ICARDA
Caravan
Issue No. 14, June 2001

Review of agriculture in the dry areas

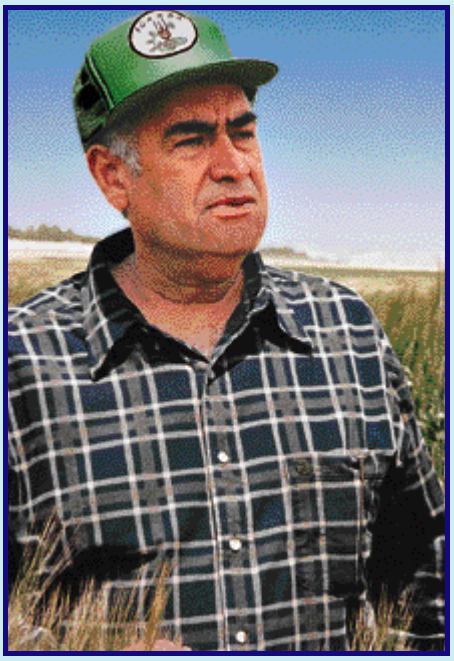
In this special issue on Information and Communication Technology:

From the Director General

Advances in technology are changing the world fast. People many time zones away are as near as our telephone, or our computer. News from around the world is delivered to our homes, live, as if the events were taking place next door. I believe that these same technologies that are bringing the world closer together can improve the lives of the millions of people who still endure poverty and hunger.

This issue of *Caravan* focuses on the use that ICARDA is making of information technologies to improve the lives of people in the world's dry areas. ICARDA uses different information technology tools such as expert systems, geographic information systems, information management, and WorldWide Web-based systems.

The expert systems technology is one of the successful applications of artificial intelligence. It is used to transfer the expertise of highly qualified experts in different domains to practitioners in those domains. Expert Systems (ES) have been developed in different fields such as aerospace, medicine, agriculture, and other disciplines. ICARDA has been collaborating with the Central Laboratory for Agricultural



Expert Systems (CLAES), Egypt for more than five years in developing expert systems for the production of wheat, faba bean, and cucumber. ICARDA and CLAES have been jointly conducting an annual regional short-term training course on Utilization of Expert Systems in Research and Production for the last five years. The aim of this course is to enhance human resources in ES technology in the Central and West Asia and North Africa (CWANA) region.

The Geographic Information System (GIS) is another exciting technology that, when combined with global positioning systems (GPS) and remote sensing, can give communities a vivid picture–maps–of their physical and social environment. With this information, communities can plan for a sustainable future, better informed about the production potential and limitations of their natural resources.

The most prominent feature of GIS is its graphical representations of spatial data, but for researchers it is the ability of GIS to reveal the relationships hidden within diverse, seemingly unrelated data.

To increase the efficiency of its collaborative research with the National Agricultural Research Systems (NARS), ICARDA places major emphasis on the use of new tools for sharing information. The Center cooperates with other players in information technology in developing appropriate databases. The Regional Information Network for West Asia and North Africa, an initiative that has

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Cover: *An ICARDA researcher uses a palm-top to record field trial data (above), and another researcher uses a touch screen and a computer to capture DNA marker data.*

been jointly undertaken by ICARDA, AARINENA (Association of Agricultural Research Institutes in the Near East and North Africa), FAO, GFAR (Global Forum for Agricultural Research) and CLAES is a good example of how developments in information technology are benefiting our regional partners.

Of course, the rapid spread of the Internet is a tremendous advance. It is allowing us to communicate much more quickly and efficiently with our cooperators. It helps avoid duplication of effort and thereby increases the relevance and impact of research. The Center's Communication, Documentation and Information Services Unit is making increasing use of computer networks, in pace with the rising availability of the Internet in CWANA. In time, all key information that ICARDA produces will be readily available "over the Net."

ICARDA promotes the use of information technology in NARS through a series of training courses, and consultancies. The Center recognizes that if NARS and ICARDA scientists have to work as equal partners, they must be able to keep pace with the advances in technology. The training courses are carefully designed based on needs of individual NARS, and have helped in producing a cadre of colleagues with advanced skills in information and communication technologies in national programs.

Prof. Dr Adel El-Beltagy
Director General

The use of trade names in Caravan does not imply endorsement of, or discrimination against, any product by the Center. Maps have been used to support research data, and are not intended to show political boundaries.

About ICARDA and the CGIAR

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

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

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

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

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

The World Bank, the Food and Agriculture Organization of the United Nations (FAO), and the United Nations Development Programme (UNDP) 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.

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Presentation Day: The Mission Continues Board Chair Robert Havener Tells Guests

Strides made in achieving mission

True to its mission, ICARDA has made giant strides in improving the welfare of the poor in dry areas, said Mr Robert Havener, Chair of the Center's Board of Trustees, addressing the Presentation Day 2001 guests at ICARDA headquarters at Tel Hadya, Syria.

"The CGIAR founders placed very high priority in addressing the problems of agriculture in the rainfed and drought-prone areas," Mr Havener said. The Consultative Group on International Agricultural Research (CGIAR), of which ICARDA is a member center, was established in 1971 with support from the Ford and Rockefeller Foundations.

The International Development Research Centre implemented the establishment of ICARDA in 1975 with support from the Government of Canada. ICARDA was entrusted the mission of improving the welfare of the poor by improving barley, durum wheat, food and feed legumes, small ruminant production and nutrition, and farm resource management in this part of the world, he explained.

"That vision of the founders of ICARDA has continued to guide the Board of Trustees and staff of the Center in their work, and the Center has made giant strides in fulfilling its mission," Mr Havener said.

Mr Robert Havener, ICARDA Board Chair

ICARDA was honored to welcome many distinguished guests to its Tel Hadya headquarters for Presentation Day 2001, on 24 April. Among those who participated in the program were H.E. Mr Asa'ad Mustafa, Minister of Agriculture and Agrarian Reform; H.E. Dr Ahmed Kabalan, former Minister of Agriculture, Syria; Dr Zuhair Zannouneh, Minister of Agriculture, Jordan; H.E. Mr Mohamed Amamou, Secretary General of the Maghreb Union, Tunisia; H.E. Rasulmat Khusanov, DG, Uzbek Research Institute of Market Reforms and former Minister of Agriculture, Uzbekistan; H.E. Shermat Numatov, Vice Minister of Agriculture, Uzbekistan; Dr Hasan Seoud, DG, Arab Center for Studies of the Arid Zones and Dry Lands; Dr Fadia Nousier, Under-Secretary for Agricultural Foreign Relations, Ministry of Agriculture and Land Reclamation, Egypt; Dr Nazal Al-Daiery, Former Minister of Agriculture, Syria; Gen. Abdel Wahab El-Wateedy, DG of Marsa Matrouh Resource Management Project, Egypt; Dr Abdul Nabi Fardous, DG of National Center for Agricultural Research and Technology Transfer, Jordan; Ambassadors of: Canada, H.E. Mr F.D. Pillarella; France, H.E. Mr Charles Henri d'Aragon; India, H.E. Mr K.M. Meena; Japan, H.E. Mr Kischichiro Amae; Pakistan, H.E. Mr S. Yahya Naqvi; Sudan, H.E. Mr Abel Hafez Ibrahim Mohamed; UK, H.E. Mr Henry Hogger; Consul General of Turkey, Mr Hulusi Kiç; Consul General of the Russian Federation, Mr Vagif M. Garaev; Consular and Deputy Head of Mission of Germany, Dr Ingrid Harff, and other senior officials from diplomatic missions in Syria; senior government officials and representatives from collaborating research institutions from Central and West Asia and North Africa; the press; and other friends of ICARDA.

Among the distinguished guests were (front row) H.E. Dr Zuhair Zannouneh (fifth from left), Minister of Agriculture, Jordan; H.E. Mr Mohamed Amamou (fourth from left), Secretary General of the Maghreb Union, Tunisia; H.E. Dr Ahmed Kabalan (fourth from right), former Minister of Agriculture, Syria; H.E. Mr Charles Hendi d'Aragon (left), Ambassador of France to Syria; H. E. Mr K.M. Meena (right), Ambassador of India to Syria; and Dr Hasan Seoud (second from right), Director General of the Arab Center for Studies of the Arid Zones and Dry Lands, Damascus.

The Challenges Can Be Met
—Prof. Dr Adel El-Beltagy, DG

Prof. Dr Adel El-Beltagy, ICARDA Director General, explained some of the challenges of agriculture in dry areas, and expressed optimism "that these challenges can be met." This optimism is "supported by the results of our research work," Prof. Dr El-Beltagy said. The Director General cited ICARDA's diverse research collaboration with national agricultural research systems and advanced institutions aimed at making sustainable use of key natural resources: soil, water, and biodiversity. The problems associated with drought are dealt with using a wide array of tools, including biotechnology, remote sensing and Geographic Information Systems, while the socioeconomic character of farming communities is assessed in order to develop appropriate technology packages and policy options designed to improve income and nutrition.

He highlighted ICARDA's increased engagement in global conventions, in particular the United Nations Convention on Combating Desertification (UNCCD), to keep pace with the changing external environment that impacts international agricultural research and development. He stressed the dangers posed by global climate change, and cited examples of new crop varieties and technologies that might help dry areas remain productive. Farmers are full partners in ICARDA's research, said Prof. Dr El-Beltagy, in describing ICARDA's success in farmer-participatory plant breeding, which blends indigenous knowledge of farmers with modern research methodologies to develop crop varieties and technologies suitable for specific environments. The work won the CGIAR Chairman's Award in 2000. Prof. Dr El-Beltagy summarized the rapid progress that ICARDA has made in strengthening its partnerships with countries in Central Asia and the Caucasus (CAC), and some key achievements made in increasing agricultural production and protecting the natural resource base through joint programs in CAC. The CAC countries are now full partners of ICARDA, similar to the West Asian and North African countries, he said.

Presentation Day guests toured the farm trials and laboratory facilities at ICARDA to take a closer look at the Center's research activities.

In summarizing ICARDA's training record, he reported that more than 10,000 researchers from 90 countries have received training through the Center since its establishment. In 2000, 616 researchers from 51 countries participated in courses organized by ICARDA at its headquarters and in partner countries. Another 71 persons are conducting research at the Center as part of their MSc and PhD requirements.

Prof. Dr El-Beltagy expressed ICARDA's gratitude to donors and to the Center's partners in more than 44 countries worldwide for their commitment to promote agriculture and conserve the natural resource base in the dry areas. He also thanked the Government of Syria for becoming a member of the CGIAR, which, he said, reaffirmed Syria's commitment to promote agricultural research and development for increased prosperity in the country and the region.

ICARDA Board of Trustees Meetings

The Board of Trustees (BoT) held its meetings at ICARDA from 22 to 26 April 2001. Prior to the start of the meetings, an orientation program for the new Board Members was organized.

The major agenda items were: approval of the minutes of the meeting of the Board held in Tehran in May 2000, and of the Executive Committee Meeting held in Washington D.C. in November 2000; discussion on and development of a response to the recommendations in the Status Paper of the Change Design and Management Team of the CGIAR; review of the audited financial statments for the year 2000, and performance in 2001, program of work and budget for 2002, and the Mediun-Term Plan 2002 to 2004 in light of the recommendations of the Audit Committee and the Program Committee; staff matters; follow-up on the External Program and Management Review of the Center, based on the recommendations of the Program Committee; and appointment of new Board Members and formulation of the Standing Committee of the Board, based on the recommendations of the Nomination Committee.

A brief ceremony was organized on Presentation Day to recognize the contributions of two outgoing Board members: Dr Raoul Dudal, a Belgian national, and Dr Luigi Monti, an Italian national. Board Chair Mr Robert Havener paid tribute to both Dr Dudal and Dr Monti for their outstanding role in guiding the growth and development of ICARDA, and in attracting increased donor funding. Prof. El-Beltagy said this ceremony was not to say good-bye to Drs Dudal and Monti because, like other Board members who have retired, they both will be ICARDA's "Ambassadors-at-Large" forever. He praised their significant contributions to the Center, and expressed ICARDA's gratefulness.

Drs Dudal and Monti, in response, said they enjoyed working on ICARDA's Board, and wished the Center well in fulfilling its noble mission.

Two new members were appointed to replace Drs Dudal and Monti and they started their term from 27 April 2001: Dr Teresa Fogelberg of the Netherlands and Prof. Rosa Rao of Italy. The former specializes in environmental matters and the latter in the application of biotechnology for crop improvement.■

ICARDA Board of Trustees with H.E. Dr Zuhair Zannouneh (center, left), Minister of Agricultute, Jordan, and Dr Abdul Nabi Fardous (third from left, front row), Director General of the National Center for Agricultural Research and Technology Transfer (NCARTT), Jordan during the Presentation Day program.

As an expression of their appreciation for ICARDA's role in Uzbekistan, H. E. Mr Rasulmat Khusanov (second from left), Director General of the Uzbek Research Institute of Market Reforms and former Minister of Uzbekistan, and H.E. Mr Shermat Numatov (second from right), Vice Minister of Uzbekistan, presented the traditional dress of Uzbekistan to Prof. Dr Adel El-Beltagy (center), ICARDA Director General, and his deputies.

