

SUMMARY

A. OVERVIEW: HIGHLIGHTS OF 1998 RESULTS AND 1999 DEVELOPMENTS

DEVELOPMENTS IN THE GEOGRAPHIC SCOPE OF ICARDA

- ! **Central Asia and Caucasus (CAC):** The First Steering Committee Meeting for the CGIAR Collaborative Research Program for Central Asia and the Caucasus (CAC) was held from 28 to 29 September, 1998 in Tashkent. The meeting was attended by representatives of the eight CAC countries and nine CG Centers (CIMMYT, CIP, ICARDA, ICRISAT, IFPRI, ILRI, IPGRI, ISNAR and IWMI). The location of the Program Facilitation Office (PFU) was confirmed at ICARDA's Regional Office in Tashkent with Dr S.P.S. Beniwal as the Head of the Unit. Within the framework of the CGIAR Collaborative Research Program several projects were agreed for support, including the consortium on Germplasm Conservation, Adaptation, and Enhancement for Diversification and Intensification of Agricultural Production in CAC of five Centers (CIMMYT, CIP, ICARDA, ICRISAT, and IPGRI); and on On-farm Soil and Water Management for Sustainable Agricultural Systems in CAC (ICARDA & IWMI). ICARDA's research in CAC continued based on available funding, particularly in rangeland resources and livestock production (in collaboration with GL-CRSP and USDA/ARS), Crop-Livestock Integration and Technology Transfer (new project funded by IFAD), and genetic resource conservation (funded by ACIAR and GRDC). This was in line with the agreement reached during the second Central Asia/ICARDA Coordination Meeting held in September 1998 in Almaty, Kazakhstan.

- ! ICARDA's cooperation in **Latin America** has focused on provision of germplasm of its global mandate crops. ICARDA is expanding its activities in Latin America, particularly in lentil, barley and faba bean, which are primarily subsistence crops grown by resource poor farmers and also offer possibilities for crop diversification in dry areas. ICARDA will broaden its collaboration to include genetic diversity and conservation, farming systems and crop-livestock interactions, in dry areas of Latin America. Dr A. Rodriguez was posted to CIP headquarters, Lima as ICARDA's Regional Coordinator for Latin America in early 1999 to develop a joint program of research with Latin American NARS.

- ! ICARDA's cooperation in **South Asia** on lentil improvement expanded in Bangladesh in 1998 through a new project funded by ACIAR, supplementing another existing ACIAR project on lentil in Nepal and Pakistan. In 1999 ICARDA will further expand its activities in the dry areas in **China**, particularly in the improvement of forage legumes, faba bean and barley.

- ! In 1998 ICARDA strengthened its linkages and expanded its activities in some of the poorest countries in its region: **Ethiopia, Eritrea, Mauritania, Sudan and Yemen**. ICARDA supported Ethiopia in the second phase of its research programs on cool season food legumes funded by the Netherlands commencing in 1998 and on barley to commence in 1999. Research on neurotoxin-free grasspea will intensify in Ethiopia in 1999 funded by DFID, UK. The outcome of this research would also have impact for the poor in Bangladesh, India and Nepal. In Eritrea, in collaboration with DANIDA, a barley breeding program has been developed, despite unsettled conditions. ICARDA is also providing graduate research training for Eritreans. Two Sudan-ICARDA research projects on natural resources management may become operational in 1999. Several projects developed in 1998 with the NARS of Mauritania on natural resource management and germplasm enhancement are planned to become operational in 1999. Throughout 1998, ICARDA assisted the Yemeni NARS in developing their research strategy and medium-term plan, and in 1999 it will assist in developing a comprehensive proposal for a National Agricultural Technology Project. The Center is also supporting Yemen in developing their genetic resources program under a UNDP funded project, collaborating in a Participatory

Plant Breeding Project, and continuing its scientific support to the Yemen Mountain Terraces Project.

ACHIEVEMENTS AND DEVELOPMENTS IN ICARDA=s RESEARCH PROGRAM

ICARDA=s research program is organized within five themes: (1) Germplasm Enhancement, (2) Production Systems Management, (3) Natural Resource Management, (4) Socioeconomics and Policy, and (5) Institutional Strengthening. Implementation is done in close collaboration with NARS in the dry areas within the framework of the seven regional programs of ICARDA (West Asia, North Africa, Nile Valley and Red Sea, Highlands, Arabian Peninsula, Latin America, and Central Asia and Caucasus regional programs).

In its MTP 1998-2000, following its in-house priority assessment, ICARDA identified areas for increased attention. These included on-farm water management, rangeland rehabilitation and management, small ruminant nutrition and management, agroecological characterization, land and water resource management, resource economics, pre-breeding and biotechnology, farmer participatory approaches, end-use quality and added value, and faba bean improvement. Highlights of progress and developments in each of these areas and other shifts in emphasis are summarized under each theme below.

1. *Germplasm Enhancement*

- ! Farmer participatory plant breeding research expanded from an initial research project on barley in Syria to other NARS such as Ecuador, Morocco and Tunisia on barley and to Yemen on both barley and lentil funded by SWP-PRGA. Research on barley in Syria (GTZ funded) is planned in 1999 to expand using a community approach and monitoring improved seed adoption and production by farmers. Further expansion of farmer participatory breeding is anticipated in 1999 into Jordan on barley and on food legumes in Syria. In May 1999 ICARDA will host an international workshop on Farmer Participatory Research.
- ! In view of the importance of barley as a staple in the diet of some very poor communities, increasing emphasis will be given in 1999 to food barley improvement, utilizing the Center's extensive germplasm collection.
- ! Research on the genetic transformation of food legumes continues with ARIs for chickpea in cooperation with the Universities of Hanover (funded by GTZ) and Naples, for lentil with CLIMA, Australia (funded by ACIAR) and for faba bean with the University of Berlin. In 1999 techniques for transformation will be transferred to Egypt, where biosafety legislation is enacted.
- ! With the identification of linkage between DNA markers and economic traits in several mandate crops (the case of lentil was among the CG Chair's Science Prizes), the use of marker assisted selection will increase in 1999.
- ! In 1998 ICARDA terminated its research on dry pea improvement.
- ! In 1999 a senior barley breeder transferred to the ICARDA CAC Office, Tashkent to work on winter cereal improvement in CAC and the Highlands of WANA, linking with the Krasnodar Lukyenko Research Institute to screen wheat and barley germplasm for cold tolerance for CAC and Russia.

2. *Production Systems Management*

- ! In 1998 promising components of IPM such as the use of entomopathogenic fungi to control sunn pest of wheat and the seed extract from the tree (*Melia azererach*) to control Sitona weevil on lentil and leafminer on chickpea were identified for further investigation.
- ! ICARDA has published the proceedings of the 1997 workshop on "The Challenge of Production System Sustainability: Long-term Studies in Agronomic Research in Dry Areas." In 1998 ICARDA

substantially reduced its on-station, long-term agronomy trials and has begun the analysis and publication of the results and assessments from this research. The shift from Center-managed long-term trials to long-term research conducted on stations and farms by NARS partners will intensify in 1999 with ICARDA support to new initiatives in Egypt, Iran and possibly Sudan.

! Following the 1997 international workshop on animal genetic resources and the WANA NARS consultation on livestock research, ICARDA has substantially restructured its small ruminant research program. A senior small ruminant scientist was recruited in 1998 and the position of an animal molecular geneticist is advertised for recruitment in 1999. New and expanded small ruminant nutrition and health research laboratory facilities were built and furnished in 1998. An international workshop on Animal Genetic Characterization, co-sponsored by ICARDA, ILRI, IPGRI, the SWP-GR, and FAO, will be held at ICARDA in the spring of 1999. At ICARDA breed characterization will be related to production environments and market opportunities. New activities are planned in the transformation of primary products from small ruminants to capitalize on added value. Funds have been secured to greatly expand livestock productivity research in Central Asia, and ICARDA has joined with ILRI in exploring and proposing new livestock research initiatives in that important region.

! Cognizant of external review recommendations to carefully examine its role in rangeland research, ICARDA has developed a draft rangeland strategy for research in non-tropical Dry Areas. Research in 1998 focussed on the assessment and spatial characterization of rangeland plant resources in key representative sites in North Africa, West Asia, and Central Asia. Key to this research is the application of GIS and remote sensing technologies.

3. Natural Resource Management

! ICARDA recruited three new senior staff in Agricultural Hydrology, Marginal Water Use, and Plant-Soil-Water Relations in 1998. These are supporting an expansion of research, respectively, in water harvesting and renewable groundwater resources; use of non-conventional water sources including saline water and treated effluent; and farm-level management practices for improved water-use efficiency in both rainfed and irrigated conditions. Regional funding is anticipated in 1999 for ICARDA's eco-regional program in AOn-farm Water Husbandry in WANA.

! Complementary to participatory plant breeding, ICARDA is developing a repertoire of participatory approaches in natural resource management. In 1998, participatory techniques were applied in natural resource valuation exercises with farmers, particularly on questions of soil erosion and water resource depletion. In 1999, these initiatives will be expanded to include participatory techniques in agroecological characterization and in estimations of water use efficiency. The May 1999 international workshop on Farmer Participatory Research will include applications in both plant breeding and natural resource management research

! The collaborative project AConservation and Management of Agrobiodiversity in the Fertile Crescent, developed by ICARDA in collaboration with the NARS of Jordan, Lebanon, the Palestinian Authority and Syria, and IPGRI, ACSAD (Arab Center for Studies of Arid Zones and Dry Lands) and UNDP/RBAS, was approved by GEF in 1998. ICARDA has responsibility for the coordination of the Project and, with the position of project coordinator under recruitment, the project will become operational in 1999. A major thrust of the project is the development of *in situ* and on-farm conservation of biodiversity through the appropriate management of habitats.

! During 1998 ICARDA substantially increased its attention to climate change and desertification. Together with NARS and ARIs, ICARDA is participating in a network of sites to monitor carbon sequestration during different land management conditions in Central Asia. Another site will be established in 1999. ICARDA is utilizing data from its long-term rotation trials to assess organic carbon increases in soil subject to different cropping patterns. ICARDA attained observer status in the Conference of Parties (COP) of the Convention to Combat Desertification in the meeting in Dakkar in December 1998. The Center, with NARS and other regional and international organizations prepared action plans for implementation under the CCD on controlling

desertification and drought mitigation research. ICARDA is hosting in 1999 a planning workshop co-sponsored by UNEP on research on wind erosion in WANA. ICARDA is a sponsor of the Sixth International Conference on the Development of Dry Lands: Desert Development Challenges beyond the Year 2000 in August 1999.

- ! Agroecological characterization at ICARDA made substantial progress in 1998. Consolidating and building upon achievements of the previous two years, a workshop on Remote Sensing Applications was held in 1998 jointly with the Center for Earth Observation of Yale University. In collaboration with Texas A&M University, a CD-ROM based land and water resource information system was produced covering Syria as a tool to determine recommendation domains and assess environmental risks for different cropping options. In 1999 it is planned to produce as a collaborative effort with seven NARS an agroecological characterization tool presenting potentials and constraints for different production systems in the Arabian Peninsula.

4. Socioeconomics and Policy

- ! ICARDA is strengthening its capacity to address the human aspects of natural resource management at the farm and community levels. A senior Resource Economist will be recruited in 1999. During 1998 partnerships were established with ESCWA (United Nations Economic and Social Commission for West Asia) and the University of Kiel (Germany) to implement research in 1999-2000 on the subjects of farmer allocation of pumped groundwater and the technical and economic efficiency of its use. Efforts will focus on identifying ways and means, including local institutional arrangements, for the sustainable utilization of groundwater by farmers.
- ! ICARDA's attention to issues of food security, poverty alleviation, and gender aspects of agriculture increased in 1998, and the foundations laid for increased research efforts in 1999. A cooperative project with the University of Massachusetts on household food systems, poverty, and the nutritional status of women and children began in 1998. Gender and the changing role of women in food production, particularly in drier areas where transhumant animal husbandry is the principal activity, is the topic of a project with Guelph University (Canada) begun in 1998. This is complementary to an on-going project on the organization of female agricultural labor in areas where crop production has been raised through new technologies and intensified exploitation of land and water resources. ICARDA is developing project proposals for research on the potential for raising incomes, particularly for poor women, through post-harvest processing and marketing of primary crop and livestock products.
- ! ICARDA is actively working with the IAEG on the impact of ICARDA's crop improvement research and its contribution to poverty alleviation. In 1999, the focus of impact assessment will be the returns to research on barley and lentil improvement.
- ! ICARDA received new grants in 1998 to support its joint work with IFPRI on property rights and agricultural policies for the critical low-rainfall areas in WANA. An important workshop was held in Amman, Jordan in November 1998 synthesizing the past three years of research with NARS partners.

5. Institutional Strengthening

- ! ICARDA continues to support bilateral projects in seed production in Central Asia and Caucasus and we expect increased seed and plant breeding activity within an agricultural support service project in Kyrgyzstan in 1999. There is continued emphasis on economic and policy issues affecting the seed supply system in WANA. Funding is being sought to support activities in the WANA Seed Network and a regional CAC seed initiative.
- ! ICARDA cooperated with Egypt in developing decision support software for an expert system in wheat and is starting a parallel effort on faba bean in 1999. ICARDA is using computer expert

systems as a tool for enhancing technology transfer to the end users via the national extension services.

- ! Activity intensified in 1998 to strengthen biotechnology in WANA and to transfer proven biotechnological techniques to NARS in WANA through finance from the Arab Fund.

B. HIGHLIGHTS OF PROJECT PORTFOLIO CHANGES FOR 2000

The Research Project Portfolio for 2000-2002 is presented in the attached Annex. There are no major structural changes in the project portfolio compared with the MTP 1998-2000. Some of the "Logframe " terminology has, however, been introduced. The backdrop to 2000 is that major structural changes were made in 1998, in line with the 1998-2000 MTP, which included reducing some research areas and an intensification on livestock, water and socio-economics, in particular. The year 2000 is thus one of consolidation of research. Accordingly, the suite of projects has not changed (no new projects), but within some projects there are shifts in emphasis or scale reflecting earlier changes:

- X expansion in research on water resource management (as indicated in the MTP 1998-2000);
- X a restructuring of research in livestock, with basic research on the nutritional value of straw being phased out and initiation of a new program on animal genetic resources;
- X increase in support for socioeconomic research on natural resource management (additional staff) and corresponding decrease in other areas of socioeconomic research.

