

SUMMARY

A. OVERVIEW: HIGHLIGHTS OF 1999 RESULTS AND 2000 DEVELOPMENTS

ICARDA's research 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 pre-breeding. 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 a pilot 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. In May 1999 ICARDA hosted an international workshop on Farmer Participatory Research. Further expansion of farmer participatory breeding occurred in 1999 into Egypt and Jordan on barley and is planned for Bolivia in 2000.
- Focusing on the poor in sub-Saharan Africa, research in Ethiopia increased through a new low-neurotoxin grasspea project supported by DFID in 1999 and was sustained on food legumes within a bilateral project. A flanking project on barley in Ethiopia is planned for 2000. In Eritrea barley improvement through participatory methods is on-going and greater involvement with other commodities planned for 2000.
- 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 a scientist was posted for legume transformation to the Agricultural Genetic Engineering Institute (AGERI) in Egypt, where biosafety legislation is enacted and containment facilities are available. In 2000 a WANA Biosafety workshop will be held in Aleppo in cooperation with FAO and AGERI.
- With the identification of linkage between DNA markers and economic traits in several mandate crops, the use of marker-assisted selection increased in 1999.
- In the Central Asia and the Caucasus (CAC) region within the framework of the CGIAR Program, projects were started on 'Germplasm Conservation, Adaptation, and Enhancement for Diversification and Intensification of Agricultural Production' on barley, forage legumes, food legumes with ICRISAT, winter wheat with CIMMYT and genetic resources with IPGRI. 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 cereal germplasm for cold tolerance.

2. *Production Systems Management*

- In 1999 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 azederach*) to control Sitona weevil on lentil and leafminer on chickpea were identified for further investigation. In 2000 the on-farm evaluation of several IPM packages is underway in Morocco, Syria and within the Nile Valley.

- In 1998/9 ICARDA substantially reduced its on-station, long-term agronomy trials and is publishing 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 intensified in 1999 with ICARDA support to initiatives in Egypt and Iran.
- Small ruminant research in 1999 moved focus toward breed characterization, on-farm adaptive research and a market orientation including value-added dairy products. An international workshop on Animal Genetic Characterization, co-sponsored by ICARDA, ILRI, IPGRI, the SWP-GR, and FAO, was held at ICARDA in 1999. Funds were secured in 1999 to greatly expand livestock productivity research in Central Asia from IFAD, and ICARDA has joined with ILRI in exploring and proposing new livestock research initiatives in that important region. In 2000 an expansion of activities in Syria on market opportunities and on on-farm adaptive research for small dairy sheep producers is anticipated.
- Based on the rangeland strategy for research in non-tropical Dry Areas, research in 1999 focused 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 was the application of GIS and remote sensing technologies. In 2000 substantial efforts will be made to transfer technology within special projects with a rangeland component

3. Natural Resource Management

- To support an expansion of research on water, ICARDA recruited senior staff in Agricultural Hydrology, Marginal Quality Water Use, and Plant-Soil-Water Relations in 1998. In 1999 there was a consequent increase in research on 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. In 1999 through projects on On-farm Water and Soil Management funded by ADB and on On-farm Soil and Water Management for Sustainable Agricultural Systems in CAC (ICARDA & IWMI) within the framework of the CGIAR Program, ICARDA expanded its water research in the CAC region. In 1999 a major international water conference was held in Jordan in collaboration with IWMI and the national program.
- Complementary to participatory plant breeding, ICARDA is developing a repertoire of participatory approaches in natural resource management. In 1999, participatory techniques were applied in natural resource valuation exercises with farmers, particularly on questions of soil erosion and water resource depletion and expanded to include participatory techniques in agroecological characterization and in estimations of water use efficiency. Land use research, together with other natural resource management research, focused on specific integrated research sites in 1999. The 1999 international workshop on Farmer Participatory Research held at ICARDA included applications in natural resource management research.
- In a collaborative project started in 1999 on 'Conservation and Management of Agrobiodiversity in the Fertile Crescent' 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 funded by GEF, ICARDA has the responsibility for the regional coordination. A major thrust of the project is the development of *in situ* and on-farm conservation of biodiversity through the appropriate management of habitats. Through funding from the CG program, ACIAR and GRDC, major focus in agrobiodiversity research in 1999 was on the CAC region with collections in two CAC countries and others planned for 2000 and assistance given to Uzbekistan in documentation. Additionally, in 1999 ICARDA continued its collaboration with the N.I. Vavilov Research Institute of Plant Industry, Russia.
- During 1999 ICARDA continued its research attention to climate change and desertification. Together with NARS and ARIs, ICARDA is participating in a network of sites to monitor carbon sequestration under different land management conditions in Central Asia. ICARDA is utilizing data from its long-term rotation trials to assess organic carbon increases in soil subject to different cropping patterns. The Center, with NARS and other regional and international organizations, are preparing action plans for implementation under the Convention to Combat Desertification (CCD) to control desertification and mitigate the effects of drought. ICARDA co-sponsored the Sixth International Conference on the Development of Dry Lands: Desert Development Challenges beyond the Year 2000 in August 1999. ICARDA has actively contributed to the Inter-Center Working Group on Climate Change in developing a CGIAR strategy in this important area of global concern.