Departing Board members Drs Raoul Dudal (second from left) and Dr Luigi Monti (fourth from right) pose for a souvenir picture with Dr Margaret Caltley-Carlson (third from left), ICARDA Board member, Dr M.C. Saxena (left), Assistant Director General (At-Large), Dr Fadia Nussir (third from right), wife of Board member Dr Mamdouh Sharafeldin, Mrs Shadia Solh (right), and Mrs Jumana El-Sebae Ahmed. Both Drs Dudal and Monti wore the traditional attire of Uzbekistan presented to them by the ICARDA Director General to recognize their role in promoting and expanding ICARDA's activities in Central Asia.

ICARDA Hosts 80th TAC Meeting

The 80th meeting of the Technical Advisory Committee (TAC) of the Consultative Group on International Agricultural Research (CGIAR) was held at ICARDA on 26-30 March 2001. More than 30 participants, including TAC members, CGIAR Center Directors General, and donor representatives attended the meeting.

In his opening remarks, TAC Chair Dr Emil Javier characterized this year's meeting as "most intense and exciting" because of the challenges the CGIAR System is facing. TAC advises the CGIAR on emerging trends in science and their importance to the overall goals of the CGIAR System. It oversees the research agendas of the CGIAR Centers, ensuring quality and consistency with the vision and strategic priorities of the CGIAR. It also assesses the impact of research conducted by the Centers.

Dr Javier welcomed TAC members, and donor representatives from France, Germany, Italy, and USA, "whose presence reaffirmed their countries' interest in the work of TAC and the CGIAR System," he said.

"Given our commitment to alleviate poverty, we have elevated our aim in trying to help the poor people through science and through our partnerships," Dr Javier said.

He acknowledged the presence of the new CGIAR Director, Dr Francisco J.B. Reifschneider, and colleagues from the Secretariat; Mr R. Havener, Chair of ICARDA's Board and Vice-Chair of the Center Board Chairs Committee; Prof. Dr Adel El-Beltagy, DG of ICARDA; Dr Hank Fitzhugh, DG of ILRI and the Chair of Center Directors Committee; Dr Frank Rijsberman, DG of the International Water Management Institute; and officials from the TAC Secretariat.

In his welcoming remarks, Prof. Dr El-Beltagy expressed appreciation for the work of TAC, as the CGIAR and international agricultural research finds itself at a "crossroads for change."

"This meeting gives us time for meditation and contemplation as we look to a new horizon, to fulfill our goals and objectives," Prof. Dr El-Beltagy said.

"In the face of diminishing natural resources, our research activities should be dynamically geared to have a positive impact on the welfare of the poor and the health of this planet," he said.

Opening session of the TAC80 meeting. Dr Emil Q. Javier (second from right), TAC Chair, welcomed the participants to the meeting. Prof. Dr Adel El-Beltagy (second from left) said ICARDA was pleased to host the meeting. Dr Francisco J.B. Reifschneider (left), Director of the CGIAR Secretariat, summed up the recent major developments in the System. Seated on right is Dr Shllemiah O. Keya, Executive Secretary, TAC.

Dr Reifschneider thanked the ICARDA Director General for his welcome and said that the way to move forward hinged on resource mobilization and the adoption of a coherent and common strategy in consultation with CGIAR members and partners.

TAC Participants See Research in Action

Prior to their meeting, the TAC participants traveled to Khanasser Valley, north of Aleppo, one of the major research sites of ICARDA for integrated natural resource management.

Their first stop was Jabul Salt Lake, at the northern end of the Valley, where Drs Willie Erskine, ADG (Research), and Adriana Bruggeman, Hydrologist, explained ICARDA's integrated approach to sustainable natural resource management in dry areas. Robert Hoogeveen then explained the groundwater system of the Valley and how over-pumping for irrigation is causing intrusion of salt water from the lake into the Valley. The group then continued to Shallalah Saghirah, a small village in the shadow of the Jebel Al Hoss, where Ms Joshka Wessels, Anthropologist, explained her action research with the villagers that led to community renovation of a *qanat*, an ancient water system that is the only

TAC participants see a **qanat***, which is the only source of water both for drinking and irrigation in the Khanasser Valley.*

source of drinking and irrigation water for the village.

In the village of Rasm Hamid, Livestock Specialist Dr Luis Iniguez explained that the fattening of sheep and the production of milk products can substantially improve the income of people in the Valley. After enjoying the tea served in a traditional style in a farmer's house, and discussions with the farmer, the group continued through Al Hobs Valley. In this small side-valley, the group looked at olive groves planted on stony slopes, fed by simple water-harvesting techniques. Within just three years, several farmers in the Valley have adopted these techniques, returning land to productivity.

In partnership with community members and the Syrian national agricultural research system, ICARDA is working to create sustainable and improved livelihoods for the people of Khanasser Valley. The resource management approaches developed or improved in Khanasser will be applied in dry areas elsewhere in Syria and in other countries.

Further south, in Qurbatieh, Irrigation Specialist Dr Theib Oweis explained strip crop water harvesting, which guides runoff water from bare strips of land to cropped strips. His experiments include a rotation of vetch and barley, two levels of fertilization, and four crop-to-runoff-strip ratios.

The group enjoyed the hospitality of a farmer in Khanasser Valley in a traditional style in his house. Right to left: Dr Michael Cernea, TAC Liaison Officer for ICARDA; Dr Emil Q. Javier, TAC Chair; Mr Robert Havener, ICARDA Board Chair; Prof. Dr Adel El-Beltagy, ICARDA Director General; the host farmer; and Dr Willie Erskine, Assistant Director General (Research).

At the next stop, the participants saw barley intercropped with indigenous saltbush (*Atriplex halimus*). Dr Mustapha Bounejmate and Fahim Ghassali, Forage and Feed Products Specialists, explained that interplanting saltbush with barley reduces land degradation and provides protein-rich feed for sheep.

From Qurbatieh the group drove into the *badia* (steppe) and was received by senior officials of the Aleppo Steppe Directorate in a traditional Bedouin tent overlooking the diverse rangeland vegetation. During lunch, research fellows Shibani Ghosh and Rahmouna Khelifi explained their work on child nutrition and the contribution women make to the accumulation of household assets in rural communities. The studies compare households in different agricultural production systems in Khanasser Valley and other areas of Syria. Finally, Dr Mustapha Bounejmate and Nabil Bathikha explained ICARDA's successful cooperation with the Steppe Directorate in the management and rehabilitation of rangeland.

On their way back to Aleppo, the group had the rare opportunity of experiencing rainfall on the steppe.■

Director General Honored by Kyrgyz Agrarian Academy

ICARDA Director General, Prof. Dr Adel El-Beltagy, has been elected an Academician of the Kyrgyz Agrarian Academy in recognition of his contributions to agricultural research in general and in development of the CGIAR and ICARDA collaborative research activities in Central Asia and the Caucasus in particular.

The honor was bestowed in early June while the Director General was in Kyrgyzstan to attend a Ministerial-Level Meeting in Issyk-Kul and visit the Kyrgyz Agrarian Academy in Bishkek.

Prof. Dr El-Beltagy was earlier elected a member of the Russian Academy of Agricultural Sciences and the Georgian Academy of Agricultural Sciences.■

Prof. Dr Adel El-Beltagy (fourth from right), ICARDA Director General, was conferred the honor of Academician of the Kygyz Agrarian Academy, during his visit to Kyrgyzstan to participate in the Ministerial-Level Fund-raising Meeting. Among those present on this occasion were Academician Jamin Akimaliev (third from left), President, Kyrgyz Agrarian Academy; Prof. Azimkhan Satyabaldin (second from right), Director General, National Academic Center for Agricultural Research, Kazakstan; Dr Timothy Reeves (right), Director General, CIMMYT; and Dr J.P. Srivastava (fourth from left), Principal Agriculturalist, The World Bank.

An Expert System for Irrigated Wheat in Egypt

By Ahmed Rafea,
Soliman Edrees,
and Mahmoud Mostafa

The NEPER wheat expert system was developed at the Central Laboratory of Agricultural Expert Systems (CLAES) in Egypt, in collaboration with the Field Crop Research Institute, Egypt, the Intelligent Systems Laboratory of Michigan State University, and the International Center for Agricultural Research in the Dry Areas (ICARDA). This system has been verified, validated, and tested in the field. The laboratory evaluation has shown that NEPER performance is comparable to human expertise, while field evaluation has shown that it can produce good economic and environmental impact.

In Egypt, bread made from wheat is called *aish*, which is also the word for life. The importance of bread in the Egyptian diet and elsewhere in the world was the motivation behind NEPER, a computer-based tool for decision-making in growing wheat crop.

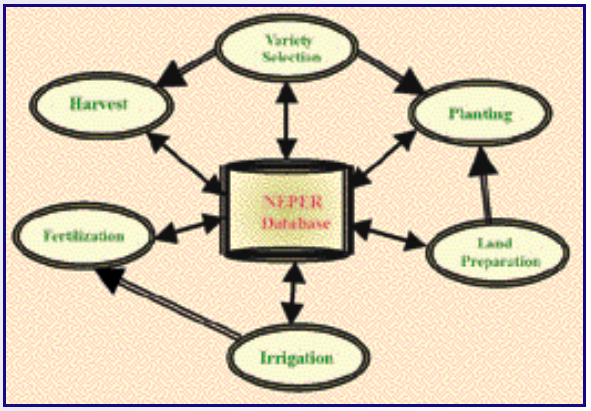
Developed and improved throughout the 1990s, the system is now proving its worth. It combines an expert system with a crop simulation model to address all aspects of irrigated wheat management in Egypt.

NEPER is an easy-to-use Microsoft Windows-based application with an English and Arabic interface. It can be used to seek advice on:

- Selecting the right variety for a specific field
- Advising farmers on field preparation
- Designing schedules for irrigation and fertilization
- Controlling pests and weeds
- Managing harvests
- Diagnosing plant nutrition problems
- Diagnosing disorders
- Suggesting treatments

Strategic component

NEPER is made up of two main integrated components: strategic and tactical. The strategic component consists of six subsystems, namely: variety selection, land preparation, planting, irrigation, fertilization, and harvest. Each subsystem has its own database. There is also a common database, which allows the combination and sharing of outputs from some sub-systems.



NEPER strategic component structure

The database component is used to gather the required inputs. Four types of database were developed: farm, soil and water, equipment, and fertilizer.

The variety selection subsystem identifies the appropriate varieties for a specific site based on various parameters, such as soil type, soil salinity, drought, weather, and resistance to certain diseases. The output of this subsystem is used by other subsystems, such as the planting and harvest subsystems.

NEPER strategic component main menu

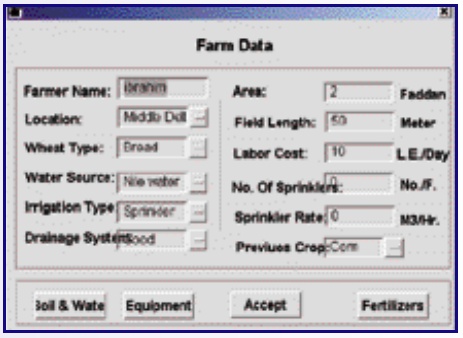
The land preparation subsystem gives recommendations on how to prepare soil, such as tillage, drainage system maintenance, clearing the previous crops and summer weeds, and soil leveling. The planting subsystem uses the output of this subsystem.

The planting subsystem determines the appropriate planting date, planting method, and seed rate. It uses the outputs of other subsystems (variety selection, land preparation) as inputs.

The irrigation subsystem produces a schedule for irrigation, including quantity, intervals, and irrigation time. It takes into consideration soil type, soil salinity, water quality, rain, and temperature, for each site.

The fertilization subsystem generates a fertilization regime, including fertilizer type, dose, and application time, based on soil fertility, previous crops, water quality, planting type, and other factors.

The harvest subsystem recom-



Farm data

mends harvest date and harvest machinery to be used.

Tactical component

NEPER's tactical component consists of three subsystems: diagnosis, weed identification, and treatment.

The weed identification and control subsystem helps users identify weeds and advises on control measures. The subsystem currently covers 53 weeds and includes detailed images and sketches

The disorder diagnosis subsystem is used to identify diseases, insect pests, and plant nutrition problems. It currently covers 19 diseases, 11 insects, and the deficiency and excess of eight elements.

The treatment subsystem recommends treatments for the identified disorder.

NEPER impact

The system was tested in six locations covering most of the wheat-growing area in Egypt. Promising results were obtained.

Three experiments were conducted in three different seasons. Two of the experiments were run on 32 fields each. The third was run on 44 fields. Sixteen fields in the first two experiments were managed using NEPER and compared with 16 fields each managed by usual practice, which served as control. In the third experiment, 22 fields were managed using NEPER, and compared with 22 fields managed by usual practice.

Economic impact

In the first experiment, the average net income per *feddan* (0.4 ha approx) for NEPER fields was 2,050 Egyptian Pounds, compared with the control's 1,600 Egyptian Pounds, a difference of 26.8%.

In the second and third experiments, the complete system was tested in Egypt's newly reclaimed area and Delta area. The following was observed:

- In both the newly reclaimed and Delta area, there was an increase in production and net profit, consistently, in two consecutive seasons.
- Percentage increase in net profit in the newly reclaimed area was greater than the percentage increase in net profit in the Delta area.
- Production in the newly reclaimed area was less than in the Delta area, due to the lack of expertise in the reclaimed area.

