Italy and ICARDA

Ties that Bind, No. 11

International Center for Agricultural Research
in the Dry Areas

About ICARDA

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

In the context of the challenges posed by the physical, social and economic environments of the dry areas, ICARDA's mission is to improve the welfare of people in the dry areas of the developing world by increasing the production and nutritional quality of food while preserving and enhancing the resource base. ICARDA meets this challenge through research, training, and dissemination of information in partnership with the national agricultural research and development systems.

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 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.

Much of ICARDA's research is carried out on a 948-hectare farm at its headquarters at Tel Hadya, about 35 km southwest of Aleppo. ICARDA also manages other sites where it tests material under a variety of agroecological conditions in Syria and Lebanon. However, the full scope of ICARDA's activities can be appreciated only when account is taken of the cooperative research carried out with many countries in West Asia and North Africa and elsewhere in the world.

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.

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WANA—home of the world's Fertile Crescent

Most of ICARDA's research is concerned with the Mediterranean region, which is still rich in wild progenitors and relatives of globally-important field crops, such as, wheat, barley, lentil, chickpea, pea, and a number of forage legumes, as well as horticultural crops, including olive, grape and other fruit trees. Germplasm collected in these areas often contains valuable genes for resistance to physical stresses such as heat, cold and drought, as well as biological stresses including pests and diseases. It is an important source of germplasm for plant breeders working on the development of more productive and stress-resistant varieties.

Italian collaboration

Genetic resources activities

Italy has a long historical connection with ICARDA and has been instrumental in much of the Center's genetic-resources activities. The Italian Government supported the establishment of a modern gene bank which has facilities for medium- and long-term storage and can accommodate 120,000 germplasm accessions. The gene bank was inaugurated in 1989 and dedicated to Prof. Nazereno Strampelli, a prominent Italian breeder.

Italy was also the second major donor of germplasm to ICARDA. The Germplasm Institute at Bari provided more than 17,000 accessions, of which 1,000 are of Italian origin and over 9,400 were collected by Italian plant explorers in Ethiopia, Tunisia and Greece. ICARDA currently holds over 111,000 accessions in its gene bank of which over 55,000 are of cereals, 27,000 of food legumes and 28,000 of forages.

Italy supports three main research projects at ICARDA: the *Spring Barley Project*; *Durum Wheat Project* and *Kabuli Chickpea Project*. More specifically, this support has produced a number of promising results as summarized under the respective projects, below. It also provides core support for other ICARDA research activities.

Improving barley yield in stress environments

Under the project on *Improving yield-stability of barley in stress envi-*

ronments, Italian and ICARDA scientists successfully developed a breeding

methodology based on the exploitation of genetic differences under stress conditions, and with little if any inputs as practiced by many poor farmers in developing countries. The methodology aims at maximizing specific adaptation to different environments and it has three particularly significant aspects:

- the role of landraces in breeding for stress environments. Pure-line selection within the genetically-heterogeneous landraces still widely grown in many developing countries is a powerful, quick, relatively inexpensive and efficient way to increase barley production in stress conditions. The importance of this methodology goes beyond barley, because it can be used for all those crops, which, like barley, are grown by poor farmers in difficult environments;
- the use of the wild progenitor of cultivated barley (*Hordeum spontaneum*) to increase plant height under severe moisture stress and hence stabilize yield;
- the use of mixtures as a means to stabilize yield in view of the year-to-year climatic variability. This last aspect is expected to generate inpact only in the long-tern.

Evaluating durum wheat genetic resources

The project *Evaluation and documentation of durum wheat genetic resources* was a collaborative effort between: ICARDA; the University of Tuscia; the Germplasm Institute at Bari; and the Experimental Institute of Plant Pathology, Rome (ENEA) with funding from Italy. The project team evaluated 18,505 wheat accessions for 22 important characters. Durum-wheat evaluation data were published jointly by ICARDA and Italian authors in the ICARDA Durum Wheat Catalog.

Scientists from the University of Tuscia were also involved in research into the diversity of storage proteins in durum wheat.