- Agroecological characterization research at ICARDA made substantial progress in 1999. ICARDA's meteorological database now contains over 5 million records. An overview of the agroecology of CWANA with thematic layers of soil, altitude/slope and land use/cover was completed, to which agroecological zones will be added in 2000. In 1999 major progress was made on the agroecological characterization of Syria, in the characterization of the Arabian Peninsula, and in developing a land suitability map of Morocco.

4. Socioeconomics and Policy

- ICARDA is strengthening its capacity to address the human aspects of natural resource management at the farm and community levels. During 1999 partnerships with ESCWA (United Nations Economic and Social Commission for West Asia) and the University of Kiel (Germany) continued research on the subjects of farmer allocation of pumped groundwater and the technical and economic efficiency of its use. Efforts focus on identifying ways and means, including local institutional arrangements, for the sustainable utilization of groundwater by farmers. With the support of the Netherlands, a new study on village-level institutions for managing shared water resources was begun in 1999. In 2000 focus will remain on water as the principle natural resource constraint in the Dry Areas.
- ICARDA's attention to issues of food security, poverty alleviation, and gender aspects of agriculture increased in 1999, and the foundations were laid for increased research efforts in 2000. A cooperative project with the University of Massachusetts on household food systems, poverty, and the nutritional status of women and children nears completion. 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 1999. 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 to be published in 2000. 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 working with the IAEG germplasm impact group on the assessment of impact of ICARDA's improvement research on barley and lentil and its contribution to poverty alleviation.
- ICARDA in cooperation with IFPRI is implementing the community approach to technology transfer in eight countries of the region. New projects on increasing the role of women in resource management, household livelihood strategies, and community level impacts of policy property rights and technical options in the low rainfall areas of WANA were funded in 1999.

5. Institutional Strengthening

- ICARDA continues to emphasize economic and policy issues affecting the seed supply system in WANA. A major training initiative is being undertaken in these aspects of seed. Funding is being sought to support activities in the WANA Seed Network and a regional CAC seed initiative.
- Activity intensified in 1999 to strengthen biotechnology in WANA and to transfer proven biotechnological techniques to NARS in WANA through finance from the Arab Fund.
- ICARDA's research across themes is incorporated within national development projects such as in the North-West Coast of Egypt and the Barani area of Punjab, Pakistan.
- In line with the evolving CGIAR Strategy in Sub-Saharan Africa (SSA), ICARDA initiatives include the following: Continued support to Ethiopia in its research programs on cool season food legumes funded by the Netherlands and an anticipated parallel project on barley to commence in 2000. Research on neurotoxin-free grasspea intensified in Ethiopia in 1999 funded by DFID, UK. In Eritrea, in collaboration with DANIDA, barley improvement developed into a participatory mode and in 2000 a project on the improvement of other small grains and legumes is planned. Several projects developed with the NARS of Mauritania on natural resource management and germplasm enhancement are planned to become operational in 2000. In SSA, under the SWNM umbrella, ICARDA and ICRISAT are active in optimizing soil water use and ICARDA is active with ILRI in the System-wide Livestock Project.

B. 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 national agricultural research systems (NARS). Highlights of collaboration are as follows:

- **NARS:** A major development in collaboration with NARS in WANA is the completion of the *WANA NARS Review Study* conducted by NARS and ICARDA in collaboration with FAO, AARINENA and CIHEAM. The Study provides detailed country monographs for 19 countries in WANA with comparative analysis of the organizational structure, mandate, research program, human and physical resources of national research and educational institutions. The published Study is available at ICARDA.
- **Outsourcing to NARS:** ICARDA continues to seek opportunities for outsourcing specific activities and training to national programs as a means to increasing efficiency, taking advantage of the experience and expertise of NARS, and achieving complementarity between NARS and ICARDA. Research areas already identified for this approach include:
 - germplasm enhancement for host plant resistance to important pests (e.g. Hessian Fly resistance in wheats outsourced to INRA, Morocco).
 - genetic engineering for transformation to improve legume disease resistance (e.g. transformation for fungal resistance in lentil outsourced to AGERI, Egypt).
 - knowledge-based expert systems for enhanced technology transfer (e.g. expert systems for wheat and fababean outsourced to CLAES, Egypt).

NARS socio-economists have been contracted to assess the impact in the region of ICARDA achievements in germplasm improvement, and specialists have provided consultancies to research and development projects implemented by ICARDA.

- **ARIs:** ICARDA's cooperation with advanced research institutes (ARIs) in the developed world is well established and expanding. Cooperation ranges from formal arrangements, often supported by restricted grants and governed by specific agreements and budgets, to more informal cooperation involving exchange of information, joint supervision of graduate research, or dialogue between individual scientists. Research mentors from ARIs are enriching ICARDA's research efforts in specific areas (see G. below).

As well as strengthening our own research, such cooperation provides a bridge, through ICARDA, between ARIs and our NARS partners, providing NARS with advanced research techniques and results and ARIs with opportunities to contribute directly to research in developing countries.