Environmental impact

The results suggest that the NEPER project goal of environmental conservation is being realized. The fields managed using NEPER used less fertilizer and pesticides than the control fields. The average cost of pesticides used on NEPER wheat fields in the first experiment was more than the control fields by 15.7 Egyptian

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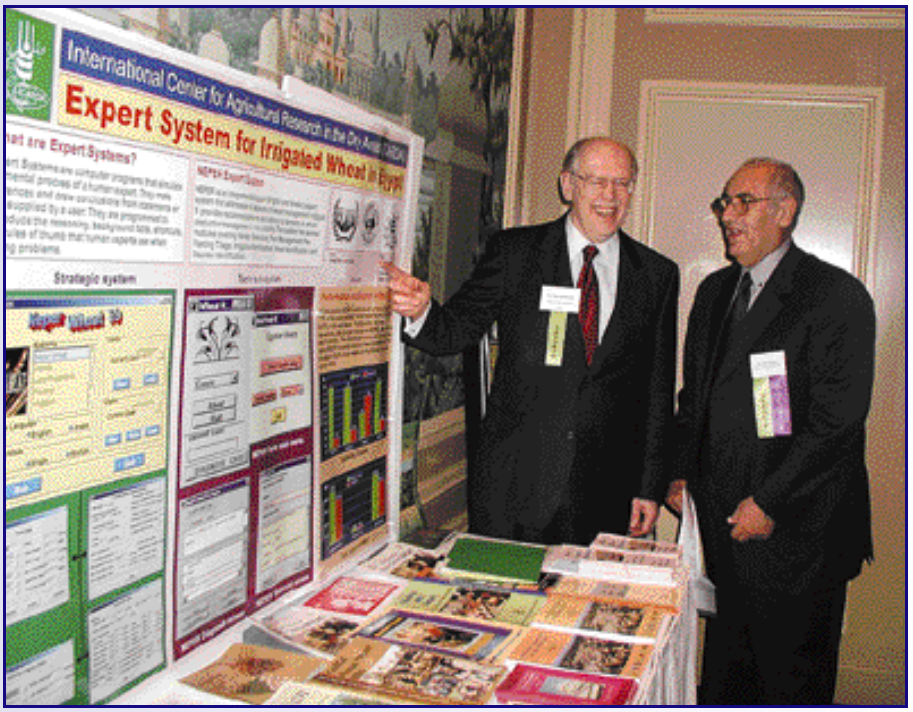
Director General Participates in Global Consortium of Higher Education



A good reason to be happy. The wheat expert system is a joint product of CLAES, MSU (Michigan State University) and ICARDA. Here, Dr M. Peter Mcpherson (left), President of Michigan State University, is seen with Prof. Dr Adel El-Beltagy, ICARDA DG, at the GCHERA Conference in San Francisco, where Prof. El-Beltagy made a poster presentation on the jointly developed expert system.

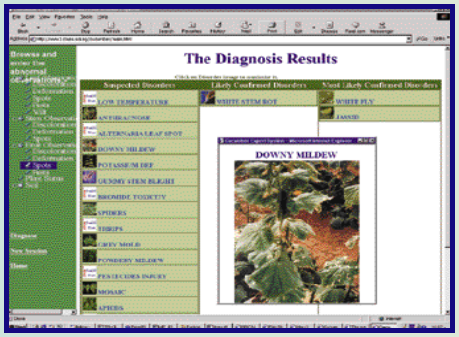
The Global Consortium of Higher Education & Research for Agriculture (GCHERA), based at Purdue University, USA, organized an international conference in San Francisco, USA, entitled "Higher Education and Research for Agriculture and Food System in the 21st Century." The conference covered three major themes: New Sciences in a New Century: Agricultural Research, Life Science and Information Technologies; The Changing Nature of Food Systems and the University Response; and Organizing the University of the Future. Prof. Dr Adel El-Beltagy, ICARDA Director General, participated in the conference as a major discussant in the theme I Session. He took the opportunity to present highlights of ICARDA's work that integrates agricultural research, life sciences, and information technology. At the conference, he displayed a poster on "An Expert System for Irrigated Wheat in Egypt" based on the work done by ICARDA in collaboration with the Central Laboratory for Agricultural Expert Systems (CLAES), Cairo, Egypt, and Michigan State University, USA. Vice-Chancellors and educators from leading universities all over the world attended the Conference.

Faba Bean, Cucumber and Tomato Expert Systems

Other than the wheat expert system for Egypt, CLAES and ICARDA are developing expert systems for faba bean, cucumber and tomato.

Faba Bean Expert System

Faba bean is an important, protein-rich food crop consumed widely in the West Asia and North Africa region. In view of its importance to farmers, a Faba-bean Pest Control Expert System (FPCES) is being developed jointly by CLAES and ICARDA to address the needs for diagnosis and treatment of diseases that attack this crop.The system will display all possible disorders and related symptoms that appear during crop growth. The user will be able to examine the symptoms and correctly diagnose the poblem.The system will then offer possible solutions. It will enable the user to view pictures and videos of the disorders and help in correct diagnosis.



The diagnostic result screen

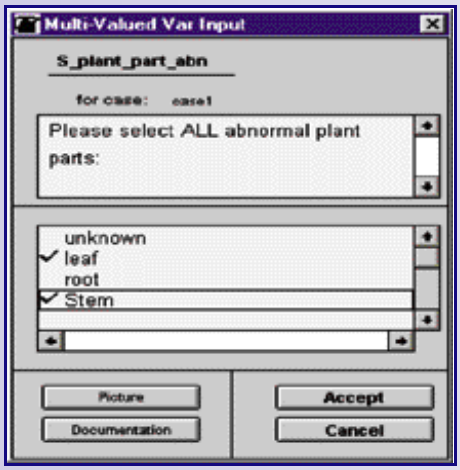
Cucumber and Tomato Expert Systems

ICARDA's Arabian Peninsula Regional Program is collaborating with CLAES in the development of an internet-based expert system for greenhouse cucumber and tomato production, encompassing crop protection and general crop management. The goal is to develop Web-based expert systems in Arabic for these two important vegetable crops for the benefit of extension workers and farmers.

First screen to select the appropriate system

The beta version of the cucumber expert system is now available at: www.claes.sci.eg/cucumber. After testing it will be further improved before it is released for general use. ■

Continued from page 10

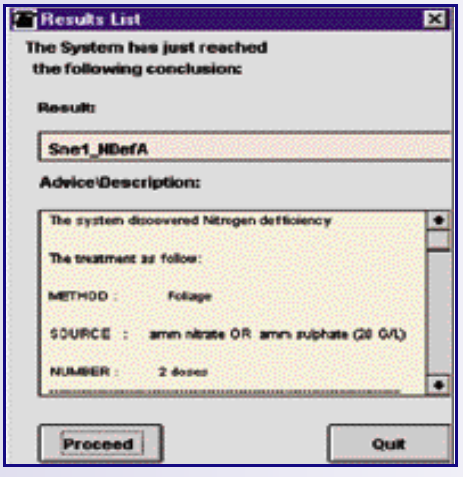


NEPER diagnosis screen

Pounds/feddan, but income increased by 450 Egyptian Pounds/feddan. Thus, the increase of cost in this experiment was negligible. In the second and third experiments the average cost of fertilizer and pesticides used on NEPER wheat fields was less than the control fields by 5.6 and 1.2 Egyptian Pounds/feddan and income increased by 247 and 287 Egyptian Pounds/feddan, respectively. On average, 112.7 m^3 of water was used to produce one *Ardab* (150 kg) of wheat in the NEPER fields, while in the control fields farmers used 152.5 m^3 to produce the same quantity of wheat. This represents a 35% decrease in water use under the NEPER system.

NEPER ready for distribution

The NEPER Wheat Expert System is being distributed to extension officers and growers in Egypt, and plans are under way to make it available on the Internet. According to field experiments, the advice it generates will help growers avoid production problems, which in turn will result in healthier plants, increased production, and more efficient use of resources.



NEPER treatment screen

The system is being enhanced to include an economic and environmental component to rank production alternatives. Integrating NEPER with the CERES simulation model of wheat growth and development is also being considered. ■

Dr Ahmed Rafea is the Director, Dr Soliman Edrees is a Researcher, and Mr Mostafa Mahmoud is an Associate Researcher at the Central Laboratory for Agricultural Expert Systems (CLAES), Giza, Egypt.

Development and evaluation of the NEPER Expert System was funded by the United States Agency for International Development.

ICARDA: Making the Most of Information and Communication Technologies

ICARDA has come a long way since 1979, when a Computer Unit was established to provide information processing services to the two-year-old Center. Since then, ICARDA has become an intensive user of information technology (IT) in all aspects of research, management, and communication, guided by a strategy that has evolved in line with the Center's research agenda and in pace with technological change.

If you stroll the fields of ICARDA's main research farm at Tel Hadya, you might well see researchers holding palm-top computers, recording directly the various plant traits under study. On the steppes of northern Syria or Marsa Matrouh in Egypt, ICARDA rangeland scientists can be seen entering observations in lap-top computers connected to geographical positioning systems. Palm-top and lap-top computers save researchers countless hours of re-transcribing data and vastly improve the accuracy of data collected. These are just a few examples of how ICARDA is making cost-effective use of IT.

ICARDA breeder using a palm-top computer in a barley field.

Information Technology and Research

The impact of IT has been most felt in research into germplasm enhancement, natural resources management, and plant genetic resources conservation. The Center's Computer and Biometrics Services Unit (CBSU) has, in close collaboration with programs and units, implemented or developed systems and databases to store, retrieve, share, manipulate, analyze, and communicate research data.

Using a touch screen and computer to capture DNA marker data in biotechnology laboratory.

By Zaid Abdul-Hadi

ICARDA's biotechnology group uses computers for genetic linkage mapping (using MAPMAKER and JOINMAP software packages) and genetic diversity analysis (using NTSYS). The group also links computers to laboratory equipment to capture genotype and DNA sequence analysis data. Capture and analysis of marker data would otherwise be virtually impossible.

Scientists use specialized tools and statistical packages tailored to meet their needs. Breeding data are stored as QPRO or EXCEL files electronically updated with data from palm-tops. At the end of a cropping season, data are sorted according to selected plant lines and transferred to a file for the following cropping season. Breeders use AGROBASE in their crossing pro-

grams, to update pedigrees of segregating populations, and to produce field books for international nurseries. They use several other software packages, including Alphanal, ASREML, GENSTAT, GEBEI, NTSYS, and SigmaPlot, to analyze breeding data. CBSU has also developed procedures for the analysis of multi-locational trials conducted in randomized complete blocks or incomplete blocks, inter-site transferability of crop varieties, and additive main-effects and multiplicative interactions model using trial data.

Wheat breeders use SYSTAT, AGROBASE, and SAS to analyze breeding data, while MAPMAKER, QGENES, and MQTL programs have facilitated basic research and analysis of the mechanisms responsible for specific plant traits.

Virologists use a digital image analysis system (SigmaScan software) to measure the area and average intensity of lesions representing virus in infected tissue.

The Genetic Resources Unit maintains more than 120,000 seed samples of ICARDA's mandate crops. Each sample is documented according to internationally developed descriptor lists of passport, characterization, and evaluation data. The computer-based system helps curators manage seed stocks and distribute germplasm. All ICARDA scientists can access the Plant Genetic Resources Database (developed using Visual FoxPro) through the Center's local area network (LAN). Since 1997, the database has been part of the CGIAR System-wide Information Network for Genetic Resources (SINGER).

Geographical information systems and satellite image processing tools, including powerful software, such as ESRI's ArcInfo, ArcView, IDRISI, and ERDAS IMAGINE, are used to assess water and soil resources. A meteorological database (MS Access) was developed to store and retrieve records (currently more than a million) from ICARDA's weather station and from countries in the region. Software was also developed to predict crop production based on weather predictions.

A key feature of IT use at ICARDA is the integration of socioeconomic data, natural resources data, and mapping techniques for natural resource management and monitoring. This allows, among other things, the development of simulation models to assist in the evaluation and modification of resource management practices and policy.

System dynamics models have been used to develop water management strategies. For example, information collected from farmers, researchers, and government officials was used to model the interactions among farmers irrigating from a common aquifer. Such models allow the development of alternative policies, technology development strategies, and government regulations related to groundwater use.

Socioeconomics researchers are turning increasingly to quantitative techniques and models for problem solving. Computer and analysis systems today can take raw data and transform them into meaningful information, such as tabulated reports, plots of distributions and trends, and results from a wide variety of statistical procedures.

Farm surveys are used, for example, to estimate costs and returns of crops, to quantify input-output relationships, to monitor technology adoption patterns, or to explore participation of women in farming. The time needed for analysis has been reduced from years to days.

Statistical Package for Social Science is used for detailed data descriptions, basic statistics, cross-tabulations and measures of association, within-cell descriptive statistics and T-tests, correlation analysis, and analysis of variance and regression.

Several years ago, ICARDA set out in cooperation with the Central Laboratory for Agricultural Expert Systems, Egypt, to develop expert systems to help extension services and farmers better manage irrigated wheat and faba bean. The work is now paying off (see page 9).

