in tracking the genes for frost susceptibility and vascular wilt in lentil, using the technique of gene mapping. "I am from the Sudan, where we use lentil a lot. It is an important source of protein," says Imad. "It is our breakfast—we call it aadis—and our national program has made great strides in lentil production over the last few years. Lentil producers can now use improved lines with resistance to both abiotic and biotic stresses." The trick is to get down to the DNA. There is no less than two meters of DNA in a cell. Incredibly, once treated, it can be seen with the naked eye, "like long, thin strands of cotton," says Imad. "Biotechnology is like any science or engineering product, including the automobile; it is as safe or as dangerous as the people who use it."

Regional Cooperation

At the regional level, ICARDA cooperates with Sudan through the Nile Valley and Red Sea Regional Program (NVRSRP), which encompasses Egypt, Eritrea, Ethiopia, Sudan, and Yemen. NVRSRP facilitates contact within and between the national agricultural research systems of the participating countries. In September 1995, a Regional Networks Project was formally established to find solutions to the major biotic and abiotic stresses facing the five cool-season cereal and food legume crops in the region. The network seeks to bring the national and international researchers together to solve common problems through sharing their experience and expertise, to optimize the use of limited financial and human resources available for research, and to promote technology transfer to farmers. The networks are still operational thanks to support from the International Fund for Agricultural Development.■

Eritrea's Rough Road ...

Continued from page 27

Unit at ICARDA has been focusing attention on institutional problems in the seed supply system, particularly in the countries of North Africa and the Nile Valley. Eritrea was part of a study on seed security assessment in drought areas, which was conducted by ICARDA between 1996 and 1998. The study was undertaken to find ways to mitigate food insecurity by restoring or maintaining the food production capacity of farmers in disaster-stricken environments.

Human Resource Development

Since its establishment in 1977, ICARDA has considered training, capacity building, and networking as essential to develop effective and sustainable national agricultural research systems. During the period 1978-2001, ICARDA provided training opportunities to over 90 Eritrean researchers in a wide range of disciplines. Also, several researchers have conducted their MSc and PhD research at ICARDA.■

Sources of resistance to yellow rust in new wheat germplasm from ICARDA.

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Recent Publications

Rangelands of the Arid and Semi-Arid Zones in Uzbekistan. 2003. Gintzburger, G., Toderich, K.N., Mardonov, B.K. and Mahmudov, M.M. Published jointly by CIRAD, France and ICARDA, Syria. ISBN CIRAD 2-87614-555-3; ISBN ICARDA 92-9127-137-8. 426 pp. This book presents a panorama of the biodiversity of the arid and semi-arid regions of Uzbekistan, their climatology, native flora (about 150 dominant range species described) with their ecology, fodder properties, utilization and range rehabilitation techniques, and with reference to other Mediterranean arid and semi-arid zones of the world. It also describes the location, the particular ecology, the specific flora and fauna of the natural reserves and national parks of Uzbekistan.
Price: 70 □.
Please order from :La Librairie du Cirad, TA283/04, avenue Agropolis, 34398 Montpellier Cedex 5, France. Librarie@cirad.fr , www.cirad.fr

A Field Guide for Cereal Disease Management: Diseases of Barley and Wheat in Eritrea. 2003. Yahyaoui, A.; Ezzahiri, B.; Havmoller, M.; Jahoor, A. 83 pp. ISBN: 92-9127-145-3. This pocket field guide is the result of detailed field surveys conducted by the authors on barley and wheat diseases in Eritrea during 2000-2003. It describes the distribution of the prevalent diseases, and provides guidelines to conducting surveys. For each pathogen, there is a description of symptoms and disease management methods appropriate for Eritrea.
Price: US$ 15.

Setting Agricultural Research Priorities for the Central and West Asia and North Africa Region (CWANA). Toward a New NARS/NARS and CGIAR/NARS Collaboration Spirit. 2003. Belaid, A.; Solh, M.; Mazid, A. 48 pp. ISBN: 92-9127-138-6. This report is the outcome of a global effort that aims to set agricultural research priorities for the CWANA region by developing a plan that might make best use of limited resources for the good of all the region's rural poor.
Price: US$ 10.

Seed Economics - Commercial Considerations for Enterprise Management in Developing Countries. 2003. Kugbei, S. (Revised Edition). 182 pp. ISBN: 92-9127-132-7. This book is intended for technologists who need to understand seed economics or economists who have become involved in seed enterprises. The publication is a useful contribution to developing seed supply systems that will help farmers reach quality seed.
Price: US$ 35.

The Socioeconomic Factors Affecting Grasspea Consumption and the Incidence of Lathyrism in Ethiopia. 2003. Dadi, L.; Teklewold, H.; Aw-Hassan, A.; Abdel Moneim A.M.; Bejiga, G. Integrated Natural Resource Management: Technical Research Report Series No. 4. 55 pp. ISBN 92-9127-136-X. This report presents the results of socioeconomic investigations of grass pea growers in selected provinces of Ethiopia, and provides useful insights into the social and economic factors influencing the utilization of grass pea, and thereby contributing to the incidence of lathyrism in rural communities in Ethiopia.
Price: US$ 10.

Drought, Livestock Losses and the Potential for Feed Production from Arable Land in Afghanistan: A Case Study of 183 Villages with Mixed Crop/Livestock Farming Systems. Thomson, Euan, Terence Barker and Joaquin Mueller. 2003. Integrated Natural Resource Management Research Report Series, No. 5. 42 pp. ISBN: 92-9127-143-7. An important element in any multi-component, long-term strategy to restore the productivity of livestock in Afghanistan is the production of more high-quality feed, by growing forage crops on fallow land and improving the yields of the existing feed crops. This would have a positive impact on the health and livelihoods of the rural and urban poor. However, there are risks associated with over-promoting the growing of forage crops on fallow land. Future efforts to increase feed supplies in Afghanistan should take note of the lessons learned from earlier programs in the region.
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