Finally, ICARDA outsources specific research to ARIs either when the staff or facilities are not available at ICARDA or when the research can be done more efficiently at an ARI. Such linkages are often supported by specific donor programs aimed at providing support for linkages between IARCs and ARIs. Cooperation with ARIs that has been initiated under such projects has subsequently developed into enduring long-term partnerships. This is particularly the case with cooperation established with German ARIs (for example with the universities of Frankfurt, Hanover, Hohenheim and Munich).

- **NGOs:** ICARDA is also seeking to strengthen its linkages with NGOs, both national NGOs in WANA and international NGOs operating in the region. Unlike other regions, WANA has only a few NGOs operating in the field of agriculture. Opportunities for linkages are, however, expanding, particularly in the field of farmer-participatory research, in the transfer of technologies developed through ICARDA's cooperative research program within the context of development programs, or where ICARDA's research links with NGO interests in poverty, nutrition, health and environmental concerns.
- **Systemwide Linkages:** ICARDA continues to participate in the seven system-wide programs listed in its MTP 2000-2001 (SGRP, SLP, SWIM, SP-SWNM, SP-IPM, SP-PRCA, and SP-PRGA).

C. HIGHLIGHTS OF PROJECT PORTFOLIO CHANGES FOR 2001

The Research Project Portfolio for 2001-2003 is presented in the attached Annex. There are no major structural changes in the project portfolio compared with the MTP 1998-2000. The "Logframe" terminology has, however, been introduced. With major structural changes made in 1998, in line with the thrusts laid out in the 1998-2000 MTP, the year 2001 is 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 and add-value products;
- X increase in support for socioeconomic research on natural resource management (additional staff) and corresponding decrease in other areas of socioeconomic research.

D. HIGHLIGHTS OF 2003 PROJECT PORTFOLIO AND IMPLICATIONS FOR 2001 AND 2002

No strategic shifts are intended in 2003. 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.

E. PROJECT MILESTONES

For details of project milestones for 2001 through 2003 and beyond, see the project summaries in the Research Project Portfolio for 2001-2003 in the attached Annex. With special projects now accounting for > 70% of the budget, the timely attainment of milestones is increasingly contingent upon successful project funding. Significant revisions of milestones include:

- Increased activity with CAC countries has resulted in the inclusion of milestones in 2001 for on-farm testing and demonstration in winter wheat (Project 1.4) and on the completion of the collection of genetic resources of cereal pasture and food legumes germplasm and wild relatives (Project 3.3).
- Expanded activities on characterization of small ruminant production systems and assessment of use of agroindustrial byproducts and lambing out of season (Project 2.5).

F. PROJECT COSTS

Based on current estimates of anticipated funding the research agenda requirement in 2001 is reduced to US\$ 26.0 million, as against US\$ 27.6 million proposed in the 2000-2002 MTP. This reduction is partly due to the application of change in CGIAR accounting principles regarding depreciation.

In computing project costs, ICARDA's overhead is 24% which 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, and four junior/associate professional officers (see G below)

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

Major changes were made in 1998 with staff recruited for priority research thrusts, balanced by reductions in staff in areas of reduced emphasis in the 1998-2000 MTP. In 1999 ICARDA recruited a senior chickpea breeder, as the previous ICRISAT-funded breeder left in 1996 and ICRISAT was unable to part-fund the post. A coordinator for the GEF-funded biodiversity project was also recruited in 1999. With these staff changes ICARDA is well positioned to fulfill the new themes of its MTP research agenda. In 2000 ICARDA aims to recruit a senior natural resources economist and an animal geneticist for breed characterization to support changes in emphasis in the research portfolio. In 2000, ICARDA is hosting a

total of four associate experts (junior/associate professional officers) from Australia, Belgium, Denmark and the Netherlands.

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. Senior Scientific Advisors appointed as 'mentors' provided support on biotechnology and water research in 1999. In 2000 this will continue and be supplemented by another mentor to focus on stress physiology and climate change. NARS scientists have been, and will continue to be, appointed, as needed, as Affiliate Research Fellows to conduct specific activities.

H. CENTER FINANCIAL INDICATORS AND CAPITAL INVESTMENTS

Non-payment of 1999 grant by the EU and an exchange loss on 1998 EU grant received in December 1999 due to a weak Euro are the main reasons for the Center's deficit of US\$ 1.8 million in 1999. As such the Center had to draw from its operating reserve and ended with a negative operating reserve of US\$ 1.2 million.

In submitting the agenda for 2001-2003, 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.

Annex

Research Project Portfolio

Theme 1: Germplasm Enhancement

- Project 1.1 Barley Germplasm Improvement for Increased Productivity
- Project 1.2 Durum Wheat Germplasm Improvement for Increased Productivity, Yield Stability and Grain Quality in West Asia and North Africa
- Project 1.3 Spring Bread Wheat Germplasm Improvement for Increased Yield and Yield Stability in West Asia and North Africa
- Project 1.4 Winter and Facultative Bread Wheat Germplasm Improvement for Increased Yield and Yield Stability in Highland West Asia and North Africa
- Project 1.5 Food Legume Germplasm Improvement (Lentil, Kabuli Chickpea, Faba Bean and Pea) for Increased Systems Productivity
- Project 1.6 Forage Legume Germplasm Improvement for Increased Feed Production and Systems Productivity in Dry Areas