Biometrics and Statistical Computing

A number of new biometric techniques have been developed for germplasm enhancement and natural resource management. These include, for example, analysis of yield trials with common checks, an index for measuring inter-site transferability of crop varieties, a test for crossover-type genotype by environment interaction and estimate of crossover point, estimation of heritability, estimation and testing of genotypic and phenotypic correlation in plant traits from variety trials, statistical assessment of screening techniques for heat tolerance in wheat, a

The ICARDA Computer Center

procedure for analysis of data from long-term rotation trials, and estimation of time-trends to measure the scale of sustainability of a farming system. Spatial models are used to enhance precision in field trials of barley, wheat, lentil, and chickpea, to increase efficiency of variety selection, and assess species abundance in biodiversity studies.

Management Information Systems and Office Automation

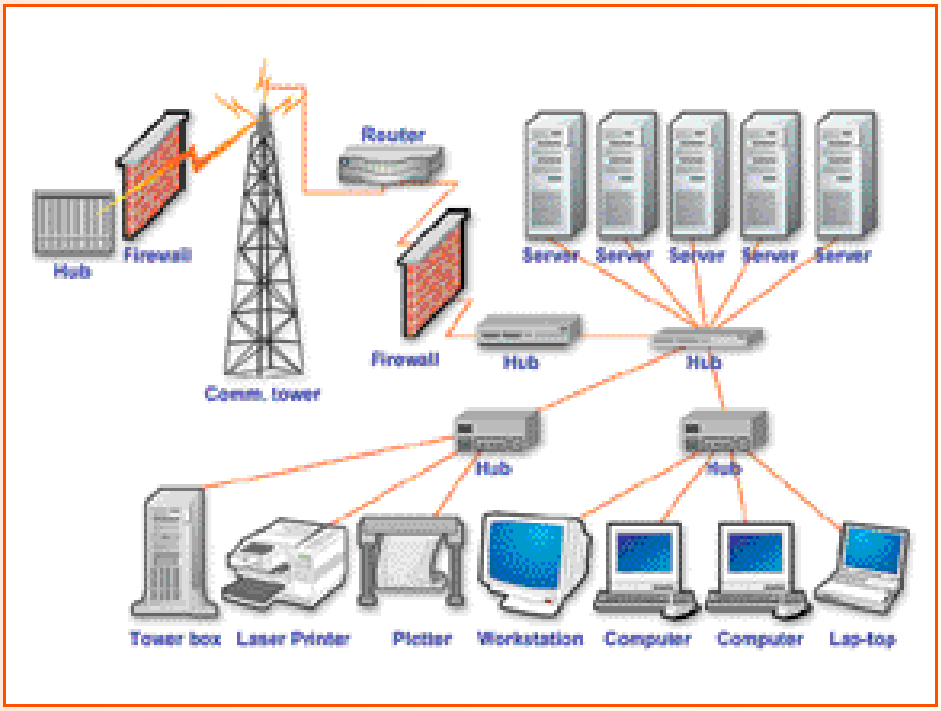
Administration and Finance departments have also benefited from IT. In 1993, ICARDA began implementing an ORACLE-based integrated management information system that handles general ledger, accounts payable, purchasing, inventory, human resources, fixed assets, payroll, and medical bills. Office automation, thanks to software applications for word processing, spread sheets, presentations, and scheduling, has had a dramatic impact on efficiency. E-mail (network and dial-up services) is another key tool.

Training and the Regional Dimension

CBSU conducts several courses for ICARDA and the national agricultural research systems (NARS) personnel annually, including:

- in-house training on IT tools, such as MS-Office products, MS FrontPage, Internet, anti-virus software, and network use; management information systems (Oracle financial suites); biometrics and statistical packages
- individual and group courses at headquarters and in-country (for NARS) on the design and analysis of experiments. These courses provide an invaluable opportunity for NARS scientists to analyze their own data, and prepare manuscripts for publication.

ICARDA also undertakes studies to help NARS develop information technology strategies, e.g., NCARTT (National Center for Agricultural Research and Technology Transfer) in Jordan, and EARO (Ethiopian Agricultural Research Organization) in Ethiopia. It has also assisted in the implementation of such strategies, including installation of LANs and acquisition of hardware and software (see also page 27).



Schematic of ICARDA Computer Network

Information Technology Infrastructure

The IT infrastructure at ICARDA in the 1980s was built around central facilities using mini-computers and user terminals. There was a fundamental shift in the early 1990s to give users local computing power through networked PCs. ICARDA headquarters now has 11 computer servers, 360 PCs, about 80 lap-top computers, 274 printers, 24 scanners, and other peripherals.

The Local Area Network–LAN (TCP/IP)–with its backbone of optical fiber cables and twisted pair cables, connects servers, PCs, and peripherals throughout the ICARDA campus. The backbone of the Ethernet network is an optical fiber cable linking a number of "wire centers" in most buildings at headquarters. In each building, twisted pair cables link all rooms and laboratories. Lap-top PCs allow researchers to work while traveling, and to stay in touch with the Center through e-mail. The Center's outreach programs are equipped with personal computers, and its office in Cairo has a LAN. CBSU provides backstopping support.

Since July 1999, ICARDA has been connected to the Internet via a 64 Kbit/sec leased IVDN (Integrated Voice and Data Network) line to an Internet service provider in California. To achieve this connection, ICARDA upgraded its connection to the Syrian telecommunications network by installing a microwave radio link. The California hub provides Microsoft Exchange servers with instant messaging within the CGIAR Centers and to the rest of the world. The Web is widely accessible within ICARDA, and the Center's website can be modified and updated easily online. The Internet is now an essential tool. Apart from the ICARDA website, an internal web server runs the ICARDA Intranet, targeted to become the main vehicle for knowledge management, dissemination, and sharing in the Center. It will also help ensure the safety of the Center's data resources.

A Look to the Future

ICARDA is already an advanced user of IT, but technology is advancing fast and the Center must stay alert to new opportunities. The Center plans to replace its LAN with a faster switched network, increase communication bandwidth to enhance Internet connectivity, implement voice over the Internet, upgrade its Intranet, set up new databases, upgrade its operating systems, implement directory services, migrate to a new version of its management information system, and utilize the benefits of e-learning and expert systems.

There are exciting times ahead.

Dr Zaid Abdul-Hadi is the Head of Computer and Biometrics Services Unit at ICARDA.

GIS Guides Khanasser Valley to a Sustainable Future

Availability of geo-referenced data is critical for successful natural resources management. Geographic information systems and remote sensing are becoming indispensable tools for acquiring and analyzing this data, for the benefit of locations such as the Khanasser Valley in Syria, where living off the land is a daunting chal-

By Roula Zougheibe, Michael Zoebisch, Christoph Studer, Zuhair Masri, Trine Nielsen, and Robert Hoogeveen

A view of the landscape of the Im Mial village in the Khanasser Valley, near Aleppo, Syria — one of the 11 villages in ICARDA's Integrated Research Site in the Valley.

GIS is a powerful computer-based system for capturing, managing, integrating, manipulating, and displaying spatially referenced data. It can also make sense of the myriad relationships contained in data from diverse sources and areas of study.

ICARDA has selected Khanasser Valley in northern Syria as one of its integrated research sites. One of the objectives is to build a GIS land inventory database. The aim is to develop an integrated and transferable approach in analyzing land degradation in marginal dry areas, and to evaluate land management options that could be applied in other dry areas throughout Central and West Asia and North Africa.

Khanasser Valley covers approximately 475 km^2 in a transitional zone between rainfed agriculture and steppe. It

Struggle amid tranquility

Shepherds tend their flocks in undulating hills overlooking quaint clusters of dusky houses made of clay. It is an image of tranquility that belies the problems faced by the people of Khanasser Valley.

Khanasser's hills have very little soil or vegetation; the Valley's livestock, mostly sheep, overgraze the land. Steeper slopes are rocky. Some of the best soils have become saline from salty groundwater, and aquifers are depleted due to over-pumping. Wind erosion affects settlements and health.

Cropland is planted with rainfed crops, such as barley. Wheat is grown near the scattered sources of groundwater. Most families grow crops and tend livestock. Poverty is widespread.

There is hope, however. Farmer participation, a critical feature of ICARDA's Khanasser Valley project, has led to the rehabilitation of the Valley's hillsides. Ten olive tree demonstration and applied research sites now flourish on degraded slopes once abandoned by farmers. Two other sites on barren slopes were made productive using pitcher irrigation to water newly-planted olive trees. The water is sourced from a Roman-style cistern recently built.

ICARDA scientists combined local knowledge and improved dryland agriculture techniques and then conducted simple on-farm evaluation experiments in collaboration with farmers. For example, farmers learned to construct tree terraces in areas they had thought could grow nothing. They also built cisterns to collect water from surrounding slopes, and learned land-forming techniques to guide runoff to newly-planted trees.

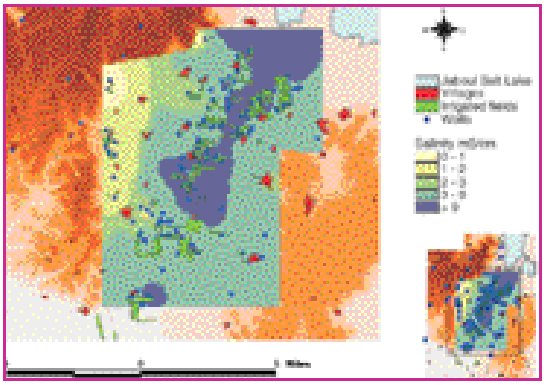
The project also developed land use options for the different parts of the Valley. These included the planting of vetch to feed sheep instead of leaving land fallow. It also included the use of phosphate fertilizer to increase barley yield, even during the dry season.

Computer-based tools, such as geographic information systems, global positioning systems, and remote sensing, helped identify land use problems and opportunities, as they relate to water resources and the socioeconomic situation in the Valley.

Farm families in Khanasser Valley echo the concerns of people living in similar adverse conditions. Now, ICARDA researchers look forward to applying the Khanasser experience in other dry areas of the developing world.

receives winter rainfall of 150–250 mm per year and is typical of dry areas in Syria.

The Valley is home to about 11,000 people (1991 census) living in 26 villages and farms. The land is marginal for cereal production, and has been degraded by a set of complex natural factors, including low and erratic rainfall, and human interventions, including inappropriate land-use and irrigation practices. Groundwater salinity, weak surface-soil structure, overgrazed and denuded rangelands, and soil erosion on hill slopes are evidence of its degradation over time.



From the GIS database several spatial layers of salinity distribution and irrigated fields in the Valley were overlaid. This overlay shows how most of the irrigated crops are located in the last two salinity classes not suitable for irrigation.

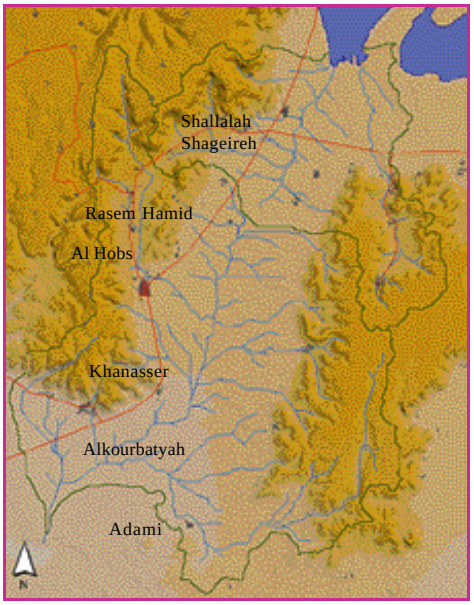
Designing measures to restore the productivity of marginal land areas like the Khanasser Valley poses a big challenge for ICARDA scientists. They turn to high technology tools capable of integrating and correlating diverse factors. They use spatial data to help assess the extent, distribution, and trends of landscape changes, as affected by land management practices and water availability and use.

Project scientists first conducted an inventory of the Valley. Data collected on terrain, soils, aquifer properties, land cover, and socioeconomic conditions were then input in the GIS application. The result is a base map that clearly identifies topography, roads, location of villages, and drainage patterns. Then a 10-m digital elevation model was developed from contour lines, elevation points, and drainage network.

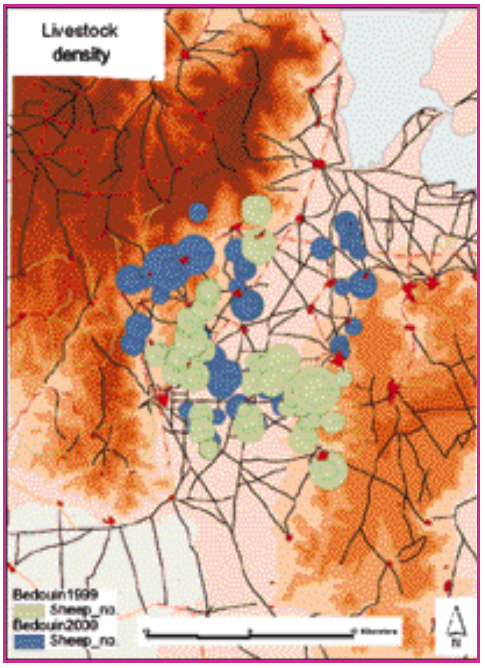
A well inventory was also undertaken and groundwater quality and groundwater use were studied. These data were then "stamped" to their geographical location using GPS—satellite-based geographic positioning system. Land-use data, location of irrigated fields, and grazing areas were likewise incorporated into the Valley's GIS database.