C. HIGHLIGHTS OF 2002 PROJECT PORTFOLIO AND IMPLICATIONS FOR 2000 AND 2001

No strategic shifts are intended in 2002. New milestones reflect changes in emphasis or relative effort within projects . ICARDA will continue to implement the strategic shifts indicated in its 1998-2000 MTP and under Section A above.

D. PROJECT MILESTONES

For details of project milestones for 2000 through 2002 and beyond, see the project summaries in the Research Project Portfolio for 2000-2002 in the attached Annex. Significant revisions of milestones include:

- X The operation of decentralized breeding on kabuli chickpea in South Asia by 2000 in Project 1.5 is due to the recent resolution of the issue of ICRISAT-supported position of senior chickpea breeder at ICARDA.
- X The expansion in staffing in water research is reflected in an increase in the scope of Project 3.1, particularly to include on-farm water use efficiency.
- X Milestones in Agronomy (Project 2.2) continue to reflect the shift in the program to the utilization of results from on-station long-term trials in system modeling and a shift to on-farm monitoring.
- X Under Small Ruminant Management (Project 2.5), establishment of a breed characterization program has been delayed to 2000, and new milestones reflect a shift towards production and genomic characterization of small ruminant breeds in WANA, identification of market opportunities, and the transformation of primary products to capitalize on added-value.
- X Milestones in these projects also reflect the expansion of ICARDA's program to Central Asia and the Caucasus
- X Milestones in socioeconomic research (Projects 4.1 & contingent on recruitment of a natural resources economist and Project 4.2) reflect a shift to the development and assessment of methodologies for transfer to NARS.

E. COLLABORATION HIGHLIGHTS

Details of collaboration are given in the project summaries in the Research Project Portfolio for 1999-2001 in the attached Annex. ICARDA will continue to conduct much of its research program in collaboration with national programs and advanced research institutes, and increasingly through outsourcing of specific activities and training to centers of excellence within the NARS. ICARDA has secured funds to support outsourcing of legume transformation and a joint training program with an advanced research institute in Egypt.

ICARDA has established sub-contracts with a number of ARIs in the developed world, particularly in the area of biotechnology and germplasm enhancement. Mentors have been identified to provide support in the fields of water use efficiency, molecular biology, and resource economics.

ICARDA is the focal point for a System-wide Collaborative Research Program for Central Asia and Caucasus. In addition, ICARDA continues to participate in the seven system-wide programs listed in its MTP 1999-2000 (SGRP, SLP, SWIM, SWP-SWNM, SWP-IPM, SWP-PRCA, and SWP-PRGA). In 1998, proposals for ICARDA convened components of SWIM and SWP-IPM (soil borne diseases) were completed and ICARDA hosted the third meeting of the SWP-IPM. Regional funding for the ecoregional programme in On-Farm Water Husbandry is expected in 1999 with ACSAD and AOAD.

F. PROJECT COSTS

The programmatic and the associated staffing adjustments made during 1998 have made it possible to reduce the project costs in 1999 to US\$ 25.1 million as against US\$ 28.49 million proposed in the 1999-2001 MTP submitted in March 1998. In line with these adjustments, the project cost estimate proposed for the year 2000 in this MTP (2000-2002) is US\$ 26.3 million as against US\$ 29.91 proposed in our 1999-2001 MTP.

In computing project costs, ICARDA's overhead is 24% of the total annual budget. This is allocated across all nineteen projects in the project portfolio, on a proportional basis.

Non-financial contributions include two scientists outposted to ICARDA from CIMMYT, a researcher in small ruminant nutrition from INRA, France, on sabbatical at the Center, and three junior/associate professional officers sponsored by European donor countries (Belgium, Denmark and Holland).

The project annual cost changes represent an increase to account for inflation. ICARDA does not expect any significant changes in local currency exchange rates.

G. CENTER STAFFING

As indicated in Section B, changes were made in 1998 with staff recruited in 1998 in priority areas. In 1999 recruitment will continue for a senior natural resources economist and an animal geneticist for breed characterization to support changes in emphasis in the research portfolio. These were balanced by reductions in staff in 1998 in areas for reduced emphasis, in line with the 1998-2000 MTP. In 1999 ICARDA recruited a senior chickpea breeder, as the previous ICRISAT-funded breeder left in 1996 and ICRISAT is not in a position to contribute to part-fund the post. With this staff renaissance completed by the end of 1999 ICARDA will be well positioned to fulfill the new themes of its MTP research agenda. In 1998, two Associate Professional Officers (APO) supported by DANIDA (one in barley germplasm enhancement and the other in land resource management) arrived on three year contracts. We anticipate in 1999 additional APO staff from other European countries (one from Belgium confirmed) as a means to increase staffing in priority areas. Support to the remaining research in livestock nutrition is being provided through a two year sabbatical of a senior staff member from INRA, France.

Several new modalities are being explored to support critical mass in specific areas of research, as indicated in the 1998-2000 plan. Short-term consultants are being used to supplement core staffing in priority areas. Three Senior Scientific Advisors have been appointed as mentors. NARS scientists will be appointed, as needed, as Affiliate Research Fellows to conduct specific activities.

H. CENTER FINANCIAL INDICATORS AND CAPITAL INVESTMENTS

In submitting the agenda for 2000-2002, it is assumed that the mode of project financing is not a constraint. Assuming full funding, ICARDA does not foresee any constraints on project activity due to financial reasons.

Project 1.1: Barley Germplasm Improvement for Increased Productivity and Yield Stability

Goal

Alleviation of poverty due to sustainable increases in barley productivity by adapting the crop to the different farming systems of developing countries, especially in those areas where the crop is grown by resource-poor farmers, and genetic erosion of the crop halted in target countries.

Purpose

- Increases in productivity of barley, particularly in dry and very dry years, independent from the level of inputs used, in the areas where the breeding methodology developed at ICARDA has been adopted by NARS;
- Reduced dependence on external inputs including fertilizers & pesticides, through the adoption by farmers of germplasm with improved resistance or tolerance to biotic and abiotic stresses.

Indicators:

- Breeding methodologies developed by ICARDA utilized in NARS breeding programs.
- Germplasm with demonstrated resistance or tolerance to biotic and abiotic stresses.
- Adoption of germplasm by farmers.

Output 1: More stable and specifically adapted cultivars developed by NARS through decentralized breeding programmes and participatory plant breeding (PPB);

Indicators:

- Number of NARS collaborating in decentralized breeding
- Number of NARS involved in PPB
- Number of varieties released by NARS and adopted by farmers

Output 2: Germplasm with improved resistance or tolerance to biotic (foliar and root diseases, viruses and insect pests) and to abiotic stresses (drought, cold, heat, salinity and micronutrient deficiencies) and breeding lines with improved quality characteristics for food and feed;

Indicators:

- Yield increases due to improved resistance to biotic and abiotic stresses
- Number of varieties adopted because of feeding value
- Number of varieties with improved food quality

Output 3: Improved performance and stability associated with the use of landraces and wild progenitors for resistance/tolerance to biotic and abiotic stresses, and for adaptation to low-input agricultural systems;

Indicators:

- Yield increases due to varieties based on landraces
- Levels of inputs before and after adoption

Output 4: Improved plant breeding methodologies

Indicator: Increased rate of production of superior breeding material.

Output 5: Improved research capability and expertise of national scientists

Indicator: Number of trainees, MSc. and PhD.

Duration: 5 years.

Milestones

- 2000: 75% of selection and testing program for the highlands of WANA undertaken by NARS. Participatory breeding initiated in Yemen, Eritrea and Nepal. Double haploid production established as routine breeding component.
- 2001: Decentralization in the highlands of WANA and Central Asia completed. Number of NARS using landraces in their breeding programs increased. International barley database available. One cycle of participatory breeding concluded in Morocco and Tunisia.
- 2002: Marker assisted selection used routinely for some specific host plant resistances. Cultivars with improved quality. 75% of the barley breeding for Latin America and China decentralized. First adoption of cultivars developed by PPB.

Users and beneficiaries

National programs will benefit from improved efficiency of germplasm enhancement through a decentralized breeding program. Farmers, especially resource-poor farmers in marginal areas, will benefit from improved varieties, specifically adapted to their conditions. Breeders of other commodities in the international research system will benefit from the experience gained through ICARDA's initiatives in decentralized breeding and gender-sensitive farmer participatory approaches to germplasm enhancement.

Collaborators

- NARS associated with ICARDA's North Africa Regional Program, Latin American Regional Program, West Asia Regional Program, Highlands Regional Program, Nile Valley and Red Sea Regional Program; NARS in Latin America, China, Russia, Vietnam, Korea, India, Nepal, Kenya, Spain, South Africa, New Zealand.
- University of Jordan; Jordan University of Science and Technology; Hassan II University, Morocco; University of Damascus, Syria; Krasnodar Research Institute, Russia; All Russian Institute of Agricultural Biotechnology; University of Weinstephan, Munich, Germany; University of Frankfurt, Germany; University of Hamburg, Germany; Scottish Crop Research Institute, UK; University of Brisbane, Australia; CRC for Molecular Plant Breeding, Waite Campus, Adelaide, Australia; North Dakota State University, USA; Oregon State University, USA; Texas Tech University, USA; Colorado State University, USA; Kansas State University, USA; Oklahoma State University, USA; Montana State University, USA;

Cost:

2000: US\$ 2,225,003

2001: US\$ 2,336,253

2002: US\$ 2,453,066

System Linkages

Germplasm Enhancement and Breeding (70%);

Production Systems Development and Management: Livestock Systems (10%): studies of barley as it relates to livestock nutrition;

Biodiversity (10%): evaluation of land races and wild barley species, and widening of the genetic base;

Strengthening of NARS (10%): provision of technical advice.

Linkage to the Systemwide Programme on Participatory Research and Gender Analysis (SP-PRGA).

Financing Plan

Unrestricted core. Allocated core contribution from Italy; grant from SP-PRGA for PPB; financing from AFESD for biotechnology; collaboration with Australian research supported by GRDC; collaborative research with NARS in Mashreq and Maghreb region financed by IFAD and AFESD; germplasm enhancement in Iran financed by Iran; small grant from World Bank for cooperation with Russia on genetic transformation of barley; cooperation with USA supported by USAID linkage funds; anticipated BMZ restricted funding for PPB; anticipated IDRC grant for PPB; anticipated support from Netherlands for barley research in Ethiopia; anticipated annual grant from the OPEC Fund.

Project 1.2: Durum Wheat Germplasm Improvement for Increased Productivity, Yield Stability and Grain Quality in West Asia and North Africa

Goal

Sustainable increases in the productivity of durum wheat through the development of genotypes and genetic stocks for the different farming systems of the WANA region.

Purpose

- Continuous and sustainable durum research in the WANA region through decentralization of breeding to NARS;
- a widened genetic base for durum wheat germplasm improvement;
- efficiency of breeding for unpredictably dry areas increased through marker-assisted selection;
- increased yield and yield stability, decreased chemical and pesticide use, and enhanced water-use efficiency;
- improved nutritional quality of durum germplasm.

Indicators:

- Improved NARS durum research capacity
- Germplasm with demonstrated resistance or tolerance to biotic and abiotic stresses.
- Adoption of germplasm by farmers.
- Less year-year variation in durum production
- Improved end-product processing and nutritional quality

Output 1: Durum cultivars and genetic stocks with improved productivity and yield stability, resistance to biotic and abiotic stresses, and improved grain quality characteristics.

Indicators:

- Durum cultivars and genetic stocks with better production and yield stability.
- Durum cultivars and genetic stocks with better resistance to diseases and insects.
- Durum cultivars and genetic stocks with better grain quality.

Output 2: Breeding methods and selection criteria for unpredictable environments

Indicators:

- Improved adaptation of cultivars for dry areas.
- Improved efficiency of development of cultivars with improved agronomic traits and yield

Output 3: Strengthened capacity in durum research in NARS

Indicators:

- Training courses; number of NARS researchers trained, MSc and PhD graduate research studies at ICARDA; NARS visiting scientists to ICARDA.
- Quality of NARS research as indicated by research results, publications, etc.

Duration: 5 years.

Milestones

2000: Durum cultivars with broadened genetic resistance to the main diseases and insect pests in WANA.

Traits associated with yield in continental and high altitude dry areas of WANA identified.

Hallmark durum cultivars with appropriate traits for processing quality identified and used in the breeding program.

2001: Durum cultivars with enhanced resistance to drought, cold, and heat.

Traits associated with yield in temperate dry areas of WANA identified.

2002: Integrative and complementary durum research activities among WANA NARS achieved.

Marker assisted selection used routinely.

Local durum end-product processing studied.

Analysis of the association of biochemical and molecular markers with improved gluten strength, yellow pigment, and vitreousness established.

Users and beneficiaries

National programs will benefit from the availability of improved germplasm with drought, cold and heat resistance, and through them farm households, especially resource-poor farm households in marginal areas, will benefit from improved varieties which require to grow less inputs and no chemicals for diseases and pests control. The ultimate beneficiaries are consumers, both rural and urban consumers, from improved grain quality and agro-processing.