Theme 2: Production Systems Management

- Project 2.1 Integrated Pest Management in Cereal and Legume-based Cropping Systems in Dry Areas
- Project 2.2 Agronomic Management of Cropping Systems for Sustainable Production in Dry Areas
- Project 2.3 Improvement of Sown Pasture and Forage Production for Livestock Feed in Dry Areas
- Project 2.4 Rehabilitation and Improved Management of Native Pastures and Rangelands in Dry Areas
- Project 2.5 Improvement of Small Ruminant Production in Dry Areas

Theme 3: Natural Resource Management

- Project 3.1 Water Resource Conservation and Management for Agricultural Production in Dry Areas
- Project 3.2 Land Management and Soil Conservation to Sustain the Agricultural Productive Capacity of Dry Areas
- Project 3.3 Agrobiodiversity Collection and Conservation for Sustainable Production
- Project 3.4 Agroecological Characterization for Agricultural Research, Crop Management, and Development Planning

Theme 4: Socioeconomics and Policy

- Project 4.1 Socioeconomics of Natural Resource Management in Dry Areas
- Project 4.2 Socioeconomics of Agricultural Production Systems in Dry Areas
- Project 4.3 Policy and Public Management Research in West Asia and North Africa

Theme 5: Institutional Strengthening

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

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

Goal: Productivity of barley in marginal areas increased.

Indicator: 20-30% increase in barley production in 15 countries.

Purpose: Adoption of improved varieties by farmers in marginal areas.

Indicator: 90 new varieties in 10 countries, adopted by 30% of the farmers in 10 years.

Output 1: Germplasm with higher and stable yield, better biotic stress resistance and better quality identified.

Indicators:

- 30 different nurseries/year distributed to NARS
- 30% of lines selected by NARS.
- 50% of lines used as parental material by NARS.

Milestones:

2001: Decentralization in the highlands of WANA and in Central Asia completed;

Decentralization in Latin America started;

New barley lines with various combinations of abiotic (cold, drought, heat, salinity) and biotic (diseases, insects and viruses) stress resistance and with improved feed (intake) and food characteristics obtained and distributed.

2002: 50% of the barley breeding for Latin America and China decentralized;

New barley lines with various combinations of abiotic (cold, drought, heat, salinity) and biotic (diseases, insects and viruses) stress resistance and with improved feed (intake) and food characteristics obtained and distributed.

2003: 80% of the barley breeding for Latin America and China decentralized;

New barley lines with various combinations of abiotic (cold, drought, heat, salinity) and biotic (diseases, insects and viruses) stress resistance and with improved feed (intake) and food characteristics obtained and distributed.

Output 2: Methodology to enhance adoption developed.

Indicators:

- 50 farmers/country participating in selection.
- 20 countries using participatory plant breeding (PPB).

Milestones:

2001: Participatory breeding initiated in Jordan and Egypt.

Scaling up of PPB in Syria and Yemen.

2002: Participatory breeding initiated in at least one country in Latin America.

Seed multiplication activities promoted in five villages in Syria.

2003: Second cycle of participatory breeding concluded in Syria and in North Africa.

Output 3: Breeding methodology for stress environments developed.

Indicators:

- New design and techniques used by 10 NARS and at ICARDA.

Milestones:

2001: 30% of International Barley Information System (IBIS) developed;

Methods for involving small farmers in PPB developed;

Transfer of Residual Maximum Likelihood (REML) method to at least 5 NARS;

Markers for plant height under drought, brittle rachis, disease resistance and growth at low temperatures developed;

Marker assisted selection (MAS) for powdery mildew and scald resistance in place;

Mapping populations developed by the DH technique;

MAS for traits identified in mapping population to be set up.

2002: 70% IBIS developed, markers for osmotic adjustment developed;

Mapping populations developed by the DH technique and tested for their suitability for genetic mapping (segregation distortion).

MAS for traits identified in mapping populations routinely used.

2003: 100% of IBIS developed.

Output 4: New methodologies disseminated.

Indicators:

- 20 NARS adopted methodologies .
- Number of better varieties generated.

Milestones:

- 2001: 90% of NARS use landraces in their breeding programs;
Three new publications on methodological issues;
Breeding methodologies presented in international conferences;
Lectures on breeding methodologies for biotic and abiotic stresses at three training courses.
- 2002: 5 NARS start using REML in their data analysis;
Three new publications on methodological issues;
Breeding methodologies presented in international conferences;
Lectures on breeding methodologies for biotic and abiotic stresses at three training courses.
- 2003: 20% of NARS have changed their methodologies.
At least 10 varieties produced as consequence of new methodologies;
Breeding methodologies presented in international conferences;
Lectures on breeding methodologies for biotic and abiotic stresses at three training courses

Output 5: NARS Research capabilities improved

Indicators:

- 50 NARS scientists trained in 5 years
- Post training employment assignment in NARS

Milestones:

- 2001: 10 scientists trained on PPB; 5 scientists trained on REML; 5 scientists trained on molecular marker technology; 5 scientists trained on IBIS; 5 scientists trained on breeding for stress environments; 10 scientists trained on breeding for biotic (diseases, insect, virus) stress resistance
- 2002: 10 scientists trained on PPB; 5 scientists trained on molecular marker technology; 5 scientists trained on REML; 5 scientists trained on IBIS; 5 scientists trained on breeding for stress environments; 10 scientists trained on breeding for biotic (diseases, insect, virus) stress resistance.
- 2003: 10 scientists trained on PPB; 5 scientists trained on molecular marker technology; 5 scientists trained on REML; 5 scientists trained on IBIS; 5 scientists trained on breeding for stress environments; 10 scientists trained on breeding for biotic (diseases, insect, virus) stress resistance.