In turn, soil characteristics were assessed and the information was plotted on maps. GIS allows scientists to interpolate or insert soil sample information into surface grid layers that show soil characteristics such as texture, erodibility, stability, and tensile strength. Using this database, scientists can then correlate soil data with other land characteristics.

Scientists also incorporated data about livestock and human population density. Areas where population is exerting pressure on the Valley's limited resources were identified. For example, the survey revealed that villagers grazed 20,000 sheep in the Valley, but that sheep numbers more than doubled with the in-migration of Bedouin flocks during summer, when Bedouin grazing grounds are dry. GIS is able to generate a visual representation of the presence and migration of sheep and the grazing pressure they exert on the land.



From the Digital Elevation Model created from contour lines, the surface hydrological features (e.g., drainage patterns and sub-watersheds) can be determined. This enables researchers to simulate hydrologic processes and soil erosion under different development scenarios and to predict ecosystem responses.



Incorporation of livestock data into GIS allows the identification of areas particularly exposed to seasonal grazing pressure.

GIS allows data overlay and analysis of all data collected and input. This means that survey data can be displayed in easy-to-read maps. But GIS is much more than maps. The Khanasser application can alert researchers and policy-makers to important changes taking place in the Valley over time.

The GIS land inventory database established by ICARDA scientists from surveys of Khanasser Valley will form the basis for determining the carrying capacities of different terrain and the degradation hazards associated with land use in dry areas. Future research priorities using GIS include design and evaluation of alternative land-use options, water resource management practices, and grazing systems. ■

Ms Roula Zougheibe is a GIS Analyst Consultant; Dr Michael Zoebisch is a former Soil Conservation and Land Management Specialist; Dr Christoph Studer is a former Plant Water Soil Specialist; Dr Zuhair Masri is a Research Associate, Soil Conservation and Land Management; Ms Trine Nielsen is a Junior Professional Officer, and Mr Robert Hoogeveen is a Hydrology Consultant at ICARDA.

Barshaya Village Groundwater Management Using GIS

Geographic Information Systems (GIS) are useful in developing strategies for exploring and exploiting groundwater resources in arid and semi-arid countries. ICARDA researchers are collecting and analyzing data that will be used to develop decision support tools that combine indigenous and scientific knowledge and that allow farmers and policy makers to assess the effects of different groundwater use strategies and policies.

By Roula Zougheibe, Adriana Bruggeman, Robert Hoogeveen, and Aden Aw-Hassan

Demand is rising for already scarce water resources in West Asia and North Africa—wells are drying up and some of the most productive irrigated areas are reverting to rainfed agriculture. The dominant, traditional land use practices need to be assessed in order to come up with more efficient water management plans and practices.

Against this backdrop, scientists at ICARDA have focused their attention on the use of groundwater for irrigation in five villages in different rainfall zones of Aleppo province in northwest Syria. The aim is to gain a better understanding of local- and policy-level factors that affect the use of groundwater resources. The data collected are fed into a computer simulation model that can be used by water consumers, extension agents, researchers, water resource administrators, and policy makers to develop and analyze strategies to avoid groundwater depletion.

In Barshaya Village, about 60 km northeast of Aleppo City, ICARDA scientists are using GIS to develop strategies for exploiting groundwater for agriculture. The village has a combined rainfed and irrigated area of approximately 1,070 ha. Annual rainfall varies between 250 and 350 mm. Groundwater-bearing strata are characterized by clayey limestone formations of middle and upper Eocene age and Neogene Helvatian limestone and conglomerates. The groundwater level is 30–50 m below the surface. The formations have low water productivity.

Barshaya's main crops are cereals (barley and wheat), fruit trees (olive, pistachio, and fig), irrigated vegetables (beans, cucumber, tomato, potato, garlic, onion), and cotton during summer. Fruit trees are irrigated according to need and availability of water. Farmers continuously search for new locations to drill for water and they have been forced to dig deeper to reach the falling water table. In some cases, tubes and channels transfer irrigation water over distances of more than 2 km.

The ICARDA research team created a village map based on a 1949 map of field boundaries in Barshaya (Fig. 1). Then, field surveys were conducted to update information on land use, wells, irrigation practices, and related information. The updated information was input to form so-called "GIS layers" (Fig. 2).

The data collected were used to generate village water use and water requirement maps, based on well water use and cropping patterns (Fig. 3). The data showed that in winter approximately 640,000 m^3 of water was used to irrigate 139 ha of wheat, barley, faba bean, garlic, and onion. In summer, approximately 390,000 m^3 of water was used to irrigate 48 ha of summer crops, such as green beans, cucumber, cotton, melon, and potato. Another 131 ha planted to fruit trees was irrigated occasionally. In total, 1,030,000 m^3 of water from 42 wells was used to irrigate crops in the village in the year 1999/2000. Well discharges were found to be highly variable, ranging between 4 and 60 m^3/hr.

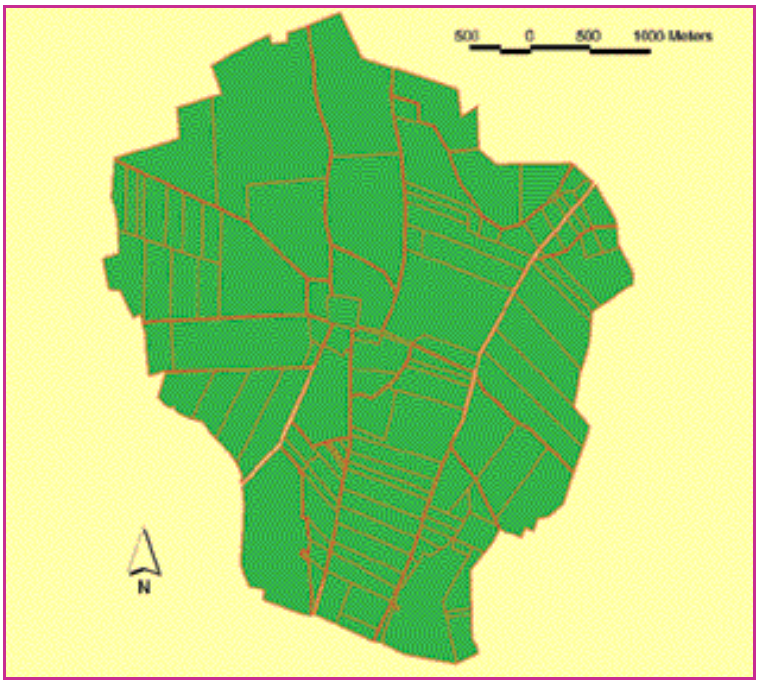


Fig. 1. The 1949 cadastral map used for updating the present land ownership and crop patterns.

Fig. 2. Barshaya winter crop patterns layer based on the field ownership of 1999.

All farmers in Barshaya use surface irrigation, which does not allow accurate control of the amount of water supplied to the crop. This was reflected in the water use and crop water requirement data, which indicated that most farmers applied more water to their crops than needed. Because of the insecurity of the water supply, however, farmers are reluctant to invest in sprinklers or drip systems that would allow them to irrigate more land with the same amount of water.

Farmers supplied information on soil types and these data were used to form another GIS layer. Fields with good, deep soil suitable for growing cotton and other irrigated crops are classified as *kaber*. Fields with shallow soils and used mainly to grow rainfed crops are referred to as *karajeh*. GIS analysis indicated that *kaber* fields make up 29% of the

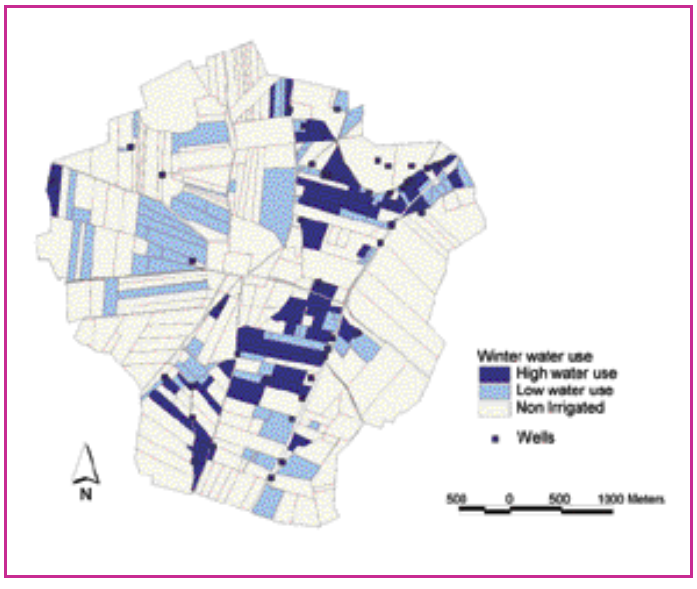


Fig. 3. The spatial layer represents winter irrigation water use, based on a land and groundwater survey in Barshaya village.

village's cultivated area, but because of water scarcity, only 42% (120 ha) of the winter crops in these good fields was irrigated. Another 19 ha of irrigated winter crops were grown on the less productive, shallow soils. Most of the orchards are located on the shallow soils.

Information on types of farm ownership was also collected and mapped during the field survey. Ownership types, such as *ajjar, hussa, murabea, masha'a, melek*, and undivided fields with one or more operators, are recognized in the village. Under *ajjar*, a tenant pays a specific amount of money in advance to a landowner. Under *hussa*, a landowner shares a predefined percentage from his field's yield, but shares with the tenant in defraying seed and labor costs. The landowner does not contribute to planting cost under *murabea*, although he shares in the crop's income. On the other hand, under *masha'a*, the whole family shares in the undivided land's yield. Under *mellek*, the owner works his own land, while in the case of undivided ownership, a family member takes care of the land while his peers are away or are uninterested in land work.

Although 72% of the land in Barshaya is owner operated (*mellek*), the ownership categories are not equally distributed over the different soil types. Twenty-four percent of the good soils are rented, whereas only 3% of the less productive soils are rented (Fig. 4). The data also revealed that dur-

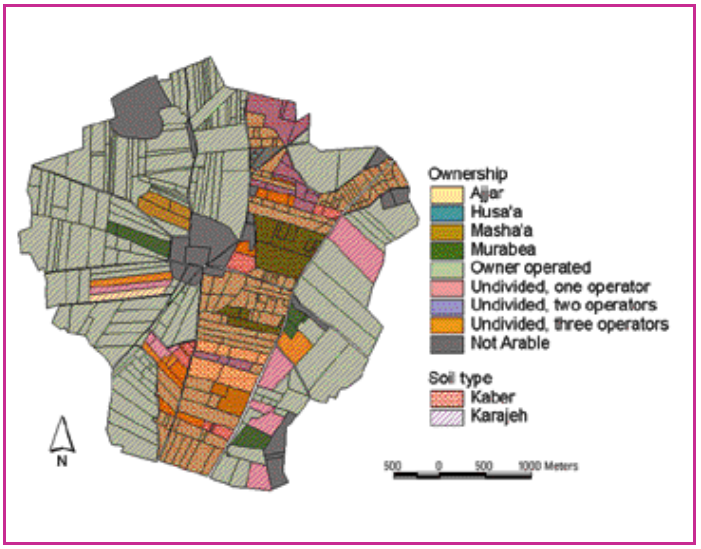


Fig. 4. Soil types overlaid with the landownership types in the village.

ing the winter cropping season 31% of the rented land was irrigated, and 13% of the owner- or family-operated land was irrigated.

The GIS database, together with a system-dynamics model that simulates the groundwater use process, will be used to formulate management strategies that might ensure a sustainable, productive future for Barshaya and its people. ■

Ms Roula Zougheibe is a GIS Analyst Consultant, Dr Adriana Bruggeman is an Agricultural Hydrology Specialist, Robert Hoogeveen is a Hydrology Consultant, and Dr Aden Aw-Hassan is an Agricultural Economist at ICARDA.

Agricultural Almanac of Syria

ICARDA's research results are a treasure, but researchers need tools to determine whether results of research conducted at one location can be extrapolated safely to another. A new product incorporating digital maps and custom-built software should help.

By Nicholas Thomas

Many ICARDA scientists are using GIS technology as a tool for their research because of its ability to combine and analyze data from different scientific disciplines and generate geographic representations of results. Once data has been input for a location, it can be described according to a set of parameters, and compared to other sites for which data has been collected. Among other uses, this allows researchers to identify sites with similar characteristics, even across a wide and diverse area. This "harvest" of digital data is a valuable resource not only for researchers but also for farmers, planners, and policy makers.

Delivering these data to external users for further analysis is a challenge, but a two-year collaboration between ICARDA and a research group at the Blacklands Research Center (BRC), Texas A+M University, has produced a solution. The team reworked a BRC software application—containing the GIS software and geographic data layers for several countries in Africa—to include ICARDA's data layers. The result is the recently released Syrian Almanac Characterization Tool, or Syrian ACT for short.

Syrian ACT comes on a single compact disc (CD) for easy installation on personal computers. Users are able to visualize and pose queries on more than 150 geographic data layers related to the biophysical environment of Syria—climate, soils, hydrology, socioeconomics, and governmental administration—by simply pointing and clicking on the on-screen map. Data are in standardized, downloadable formats that can be used in other GIS software, and new data layers can be added and incorporated into analysis routines.