Collaborators

- The Durum Improvement Program at ICARDA is conducted in collaboration with CIMMYT; a CIMMYT Durum Wheat Breeder is outposted to ICARDA headquarters.
- Resistance breeding for drought, cold, terminal stress, diseases, insects, viruses: ITGC, Algeria; ARC, Egypt; NCARTT, Jordan; INRA, Morocco; IAV-Hassan II, Morocco; ARC, Syria; University of Aleppo, Syria; University of Tichreen, Syria; INRAT, Tunisia; FCRI, Turkey; Plant Breeding Institute, Cabbity, Australia; University of Sydney, Australia; Agriculture Canada; Laval University, Canada.
- Molecular markers, genome mapping, double haploids: CIMMYT; Cornell University, USA; Paris-Sud University, France.
- Grain quality: Hassan II University, Morocco; Tuscia University, Italy; Cordoba University, Spain.
- Moisture stress: ENSA/INRA Montpellier, France; Barcelona University, Spain; IRTA-Llerida, Spain; Grenada University, Spain.
- Adoption studies: ARC, Libya; NCARTT, Jordan; ARC, Syria; LARI, Lebanon; ARC, Iraq.
- Crop modelling/GIS: Wageningen University, Netherlands.

Cost

2000: US\$ 991,300

2001: US\$ 1,040,865

2002: US\$ 1,092,908

System Linkages

Germplasm Enhancement and Breeding (80%);

Biodiversity (15%) through evaluation of germplasm and widening of the genetic base;

Strengthening of NARS (5%): provision of technical advice on conduct of research.

Financing Plan

Core funds of ICARDA and CIMMYT. Allocated core funds from Italy; BMZ restricted funding for DNA marker assisted breeding and genetic engineering; financing from AFESD for biotechnology; restricted funding from Spain; USDA/FAS ATUT (Agricultural Technology Utilization and Transfer) project for application of molecular genetics to durum wheat in Egypt; germplasm enhancement in Iran financed by Iran; anticipated allocated core funds from France.

Project 1.3: Spring Bread Wheat Germplasm Improvement for Increased Yield and Yield Stability in West Asia and North Africa

Goal

Sustainable food security through enhanced productivity and production of spring bread wheat in dry areas of WANA for the benefit of resource-poor farmers.

Purpose

Sustainable improvement in spring bread wheat productivity, yield stability and end-use quality in the rainfed low-rainfall areas of the West Asia and North Africa (WANA) region.

Indicators:

- ICARDA developed germplasm utilized by NARS in their breeding programs.
- Increased productivity and production through release of improved spring bread and wheat cultivars and their adoption by farmers.

Output 1: Improved spring bread wheat germplasm adapted to rainfed, particularly low-rainfall areas, resistant/tolerant to prevailing biotic and abiotic stresses and with the required end-use quality characteristics.

Indicators:

- Spring bread wheat cultivars with improved drought tolerance.
- Spring bread wheat cultivars with improved resistance/tolerance to prevailing biotic and abiotic stresses in WANA.
- Spring bread wheat cultivars with improved end-use quality characteristics.

Output 2: Improved breeding methodology and selection techniques for dry environments.

Indicators:

- Spring bread wheat cultivars better adapted to dry environments.
- Increased efficiency in identifying spring bread wheat cultivars adapted to dry environments

Output 3: Improved research capabilities and expertise of national scientists.

Indicators:

- Number of researchers trained.
- Quality of research undertaken, as indicated by research results, publications, etc..

Duration: 5 years.

Milestones

2000: Identification of 30-100 drought tolerant sources of spring bread wheat.

2001: Between 200 - 300 lines of spring bread wheat targeted specifically for dry environments provided to NARS through the International Nursery distribution system.

2002: Between 6 – 10 national program scientists trained in breeding methodologies relevant to dry environments.

Users and beneficiaries

National programs will benefit from improved efficiency of germplasm enhancement through a decentralized breeding program, and through them farm households, especially resource-poor farm households in marginal areas, will benefit from improved varieties, specifically adapted to their conditions. Consumers will benefit from improved nutritional quality of bread wheat products.

Collaborators

- ICARDA's Spring Bread Wheat Improvement Program is conducted in collaboration with CIMMYT; a CIMMYT Bread Wheat Breeder is outposted to ICARDA headquarters.
- Breeding for Hessian fly and Russian Wheat Aphid: INRA, Morocco.
- Breeding for Septoria Leaf Blotch: INRAT, Tunisia.
- Networks on foliar diseases, heat tolerance and water use efficiency: ARC, Egypt; EARO, Ethiopia; ARC, Sudan; AREA, Yemen.
- Exchange of germplasm and information: CIMMYT, Mexico; ACSAD, Syria.
- Development of high yielding long spike, heat tolerant and rust resistant wheat facilitated by microsatellite DNA markers: FCRI-ARC, Egypt; USDA-ARS, Beltsville, MD, USA.

Cost

2000: US\$ 517,193

2001: US\$ 543,053
2002: US\$ 570,206

System Linkages

Germplasm Enhancement and Breeding (85%);
Biodiversity (10%) through evaluation of germplasm and widening of the genetic base;
Strengthening of NARS (5%): provision of technical advice.

Financing Plan

Core funds of ICARDA and CIMMYT. USDA/FAS ATUT (Agricultural Technology Utilization and Transfer) project for microsatellite DNA markers for bread wheat in Egypt; financing from AFESD for biotechnology.

Project 1.4: Winter and Facultative Bread Wheat Germplasm Improvement for Increased Yield and Yield Stability in Highlands and Cold Winter Areas of West Asia and North Africa

Goal

Alleviation of poverty and enhanced nutrition of rural populations in some of the harshest environments, the highlands and cold winter areas, of West Asia and North Africa, through improved and sustainable productivity of bread wheat.

Purpose

Improved winter and facultative bread wheat (WFBW) germplasm and related technology that will achieve sustainable yield increases and maintain or enhance plant biodiversity.

Indicator: WFBW germplasm with superior performance to cultivars presently grown in the region utilized in NARS breeding programs.

Output 1: Germplasm and breeding lines with improved yield potential, grain quality, and adaptation to cold environments, developed for use by NARS.

Indicators:

- Germplasm with improved performance for one or more traits (yield, quality, stability of performance) relative to locally grown cultivars, is made available to NARS through international nurseries.

Output 2: Improved understanding of cultivar response to abiotic stresses and the mechanism of adaptation to harsh environments, made accessible to NARS and other partners.

Indicators:

- The performance of successful WFBW cultivars in terms of their response to cold and drought documented and results published and shared with NARS and other partners.
- DNA markers associated with tolerance to cold and drought identified and results made accessible to NARS and other partners.

Output 3: Enhanced genetic diversity, tolerance to biotic stresses, and adaptation in WFBW germplasm, achieved and made accessible to NARS through trait-specific nurseries.

Indicators:

- Wide intra- and inter-specific crosses that diversify breeder's genetic materials made accessible to NARS for use in their own breeding programs.
- Genetic stocks with specific attributes of adaptation (tolerance to yellow rust, leaf rust, common bunt, Russian wheat aphid, root rot, nematodes) made accessible to NARS and other partners.
- DNA markers for resistance to yellow rust and Russian wheat aphid, explored/identified and made accessible to NARS and other partners.

Output 4: Strengthened NARS' capacity for wheat research in the target region.

Indicators:

- Twenty researchers trained in WFBW breeding and associated techniques for the improvement of wheat productivity and protection of wheat genetic resources in the target region.
- Regular scientific and field visits among NARS and CG center scientists undertaken, and networks of WFBW researchers established in at least two areas (germplasm improvement and pathology).

Duration: 6 years.

Milestones

- 2000: Delivery of five WFBW germplasm nurseries to NARS in the target region.
Characterization of major WFBW cultivars in the target region for their responses to cold and drought.
- 2001: Development of genetic stocks for resistance to yellow rust, leaf rust and common bunt.
Network of WFBW breeders and network for pathologists formed in the target region.
- 2002: Development of genetic stocks for resistance to Russian wheat aphid.
DNA markers for cold tolerance in WFBW identified.
- 2003: Development of genetic stocks for tolerance to root rot.
DNA markers for yellow rust resistance identified.
- 2004: Development of genetic stocks with resistance to nematodes.

Users and beneficiaries

National programs will benefit from improved germplasm developed through a decentralized breeding program, and through them farm households in the highlands and cold-winters lowlands of Central and West Asia and North Africa will benefit from improved varieties, specifically adapted to their conditions. Consumers will benefit from improved nutritional quality of bread wheat products.

Collaborators

- ICARDA's Winter Bread Wheat Improvement work is conducted in collaboration with CIMMYT through the Turkey/CIMMYT/ICARDA program operated from Ankara, Turkey.
- *In situ* germplasm evaluation for adaptation to specific agroecologies: NARS associated with ICARDA's North Africa Regional Program, West Asia Regional Program, Highlands Regional Program, and the Regional Program for Central Asia and the Caucasus (CAC).
- Exchange of specific germplasm of winter wheat: China; Russia; Bulgaria; Hungary; Romania; France; Oklahoma State University, USA; Colorado State University, USA; Kansas State University, USA.
- Cold tolerance: NARS of Russia, Ukraine, Turkey and Iran
- Drought tolerance: NARS of Turkey and Iran. John Innes Institute, UK.
- Yellow rust: NARS in West Asia, Central Asia, and Morocco. University of Sydney, Australia.
- Root rot: NARS in Turkey, Morocco, and Iran.
- Nematodes: NARS in Turkey; INRA, France.
- International facultative and winter bread wheat nurseries: Oregon State University, USA; NARS.

Cost

2000: US\$ 830,119

2001: US\$ 871,625

2002: US\$ 915,206

System Linkages

Germplasm Enhancement and Breeding (85%);

Biodiversity (10%): germplasm evaluation and widening of the genetic base;

Strengthening of NARS (5%): provision of technical advice.

Financing Plan

Unrestricted core. Collaboration with Iran supported by Iran. Collaboration with Central Asia and the Caucasus supported by restricted funding through the CGIAR approved Collaborative Research Program. Additional funds are being sought to continue collaboration with Central Asia and the Caucasus and other countries in WANA.

Project 1.5: Food Legume Improvement (Lentil, Kabuli Chickpea and Faba Bean) for Increased Systems Productivity

Goal

Increased production of food legumes (through a reduction in the ratio of cereal to legume sown areas in sub-tropical dry areas) will contribute to food security in the region by increasing the availability of protein-rich food and feed, and will contribute to resource conservation through increased flow of nitrogen into the production systems, reducing the requirement for external nitrogenous fertilizers and, hence, enhancing the profitability and sustainability of cereal based farming systems.

Purpose

Increased returns from food legume (Lentil, Kabuli Chickpea, and Faba Bean) production that renders it economically competitive with cereal production.

- Lentil improvement focuses on the development and delivery to NARS of production technology, particularly genetic material with appropriate combinations of increased biomass for food and feed and resistance to key stresses.
- Adoption of winter sowing of chickpea will be promoted in Mediterranean environments with mild winters and extended to high altitude areas.
- Faba bean improvement aims to reduce the losses from biotic stresses through host-plant resistance in a targeted pre-breeding program in close partnership with NARS. Increasingly, a decentralized breeding strategy will be used in food legume improvement and biotechnological techniques will be utilized to assist the solution of key problems.

Indicator: Germplasm and production technology developed by ICARDA is utilized by NARS.

Output 1: Improved methodologies for food legume breeding i.e. decentralized breeding, marker assisted selection, durable disease resistance breeding and automation.

Indicators:

- Breeding decentralized
- Marker-assisted selection in use
- Key pathogen variability characterized
- Improved screens for selection for stress tolerance developed

Output 2: Twenty researchers/year trained on breeding philosophies, selection methods and techniques related to food legume germplasm enhancement in the target areas of the project.

Indicators:

- Number of researchers trained

Output 3: **Lentil:** Improved production practices and genetic stocks with increased biomass for food and feed and resistance to key stresses (winter cold, drought, vascular wilt, rust and Ascochyta blight).

Indicators:

- 200 crosses/an. followed by selection for key stresses in partnership with NARS.
- Wide crosses made with *Vicia* sp. to incorporate genes for increased biomass
- Improved methods of weed control and harvest mechanization developed with NARS.
- Suitable DNA markers identified for rust and Ascochyta blight resistance and for cold tolerance.

Output 4: Transgenic lentils with the appropriate Bt toxin gene to control Sitona weevil and herbicide resistance for Orobanche control.

Indicator: Production of transgenic lentils through collaboration with other institutes, their testing and use in breeding.

Output 5: **Kabuli chickpea:** Germplasm with large seed, durable sources of resistance to Ascochyta blight, fusarium wilt, insect pests, cold and drought in those combinations required by the target environment.

Indicators:

- DNA markers used to tag and pyramid genes for Ascochyta blight resistance.
- Transformation and regeneration protocol developed with other institutes.
- Screening techniques to identify durable resistance to Ascochyta blight developed
- Transfer of genes for resistance to key biotic and abiotic stresses from wild to cultivated species achieved.
- Additional source of resistance to fusarium wilt and drought identified.
- Improved techniques to screen for resistance to leaf miner and pod borer used.
- Lines developed with winter vigor and the ability to flower and pod at low temperatures.
- Activities decentralized to NARS with high capacity.

Output 6: Kabuli chickpea germplasm with higher yield and improved levels of cold tolerance and fusarium wilt resistance.

Indicators:

- Screening for yield and cold tolerance in germplasm adapted to early spring sowing undertaken.
- Screening for yield and fusarium wilt resistance in germplasm adapted to sowing in southerly latitude done.

Output 7: Faba Bean: Gene pools for West Asia, North Africa, the Nile Valley, and China for recurrent selection for adaptation and high yield and biotic stress resistance.

Indicators:

- Sub-programs established in Tunisia for North Africa, Egypt for Nile Valley, and ZAAS for China.
- Regional sub-programs and gene-pools with specific adaptation developed.
- Stress resistant germplasm (including multiple stress resistance) developed in a decentralized, pre-breeding system.
- Identification of sources of resistance for Orobanche, viruses and stem nematodes and additional sources of resistance for Ascochyta blight, rust, and chocolate spot.
- Recombination of sources of resistance for Ascochyta blight, rust, and chocolate spot, Orobanche and stem nematodes

Output 8: Alternative plant types (independent vascular system, determinate and auto-fertile populations) of faba bean for NARS and their recombination with biotic stress resistances

Indicator: Genepools for independent vascular system, determinate, and high auto-fertile populations and their recombination with multiple disease resistance developed.