Duration: 5 years.

Users: 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, Central Asia and Caucasus (CAC) 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; National Centre for Agricultural Research and Technology Transfer (NCARTT), Jordan; University of Damascus, Syria; Krasnodar Research Institute; All Russian Institute of Agricultural Biotechnology; National Laboratory Risoe, Denmark; University of Hamburg; Scottish Crop Research Institute, UK; University of Brisbane; North Dakota State University; Oregon State University; Texas Tech University; University of Adelaide; Colorado State University; Kansas State University; Oklahoma State University; Montana State University; CRC for Molecular Plant Breeding, Waite Campus, Adelaide.

Cost:

2001: US\$ 2.20 million

2002: US\$ 2.29 million

2003: US\$ 2.38 million

System Linkages:

Output 1: Germplasm Improvement: 60%

Output 2: Germplasm collection: 10%

Output 3: Sustainable Production: 10%

Output 5: Enhancing NARS: 20%

The project participates in the Systemwide Program on Participatory Research and Gender Analysis (SWP PRGA).

Financing Plan: Unrestricted core. Allocated core contribution from Italy; grant from SWP-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; IDRC grant for PPB; support from Denmark for the PPB work in Eritrea; BMZ funding for molecular marker research; Danish funding for molecular marker research in Risoe, Denmark. Anticipated support from Netherlands for barley research in Ethiopia; anticipated annual grant from the OPEC Fund; anticipated support for collaboration with Eritrea and Mauritania.

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

Goal: Increased productivity of durum wheat in the WANA region.

Indicator: 10 % increase in durum production in 5 countries.

Purpose: Development of improved durum varieties with NARS in the WANA region.

Indicator: 10-15 new varieties identified by NARS in 5-7 countries in 5 years.

Output 1: Genotypes with high and stable yield, resistance to abiotic and biotic stresses, and better grain quality.

Indicators:

- 10 nurseries distributed to 20-25 NARS.
- Number of lines selected by NARS.
- Number of lines used as parental material by NARS.

Milestones:

2001: Hallmark germplasm combining high yield with resistances to drought, cold, and heat.

2002: Broadening the genetic base and improving grain quality traits.

2003: Broadening the genetic base for resistance to rusts, Hessian fly and Septoria and for resistance to abiotic stresses.

Output 2: New breeding methodology for Mediterranean dryland developed.

Indicators:

- Stress physiological tools are used such as carbon isotope discrimination and spectral radiometry.
- Molecular markers techniques; Marker assisted selection.

Milestones:

2001: Genome mapping of quality population will be accomplished and QTLs for grain quality determined.

2002: Genome mapping of the population for cold and boron toxicity in the Atlas/ Anatolian plateaus will be accomplished and QTLs for grain quality determined.

2003: Genome mapping of the population for continental and temperate drylands will be accomplished and QTLs for grain quality determined.

Output 3: Breeding methodology for temperate, continental, & high elevation areas.

Indicators:

- New designs and tools used by 3 NARS programs.
- Enhanced scientific expertise.

Milestones:

2001: Decentralized breeding for highlands accomplished.

2002: Genetic stocks with multiple resistance to abiotic and biotic stresses for temperate drylands available.

2003: Genetic stocks with multiple resistance to abiotic and biotic stresses for highlands available.

Output 4: Identified improved varieties for commercial production

Indicators:

- On-farm trials in 5 NARS are established in the durum growing areas in each country
- High yielding varieties in dryland are available

Milestones:

2001: 20-30 genotypes with resistance to drought, cold, and heat will be tested in on-farm trials in 5 NARS and per year; and 3 coordination meetings will be attended.

2002: 20-30 genotypes with improved grain quality will be tested in on-farm trials in 5 NARS and per year; and 3 coordination meetings will be attended.

2003: 20-30 genotypes with broadened genetic base for resistance to rusts, Hessian fly and Septoria and abiotic stresses will be tested in on-farm trials in 5 NARS and per year; and 3 coordination meetings will be attended.

Output 5: Enhancement of NARS research capabilities.

Indicators:

- NARS scientists trained in 5 years: 30 at HQ & 50-60 at NARS.
- Expertise in advanced breeding techniques enhanced (10 Ph.D).

Milestones:

- 2001: 1 trainee per country per year for 5-7 NARS on breeding for drought, cold, and heat; Ph.D students on quality, stress physiology, and molecular markers.
- 2002: 1 trainee per country per year for 5-7 NARS on breeding for broadening the genetic base for biotic stress resistance; Ph.D students on quality, stress physiology, and molecular markers.
- 2003: 1 trainee per country per year for 5-7 NARS on breeding for broadening the genetic base for abiotic stress resistance; Ph.D students on quality, stress physiology, and molecular markers.