Each data layer is stored as a series of cells on a grid. The module can be used to identify all cells that match certain user-defined parameters, and the results are turned into new data layers. Researchers can thus determine whether results generated at one or a few sites might apply across a much wider landscape.

Graphic representations of data can be generated using Syrian ACT's graphing module to illustrate the differences and potential relationships that exist between different data layers and locations. Syrian ACT also features a database search engine that can be used as a place name gazetteer, and two other modules: a documentation module, where general information and specific papers on topics related to land use management and natural resources within Syria are included, and a weather report module that provides and analyzes climatic information from more than 50 Syrian weather stations, and which can indicate variance of all the major meteorological variables over a 30-year time frame.

Using Syrian ACT's zonal statistics module, areas can be further described based on additional data layers. For example, once sites with similar climate are identified, they can then be sorted and grouped according to the type of vegetation they contain, or even according to the percentage of area of certain vegetation they contain. Such an analysis, aside from grouping similar sites, would illustrate the influence of climate on the type of vegetation found in a given zone. And Syrian ACT handles more than biophysical data; it can also be used to identify differences in social well-being across a climatic zone and help researchers and decision-makers understand the factors that affect such differences.

All Syrian ACT data layers have associated "metadata," or data about data—source, collection date, file specifications, etc.

ICARDA believes that the data incorporated in Syrian ACT will prove beneficial in several important agricultural research areas, especially in

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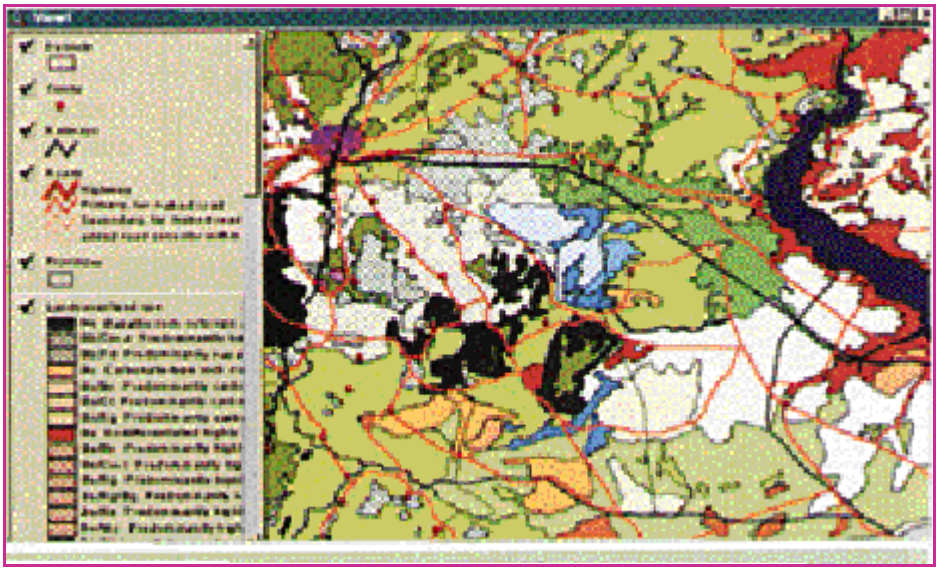


Detail of land-cover/land-use map of Syria.

Bridging the Gap Between Experiment Stations and Farmers' Fields in Central Asia

For nutrition and income in developing countries to improve, advances made on agricultural experiment stations must find their way to farmers' fields. Agroecological characterization studies and geographic information systems can help by telling researchers whether improved technologies developed at one location can be put to good use at other, diverse locations.

By Eddy De Pauw

The Central Asian republics have a tremendous diversity in climatic conditions, spanning a wide range of rainfall and temperature gradients. It is a region of climatic extremes, of drought and very high and very low temperatures. This climatic diversity has been a key determinant of land use systems and their productivity. Another determinant is the relatively short growing season. Only during relatively short periods in autumn and spring are temperature and moisture adequate for crop growth.

With the collapse of trade within the former Soviet Union, the governments of the Central Asian republics have had to place a higher priority on food self-sufficiency. At the same time, privatization of collective farms has resulted in smaller land management units and development of new farming systems.

To maintain or enhance productivity on these smaller farms, greater knowledge of the agricultural environments is needed. The information would help guide land use diversification and agricultural research efforts.

So, ICARDA and its national agricultural research system partners have initiated a comprehensive study of the Central Asian republics, starting with Kazakstan and Uzbekistan. Conducted within the framework of an Asian Development Bank-funded project entitled "On-farm Soil and Water Management in Central Asia," the study has two main components: characterization (climate, landforms, soils, land use systems and land degradation) of ICARDA's integrated research sites, and characterization of the region's agroecology.

ICARDA's integrated research sites in Central Asia (Fig. 1) are located in Boykozon (Uzbekistan), and Sorbulak (Kazakstan). Both sites are on the outer rim of the mountain ranges bordering Kyrgyzstan. They are focal points for ICARDA research in soil and water management. However, the sites have quite different agroecological and socioeconomic characteristics and production systems. Sorbulak has lower rainfall and a longer winter, and, thus, a shorter growing season than Boykozon. The terrain in Sorbulak is flat, whereas the Boykozon site has complex rolling topography with moderate to steep slopes. Their production systems are also very different. Boykozon has mostly rainfed cooperative farms, while Sorbulak has newly privatized farms under irrigation.

The challenge is to develop and test technologies that can improve agriculture at these sites, and then transfer them to other areas. To do this, methods are needed to locate areas where transfer is feasible, in terms of agroecology and socioeconmics–technologies must suit the land and its people. The work begins with the recognition that each site is unique, and that differences between sites are complex. In order to see similarity between sites, researchers must let go of some of this complexity by synthesizing information at different levels of detail, or scale.

The local environment must be understood before improved soil and water management 'packages' can be developed. At the level of the integrated research sites, this requires that

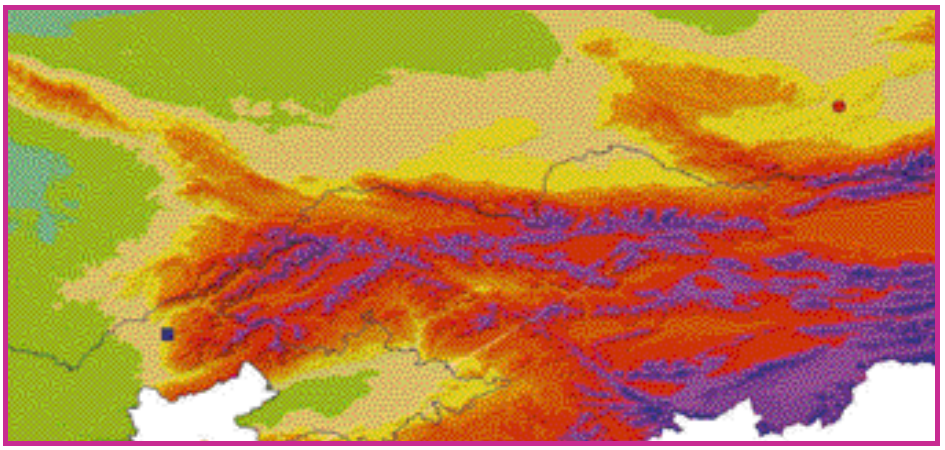


Fig. 1. ICARDA's integrated research sites in Boykozon (blue), Uzbekistan and Sorbulak (red), Kazakstan.

researchers study the climate, soil, terrain, and water resources, and characterize the prevailing production systems in detail. Depending on what information is already available, researchers might need to conduct a soil survey, develop a land-use map, or even install a weather station (Fig. 2).

On a broader, regional scale, this will require a great deal of information–resource maps (less detailed than the research site maps), soil maps, and climatic data, such as rainfall. If soil maps are available, for example, researchers will be able to correlate them with the soil types identified at the integrated research sites. Similarly, climatic data from the integrated sites will be compared to data from other areas (Fig. 3).

Fig. 2. Installation of an automatic weather station at Boykozon, Uzbekistan.

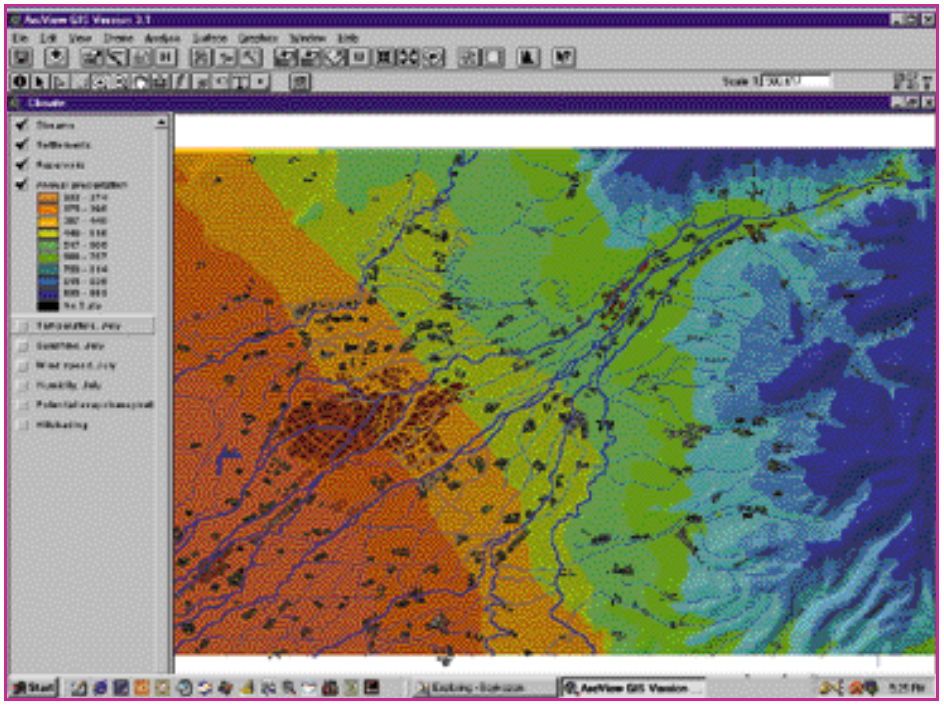


Fig. 3. Construction of a precipitation map of the Boykozon area through spatial interpolation of data from neighboring weather stations.

Geographic information systems (GIS) help researchers bridge the gap between the research site and the region. The main tools at their disposal are remote sensing, classification techniques, and spatial interpolation using digital terrain models. Using GIS, researchers can extrapolate available data to gain a picture of the whole region. To do this, detail must be shed, but the essential variations in agroecological and socioeconomic characteristics must remain obvious (Fig. 4).

This might sound like researchers are in full control, that it is just a matter of pressing a few buttons to predict whether technology X will work in location Y. Unfortunately the process is less straightforward. It is impossible to extrapolate the suitability of an agrotechnology in a single giant step, from research site to the region. Land is just too complex and diverse for that. Agroecological characterization studies at different scales require different methods and datasets, which further complicates the process. Data gaps are another major problem to overcome, through investment in data collection and database development.

Despite the challenges, characterization studies and GIS are helping to ensure that advances achieved on ICARDA's research sites find their way to farmers' fields.■

Dr Eddy De Pauw is an

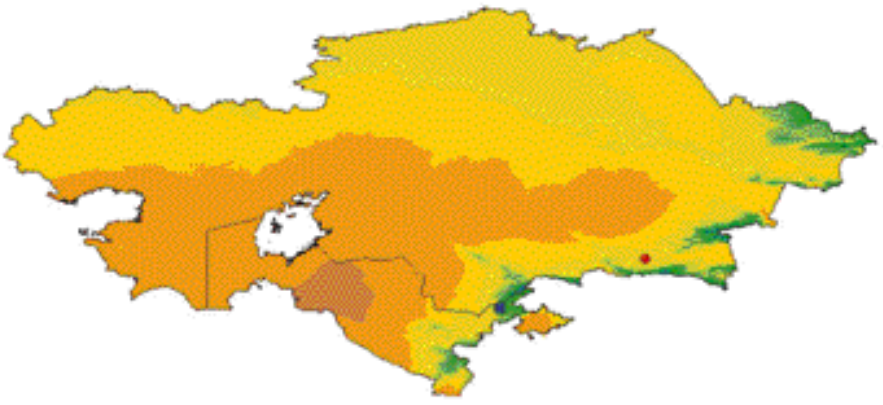


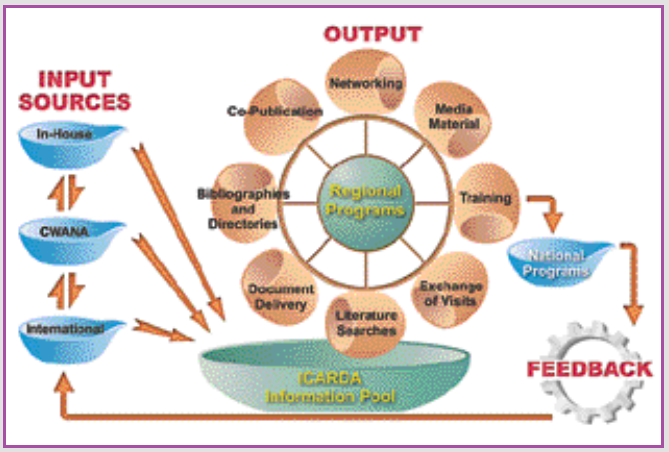
Fig. 4. An annual precipitation map of Uzbekistan and Kazakstan, based on a regional meteorological database–an example of a region-level extrapolation.