Duration: 10 years.

Milestones

- 2000: Appraisal of marker-assisted selection for key stresses.
DNA markers for rust, Ascochyta blight and winter hardiness in lentil.
Winter sown chickpea technology transferred to NARS.
Decentralized breeding program for kabuli chickpea operative in South Asia.
Faba bean lines with improved resistance to chocolate spot and Ascochyta blight.
Faba bean populations for recurrent selection for major biotic and abiotic stresses developed.
- 2001: Resistance to Ascochyta blight in kabuli chickpea marked by molecular markers;
Transformation system for chickpea established.
- 2002: Transgenic lentils to control Sitona weevil and Orobanche developed
Genes for resistance and increased yield in kabuli chickpea transferred from wild to cultivated species.
Transformation system for faba bean established.

Users and beneficiaries

Direct users will be NARS legume improvement programs and, through them, farm households in cereal/food legume production systems, with priority given to resource-poor farm households in marginal environments. The ultimate beneficiaries are consumers of food legumes, who tend to be the poorer consumers.

Collaborators

- The Kabuli Chickpea Improvement Program at ICARDA is conducted in collaboration with ICRISAT.
- Food legume improvement: NARS associated with ICARDA's regional programs in North Africa, Latin America, West Asia, and Nile Valley and Red Sea; NARS in South Asia and China.
- Marker assisted selection: Washington State University, USA; University of Frankfurt, Germany
- Lentil transformation & chickpea for Mediterranean environments: Center for Legumes in Mediterranean Agriculture (CLIMA), Australia
- Transformation with chickpea: University of Hannover, Germany
- Transformation protocols: AGERI, Egypt
- Mapping WANA chickpea wilt races: University of Cordoba, Spain
- Food legume nematology: Institute of Nematology Bari, Italy
- Lentil adaptation: Victorian Institute of Dryland Agriculture, Australia
- Faba bean improvement: New South Wales Department of Agriculture, Australia

Cost

2000: US\$ 2,193,475

2001: US\$ 2,303,149

2002: US\$ 2,418,306

System Linkages

Germplasm Enhancement and Breeding (75%);

Production Systems Development and Management: Crop Systems (10%): food legumes in rotations.

Biodiversity (10%): evaluation of land races and wild relatives and widening of the genetic base;

Strengthening of NARS (5%): provision of technical advice.

Financing Plan

Unrestricted core funds of ICARDA and, for chickpea, ICRISAT. Allocated core funding from UK for food legumes; allocated core funding from Italy for chickpea; restricted project grants from ACIAR for lentils in Bangladesh and pulse transformation technology transfer; GRDC grant supports collaboration with Australia on chickpea; restricted funding from Spain for chickpea; financing from AFESD for biotechnology; collaborative research with NARS on cool season legumes in Ethiopia supported by the Netherlands; collaborative research on germplasm enhancement in Iran financed by Iran; restricted project grant from BMZ for DNA assisted breeding and genetic engineering.

Project 1.6: Forage Legume Germplasm Improvement for Increased Feed and Food Production and System Productivity in Dry Areas.

Goal

Sustainable increases in crop and livestock production, particularly in marginal low rainfall areas, and enhanced food security and alleviation of malnutrition among the rural poor in regions where grasspea (*Lathyrus sativus*, L.) is an important food crop through improved productivity, reduction in the neurotoxin content that causes paralysis, and improved amino acid complement.

Purpose

Enhanced production from mixed crop/livestock farming systems based on improved productivity of forage legumes (*Vicia* spp. and *Lathyrus* spp.) and their nutritional content (for both livestock feed and human consumption) through germplasm enhancement.

Indicators:

- Improved germplasm with the necessary traits for inclusion in mixed crop/livestock farming systems introduced into cereal-based systems and utilized in the development of integrated crop-livestock production systems.
- Improved cultivars of *Lathyrus sativus* (grasspea) with low antinutritional factor B-ODAP content adapted to the areas where the crop is an important human food and livestock feed (Afghanistan, Bangladesh, China, Ethiopia, India, Nepal and Pakistan).
- The stigma of neurolathyris is removed from *Lathyrus sativus* (grasspea), and the incidence of paralysis and human suffering reduced.
- Increased genetic diversity of cultivated forage legume species.

Output 1: Improved cultivars and populations of forage vetches (*Vicia* spp.) and chicklings (*Lathyrus* spp.) adapted to low rainfall areas, resistant to biotic and abiotic stresses and suitable for different end uses (direct grazing, hay, grain and straw).

Indicators:

- New cultivars of forage vetches and chicklings utilized by NARS
- High yielding non-shattering types of vetches, free from anti-nutritional factors such as BCA (B-cyano alanin) in common vetch and tannins in narbon vetch.

Output 2: Improved cultivars of grasspea (*Lathyrus sativus* L.) with high yield potential under low inputs with low or zero neurotoxin B-ODAP (3-N-oxalyl-L-2, 3 diaminopropionic acid), and improved amino acid complement.

Indicators:

- Improved lines of grasspea (*Lathyrus sativus* L.) with minimal neurotoxin content and improved amino acid complement, adapted to minimum input conditions.
- Improved production practices for grasspea such as optimum land preparation, planting time, seed rate, disease and insect control, harvesting time and methods.

Output 3: Improved types of amphicarpic type forage legumes such as underground vetch (*Vicia amphicarpa*) for marginal non-arable lands.

Indicator: Increase in productivity and carrying capacity of marginal lands in the region.

Output 4: Strengthened capacity of NARS in forage germplasm evaluation, enhancement and quality assessments.

Indicator: Number of NARS scientists trained.

Duration: 4 years.

Milestones

2000: Cultivars of vetches adapted to specific environment (cold highlands, and low rainfall areas of low lands).
Low neurotoxin lines of *Lathyrus sativus* identified in Ethiopia and Bangladesh.

2001: On-farm testing of low neurotoxin lines of *Lathyrus sativus* in Ethiopia and Bangladesh.
On-farm testing of new cultivars of vetches.
Distribution of underground vetch to national programs for testing in marginal land rehabilitation.

2002: Cold tolerant vetch varieties for highlands.

2003: 10-15 NARS scientists trained and 2 M.Sc / Ph.D. graduate students completed studies.

Users and beneficiaries

The project is targeted at farm households and particularly livestock owners, in marginal lands, where interruption of continuous cereal cropping with forage crops, will increase feed supplies for livestock. Similarly, feed resources can be augmented through use of suitable adapted amphicarpic self-regenerated forage legumes in rehabilitating non-arable grazing lands. Development of grasspea germplasm with low neurotoxin content, that will reduce the incidence of neurolathyrism, will benefit small farmers relying on grasspea land races as a major component of their diet in areas, or under environmental conditions, where other legume crops fail.

Collaborators

- Germplasm enhancement & utilization: NARs associated with ICARDA, Regional Programs, West Asia Regional Program, Highlands Regional Program, Central Asia Countries (CAC), Aleppo University.
- Low neurotoxin grasspea: National Programs of Bangladesh, Ethiopia, China, Nepal, Pakistan, India, University of Ghent, Belgium, University of Alberta, Canada.
- Antinutritional factors (ANFs) and nutritional aspects: International Food Policy Research Institute; International Livestock Research Institute; Center for Legumes in Mediterranean Agriculture (CLIMA), Australia; University of Western Australia, Victoria; Institute of Dryland Agriculture; University of Addis Ababa, Ethiopia; Institute of Food Research, Norwich, UK; University of Alberta, Canada; University of Ghent, Belgium; Washington State University; Indian Agriculture Research Institute, New Delhi, India.

Cost

2000: US\$ 605,303

2001: US\$ 635,568

2002: US\$ 667,346

System Linkages

Germplasm Enhancement and Breeding (70%);

Production Systems Development and Management: Livestock Systems (10%): studies of forage legumes as they relate to livestock nutrition;

Biodiversity (15%): collection and evaluation of land races and wild species and widening of the genetic base of cultivated forage legumes;

Strengthening of NARS (5%): provision of technical advice.

Financing Plan

Unrestricted core funds; use of forage legumes in development of integrated crop-livestock production in Mashreq and Maghreb financed by IFAD and AFESD, and in Central Asia by IFAD; grant from DFID CRF for antinutritional aspects of grasspea in Ethiopia; restricted project grant from ACIAR for grasspea in Bangladesh.

Project 2.1: Integrated Pest Management in Cereal and Legume Based Cropping Systems in Dry Areas

Goal

Improved and sustainable crop production systems, protection of the environment, and increased farm incomes in dry areas of WANA, through adoption of integrated pest management practices.

Purpose

Reduced the variability in cereal and legume production attributable to disease and pest attacks, through successful transfer of IPM practices to farmers

Indicators: IPM packages developed in collaboration with NARS partners.
Adoption of IPM by farmers to manage pest problems.

Output 1: IPM packages for the different cropping systems and agroecological zones of WANA comprising (i) host resistance, (ii) crop rotation and other agronomic practices, (iii) chemicals, (iv) biological agents, and (v) healthy seed.

Indicators:

- Establishment of IPM packages by NARS and level of introduction at the farm level.
- Increased demand for treated seed of improved crop cultivars from national seed supply schemes.
- Changes in farming systems from large fields with monoculture to strip cropping with built in rotations and tillage practices.

Output 2: Research capability and expertise of national scientists improved.

Indicators:

- Increase in number of NARS scientists collaborating with ICARDA colleagues in developing and testing IPM packages in their respective countries.
- Number of NARS staff that received IPM training at ICARDA.

Duration: 10 years

Milestones

2000: Establishment of on-farm trials in selected areas with farmers' participation.

2001: Evaluation of on-farm performance of IPM packages in different agro-ecological zones of WANA

2002: Evaluation of the level of adoption by farmers.

Annual: Long-term training of NARS scientists in IPM through Visiting Scientists Program

Users and beneficiaries

The project will promote the concept of an IPM research approach in national research programs, and will work in partnership with NARS in developing the components of IPM packages and in making the adjustments where necessary to meet the conditions of different locations and cropping systems. The main beneficiaries and users of the IPM technology are the resource-poor farmers of the different agro-ecological zones of WANA.

Collaborators

- Testing packages of IPM in selected sites of West Asia and North Africa: Institute National de la Recherche Agronomique (INRA), Morocco; Agriculture Research Center (ARC), Egypt; Ethiopian Agricultural Research Organization (EARO), Ethiopia; Directorate of Agricultural and Scientific Research, Syria;
- Exchange of resistant germplasm: CIMMYT, ICRISAT, NARS of CWANA.
- Study of population dynamics of powdery mildew: Riso Laboratory, Denmark
- Ecology and biological control of soil-borne pathogens: University of Bonn, Germany; KVL, Denmark
- Viral pathogens and virus resistance: ARC, Egypt; German Federal Research Laboratories for Agriculture and Forestry, Germany; CNRS, ISV, France; NSW Agriculture, Australia.
- Monitoring of leaf and stem rust variability: IAVHII, Morocco; ARC, Egypt; University of Aleppo, Syria.
- Yellow rust: University of Sydney, Australia; FCRI, Egypt; USDA/ARS, USA
- Characterization of pathogenic variability in Scald: University of Adelaide, Australia.
- Hessian fly resistance and molecular biology: INRA, Morocco; Kansas State University, USA; Purdue University, USA.

- Russian wheat aphid; legume pests: Washington State University, USA; Colorado State University, USA; ARC, Egypt.
- IPM of Sunn Pest: Plant Protection Research Institute, Turkey; Cukurova University, Turkey; University of Aleppo, Syria; University of Vermont, USA; CABI, NRI, UK.
- Nematodes control in legumes and cereals: CNRS/Bari, Italy; IPO-DLO, Netherlands; INRA-Rennes, France.
- Diseases in chickpea: International Mycological Institute, UK; University of Frankfurt, Germany; University of Cordoba, Spain
- Use of Systemic Activated Resistance in disease management: University of Giessen, Germany

Cost

2000: US\$ 1,259,454

2001: US\$ 1,322,427

2002: US\$ 1,388,548

System Linkages

Production Systems Development and Management: Cropping Systems (75%)

Protecting the Environment (15%)

Strengthening NARS (10%)

Linkage to the Systemwide Programme on IPM.

Financing Plan

Core funds. Support for collaboration with University of Vermont from USAID linkage funds; support for collaboration with CIMMYT on near-isogenic lines for yellow rust from ACIAR; support for resistance to viruses in legumes by GRDC, Australia. Support is being sought for inter-center project on soil-borne pathogens within SP-IPM; support is being sought for multi-institutional project on Sunn Pest in West Asia.

Project 2.2: Agronomic Management of Cropping Systems for Sustainable Production in Dry Areas

Goal

Increased productivity and productive capacity of soils through improved soil and crop management and the use of appropriate crop rotations; sustainable crop productivity through improved water use efficiency, and maintained soil fertility; greater awareness among decision makers of the value of improved soil, water and crop management within cropping systems, with a view to removing constraints to their adoption by farmers.

Purpose

Efficient locally adapted arable systems for the biophysically and economically sustainable production of field crops -- appropriately integrated and in balance with any local tree-crop or animal production system -- making efficient and conservative use of natural resources and externally derived inputs.

Indicators:

- Information on soil, water and crop management technologies utilized by NARS.
- Adoption rate of appropriate soil, water and crop management technologies increased through participatory actions by farmers.
- Efficient and conservative use of soil and water and external inputs achieved.

Output 1: Management principles for choice of crop, crop rotation, input use and husbandry practice, with respect to rotational output, resource-use efficiency and long-term soil and crop productivity.

Indicators:

- Technically feasible, economically viable, and environmentally sound sustainable production systems management developed in collaboration with NARS.
- Participation of farmers in technology testing and long-term effects of dynamic farming systems on sustainability of production monitored.
- Network of long-term trials in the region established.
- Information published.

Output 2: Validated cropping systems simulation models for the spatial extrapolation and generalization of results of limited agronomic trials through use of GIS.