Duration: 5 years.

Users: 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 less inputs to grow 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; ARC, Syria; University of Aleppo, Syria; University of Tichreen, Syria; INRAT, Tunisia; FCRI, Turkey; CCI-Tamworth, Australia; Plant Breeding Institute, Cobbity, Australia; University of Sydney, Australia; Agriculture Canada; Laval University, Canada.
- Molecular markers, genome mapping, double haploids: CIMMYT; Cornell University, USA; McGill University, Canada; 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: NCARTT, Jordan; ARC, Syria; LARI, Lebanon; ARC, Iraq; INRA, Morocco.
- Crop modelling/GIS: Wageningen University, Netherlands.

Cost:

2001: US\$ 0.98 million

2002: US\$ 1.02 million

2003: US\$ 1.06 million

System Linkages:

Output 1: Germplasm Improvement: 70%

Output 2: Germplasm collection: 10%

Output 3: Sustainable Production: 5%

Output 5: Enhancing NARS: 15%

Financing Plan: Core funds of ICARDA and CIMMYT. Allocated core funds from Italy; allocated funds from France for breeding for drought tolerance and use of biotechnological tools in breeding; 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; BMZ restricted funding for DNA marker assisted breeding and genetic engineering; financing from AFESD for biotechnology. Anticipated funding from IFAD for basic research on grain quality and drought resistance, on-farm trials, and socio-economic studies on post-harvest processing and adoption; anticipated support for collaboration with Eritrea and Mauritania.

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

Goal: Increased productivity of spring bread wheat in WANA.
Indicator: 10% increase in bread wheat production in five countries.

Purpose: Development of improved varieties with NARS in the WANA region.
Indicator: Five new varieties identified by NARS in 5 countries in 5 years.

Output 1: Spring bread wheat genotypes with high and stable yield, resistant/tolerant to abiotic and biotic stresses, and better grain quality.

Indicators:

- 8 nurseries distributed to 20-25 NARS.
- Number of lines selected by NARS.
- Number of lines used as parental material by NARS.

Milestones:

2001: Elite germplasm combining high yield with resistance to drought, cold, and heat.

2002: Broadening the genetic base for resistance to rusts, Hessian fly, Septoria and for abiotic stresses.

2003: Broadening the genetic base and improving grain quality traits.

Output 2: New breeding methodology for stress environments developed.

Indicators:

- New designs and field plot techniques used.
- Stress physiological and morpho-physiological tools used.

Milestones:

2001: New experimental designs utilized in international trials.

2002: Physiological and morpho-physiological adaptive traits associated with wheat adaptation under drought identified.

2003: Physiological and morpho-physiological adaptive traits utilized in the selection program.

Output 3: New breeding methodologies disseminated.

Indicators:

- New designs and tools used by 3 NARS programs.
- Number of better varieties generated.

Milestones:

2001: NARS visiting scientist will be exposed to the new breeding methodologies at ICARDA.

2002: New designs and breeding methodologies will be discussed in national research coordination meetings and national traveling workshops.

2003: New designs and breeding methodologies will be discussed in regional research coordination meetings and regional traveling workshops.

Output 4: Identified improved varieties for commercial production

Indicators:

- On-farm trials in 3 NARS are established in bread wheat growing areas in each country.
- Number of improved spring bread wheat varieties adopted.

Milestones:

2001: 20-30 genotypes with resistance to drought, cold, and heat tested in on-farm trials in 3 NARS;
Three national research coordination meetings attended.

2002: 20-30 genotypes with improved grain quality tested in on-farm trials in 3 NARS;
Three national research coordination meetings attended.

2003: 20-30 genotypes with broadened genetic base for resistance to rusts, Hessian fly and Septoria and abiotic stresses tested in on-farm trials in 3 NARS;
Three national research coordination meetings attended.

Output 5: Enhanced NARS research capabilities

Indicators:

- NARS scientists trained in 3 years: 20 at headquarters and 30-50 within NARS programs.
- 3-5 workshops/courses organized with NARS.

Milestones:

2001: 1 trainee per country per year for 5 NARS on breeding for drought, cold, and heat.

2002: 1 trainee per country per year for 5 NARS on breeding for broadening genetic base for biotic stress resistance.

2003: 1 trainee per country per year for 5 NARS on breeding for broadening genetic base for abiotic stress resistance.

Duration: 5 years.

Users: 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 less inputs to grow 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 Spring Bread Wheat Improvement Program at ICARDA is conducted in collaboration with CIMMYT; a CIMMYT Bread Wheat Breeder is outposted to ICARDA headquarters.

- Breeding for Hessian fly and Russian Wheat Aphid resistance: INRA-Morocco.
- Breeding for Septoria Leaf Blotch resistance: INRAT-Tunisia.
- Networks on foliar diseases, heat tolerance and water use efficiency: Nile Valley and Red Sea Regional Program, ARC-Egypt, EARO-Ethiopia, ARC-Sudan and AREA-Yemen.
- Doubled haploids and microsatellite DNA markers: FCRI-ARC, Egypt and USDA-ARS, Beltsville, MD, USA.
- On-farm and adoption studies: ARC, Syria and LARI, Lebanon.