Building and Sharing the Information Capital

Surendra Varma
and Nihad Maliha

In pursuit of its challenging mandate of poverty alleviation in the dry areas, ICARDA uses modern information technology to increase the speed, quality, and relevance of its research. New information and communication technology (ICT) is breaking geographical barriers and opening new windows to the world. In the future, countries might be judged as poor or rich based on their information capital.

Modern ICT occupies a place of importance in all research programs by providing efficient tools for retrieving, storing, categorizing, managing, and disseminating information. At ICARDA, these functions are carried out by the Communication, Documentation and Information Services Unit (CODIS). The Unit links the Center with donors/investors, national agricultural research and development systems (NARS), advanced research institutes, non-government organizations (NGOs), policy makers, extension personnel, farmers, media, and the public. CODIS also promotes the use of ICT by training national program colleagues.



Strategic Alliances for Targeted Information Management

Partnerships and networking play an important role in the collection, storage, and dissemination of information. The Center participates in the Food and Agriculture Organization's (FAO) International Information System for Agricultural Science and Technology (AGRIS) and Current Agricultural Research Information System (CARIS). The AGRIS and CARIS databases, to which ICARDA contributes information, are available free to the participating centers. They are invaluable sources of literature, available on compact disk (CD) and at the FAO website. In 1992, ICARDA established an agricultural information network for the West Asia and North Africa (AINWANA) region (see also page 24). Participants share resources and receive training.

More than 700 organizations and individuals in developing countries benefit from free subscriptions to *Literature Update on Wheat, Barley and Triticale*, a bibliographic service jointly produced by ICARDA, CIMMYT (Centro Internacional de Mejoramiento de Maiz y Trigo), ISI (Institute for Scientific Information), and AGRIS. Recently ICARDA collaborated with the Center for Legumes in Mediterranean Agriculture (CLIMA) to produce a comprehensive bibliography on *Lathyrus* spp., distributed to collaborators in developing countries.

ICARDA also cooperated in the development of a Union List of Serial Holdings (SRLS) of the 16 CGIAR Centers and some NGOs. The List is updated periodically and is available on the web.

Specialized Databases and Library Holdings

ICARDA has adopted CDS/ISIS as its bibliographic database management system. The Center has used this software, developed by the United Nations Educational, Scientific and Cultural Organization, to produce databases of books, reports, and technical publications available in the ICARDA library (ILDOC); ICARDA publications list (PUBLST); and global databases on such crops as faba bean (FABIS), lentil (LENS), durum wheat (DURUM), and barley (BARLEY). Discipline-specific databases have also been developed, such as the West Asia and North Africa agroecological zones (STEPPE) database.

The Library holds monographs and theses (16,400), annual reports (2,300), reprints (13,000), current periodicals/newsletters (600), bound volumes of periodicals (5,500), and microforms or Microfiche (3,000).

Support to NARS

In the past five years, CODIS has responded to 24,500 requests for services, 14,000 from the ICARDA community and the rest from national agricultural research systems in West Asia and North Africa and beyond. The services have included literature searches, reference services, access to journal and document collections, selective

Staff members from the National Program of Yemen conduct a literature search in the ICARDA library. They were at the Center for training in automated library management.

dissemination of information, document delivery, training in information management and scientific writing, and publications exchange.

In Syria, ICARDA has helped the National Center for Agricultural Information and Documentation and the Directorate for Agricultural Scientific Research to automate their library functions, and has provided training in CDS/ISIS and AGRIS. In 1999, CODIS teamed with ICARDA's Computer and Biometric Services Unit and Natural Resource Management Program to help the Ethiopian Agricultural Research Organization develop an information strategy and work plan, which is now bearing fruit (see page 27).

Intranet as a Tool for Increased Access to Information

Three CD towers, each housing seven CDs, are linked to the CODIS Library page on the Center's Intranet. Scientists at ICARDA headquarters can use their personal computers to access this "electronic library" of conference proceedings, electronic books, and journals. Soon, desktop access will be extended to the Center's regional offices in Central and West Asia, North Africa, and Latin America.

Establishing ICARDA's Presence on the Worldwide Web

ICARDA uses the Internet and its WorldWide Web site (www.icarda.cgiar.org) to:

- Make available electronic versions of the Center's key publications, such as its annual report; *Caravan*; and the Center's Medium-term Plan;
- Share information about the Center's Board of Trustees, donors, staff, facilities, job opportunities, research strategy, and research and training at headquarters and in regional programs;
- Link the Library with the Network of Agricultural Libraries in Industrialized Countries, the Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA), AGRIS, and CARIS;

Training is an important way of promoting information sharing. Above, two staff members from the Ethiopian Agricultural Research Organization (right), who recently completed a short-term training course in multi-media at ICARDA, receive certificates.

- Facilitate acquisition of journals, books, and bibliographic descriptions from other databases;
- Send and receive electronic documents; and
- Provide online access to the Center's in-house databases.

Knowledge Sharing

ICARDA is an active player in the Global Knowledge Sharing project for Information Management Professions (GKS) established after extensive discussions and exchange of expertise among the CG Library and Information Management group through their own Community of Practice.

The GKS project calls for the execution of the following activities which are coordinated by different Centers:

ICARDA reaches out to its partners around the world through its website. The site's usefulness is increased continually with the addition of digital publications and information search services.

joint acquisition of journal subscriptions, electronic document delivery through Ariel, joint catalog of CG serials (SRLS), joint catalog of center library holdings, joint catalog of all CG publications, inventory of CG electronic resources, CG image library, expert directory (database of CG staff and their specialties), and CG library gateway (which can be accessed at http://www-int.cgiar.org/library/cglib.htm).

ICARDA has developed another project with FAO, which involves the translation of AGROVOC (Multilingual Agricultural Thesaurus) terms into Arabic.

Desk-top Publishing

ICARDA produces a variety of publications and public-awareness materials. Files are shared electronically within CODIS and between CODIS and ICARDA scientists at headquarters and in the regional programs. The Center uses QuarkExpress to lay out pages and Adobe PhotoShop to edit images. The Center's mailing list is in Microsoft Access, set up for targeted distribution.

Multimedia Laboratory

CODIS recently upgraded its multimedia laboratory with a digital video editing suite comprising a Mac computer, digital video camera, digital audio tape recorder, and digital audio mixer. The laboratory produces videos and interactive disks for training and public awareness.

More than 1,000 copies of *This is ICARDA*, a 22-minute documentary on the Center's history and research, have been distributed on CD. Among the new training CDs are interactive lessons in seed cleaning and testing seed for fungal pathogens. *ICARDA Annual Report 2000* was the

first of the Center's annual reports to be produced in digital format. Publishing on CD extended the publication's reach.

An email newsletter, *ICARDA eNewsAlert*, was launched recently to promote the Center's work and to help forge new partnerships. The newsletter includes news summaries that link directly to related stories posted on the ICARDA website. Further on the migration from paper to digital, *The Week at ICARDA* is now also distributed electronically to keep the Center's regional offices and friends around the world up to date on events at headquarters.

Training

ICARDA has a responsibility to promote global knowledge sharing. An important mechanism for this is on-the-job training and regular courses in information management, web publishing, and scientific writing. Agricultural research and development workers from 19 countries have benefited from these programs.

Self-Learning Laboratory

Hundreds of trainees from many countries come to ICARDA every year. For their benefit, CODIS runs a self-learning laboratory equipped with computers, videos, audio players, and interactive educational CDs.

Making the Most of Emerging Technologies

The CODIS team includes an information specialist, public awareness specialist, librarians, multimedia and training materials specialist, editors, writers, translators, simultaneous interpreters, graphic artists, typesetters, printers, and photographers. The team is committed to making the most of emerging technologies to create and share knowledge in pursuit of ICARDA's mandate and mission.■

Dr Surendra Varma is the Head of Communication, Documentation and Information Services (CODIS) Unit, and Mr Nihad Maliha is Manager, Library and Information Services in the same Unit at ICARDA.

Promoting Information and Communication Technologies for Research and Development

N. Maliha and S. Varma

Researchers in most developing countries work at a considerable disadvantage compared to their counterparts in developed countries, especially when it comes to information services. In the Central and West Asia and North Africa (CWANA) region, with few exceptions, most libraries are small and inadequately staffed. Personal computers, where available, are not networked.

Several projects have been launched by international and regional centers and organizations to foster information exchange and to improve the documentation and reporting systems in developing countries. Canada's International Development Research Centre (IDRC), for example, has helped many developing countries establish national information and documentation centers, usually attached to ministries of agriculture. However, due to lack of well-defined policy at the national level, many such centers either lose momentum or cease to operate once donor funding ends.

ICARDA's Role in the Region

ICARDA and national agricultural research system scientists are involved in several research networks in CWANA. Information exchange is invariably a critical component. National information systems working alone stand a poor chance of meeting the networks' information needs. To help remedy the problem, ICARDA works closely with national partners to give network scientists the information services they need, including literature searches and document delivery. ICARDA's library supplies information directly to scientists throughout the region.

Advances in information and communication technology, especially the spread of the Internet, are creating unique opportunities for accelerating scientific research.

One of the areas that receives emphasis in ICARDA's activities is to increase the capacity of national agricultural research systems (NARS). The following activities are pursued within the framework of AINWANA (Agricultural Information Network for West Asia and North Africa), with active involvement of ICARDA's regional programs:

- Increased adoption of new information technology through knowledge sharing
- Training in library and information management
- Training in website development, including database publishing
- Increased involvement of researchers and extension workers in information activities

With these efforts, ICARDA has been successful in increasing the speed and efficiency of information access and exchange, strengthening NARS capabilities in information management (retrieval, storage, and exchange), and contributing to technology transfer through training, networking, and resource sharing, by way of appropriate print and multimedia products, including expert systems.

Creation of a Regional Agricultural Information System

In the past few years, considerable progress has been made in strengthening collaboration between international and regional information and research networks in the area of information management and dissemination. ICARDA has participated in several meetings to plan a Regional Agricultural Information System for West Asia and North Africa (RAIS-WANA), organized by AARINENA (Association of Agricultural Research Institutes in Near East and North Africa), FAO (Food and Agriculture Organization of the United Nations), GFAR (Global Forum for Agricultural Research), and CLAES (Central Laboratory for Agricultural Expert Systems).

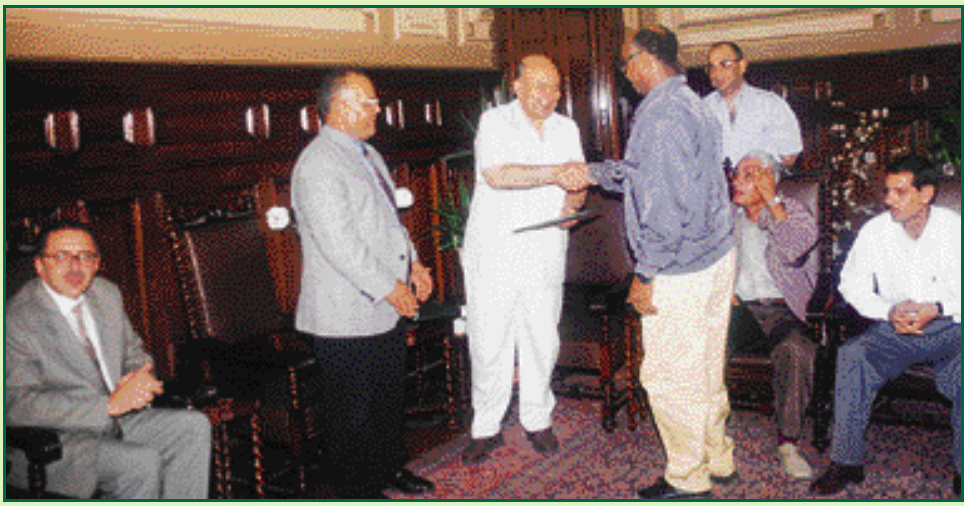
The service will work to generate and coordinate contributions from national programs and regional and international centers, and cover regional projects under the supervision of AARINENA and other agencies, such as the Consultative Group on

Continued on page 26

Training Future Leaders: Human Resource Development at ICARDA

For ICARDA partnerships in research to succeed, human resource development is an essential component in the Center's program of work. ICARDA recognizes that a well-trained cadre of scientists, managers and technicians in its partner national programs is crucial to achieve the goal of sustainable agriculture in the dry areas. This is why training has been an integral part of the Center's mandate since its establishment in 1977.

ICARDA first offered training courses in the 1977–78 cropping season. Since then, the number of courses requested , training subjects, and participants has increased steadily. To date, more than 10,000 scientists from over 90 countries have been trained at ICARDA headquarters or in non-headquarters courses organized jointly with national agricultural research systems (NARS).



H.E. Prof. Dr Youssef Wally, Deputy Prime Minister and Minister of Agriculture and Land Reclamation, Egypt, presents certificates to the participants in the regional training course on "The Utilization of Expert Systems in Agricultural Research and Production." Prof. Ahmed Rafea (left), Director of CLAES, was also present at the ceremony.