Indicators:

- Maps of production of specific crops, water use and its efficiency, evaporation and transpiration, soil fertility build-up, nutrient dynamics under different soil, water and crop management practices.
- Guidelines and decision support systems developed.

Output 3: Field tested techniques for more efficient water use in dry area cropping systems.

Indicators:

- New or improved technologies for soil water conservation and its efficient use developed in partnership with NARS.
- Promising techniques in soil, water and crop management which increase water use efficiency are adopted by farmers.

Output 4: Management strategies for the enhancement of soil chemical fertility in production systems.

Indicators:

- Literature on nutrient management for efficient use is upgraded.
- Soil sampling and laboratory analysis procedures for fertilizer recommendation is developed.
- Biological, chemical and physical soil quality indicators developed.
- Training manuals and guidelines in soil quality produced.

Output 5: Maps of the distribution and severity of soil micronutrient imbalances in collaboration with NARS.

Indicators:

- Soil micronutrient database developed with NARS.
- Climate and soil-type patterns identified.
- Maps and reports on micronutrient stresses affecting plant, animal and human health produced.

Output 6: Strengthened capacity of NARS

Indicators:

- NARS scientists collaborating in joint research with ICARDA
- NARS personnel trained in standardized analytical techniques, soil, water and cropping system management, the development of productive and sustainable technologies, and in using cropping systems simulation models for developing decision support systems.
- Training manuals and guidelines produced.
- Workshops and symposia attended by NARS and their papers published.

Duration: 5 years.

Milestones

- 2000: Recommendations arising from analysis of on-station long-term trials.
Publications from evaluation of long-term trials.
Energy efficient tillage systems identified and tested under farmers' conditions.
Methods of field sampling and laboratory analysis upgraded.
Validated techniques for measuring bacterial biomass.
Long-term trials information network established.
NARS staff trained.
- 2001: Systems models developed using results from on-station trials.
Production risks quantified (in pilot areas) using cropping system models and GIS.
Distribution of micronutrient stresses mapped.
Soil fertility network established.
Implementation of SP-SWNM-OSWU projects by NARS.
Long-term monitoring of farmers dynamic systems with NARS extended.
NARS staff trained.
- 2002: Validated cropping systems simulation models for the spatial extrapolation of site specific findings on the optimization of soil water use and management practices.
Production risks quantified in wider areas.
Crop cultivars and management systems that optimize WUE tested on-farm.
Review of N and P studies completed, soil N transformations quantified.
Climate and soil-type patterns in micronutrient stresses identified
NARS staff trained.

Users and beneficiaries

The project will work directly with national research and extension personnel with responsibility for agronomic management of cropping systems and with farmers in ICARDA's mandate area.

Collaborators

- Long-term trials for resource management: NARS of Algeria, Egypt, Jordan, Lebanon, Iran, Morocco, Syria, Turkey, CAC;
- Farm surveys and on-farm experimentation: NARS of Algeria, Jordan, Iran, Morocco, Syria and Turkey; ICRISAT.
- Boron toxicity: NARS of Algeria, Iraq, Iran, Tunisia and Turkey;
- Optimizing Soil water Use: NARS of Egypt, Jordan, Iran, Morocco, Syria, Turkey, Niger, Zimbabwe, Mali, Kenya, Burkina Faso, South Africa; and ICRISAT as co-convenor.
- Soil fertility trends; systems modeling; and use of 15N: University of Reading, UK; Atomic Energy Commission of Syria; International Atomic Energy Agency (IAEA), Austria.
- Testing and validation of simulation models: NARS of Egypt, Iran, Jordan, Morocco, Syria and Turkey; Washington State University, USA; Wageningen University, Netherlands; Giessen University, Germany
- Soils laboratory standardization: NARS of Egypt, Iran, Jordan, Lebanon, Morocco, Pakistan, Syria, Turkey and Yemen; Wageningen University.
- Soil chemistry: International Atomic Energy Agency (IAEA); IMPHOS; International Fertilizer Association (IFA).

Cost

2000: US\$ 1,690,104
2001: US\$ 1,774,609
2002: US\$ 1,863,339

System Linkages

Production Systems Development and Management: Cropping Systems (70%);
Protecting the Environment (25%) specifically through research on physical and biological

characteristics of the soil and research on soil water management; Institution Building (10%): provision of technical advice on conduct of research.
Strengthening of NARS (5%)
Linkage to the Systemwide Programme on Soil Water and Nutrient Management (SP-SWNM): Optimizing Soil Water Use (OSWU), with ICRISAT.

Financing Plan

Unrestricted core funds. Collaboration with NARS in Egypt in long-term trials and farm monitoring supported by EC; support to consortium on Optimizing Soil Water Use through the SP-SWNM; grant for soil fertility network from IMPHOS (Institut Mondial du Phosphate, Morocco); collaboration with Iran financed by Iran; anticipated financing for soil fertility research from IFA (International Fertilizer Association); anticipated financing for research on soil water and nutrient management in Central Asia from Asian Development Bank.

Project 2.3: Improvement of Sown Pasture and Forage Production for Livestock Feed in Dry Areas

Goal

Improved livelihoods of rural families by improving the productivity and the sustainability of farming systems, and thus increasing farm incomes; improved food security by meeting the increasing demand for livestock products; and conservation of natural resources by increasing use of feed legumes in farming systems and more extensive use of available resources in animal feed production.

Purpose

Improvement of small ruminant feed and nutrition, diversification of farming systems, sustainable system productivity and maintenance of soil fertility through the adoption by farmers of annual pasture and forage legumes in crop rotations or to rehabilitate native pasture land.

Indicator: Area grown to annual pasture and forage legumes in crop rotations or to rehabilitate native pastures.

Output 1: Identification of species and selection of adapted cultivars of annual pasture and forage legumes (in cooperation with Project 1.6)

Indicators:

- Cultivars released to NARS
- On-farm testing by farmers of selected cultivars.

Output 2: Forage and pasture seed production technologies developed for small farmers.

Indicators:

- Small-scale farm machinery adapted or developed for pasture seed collection and production.
- On-farm demonstrations and published manual.

Output 3: Demonstration of higher and sustainable system productivity from barley in rotation with pasture or forage legumes, compared to continuous barley cropping or barley in rotation with other food legumes, clean fallow, weedy fallow, or other relevant crops.

Indicator: On-farm trials

Output 4: Management recommendations that provide the highest economic output at a minimum cost from pasture and forage legume rotation treatments.

Indicator: Recommendations utilized by NARS in extension and demonstration programs

Duration: 10 years.

Milestones

- 2000: A functional system for production of locally adapted pasture species established with NGOs, NARS and farm communities.
Rotation trials established in cooperation with NARS in three countries analyzed for economic ranking of treatments.
Regional project on pasture seed production initiated.
Appraisal of long-term trials: treatment effects on grain and straw yields, total nutritive value of feeds produced, and seed bank dynamics.
Quantification of animal performance under low-input year-round management in integrated pasture/cereal/livestock farming systems.
- 2001: Mechanisms established between Maghreb countries for the exchange of genetic material and experience in oat and vetch production.
Adoption of vetch within rotations by farmers in the Mashreq region.
Adaptation and on-farm testing of available technologies for on-farm forage production in Central Asia.
- 2002: Potential use of waste water to irrigate forage crops evaluated.
Genetic diversity of cultivated and wild pasture and forage species of Central and West Asia and North Africa documented and conserved.

Users and beneficiaries

The immediate users are ICARDA's NARS partners; the ultimate beneficiaries are farmers and their families, through the sustainability of production systems and livelihoods and, through provision of livestock feed, rural and urban consumers.

Collaborators

Pasture/forage rotation trials with cereals: AUB/AREC, Lebanon; SMAAR, Syria, Aleppo university
Forage and pasture management: NARS of Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia, Turkey and Central Asia; USDA-ARS; GL-CRSP; INIA, Spain.
Pasture rehabilitation and vetch in Turkey: Field Crops Research Institute, Ankara, Turkey

Cost

2000: US\$ 785,518
2001: US\$ 824,794
2002: US\$ 866,034

System Linkages

Production Systems Development and Management: Cropping Systems (70%) and Livestock Systems (15%)
Protecting the Environment (10%)
Strengthening NARS (5%).

Financing Plan

Unrestricted core funds. Restricted grant from Spain. Funding for collaborative research with NARS in Mashreq and Maghreb from IFAD and AFESD. Grant from IFAD for integrated feed and livestock production in Central Asia.

Project 2.4: Rehabilitation and Improved Management of Native Pastures and Rangelands in Dry Areas

Goal

Poverty alleviation and environmental conservation based on the rehabilitation of native pastures and rangelands which support some of the poorest communities in dry areas; enhanced food security by restoration of the contribution of rangelands to national livestock feed demands. Rangelands also contribute significantly to global carbon sequestration; revegetation can contribute to reducing global warming as well as desertification.

Purpose

The development of rehabilitation and management measures for rangelands and marginal lands, which are sustainable, socially and environmentally acceptable and contribute significantly to increasing the supplies of feed for small ruminants and fuel wood in dry areas.

Indicator:

Rehabilitation and management measures utilized by NARS in rangeland development programs.

Output 1: A management plan for rangeland natural resources in two test sites in WANA.

Indicator: National and community acceptance of management plan.

Output 2: Low cost techniques for rehabilitation of rangeland and marginal lands.

Indicator: Techniques tested and utilized by NARS.

Output 3: Inventory of useful native and exotic plants for feed, fuel-wood, or erosion control.

Indicator: Documentation, database and herbarium of useful species.

Output 4: Formulated measures for the introduction of fodder shrubs into rangeland settings based on assessment of success and failures in past projects.

Indicator: Documentation of measures made available to NARS.

Duration: 8 years.

Milestones

2000: Natural resource, land use and management maps of two representative rangeland zones in WANA.

Nurseries, pasture and fodder shrub observation blocks established in representative villages of at least three countries.

Assessment of the present and potential seasonal use of rangeland by pastoral communities in selected sites in Central Asia.

Measurement of CO₂ in three sites in Central Asia completed (in collaboration with GL-CRSP).

2001: Guidelines for proper management of fodder shrub plantations established with users.

2002: Significant diversity of major local rangeland species of the Central & West Asia and North Africa conserved.

Fodder shrubs for cold environments released.

Trials and demonstrations established, in participation with local communities, of methods for range restoration.

Users and beneficiaries

The research targets low potential areas, including native pastures on non-cultivable lands within arable areas and the vast areas of rangelands, which support some of the poorest communities in the dry areas of the world. Users are agro-pastoral groups living in rangelands. Women and children will benefit in particular, because of their responsibilities in feeding and managing animals and the dependence of rangeland communities for a large proportion of their diet on the production from their own animals.

Collaborators

- Data base on useful arid zone plants: INRAT, Tunisia; Arid Zone Research Institute, Pakistan;
- SEPASAL project, Kew Botanical Gardens, UK .
- Studies on shrub utilization by sheep: Arab Center for Studies of Arid Zones and Dry Lands (ACSAD)
- Geographic Information System (GIS): JICA-JIRCAS, Japan; Maison de l'Orient, CNRS, France: IUED, Switzerland.
- Fodder shrubs and trees: ILRI; ICRISAT; ICRAF; University of Göttingen; Centro de Investigación y Desarrollo Agroalimentario (CIDA), Spain
- Monitoring of range biomass production and carbon sequestration in Central Asia: USDA/ARS Range Sheep Production Efficiency Unit (RSPEU), Dubois, Idaho; USDA/ARS Forage and Range Research Laboratory (FRRL), Logan, Utah; University of California, Davis; Utah State University; National Programs of Kazakstan, Turkmenistan and Uzbekistan
- Rehabilitation of marginal land and range: Syria: Steppe Directorate; University of Aleppo. Lebanon: American University of Beirut; Lebanese University; Lebanese Agricultural Research Institute; Jordan: University of Jordan; National Centre for Agricultural Research and Technology Transfer; University of Western Australia.

Cost

2000: US\$ 2,156,830
2001: US\$ 2,264,671
2002: US\$ 2,377,905

System Linkages

Protecting the Environment (60%), through research on land resource conservation;
Production Systems Development and Management: Livestock Systems (25%), through studies of livestock nutrition and feed resources;
Biodiversity (10%), through collection of range species, establishment of nurseries and pastoretum, and in situ conservation;
Strengthening NARS (5%): provision of advice to NARS.
Linkage to the Systemwide Livestock Programme.

Financing Plan

Unrestricted core funds. Financing from Egypt for technical assistance to north-west Egypt; collaborative research with NARS in Mashreq and Maghreb financed by IFAD and AFESD; collaborative work on fodder shrubs supported within the Systemwide Livestock Programme; work on range vegetation monitoring and carbon sequestration in Central Asia supported by USDA/ARS and USAID GL-CRSP; financing from IFAD for integrated feed/livestock research in Central Asia; use of GIS and remote sensing in rangeland mapping financed by SDC, Switzerland; Restricted funding from Spain; anticipated financing within the sub-regional action program of the CCD.

Project 2.5: Improvement of Small Ruminant Productivity in Dry Areas

Goal

Poverty alleviation among small ruminant producers, sustainability of small ruminant production systems, increased value derived from small ruminant products, and enhanced food security through increased supply to consumers of livestock products.

Purpose

Improved productivity of small ruminants, increased supply and improved quality of livestock products, optimal utilization of feed resources, and reduced dependency on imported feed concentrates.

Indicators:

- National production and consumption statistics and on-farm surveys monitoring productivity and income of small ruminant production systems.
- Developed and tested market-oriented resource efficient technologies to improve small ruminant productivity and producers' income, involving management, nutrition, breeding, animal health and transformation of primary products that are demonstrably better than former practices.
- Actions by NARS to reduce the threat to the integrity of small ruminant germplasm, identifying avenues for their management, improvement and conservation.