Enhancing wheat productivity in stress environments

The project *Enhancing wheat productivity in stress environments utilizing wild progenitors and primitive forms* resulted in improved germplasm, which is now used in wheat-breeding programs. More

specifically, it involved work on gene transfer from wild ancestors to durum wheat. This led to the development of new techniques, primarily at the Department of Agrobiology and Agrochemistry of the University of Tuscia. Scientists have perfected a molecular-marker technique to assess the genetic variability of *Triticum dicoccoides* populations and of several other wheat ancestors. In particular, they have carried out polymerase chain-reaction analyses of high and low molecular weight glutenin sequences. This has facilitated breeding for improved quality in durum. In addition, scientists have used 30 RFLP (restriction fragment length polymorphism) clones, isolated from a *Triticum urartu* genomic library, to evaluate the genetic relationship between *Triticum* species introgression of desirable traits from wild relatives to cultivated durum wheat.

Rehabilitating graded land

A collaborative project, *Adaptation and seed production of pasture species for marginal land rehabilitation in semi-arid environments,* between ICARDA, the University of Perugia, Italy, and Reading University, UK, initiated some important research into rangeland management, for example, the role of phosphate application in increasing livestock production. Two Italian students at Reading University, with supervision from the University of Perugia, carried out their PhD research within this project, which was part of ICARDA's Pasture, Forage and Livestock Program.

In addition to a significant number of international papers, the project resulted in two international workshops: one, *Role of legumes in the farming systems of the Mediterranean areas*, sponsored by UNDP/ICARDA, was held in Tunis, Tunisia in June 1998. The other workshop, *Introducing ley farming to the Mediterrannean Basin* was held in Perugia, Italy in June 1989 and the proceedings were published by ICARDA in 1993.

Developing resistant chickpea plants

Chickpea is the most important pulse in the Mediterranean region, nethertheless, chickpea production in this region has remained static in the past three decades, whereas the population has doubled. The

demand for chickpea as a cheap substitute for animal protein has also been rising. Scientists from: the University of Naples; ENEA, Casaccia, Rome; Stazione Sperimental di Granicoltura per la Sicilia, Caltageron; Instituto Sperimentale per la Patalogia Vegetale, Rome; and ICARDA have been involved in a project on *Development of resistant chickpea germplasm with combined resistance to asochyta blight and fusarium wilt using wild and cultivated species*. The aim of this collaborative effort is to develop varieties of chickpea with multiple resistance to ascochyta blight, fusarium wilt, cyst nematode and cold.

Previously, scientists were unable to cross cultivated chickpea plants with wild relatives which carried desirable agronomic traits, techniques developed under this project have made this possible—with spectacular results. For example, the incorporation of genes from *Cicer reticulatum* and *Cicer echinospermum,* for increased yield potential, produced gains of up to 50% in preliminary trials.

A field-screening technique for ascochyta-blight resistance and cold tolerance has also been developed, which permits the simultaneous selection for resistance to these two stresses and has therefore helped scientists to develop new cultivars. Four kabuli chickpea varieties have been released in Italy from germplasm developed at ICARDA. A chickpea cookbook has been published in Italy jointly by the International Agruculture Research European Service (INTAGRES) and ICARDA.

In collaboration with Italian researchers, the ICARDA collection of annual wild *Cicer* species has been evaluated and characterized for important agronomic, phenological and morphological traits. Screening carried out both at ICARDA and in Italy has shown that valuable sources of resistance to biotic and abiotic stresses are available in the collection. Research has also been carried out in Italy into the pathogenic variability of asochyta blight.

An international workshop was held in 1990 at Ravillo, Italy in which results of this and other collaborative work were reviewed. The proceedings were published in 1993 as a reference book *Breeding for Stress Tolerance in Cool Season Food legumes*. Another meeting was held in 1996 between scientists from Italy and ICARDA, to review collaboration in the field of chickpea research. The proceedings of this meeting will be published in 1997.

Variety releases

As a result of collaboration between ICARDA and Italy, many new crop varieties have been released. In addition, and possibly of more importance, superior traits identified in the cooperative research have been used by breeding programs wordwide. The cases of crop improvement shown here can be attributed to Italian support.

- Five barley varieties have been developed through pure-line selection within landraces. Three have been officially released in Syria and two in Ethiopia. Their acreage of production is increasing rapidly.
- Four chickpea varieties were released in Italy: Califfo, Sultano, Pascia and Otello. These were released for winter sowing and machine harvesting, which was possible because they are much taller than traditional varieties.
- Work in the Italian-supported chickpea project contributed to new releases in Algeria; Morocco, Portugal, Syria, Tunisia, Turkey and the U.S.A.