Goal and Focus

The Center follows methodologies that enable participants to adapt learning to their unique situations. The training programs are highly participatory; the participants are encouraged to share their knowledge and experience with one another, in addition to their interaction with ICARDA scientists who impart training. This improves the value of the training courses. ICARDA's objective is to improve NARS researchers' ability to identify and implement independent and collaborative research programs to overcome constraints that limit food and feed production and farm income. To do that, they need to understand the process of technology transfer and the complexity of farmers' decisions in adopting or rejecting new technologies.

In recent years, emphasis has been placed on training in advanced technologies, including geographic information systems and remote sensing, agricultural expert systems, and automated library and information management, particularly for those NARS that are falling behind in adopting the emerging information and communication technologies relevant to agricultural research. Table 1 presents the areas in information technolgy in which training has been offered over the past 10 years, the number of trainees, and the countries they came from.

Categories of Training

The Center offers long-term group courses, specialized short-term courses, individual non-degree training, and training related to MSc and PhD studies. ICARDA also organizes courses at the regional, sub-regional, and country level, and regularly works in collaboration with other international and/or regional organizations on subjects of mutual interest. Regional integration of training courses receives emphasis, and international courses are also organized in collaboration with appropriate partners.

Planning and Budgeting

The Center holds annual planning and coordination meetings with NARS to assess their training requirements.

By Samir El-Sebae Ahmed

Requests for training are evaluated and ICARDA scientists then develop proposals that detail objectives, number of candidates, selection criteria, content, and schedule. A list of priority countries for each course is developed based on need, and regional courses are considered.

Non-headquarters courses require the collaboration of host country institutions, such as national agricultural research centers, seed organizations, and universities, which work closely with ICARDA's Regional Program Coordinators and headquarters programs and units. Training programs for some specially funded projects are developed separately during annual national or regional coordination meetings.

Proposals are then put together into a Center-wide annual training work

Table 1. National scientists trained by ICARDA in information technology, 1991-2000

1.	**Agricultural Expert Systems**	39	Algeria, Armenia, Egypt, Eritrea, Kazakstan, Iran, Iraq, Jordan, Lebanon, Libya, Oman, Morocco, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, Turkey, Tajikistan, United Arab Emirates, Yemen
2.	**Geographic Information Systems & Remote Sensing**	35	Algeria, Egypt, Iraq, Jordan, Kazakstan, Lebanon, Morocco, Oman, Tunisia, Turkey, Sudan, Syria, Yemen, Uzbekistan.
3.	**Library, Information Management and Scientific Writing**	282	Algeria, Bahrain, Cyprus, Egypt, Eritrea, Ethiopia, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Sudan, Syria, Pakistan, Palestine Tajikistan, Tunisia, Turkey, United Arab Emirates, Uzbekistan, Yemen

plan and budget. Demand often surpasses the financial resources available to the Center, so institutions and individuals seeking training are also encouraged to secure funds from other sources.

Future Perspectives

Through follow-up studies and continuous consultation with NARS, the Center is able to respond to the evolving need for training and capacity building. Greater emphasis is being given to alternative training approaches, such as distance learning and audio-conferencing in collaboration with advanced research and training institutions, and participatory training through 'learning by doing' and 'training the trainer' approaches. As more NARS trainers are trained, junior level (research technician) training at ICARDA is being reduced, and resources are shifted to advanced long-term training in new technologies.

Development of Leaders

ICARDA "alumni" now occupy senior positions in their respective countries. The Center knows that regardless of the positions the trainees hold when they return to their home countries, some will one day lead efforts to increase food production and narrow the food gap in the developing world. They all work as ICARDA's ''ambassadors," promoting goodwill and cooperation, necessary for effective partnerships.■

Dr Samir El-Sebae Ahmed is the Head of Human Resource Development Unit at ICARDA.

Agricultural Almanac of Syria

Continued from page 19

investigating germplasm–environment (GxE) interactions and in planning future germplasm collection missions. Scientists could, for example, cut cost and save time in identifying sites likely to contain desired germplasm.

The information in Syrian ACT can also help fill the gaps in data about germplasm (so-called passport data) or provide basic information about plant accessions, such as name, origin, etc. Plant breeders can use Syrian ACT to "visualize" suitable areas for their new varieties, based on the characteristics of the location at which the variety was bred.

ICARDA hopes to build on the experience gained through the Syrian ACT project. The valuable lessons learned from this collaboration will enable ICARDA to develop similar applications in cooperation with national agricultural research and development systems in other parts of Central and West Asia and North Africa.

Blackland Research Center will distribute CD copies of Syrian ACT upon request. Enquiries should be addressed to: Agroecological Characterization Project, Natural Resource Management Program, ICARDA, P.O.#Box 5466, Aleppo, Syria.

Mr Nicholas Thomas is a former GIS Analyst at ICARDA.

Promoting Information and...

Continued from page 24

International Agricultural Research (CGIAR). It will facilitate advances in agricultural research and development by sharing knowledge and resources. A regional reference center will serve as a document repository for regional projects and networks. It will also hold contributions from national agricultural information systems, including agricultural research institutions and other stakeholders, focusing on scientific and technical publications, project documents, and subjects related to human resource development.

As part of RAIS activities, ICARDA, FAO and CLAES collaborated in the redesign of the AARINENA website. This initiative, supported by FAO, is intended to make the site a prime gateway to agricultural research and development resources in West Asia and North Africa available on the Internet. RAIS has since been developed into a project proposal, which will soon be submitted to donors for funding.

The AARINENA website, containing a NARS directory, structured database of annotated websites of importance in the region, interface for query construction and search output, links to major agricultural gateway sites covering the rest of the world, and key AARINENA documents, is near completion. ICARDA is in the process of loading it on the CGIAR network server.

Mr Nihad Maliha is Manager, Library and Information Services, and Dr S. Varma is the Head of Communication, Documentation and Information Services at ICARDA.

Ethiopia and ICARDA Cooperation: Putting Information Technology at the Service of National Partners

Information sharing is critical to the success of agricultural research and development, so ICARDA has been playing an active role in developing the capacities of national agricultural systems in the use of information technologies.

Dr Seyfu Ketema, Director General, Ethiopian Agricultural Research Organization (EARO), and former Minister of Agriculture, Ethiopia, has been the driving force in implementing and promoting the use of modern information technologies at EARO in collaboration with ICARDA. Dr Ketema joined as a member of ICARDA Board of Trustees in 2000.

In 1998, the Ethiopian Agricultural Research Organization (EARO) requested ICARDA's help in producing a comprehensive information technology development plan. Scientists and technical staff from ICARDA carried out a detailed study involving interviews with key scientists at EARO's headquarters and its various research stations.

Those interviewed included Dr Seyfu Ketema, EARO's Director General; Dr Abera Debelo, Deputy Director General; Dr Geletu Bejiga, Director, Crops Research; and other key managers. On the basis of these interviews a plan was developed in close cooperation with EARO management and scientists. The plan, tabled in February 1999, was a blueprint for information systems at EARO, and it detailed the information technology infrastructure and facilities required.

The proposed Information Technology Strategy, 1999-2003, outlined recommendations for the development and implementation of information systems, biometrics support, geographic information systems (GIS) and remote sensing, crop modeling, library and information management, computer hardware, network hardware, and software. The report also advised on the organization of information services and development of human resources.

The strategy proposed equipping scientists with personal computers (PCs). It suggested that EARO's information processing computer hardware combine application and database computer servers and networked PCs in a cooperative processing mode. It also proposed the use of more powerful workstations for GIS, image processing, and graphics applications.

The study recommended that a local-area network be established in each of EARO's major research stations and that the local-area network in EARO headquarters be upgraded with new servers, graphic workstations, PCs, and printers. A wide-area computer network linking all local-area networks in EARO headquarters and at its research stations was proposed to give users access to common databases and computing resources, and to allow electronic communication between staff. Internet access was also recommended, as was establishment of an EARO-wide Intranet to serve as the main information conduit.

The plan recommended wide usage of ready-made scientific software packages, but also proposed the setting up of a number of research databases and agricultural research systems, either through cooperation between researchers and information technology services personnel, or by adopting systems and databases available in international research centers. It also recommended standardization of PC packages.

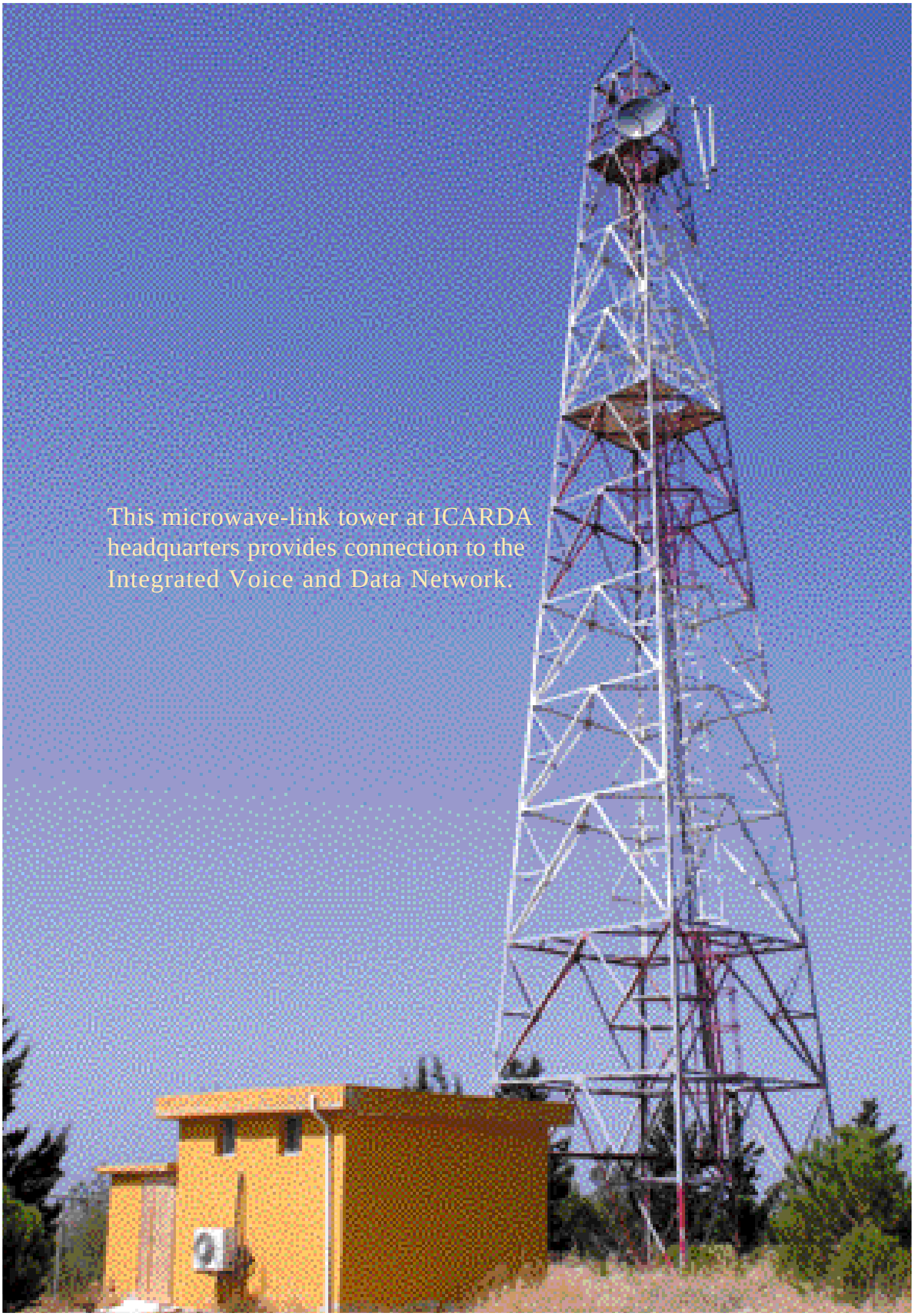
The use of GIS and remote sensing tools was given priority, especially for natural resource research, and crop modeling capability was to be developed to support all aspects of research.

It was felt that management information systems could make use of commercial software packages, customized to meet EARO's needs.

EARO has begun to implement the plan with the help of a loan from the World Bank. ICARDA staff designed the local area computer network in EARO's headquarters, and a networking engineer from ICARDA's Computer and Biometrics Services Unit participated in the installation and commissioning of the computer network, including installation of equipment, switches, fiber optic cables, fiber to twisted pair converters, and network cards.

Now EARO has an advanced computer network (100 Mbit/sec) with a backbone of fiber optic and twisted pair cables, advanced switches, and highly reliable nodes, and has plans to connect with 32 research stations via V-Sat. ICARDA continues to provide support.

ICARDA's Senior Biometrician trained 48 Ethiopian scientists, in Addis Ababa and at ICARDA headquarters, in biometrics and the use of statistical analysis software. Two other EARO staff members were trained in photography and the use of audio-visual equipment in ICARDA's Communication, Documentation and Information Services Unit, while another was trained in automated library management.■



This microwave-link tower at ICARDA headquarters provides connection to the Integrated Voice and Data Network.