Output 1: Assessment of markets and market opportunities for small ruminant products, identifying niches where small ruminants have a comparative advantage

Indicators:

- Databases with market information concerning small ruminant products are available and accessible to NARS.
- Country guidelines highlighting market opportunities and unused niches, as well as suggestions for reorientation of small ruminant production available to the national programs concerned.

Output 2: Technologies to improve small ruminant productivity and farmers' income integrated in on-farm adaptive market-oriented research, including efficient low-cost technologies and management strategies that optimize use of available feed resources and reduce parasite loads and inbreeding.

Indicators:

- Results of the on-farm performance of monitored pilot farms where small ruminant productivity-increasing and resource-conserving technologies are being tested are accessible to end-users.
- Tested low-cost technologies that improve small ruminant productivity made available to NARS.

Output 3: Assessment of the potential for, or improvement of, transformation of primary products, such as milk into cheese and yogurt, to capitalize on added value as a means to further increase the income of farmers.

Indicators:

- Database and reports involving information on the role of milk production in small ruminant farmers' economies are available to NARS and end-users.
- Manuals including suitable tested transformation technologies of primary products for different types of small ruminant production systems.
- Prototype experimental unit at ICARDA's research station and on-farm demonstrations.

Output 4: Production and genomic characterization of small ruminant breeds in Central and West Asia and North Africa (CWANA), along with characterization of their production and market environments, documented and databased; and matching of breed specializations with market and environmental potentials. Particular consideration given to traits involving milk production, resistance to parasites and capacity to produce under severe conditions.

Indicators:

- Regional and FAO's Animal Genetic Resources databases updated with the characterization of small ruminant breeds.
- Guidelines for matching breed specializations with production and market potentials.
- Guidelines for improvement and conservation of small ruminant germplasm.

Duration: 6 years.

Milestones

- 2000: Regional databases for market assessment.
Establishment of on-farm adaptive research network integrating technologies to improve productivity and income in Central Asia.
ICARDA's small ruminant research facility is enhanced with a milk parlor and transformation plant.
Establishment of breed characterization facility at ICARDA with a molecular small ruminant geneticist.
Protocols, databases and first results on characterization of small ruminant breeds.
- 2003: Markets and market opportunities of CWANA are assessed.
Groups of farmers applying market-oriented resource-efficient technologies to improve productivity and income.
Groups of farmers test transformation technologies to produce milk derivatives that enhance income.
- 2005: Breed characterization information is integrated to match market and production potentials to specializations of breeds.

Users and beneficiaries

Beneficiaries are both producers and consumers of livestock products. Milk and meat from productive small ruminants are rich in protein and micronutrients which are needed by the rural and urban poor, particularly infants, children and women. At the national level, the use of available crop residues and agroindustrial by-products will reduce imports of feed concentrates.

Collaborators

- Market studies: FAO; USDA.
- Adaptive research: NARS of Central Asia, West Asia, North Africa and Egypt; IPA, Iraq; INRA, Tunisia; Jordan University of Science and Technology; FAO; GL-CRSP, University of California, Davis, USA; GL-CRSP University of Wisconsin-Madison, USA; USDA.
- Transformation of primary products: FAO; University of Wisconsin-Madison, USA; University of Hohenheim, Germany; INRA, France; Çukurova University, Turkey.
- Breed characterization: University of Hohenheim, Germany; ILRI; IPGRI; University of Wisconsin-Madison, USA.
- Animal Health: ILRI; JICA, Japan; University of Hohenheim, Germany.

Cost

2000: US\$ 1,719,627
2001: US\$ 1,805,608
2002: US\$ 1,895,888

System Linkages

Production Systems Development and Management: Livestock Systems (90%). Additional linkages are to Protecting the Environment (5%) and Strengthening NARS (5%).
Linkage to the Systemwide Livestock Programme.

Financing Plan

Unrestricted core funds. Financing of collaborative research with NARS in Mashreq and Maghreb regions from IFAD and AFESD; financing for integrated feed/livestock research in Central Asia from IFAD; anticipated funding for breed characterization in WANA from BMZ.

Project 3.1: Water Resource Conservation and Management for Agricultural Production in Dry Areas

Goal

Sustainable production systems and conservation of limited water resources through the optimal use of all water sources currently and potentially available for agricultural use

Purpose

Improved management of rainfall, conventional and non-conventional water resources at the farm level to attain higher water use efficiency and sustainable agricultural production.

Indicators:

- Improved technologies, methodologies, and recommendations are utilized by national programs at appropriate sites.
- Progressive actions taken by NARS for encouraging the adoption of technologies that improve water use efficiency and the sustainability use of scarce water resources.
- Improved on-farm water use efficiency by farmers in Central and West Asia and North Africa (CWANA).

Output 1: Methodologies and recommendations for efficient capture, storage and utilization of rainfall (water harvesting) available to NARS of the drier environments of CWANA.

Indicators:

- Improved models and methods for evaluating the potential for water harvesting utilized by NARS in selecting appropriate sites and methods for water harvesting.
- Techniques suitable for various conditions tested and demonstrated with NARS at relevant sites for transfer to similar conditions.
- Information on the socioeconomic constraints and potential policies and actions to overcome them are accessible to national decision-makers.

Output 2: Optimal strategies and practices for using limited water resources conjunctively with rainfall through supplemental irrigation.

Indicators:

- Characteristics of the major environments in which supplemental irrigation is practiced and their interaction with farm management of supplemental irrigation documented and utilized by NARS in improving supplemental irrigation practices.
- Technologies for efficient water use in supplemental irrigation available to national research and extension systems for transfer to farmers in major supplemental irrigation areas of CWANA.
- Workshops and regional meetings in which research results are communicated to local, national and regional institutions.
- Farmer's demonstration trials established in representative sites for the adaptation of improved technologies.

Output 3: Optimal combinations of management strategies, practices and inputs to improve on-farm water use efficiency, particularly in irrigated areas (in cooperation with Project 2.2).

Indicators:

- Packages that ensure improved water use efficiency and sustainability utilized by NARS.
- Recommended on-farm irrigation management strategies and techniques that improve soil quality, shallow groundwater quality, and yield, transferred to NARS for further testing and application.
- Research trials and monitoring sites for studying sustainability and improved water use efficiency established, in collaboration with NARS, in representative irrigated areas in CWANA.
- Cropping systems simulation models that integrate results and estimate the effects of different crop management strategies and techniques on on-farm water use efficiency made available to NARS
- Crop management strategies and techniques with the potential to improve on-farm water use efficiency identified and recommendations developed.

Output 4: Strategies, methods and techniques for the safe and sustainable long-term use of marginal water and treated sewage effluent in agriculture.

Indicators:

- Guidelines for the safe, productive and sustainable use of treated sewage effluent made available to NARS.

- Packages for the safe and sustainable utilization of saline water in agriculture tested by NARS.
- Awareness increased through publications, meetings and workshops on the potential use of marginal water and the special management needed to reduce the possible adverse effects of using it.
- Research trials established in collaboration with NARS in representative locations to adapt improved packages.

Output 5: Strategies for the conservation and sustainable utilization of renewable groundwater resources.

Indicators:

- Farm level models available to NARS for the assessment and the sustainable management of renewable groundwater in agriculture.
- Recommendations for improved management of renewable ground water made available to national decision-makers.

Output 6: Strengthened capacity of national research, extension and management personnel and greater public and governmental awareness of the importance of water conservation and management issues.

Indicators:

- Formal training courses for NARS in the supplemental irrigation, water harvesting, hydrology, water use efficiency and management of marginal water
- Medium and long-term training for individuals in NARS in specific techniques, e.g., the use of remote sensing, GIS, modeling, etc.
- Workshops with national decision and policy makers that increase awareness of the needs for policies and actions to promote the adoption of recommended technologies and management strategies.

Duration: 10 years.

Milestones

- 2000: Workshop on the methodologies and recommended technologies of water harvesting. Trials initiated in major supplemental irrigation areas. New research sites established in Central Asia. A project for the assessment of farm water use efficiency initiated for the region. Preliminary recommendations on appropriate crops, inputs and management strategies for non-conventional water sources. Assessment of the management of renewable groundwater and methodologies for developing improved strategies.
- 2001: Package on using GIS and remote sensing in planning water harvesting systems completed with the integration of an hydrologic model. Proceedings of the workshop held in 2000 published. Regional workshop on supplemental irrigation; proceedings published. Publication of guidelines that ensure protection of human health and environment when using treated sewage effluent. Recommendations for improved strategies and technologies to increase on-farm water use efficiency finalized. In collaboration with IWMI and other CG centers, integration of on-farm strategies and technologies for improved water use efficiency at the basin level initiated and accounting standards of water use efficiency developed. Recommended methodologies combining technical and socio-economical parameters for sustainable use of groundwater in irrigation.
- 2002: Regional conference on water harvesting. Models for optimal management of supplemental irrigation calibrated and verified. Promising and effective alternative cropping strategies and management practices to improve on-farm water use efficiency identified. Workshop on advanced management strategies that facilitate the sustainable use of low quality water in agriculture. Model for renewable groundwater use developed and published.

Users and beneficiaries

The main beneficiaries are farm households in rainfed and irrigated areas. Others include national researchers; technicians, policy makers and others concerned with water issues.

Collaborators

- Water harvesting systems: Continue linkages with 11 countries through the Ecoregional Programme: On-farm Water Husbandry in WANA: Egypt, Iraq, Jordan, Libya, Morocco, Pakistan, Syria, Tunisia, Iran, Algeria and Yemen.
- Supplemental irrigation: University of Mosul, Iraq; NARS of Syria, Iraq, Turkey, Tunisia, Iran, Morocco and Central Asian states.
- On-farm water use efficiency: IWMI, ICRISAT, Ein Shams University, Egypt; collaboration through Nile Valley and Red Sea Regional Program; NARS of Morocco, Syria, Turkey, Ethiopia; Sudan and Central Asian states.
- Use of remote sensing, GIS and the modeling of rainfall and water harvesting: General Organization for Remote Sensing, Syria; University of Karlsruhe (Germany); NARS of Jordan and Turkey.
- Non-conventional water sources: Collaboration with the Gulf States, Jordan, Tunisia; CIHEAM-Bari, McGill University, Canada; NCARTT, Jordan; Jordan University for Science and Technology; Aleppo University, Syria and Central Asian states.

Cost

2000: US\$ 2,639,469

2001: US\$ 2,771,443

2002: US\$ 2,910,015

System Linkages

Protecting the Environment (80%).

Production Systems Development and Management: Crop Systems (15%)

Strengthening NARS (5%).

Linkages to the Systemwide Programme in Soil Water and Nutrient Management (SP-SWNM) convened by CIAT and the Systemwide Initiative on Water Management (SWIM) convened by IWMI.

Financing Plan

Unrestricted core funds. Allocated core funding from EC; collaboration with NARS in Egypt financed by EC; technical backstopping provided to NARS financed by IFAD. Anticipated funding for a regional program from AFESD; anticipated funding for activities within SWIM (Systemwide Program on Water Management convened by IIMI); anticipated funding for activities in Central Asia from the Asian Development Bank; anticipated financing within the sub-regional action program of the CCD.

Project 3.2: Land management and soil conservation to sustain the agricultural productive capacity of dry areas

Goal

Alleviation of poverty through the sustainable management of dry area landscapes and their productive capacity.

Purpose

Improved management of agricultural and range lands in dry areas of WANA.

Indicator: Adoption by land users in selected sites of appropriate land management practices and investment in land improvement.

Output 1: Documentation of land conservation needs in WANA

Indicator: Synthesis reports for selected countries available.

Output 2: Erosion-hazard assessment methodologies made user-friendly

Indicator: Hazard assessment methodologies simplified and tested and made available to NARS.

Output 3: Soil losses due to erosion assessed and quantified

Indicator: Database soil erosion (types and rates) in two representative land-use systems.

Output 4: An integrated and interdisciplinary approach to sustainable land management.

Indicator: Integrated land management research and development approach implemented at a representative project site.

Output 5: Strengthened capacity of NARS.

Indicator: Approaches developed by ICARDA and their results transferred to NARS through workshops, training and field day demonstrations.

Duration: 4 years.

Milestones

2000: Interdisciplinary project site operational.

2001: Regional workshop on future directions in land management research.

2002: Erosion hazard assessment methodology tested in two representative countries.

2003: Collaborative network (with NARES) on land management is operational.

Users and beneficiaries

The intended beneficiaries are current and future resource users through the improved management of their land resources. Immediate users of the project's research results and the methodologies and approaches developed, are national policy makers, researchers and extensionists.

Collaborators

ICRISAT; FAO; UNEP; DRC, Egypt; IRA, Tunisia; University of Aleppo, Syria; Soils Directorate, Syria.

Cost

2000: US\$ 843,923

2001: US\$ 886,119

2002: US\$ 930,425

System Linkages: Protecting the Environment (70%); Production Systems Development and Management: Crop Systems (15%); Biodiversity (10%); Strengthening NARS (5%).

Financing Plan: Unrestricted core funds. Allocated core funding from DFID, UK; restricted financing from Spain; technical assistance to NARS in Egypt financed by Egypt/World Bank; anticipated financing within the sub-regional action program of the CCD.

Project 3.3: Agrobiodiversity Collection and Conservation for Sustainable Production

Goal

Enhanced food security and sustainable agricultural production systems based on the conservation and utilization of the biodiversity of ICARDA's mandate crops: wheat, barley, lentil, chickpea, faba bean and pasture and forage legume species and their associated rhizobia

Purpose

- Expansion, conservation, characterization, preliminary evaluation and documentation of the current *ex situ* collections of the genetic resources of wheat, barley, lentil, chickpea, faba bean and pasture and forage species and their rhizobia, in order to support the quest for germplasm with useful characters, such as tolerance to biotic and abiotic stresses, to be utilized in crop improvement programs of ICARDA and NARS;
- Development of approaches to the successful *in situ* conservation of the biodiversity of agriculturally useful plant species within the agricultural landscapes of WANA.

Indicators:

- Number of accessions conserved, characterized and documented in the GRU/ICARDA genebank
- Useful characters and traits from these collections utilized by ICARDA and NARS in their germplasm enhancement programs.
- Number and area of target species, and areas of associated natural habitat, conserved *in situ*.