Cost:

2001: US\$ 0.51 million

2002: US\$ 0.53 million

2003: US\$ 0.55 million

System Linkages:

Output 1: Germplasm Improvement: 70%

Output 2: Germplasm collection: 10%

Output 3: Sustainable Production: 5%

Output 5: Enhancing NARS: 15%

Financing Plan: Core funds of ICARDA and CIMMYT. USDA/ ATUT (Agricultural Technology Utilization and Transfer) project for application of molecular genetics to bread wheat in Egypt. Anticipated support for collaboration with Eritrea and Mauritania.

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

Goal: Increased and sustainable productivity of wheat in highland and continental areas of CWANA.

Indicator: Yield level raised and maintained.

Purpose: Increased adoption of improved bread wheat varieties in highland and continental areas of CWANA.

Indicator: Adoption by farmers of improved varieties.

Output 1: Wheat germplasm with improved yield potential, enhanced adaptation to local environments, and better grain quality developed for use by NARS.

Indicators:

- Superior germplasm performance confirmed.
- New varieties released by NARS for the target region.

Milestones:

2001: Delivery of a sixth WFBW germplasm nursery to NARS in CWANA.

2002: DH lines field tested.

Output 2: Improved understanding of cultivar response to abiotic stresses achieved, used in breeding, and made accessible to NARS.

Indicators:

- Mechanism of adaptation to drought and cold documented.
- Effect on yield of cold and drought reduced.

Milestones:

2002: DNA markers for cold tolerance identified.

2003: DNA markers for cold tolerance used for routine germplasm screening.

Output 3: Genetic diversity for enhanced tolerance to biotic stresses.

Indicator: Incidence of biotic stresses and their effect on yield reduced.

Milestones:

2001: Slow-rusting and durability of Yellow Rust resistance documented.

2002: Genetic stocks for Russian wheat aphid (RWA) produced and made accessible to NARS.

2003: DNA markers for Yellow Rust resistance identified.

2004: First genetic stocks for dryland root rot developed and made accessible to NARS; DNA markers for RWA tolerance identified.

Output 4: Strategies to improve technology adoption.

Indicator: Percent of farmers growing new cultivars.

Milestones:

2001: On-farm testing and demonstration conducted in collaboration with NARS and farmers in Uzbekistan, Azerbaijan, Turkmenistan, Kyrgyzstan, and Tajikistan.

2004: NARS release varieties based on joint activities.

Output 5: NARS capacity for wheat research in highlands strengthened.

Indicator: Number of skilled wheat researchers working in highland areas.

Milestones:

2001: Winter wheat travelling workshop for CWANA organized in Iran.

2001: Network of winter and facultative bread wheat (WFBW) breeders in WANA established and strengthened with sub-network of CAC breeders.

2002: Network of WFBW pathologists in CWANA established, with an effort focus on yellow rust.

Duration: 6 years.

Users: National Programs will benefit from training, and improved germplasm; and through them, farm households in the highlands and cold-winter areas of CWANA will benefit from the improved varieties, specifically adapted to their conditions and needs. Consumers will benefit from improved nutritional quality of bread wheat products.

Collaborators: ICARDA's winter and facultative bread wheat improvement work is conducted in collaboration with CIMMYT and Turkey through the Turkey/CIMMYT/ICARDA program operated from Ankara, Turkey. An important component of ICARDA breeding work is also conducted in collaboration with Iran, with a special emphasis on rainfed winter wheat in dry areas, and on yellow rust.

- *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; and several US universities (Oregon, Kansas, Colorado, Oklahoma, etc)
- Cold tolerance: NARS of Russia, Ukraine, Turkey and Iran
- Drought tolerance: NARS of Iran and Turkey. John Innes Institute, UK.
- Yellow rust: NARS in West Asia, CAC, 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:

2001: US\$ 0.82 million

2002: US\$ 0.85 million

2003: US\$ 0.89 million

System Linkages:

Output 1: Germplasm Improvement: 65%

Output 2: Germplasm collection: 10%

Output 3: Sustainable Production: 5%

Output 5: Enhancing NARS: 20%

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. Funding is being sought to support collaboration with NARS in Yellow Rust resistance.

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, enhancing the profitability and sustainability of cereal based farming systems.

Indicators:

- Increased production and improved per capita availability of food legumes.
- Increased profitability and sustainability of the cereal based farming system.

Purpose Development and delivery to NARS of lentil 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 in Mediterranean environments with mild winters and extended to high altitude areas.

Faba bean improvement to reduce the losses from biotic stresses through host-plant resistance in a targeted pre-breeding program in close partnership with NARS.

Indicators: 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.

Milestones:

2001: Appraisal of marker assisted selection for key stress;

Decentralization of chickpea improvement activities for Southern latitude initiated;
DNA markers for rust, Ascochyta blight and winter hardiness in lentil.

2002: Pathogenic variability for Fusarium wilt characterized;
Key markers identified for various traits and tested.

2003: Screening methodologies for Ascochyta blight, Fusarium wilt, and cold improved and marker assisted selection for these traits in use;
Breeding for southerly latitudes decentralized.