Italy and ICARDA's Highland Regional Program

Financial support from the Italian Government enabled ICARDA to establish its Highland Regional Program (HRP) in Ankara in July 1990. Under the joint Turkey/ICARDA Highland Project, created within this program, ICARDA initiated research activities in the highland areas of Turkey from the 1990/91 crop season. Initially, seven small collaborative research projects were initiated; six in the highland plateaux of Central Anatolia, and one for the small-scale farmers of the Taurus Mountains in southern Turkey. These were decided on the basis of the priorities of the highland areas, both in high plateax and mountainous regions in WANA. In 1993, the sub-project on *Survey of Rhizobium numbers and symbiotic effectiveness in the West Asian highlands* was completed, and a new small project on *Improvement of durum wheat for highland environments* was initiated in its place.

Eight new sub-projects have been added since 1993 giving a total of 15 sub-projects. These sub-projects now cover a full range of research activities directed towards the highland areas of WANA. The

fruits of these sub-projects are now being shared with other countries of the WANA highlands, and also with the eight newly independent republics of Central and Transcaucasian Asia (CTA), where ICARDA now has succeeded in extending its research activities through the HRP under the patronage and good support of the CGIAR. Also, it has now been possible to create formal and informal scientific and information networks to link the NARSs of highland areas of WANA and CTA. Thus, HRP is now generating technology for increreasing agricultural production in the highland areas of WANA and CTA, areas which have been generally neglected in the past by both national and international programs. And in this effort, ICARDA always remembers and is grateful for the contributions of the Government of Italy.

Training of NARS staff

NARS researchers participated in two training courses on the utilization of electrophoresis in germplasm characterization given at ICARDA by scientists from the University of Tuscia and the Germplasm Institute at Bari.

Additional cooperative work with Italy

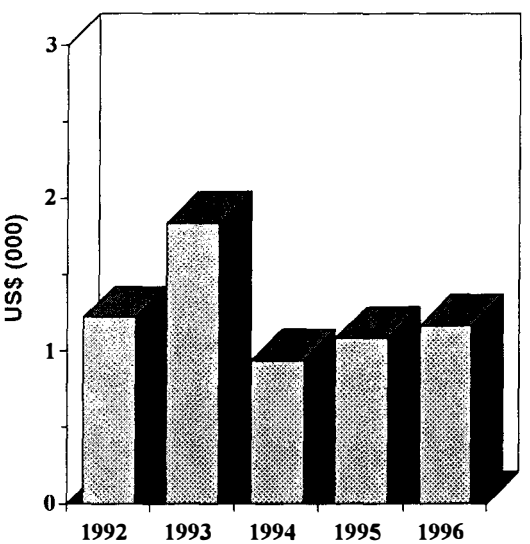
In partnership with the University of Tuscia, ICARDA contributes to the European Economic Community's MEDCAMPUS program, which was set up to establish a Master of Science program in seed technology at the University of Jordan. Italian scientists also participate extensively in ICARDA's International Germplasm Testing Program in barley, wheat, chickpea, faba bean, lentil and forage legumes, which has contributed to the varietal releases mentioned above.

In addition, the Applied Meteorology Foundation, Florence, is involved in research into agroecological characterization for the generation of weather data; and scientists from the Institute of Nematology, Bari are working with ICARDA on a study of parasitic nematodes in food legumes. The Center is also forging links with Instituto Agronomico per l'Oltemare, Florence.

The human dimension

In addition to Italy's financial support to ICARDA, Italy has had an important voice in the governance of the Center. Italy has had representatives on the Board of Trustees since the Center started in the late 1970s, with Prof. Serasia Mugnoza as the first Italian Board member. Prof. Dr E. Porceddu, a distinguished plant geneticist held the Chair for a number of years. The current Italian representative is the geneticist Prof. Dr L. Monti. A number of Italian nationals have worked at ICARD; these include two current senior scientists: Dr Salvatore Ceccarelli (barley breeder) and Stephanie Grando (research scientist). In addition to visiting and seconded scientists, ICARDA has also trained a number of Italian nationals in both degree and non-degree training.

Italy's contributions to ICARDA's annual budget, 1992–1996



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