Output 1: Expanded *ex situ* collections of the genetic resources to be utilized in crop improvement programs of ICARDA and NARS.

Indicators:

- Number of accessions in the active collection
- More than 1000 seeds in the active collection
- Seed viability higher than 80%

Output 2: Germplasm characterization and preliminary evaluation for biotic and abiotic stresses as well as for morphological and agronomic traits using international descriptors. Genetic diversity analysis and assessment of the potential of conserved material for crop enhancement.

Indicators:

- Number of accessions characterized/evaluated
- Number of traits characterized/evaluated

Output 3: Special purpose collections with multiplied seed for distribution

Indicators:

- Number of collections
- Number of accessions

Output 4: Wheat germplasm with new genes from wild relatives

Indicators:

- Number of useful traits transferred
- Number of lines with useful genes introgressed

Output 5: In cooperation with NARS, implementation in pilot areas of approaches and strategies for on-farm conservation of cultivated species and *in situ* conservation of wild relatives and rangeland species.

Indicators:

- No. of target species conserved in pilot areas.
- Areas of natural habitat conserved in pilot areas.

Output 6: Strengthened capacity of national and regional genetic resources institutes

Indicators:

- Number of training courses and NARS staff trained
- Technical assistance provided to national genetic resource institutes and genebanks.

Duration: 5 years.

Milestones

2000: Bread wheat CD-ROM catalog; *Aegilops* CD-ROM catalog; *Vicia* CD-ROM catalog.
ICARDA's databases integrated with GIS.
Biochemical and molecular characterization of barley core collection.

Pilot sites established for testing *in situ* conservation in four countries of the Near East. ICARDA germplasm database accessible on-line via Internet, as part of SINGER. Multiple stress resistant faba bean germplasm.

- 2001: Collection and conservation of cereal and pasture, forage and food legume germplasm and their wild relatives and progenitors along with range land species in the Central Asia, completed.
Lentil core collection .
Wild *Triticum* CD-ROM catalog.
Wild barley core collection.
Hexaploid introgressed wheat lines.
- 2002: Germplasm characterized and evaluated in partnership with Central Asian program. Central Asia genetic resources regional database.
90% of accessions held at ICARDA meets the international standards of seed quantity and viability.
90% of accessions held in the long-term base collections.

Users and beneficiaries

The conserved germplasm is and will be utilized by a diverse group of scientists from NARS and other institutions seeking to establish and/or enlarge their genetic resources collections, to research a particular aspect of biodiversity, or to utilize germplasm in breeding programs.

Agricultural producers may be direct beneficiaries in "disaster" situations, when seed of traditional germplasm is lost and may be recovered from *ex situ* collections held by ICARDA. The ultimate beneficiaries are agricultural producers, who will have access to a more diverse spectrum of cultivars, and future generations who will be assured of the availability of agriculturally important biological resources

Collaborators

- *Ex situ* Collections: ICRISAT; CIMMYT; Center for Legumes in Mediterranean Agriculture (CLIMA), Australia; NSW Agriculture, Australia; Vavilov Institute (VIR), Russia
- Assessment of threats to gene pools: NARS; ICRISAT; CIMMYT
- Germplasm collection: NARS; ICRISAT; CIMMYT; CLIMA; NSW Agriculture, Australia; University of Adelaide, Australia.
- Germplasm acquisition from donor institutions: NARS; ICRISAT; CIMMYT; VIR; other major genebanks
- Collection/acquisition of rhizobia: NARS; CLIMA; other *ex situ* collection holders
- Germplasm multiplication/rejuvenation: CLIMA; NSW Agriculture, Australia.
- Safety duplication outside ICARDA: National Board for Plant Genetic Resources (NBPGR), India; ICRISAT; CIMMYT; Federal Institute of Agrobiolgy (FIA); Federal Research Station for Plant Production (RAC), Switzerland
- Germplasm characterization and evaluation: NARS; NSW Agriculture, Australia; CLIMA; University of Bristol, UK; University of Birmingham, UK.
- Passport, site and evaluation data base: NARS; ICRISAT; CIMMYT; CLIMA; NSW Agriculture, Australia; University of Adelaide, Australia.
- Classification, catalogs, information dissemination: NARS; ICRISAT; CIMMYT; IPGRI; CLIMA.
- Gene transfer from wild progenitors and relatives: ICRISAT; University of California; CLIMA

Cost

2000: US\$ 2,934,504
2001: US\$ 3,081,229
2002: US\$ 3,235,290

System Linkages

Biodiversity (95%). Strengthening NARS (5%) through support of NARS' genetic resource collections. Linkage with the Systemwide Genetic Resources Programme (SGRP), convened by IPGRI.

Financing Plan

Unrestricted core funds. Allocated core funds from EC; grant from GDRC, Australia, supports preservation and utilization of the genetic resources of the Vavilov Institute; restricted project grant from ACIAR, Australia, supports collection and conservation of plant genetic resources of Central Asia; financing from Global Environment Facility (GEF) for a collaborative project with NARS on conservation of biodiversity in the Near East.

Project 3.4: Agroecological Characterization for Agricultural Research, Crop Management and Development Planning

Goal

Agricultural development, land use planning and environmental management of the agricultural production systems of Central and West Asia and North Africa (CWANA) by a better definition and understanding of the specific potentials and constraints of their agricultural environments.

Purpose

Assistance to NARS in the characterization of the diverse agroecologies and associated land use systems of CWANA through development and transfer of approaches, methodologies and procedures for the quantitative description, at different levels of detail, of agricultural environments.

Indicators:

- Approaches, methodologies and procedures for agroecological characterization adopted by NARS of CWANA.
- Information systems developed by the project used by NARS, the international research community and development planners.

Output 1: Digital databases on climate, land resources, land use/cover, ecological crop requirements and genetic characteristics, linked to databases describing the socioeconomic environments.

Indicators:

- Climate database system for CWANA.
- Soil database for CWANA.
- Satellite data archive for CWANA established.
- Digital maps on land and climate resources in CWANA compiled or generated.

Output 2: Knowledge systems based on modeling of the interactions between environments, crops or production systems and land management, linked to GIS and attribute databases

Indicator: Models of crop productivity, linked to geo-referenced datasets of land resources, used for spatial characterization of land potentials and constraints in actual studies.

Output 3: Comprehensive physical frameworks of ICARDA's mandate region.

Indicators:

- Small-scale maps of agroecological zones indicating potentials and constraints for agricultural development, research priorities, and land use/management recommendations.
- Digital maps integrated into GIS-based land and water resource information systems.

Output 4: Methodologies and practical procedures for informal local-level land appraisal.

Indicator: Manual on guidelines for participatory agroecological characterization.

Output 5: Strengthening of NARS capacity in agroecological characterization.

Indicators:

- National and regional networks in agroecological characterization established.
- Training courses, workshops, etc.

Duration: 5 years.

Milestones

- 2000: Meteorological database on Internet.
Software package for spatial interpolation of meteorological variables developed.
Agroecological Atlas of Syria on CD-ROM.
Agroecological Atlas of Arabian Peninsula on CD-ROM.
Annual training course on AEC in Arabian Peninsula
Training manual
- 2001: Agroecological Atlas of CWANA on CD-ROM.
Annual training course on AEC in Central Asia.
Establishment of subregional AEC network for Central Asia
- 2002: Assessment of sustainability of water resource use in Syria.
Annual training course on AEC in North Africa.

2003: Agroecological Atlas of another CWANA country completed by NARS.
Establishment of subregional AEC network for North Africa.

Users and beneficiaries

The project benefits the NARS of CWANA by the provision of new methodologies and technology transfer through training and joint projects and the provision of essential and multi-scale frameworks for the extrapolation of site-specific research.

The project is also of benefit to the international research community by generating geo-referenced information on types and severity of abiotic stresses, land degradation, suitability for specified production systems, and recommendations for land management.

Collaborators

- The project operates through linkages with NARS and national meteorological services and land resource assessment institutions.
- Collaborative activities exist or are planned with the following NARS: Meteorological Services of Syria, Morocco, Ethiopia, Kazakstan; INRA, Morocco; DPV of the Ministry of Agriculture, Morocco;
- Cropping system simulation: University of Guelph; Research Institute of King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia; University of Hohenheim, Germany
- Yield forecasting and land evaluation: Space Applications Institute of Joint Research Centre of the European Commission, Ispra, Italy
- Agroclimatology: CESIA and FMA, University of Florence; Texas A&M University, Texas
- Remote sensing: Center for Earth Observations, Yale University; Kuwait Institute for Scientific Research (KISR)
- Mediterranean rainfall mapping: University of Genoa; University of Bristol
- Participatory agroecological characterization: Katholieke Universiteit Leuven, Belgium
- Training: Statistical Services Centre, University of Reading
- Inter-center exchange of data and methods with other IARCs, as part of the proposed network

Cost

2000: US\$ 977,605

2001: US\$ 1,026,485

2002: US\$ 1,077,809

System Linkages

Protecting the Environment (70%): ecosystems analysis and ecological characterization;
Production Systems Development and Management (20%), through characterization of farming systems;

Strengthening NARS (10%), through advice in research methods.

Financing Plan

Unrestricted core funds. Allocated core funding from European Commission (EC); training and institutional strengthening of NARS in agroecological characterization in the Arabian Peninsula and the Mashreq and Maghreb regions financed by AFESD and IFAD; anticipated financing within the sub-regional action program of the CCD.

Project 4.1: Socioeconomics of Natural Resources Management in Dry Areas

Goal

Conservation and sustainable management of the natural resource base.

Purpose

Analysis of the social, institutional and economic factors that influence resource management and a greater understanding of resource users' perceptions and objectives that will assist in the design of proposed technical interventions and reveal where opportunities may exist for community action and cooperative management of resources.

Indicators:

- Utilization of formal methods of natural resource and environmental valuation, and institutional options for supporting resource management decisions at farm, community and national levels.
- Utilization of these methods by NARS.
- Increased public awareness of the costs involved in the mismanagement of natural resources, in terms of local livelihoods, national agricultural sustainability and the global environment.

Output 1: Market and non-market valuation of natural resources and estimation of the economic and social costs of their degradation.

Indicator: Decision tools for sustainable natural resources management that take into consideration the environmental impact of agricultural practices.

Output 2: Economic assessment of the environmental impact of resource management strategies.

Indicator: Methods for the valuation of natural resources and the costs associated with their degradation developed and applied in conjunction with other Projects involved.

Output 3: Socioeconomic evaluation of potential resource management options.

Indicator: Factors in the broader socioeconomic environment that influence individuals' resource management decisions identified, including the socio-cultural organization of communities.

Output 4: Institutionalized multidisciplinary and participatory approaches to natural resource management research in national systems.

Indicator: Users' perceptions and valuations of their resource base, which contribute to decisions regarding resource management practices determined.

Duration: 5 years.

Milestones

- 2000: Analysis of case studies of identified resource management problems.
Evaluation of potential interventions.
Generalization of methodologies and approaches used in the case studies, including the use of participatory methods.
Workshop to transfer findings.
Methods for economic valuation of resources developed and data compiled.
- 2001: Comparative study of the economics and organization of individual, community and public management of groundwater resources.
- 2002: Models for the economic evaluation (impact assessment) of the changes in ground and surface water utilization and irrigation technologies in Syria, Pakistan and Tunisia.
Training NARS in applying natural resources valuation methodologies.

Users and beneficiaries

Immediate users of the valuation of natural resources and the social and economic costs of their degradation are ICARDA's researchers in natural resource management, and national planners and decision-makers. Because of the problem-solving, participatory approach employed, the immediate beneficiaries are the resource users involved in the case studies. The approaches and methodologies developed in these studies will be disseminated for use by NARS and other researchers in natural resource management.

Collaborators

- NARS partners include the following institutes: Morocco: Centre Regional de Recherche Agricole/

INRA. Algeria: Institut Technique des Grandes Cultures; Haute Commission de Developement de la Steppe. Tunisia: INRAT; Institute des Hautes Etudes Commerciales; University of Tunis; Institute des Regions Arides (IRA). Iraq: IPA Agricultural Research Center; Jordan: University of Jordan; National Center for Agricultural and Technology Transfer. Lebanon: Lebanese University; American University of Beirut; Agricultural Research Institute. Syria: Agriculture; University of Aleppo. Yemen: Aden University; Sanaa University; Agriculture Research and Extension Authority. Pakistan: Water Resources Research Institute

- Christian Albrecht University, Kiel, Germany; Systemwide Programme on Participatory Research and Gender Analysis (SP-PRGA) convened by CIAT; Instituto Nacional de Investigacion y Tecnologia Agraria y Alimentaria (INIA), Spain.

Cost

2000: US\$ 1,192,593

2001: US\$ 1,252,223

2002: US\$ 1,314,834

System Linkages

Protecting the Environment (45%);

Socioeconomic, Policy and Public Management Research (40%).

Saving Biodiversity (10%)

Strengthening NARS (5%).

Participation in the Systemwide Programme on Participatory Research and Gender Analysis (SP-PRGA) convened by CIAT.

Financing Plan

Unrestricted core funds. Restricted funding from Spain; collaboration with NARS in Egypt supported by EC; grant from BMZ/GTZ for research on institutions for sustainable groundwater use. Anticipated support for participatory research in natural resource management in Yemen from IDRC; anticipated financing from AFESD for regional program on water resource management; anticipated financing within sub-regional action program of CCD.

Project 4.2: Socioeconomics of Agricultural Production Systems in Dry Areas

Goal

Fluent communication and congruence of purpose between agricultural producers, researchers and research managers that ensures the efficient identification of problems and the development, transfer and adoption of appropriate farm technologies.

Purpose

- Development of appropriate technologies and solutions to production problems that meet farm households' requirements and are adapted to farm-level constraints, thereby enhancing the likelihood and extent of their adoption.
- Micro-economic and social analysis of farm households and rural poverty will ensure that research is better targeted toward poverty alleviation and takes account of the social differentiation, including gender, in the potential impact of research products.
- Proper identification of research objectives, as well as to the improved targeting of transfer efforts once the technology has been developed.

Indicators:

- Adoption of formal methods of impact assessment for evaluating the potential impacts of ICARDA's research program.
- Adoption by national programs of effective methods (including participatory techniques) of problem diagnosis and constraint analysis of agricultural systems with noticeable impact on the technology development and transfer process.
- Adoption by national programs of formal and quantitative methods of impact (*ex ante* and *ex post*) assessment which takes into account the economic, social and environmental aspects of the technology in target agricultural systems.

Output 1: Production problems of resource-poor farmers identified jointly by researchers and producers.

Indicator: Diagnostic surveys carried out and production problems identified with in farming systems.

Output 2: Potential new technologies and resource management options evaluated by researchers and producers.

Indicators:

- Guidelines and procedures for effective farmer participation in research provided to NARS.
- Guidelines and procedures for user participation in the dialogue and evaluation of improved technology provided to NARS researchers.

Output 3: Documented adoption, and feedback of user evaluations into the technology generation process.

Indicator: Adoption studies and analysis of constraints to adoption of technologies identified in target agricultural systems.

Output 4: Determinants of rural poverty and the farm household circumstances that may constrain or enhance the adoption of potential new technologies, identified.

Indicator: In-depth household studies.

Output 5: Quantified *ex ante* and *ex post* impact of new technologies and information for research priority setting and planning.

Indicators:

- Guidelines for identifying and assessing the different types of impacts of agricultural research made available to NARS of WANA.
- *Ex ante* and *ex post* impact assessments of agricultural technology and analysis of the returns to research supplied to research managers in ICARDA, NARS, the CGIAR, and the donor community.

Output 6: Strengthened research capacity of NARS.

Indicators:

- Training of NARS personnel in research methods in the socioeconomic aspects of technology development and transfer.
- Thematic workshops on multidisciplinary and socioeconomic research.

Duration: 3 years.

Milestones

- 2000: Impact assessment of two ICARDA mandate crops completed.
Guidelines for impact assessment provided to NARS partners.
Report on determinants of agricultural productivity in the WANA region published.
- 2001: Case study of local community participation in evaluation of technology options completed.
Guidelines and methods for farmer participation in research developed.
- 2002: Determinants of rural poverty in selected cases in the dry areas of WANA analyzed

Users and beneficiaries

ICARDA and NARS researchers will benefit from the feedback provided by the project, through better targeting of their research and greater awareness of the problems and constraints faced by farm households. Farmers will, in turn, benefit from the development of appropriate technologies and solutions to production problems that take account of their needs and constraints. The information generated from the analysis of rural poverty and the micro-studies of farm households will ensure that technical solutions are developed that take account of the different needs of the rural poor.

Collaborators

All activities are conducted in collaboration with NARS and universities in WANA.
University of Massachusetts, USA; Yale University, USA.

Cost

- 2000: US\$ 1,149,744
2001: US\$ 1,207,231
2002: US\$ 1,267,593

System Linkages

Production Systems Development and Management: Crop and Livestock Systems (35%)
Socioeconomics, Public Policy and Public Management Research (60%).
Strengthening NARS (5%).
Participation in the Systemwide Programme on Participatory Research and Gender Analysis (SP-PRGA) convened by CIAT. Linkage with CGIAR IAEG.

Financing Plan

Unrestricted core funds. Allocated core funds from DFID, UK; studies on the adoption and impact of specific technologies is supported under the respective technical projects; collaborative research with NARS in Mashreq and Maghreb regions financed by IFAD and AFESD; research on nutrition financed by USAID linkage funds.

Project 4.3: Policy and Public Management Research in the Dry Areas of Central and West Asia and North Africa

Goal

Food security and poverty eradication through policy and public management research that promotes sustainable production systems and livelihood strategies in the dry areas of Central and West Asia and North Africa regions.

Purpose

Improvement of national policies and institutions that influence agricultural investment and management decisions in dry areas with respect to efficiency, equity and environmental sustainability.

Indicators:

- Governments and research institutions have clearly defined tools to evaluate the welfare and resource management consequences of different policy, institutional and public management options in the dry areas;
- Evidence that research findings are included in the design of rural development policies, policy reforms and public management systems in term of efficiency, equity and sustainability of production systems and livelihood strategies in the dry areas;
- Decision-making environments of local institutions are enhanced to promote the sustainable management of common rangeland and water resources;

Output 1: Identification of the policy and property rights environments under which rural producers and communities make their decisions and characterize the incentive and disincentive structures that shape their resource management and production strategies;

Indicators:

- A synthesis review document analyzing the current policy environment in WANA and discussing the implications of policy reforms in terms of welfare changes and sustainability in the region.
- Synthesis document on property rights policies and the management of rangeland resources in selected CWANA countries.

Output 2: Evaluation of the effects of policy, property rights and technological options on sustainable resource management and livelihood strategies of farming and herding communities in the dry areas.

Indicators:

- Three studies identifying the feasibility of policy, property rights and technological options in selected communities in Morocco, Tunisia and Syria
- Five preliminary community studies describing the model building and evaluation of selected policy, property rights and technological options in communities in Algeria, Iraq, Jordan, Lebanon, and Libya
- Effects of property rights on land improvement, technology use and livelihood strategies in 16 selected communities in Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia.
- Effects of land reform policies on rangeland production systems and livelihood strategies of the farmers in the low rainfall areas of Kazakstan, Turkmenistan and Uzbekistan,

Output 3: Development of research and analytical tools for training and building the capacity of NARS partners on policy and institutional research

Indicators:

- Technical guide on implementing an integrated community approach to policy and property rights research in selected WANA countries.
- Community modelling techniques for estimating the economic and environmental impacts of different policy scenarios in dry areas of WANA.

Output 4: Updates of commodity, resources and system trends for more effective research targeting and priority assessment;

Indicators

- Synthesis report on ICARDA's mandate commodities and resources
- System trend analysis

Duration: 3 years.

Milestones

- 2000: Completion of research on property rights and local institutions for managing rangeland resources in Jordan, Morocco, Syria and Tunisia
Completion of community studies in Morocco, Syria and Tunisia and drafting of community action plans
Publication of a book on Policy and Property rights research in Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia
Finalization of a guide on the community approach in the low rainfall areas of West Asia and North Africa
- 2001: Completion of collaborative research with IFPRI on policy and property rights in low rainfall areas of Algeria, Iraq, Jordan, Lebanon, Libya, Morocco, Syria and Tunisia; cross-country syntheses
Completion of eight syntheses monographs (one for each country) on the above research
Completion of the policy and property rights in low rainfall areas of Kazakstan, Turkmenistan and Uzbekistan; cross-country syntheses
- 2002: Publication of book on the management of rangelands in the dry areas of Central and West Asia, and North Africa.

Users and beneficiaries

The primary clientele are policy makers in the target countries of North Africa and West and Central Asia; NARS partners and other researchers will benefit from research on the efficiency, equity and environmental consequences of policy, property rights and technological options.

Collaborators

- NARS partners include: Ministries of Agriculture and Planning; Centre Aridoculture-INRA, Ecole Nationale d'Agriculture, and Hassan II University, Morocco; INRAT, INAT and Institut des Hautes Etudes Commerciales, Tunisia; Lebanese Agricultural Research Institute, Lebanese University and American University of Beirut, Lebanon; NCARTT and the University of Jordan, Jordan; Directorate of Agricultural Scientific Research and University of Aleppo, Syria; IPA Agricultural Research Center, Iraq; Station Experimentale ITGC, Algeria; ARC, Libya; Karakul Sheep Research Institute, Livestock Research Center, and Kazak Research Institute of Forage and Rangelands, Kazakstan; Institute of Animal Industry, Veterinary and Pasture, Statistics and Policy Unit, and the Desert Institute, Turkmenistan; Karakul Sheep Research Institute, Institute of Market Reforms and University of Sarmakand, Uzbekistan.
- Other research partners: Environmental and Production Technology Division of IFPRI; University of California-Davis, USA (GL-CRSP); Land Tenure Center, University of Wisconsin-Madison, USA.

Cost

- 2000: US\$ 483,056
2001: US\$ 507,209
2002: US\$ 532,569

System Linkages

Socioeconomics, Policy and Public Management Research (90%). Strengthening NARS (10%).
Linkage to Systemwide Programme on Property Rights and Collective Action, convened by IFPRI.

Financing Plan

Collaboration with NARS on property rights and community studies in Mashreq/Maghreb region financed by AFESD, IFAD and IDRC; research in Central Asia financed by IFAD; anticipated funding from the SP-PRCA and the Ford Foundation.

Project 5.1: Strengthening National Seed Systems in West Asia and North Africa

Goal

Increased productivity and sustainable food security through improved seed security and access to quality seed.

Purpose

Strengthened capacity of formal and informal seed systems of WANA countries to supply farming communities with quality seed of adapted varieties in a cost-effective and sustainable manner.

Indicators:

- Information on how to improve the efficiency, reliability and quality of seed supply to farmers of all types, transferred to national seed programs and organizations.
- Improved availability of seed, increased productivity and improved farm incomes in crop production systems.

Output 1: Enhanced knowledge and expertise in national seed programs.

Indicators:

- Knowledge and skills acquired by trainers during 'train-the-trainer' courses adapted and transferred successfully through follow-up courses organized within countries in the region.
- Personnel from various levels in the national seed program participating actively in workshops, seminars and roundtable discussions organized by ICARDA's Seed Unit.
- Graduates of collaborative MSc programs active in solving problems in their countries using expertise acquired with the support of ICARDA.
- Collaborative links established with academic institutions in the region which are involved in teaching seed technology.

Output 2: WANA Seed Network providing close linkages between, and implemented by, the national seed programs in the region in collaboration with the ICARDA Seed Unit.

Indicators:

- Published comparative information on national seed policies, quality control procedures, import/export regulations and quarantine measures used by member countries.
- Standardized seed production and control procedures adopted by Seed Network members.
- Committees guiding and coordinating privatization efforts in WANA countries.
- Countries receiving regular information through a Network Newsletter, variety catalogues and other working documents using material compiled by member countries and widely distributed within the region.
- Establishment and operation of national Seed Associations with private sector participation.

Output 3: Strategies and methodologies for improving economic efficiency of formal and alternative seed delivery systems.

Indicators:

- Options for increased cost efficiency of seed systems and policy recommendations for improvement of performance of the seed sector prepared and implemented by national seed programs.
- National seed programs participating actively in collaborative case studies on financial and economic analysis of national seed systems.
- Results and recommendations of country studies used by national programs.
- Ideas and experiences from successful cases extended to seed systems in several countries.
- Countries recognizing and applying different approaches to seed system development and adopting those that best suit their respective conditions.
- Regulatory barriers to new seed providers reduced or removed

Output 4: Informal seed sector concerns reflected in national seed system development as a result of awareness created on this issue.

Indicators:

- Published results and recommendations based on informal sector studies widely distributed and utilized by development agencies, NGOs and other interested institutions.

Output 5: Coping mechanisms enhanced in disaster prone countries through knowledge disseminated and regional cooperation in seed security

Indicators:

- Countries aware of recommendations on: (i) the establishment of national seed stocks, regional seed security reserves, community based seed initiatives, or strategic area seed reserves; (ii) appropriate means of reacting to disaster relief; (iii) linking seed relief with disaster preparedness and long-term development.
- Organizations using published guidelines as reference or training material.

Output 6: Relevant new information available through applied research into practical seed-related issues.

Indicators:

- Research results accepted for publication in relevant journals and media
- Citation and use of research results from similar studies undertaken in national seed programs.

Output 7: Use of adapted germplasm in national programs promoted by transfer of promising lines through seed supplied by ICARDA and maintained by NARS.

Indicators:

- Seed of promising lines used as start-up multiplication material in national programs and in trials.
- National programs aware of merits of introduced varieties from ICARDA Seed Unit.
- Procedures and facilities for producing high-quality breeder seed established within NARS to support the national seed sector.

Duration: 5 years.

Milestones

2000: One train-the-trainer course, five follow-up courses organized and benefiting up to 120 participants.

Two manuals published on various seed-related disciplines.

A total of 8 country case studies initiated in the economics of seed production.

A seminar organized on regional seed security

2001: Standardized seed production procedures adopted by WANA Seed Network members and comparative information on national seed policies, seed regulations, quality control, import and export and quarantine measures, compiled and distributed for use by Network members.

2002: Analysis of alternative seed production systems in WANA and recommendations regarding their integration and development into national seed production systems.

Users and beneficiaries

In strengthening national seed systems, the immediate target groups are policy makers, managers and staff of formal sector seed producing organizations, as well as alternative seed producing groups such as NGOs, seed growers, cooperatives, and farmers' organizations. The ultimate beneficiaries are producers who will benefit from access to quality seed, farmers who use the seed for planting and consumers who use grain for food, livestock feed and other purposes.

Collaborators

- NARS and seed programs of WANA countries through activities of WANA Seed Network and collaborative country studies.
- International Organizations involved in seeds including FAO; International Seed Testing Association (ISTA); International Union for the Protection of New Varieties of Plants (UPOV).
- Introduction of seed topics in teaching curricula and graduate research: University of Jordan; University of Khartoum, Sudan; Cukurova University, Turkey.

Cost

2000: US\$ 1,104,531

2001: US\$ 1,159,758

2002: US\$ 1,217,746

System Linkages

Strengthening NARS: Institution building/advice to NARS (30%) and Networks (40%);

Production Systems Development and Management: Cropping systems (20%) through increase in seed of elite materials, its certification and release;

Socioeconomics, Policy and Public Management Research (10%), through research on seed production economics.

Financing Plan

Unrestricted core funds. Restricted project grant from Netherlands for training in seed technology; project grant from GTZ for studies of cost effective seed delivery to small farmers; anticipated financing for technical support to seed production in Kyrgyzstan. Support currently being sought for WANA Seed Network.