Output 2: 20 researchers/year trained on breeding philosophies, selection methods and techniques related to food legume germplasm enhancement in the target areas of the project.

Indicator: Number of researchers trained.

Milestones:

2001-2003: 20 persons per year from different national programs trained. More emphasis will be given to CAC countries where in-country and sub-regional courses will be organized.

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.

Milestones:

2001: Improved methods of weed control and harvest mechanization will be evaluated at few sites in different countries. DNA markers developed for chickpea will be tested for Ascochyta blight and cold tolerance in lentil.

2002: Improved methods of weed control and harvest mechanization will be evaluated at few sites in different countries. DNA markers developed for chickpea will be tested for Ascochyta blight and cold tolerance in lentil.

2003: Suitable combinations of genetic stocks with high biomass and resistance to key stresses developed and DNA markers for rust, Ascochyta blight and cold identified for use. Improved Methods of weed control and harvest mechanization documented and in use.

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.

Milestones:

2002: Transformation and regeneration protocol developed and tested in collaboration with other institutes.

2003: Transgenic lines with Bt gene for control of Sitona weevil and herbicide tolerance for Orobanche control made available.

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.

Milestones:

2001: Transformation and regeneration protocol developed and tested in collaboration with other institutes;

DNA molecular markers for Ascochyta blight tested for use;

Demonstrations of late winter sown technology and seed increases.

2002: The genetics of leaf miner resistance studied and strategy to improve leaf miner resistance established;

Large seed size and stress resistance combined in Kabuli Chickpea;

Demonstrations of late winter sown technology and seed increases.

2003: Chickpea winter sown technology transferred to NARS;

Transformation and regeneration protocol tested and transgenic lines with Ascochyta blight resistance made available;

Breeding for Fusarium wilt resistance decentralized to North Africa in Tunisia;

International nurseries with large seed size and stress resistance made available to NARS;

Genes for resistance to cold, Ascochyta blight, nematodes, and high biomass transferred from wild to the cultivated chickpea.

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.

Milestones:

2001: Fusarium wilt pathogen characterized; new sources of resistance to Fusarium wilt identified; and genetics of Fusarium wilt studied.

- 2002: Screening for flowering and podding under low temperature under North Indian conditions established. Screening for existing race of Fusarium wilt initiated at site in Northern India.
- 2003: Elite lines with resistance to Fusarium wilt and flowering and podding under low temperature conditions developed and ready for increase and sharing with NARS in the southern latitudes.

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 Orobancha, viruses, aphids 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, Orobancha and stem nematodes

Milestones:

- 2001: Sources of resistance to Orobancha, viruses, stem nematodes, Ascochyta blight, rust, and chocolate spot identified and shared with NARS through International Nursery Network; Sub-programs in Tunisia for North Africa, Egypt for Nile Valley, and ZAAS for China, in progress; Faba bean populations for recurrent selection developed for biotic and abiotic stresses.
- 2002: Gene pools for combined resistance to various biotic and abiotic stresses distributed for testing in sub-regional programs.
- 2003: Gene pools with adaptation to various sub-regions established for use in development of sub-regional nurseries; Transformation system for faba bean established.

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

Indicator: Gene pools for independent vascular system, determinate growth, and high auto-fertility, and their recombination with multiple disease resistance, developed.

Milestones:

- 2001: Selection of different plant types with stress resistance from the populations developed through hybridization for combining these traits.
- 2002: Selection of different plant types with stress resistance from the populations developed through hybridization for combining these traits.
- 2003: Elite materials of different plant types with resistance to various stresses identified for testing in sub-regional programs.

Duration: 10 years.

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 is conducted in collaboration with ICRISAT.

- Food legume improvement: NARS associated with ICARDA's regional programs in North Africa, Latin America, West Asia, Central Asia and Nile Valley and Red Sea; NARS in South Asia and China.
- Marker assisted selection: Washington State University, USA; University of Frankfurt, Germany; University of Naples, Italy.
- Lentil transformation and chickpea for Mediterranean environments: Center for Legumes in Mediterranean Agriculture (CLIMA), Australia.
- Transformation in 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

2001: US\$ 2.17 million

2002: US\$ 2.26 million

2003: US\$ 2.35 million

System Linkages:

Output 1: Germplasm Improvement: 70%

Output 2: Germplasm collection: 10%

Output 3: Sustainable Production: 10%

Output 5: Enhancing NARS: 10%

Financing Plan: Unrestricted core funds of ICARDA and, for chickpea, ICRISAT. Allocated core funding from DFID, 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; collaboration with Australia on chickpea supported by GRDC grant; 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. Anticipated support for collaboration with Eritrea.

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

Goal: Enhanced production from mixed crop/livestock farming systems based on improved productivity and nutritional content of forage legumes (*Vicia* spp. & *Lathyrus* spp) for livestock feed in marginal low rainfall areas; and improved sources of dietary protein in areas where grasspea (*Lathyrus sativus*) is a major food crop.

Indicators: Livestock feed resources increased; reduced incidence of neurolathyrism.

Purpose: Adoption by farmers in marginal low rainfall areas of improved varieties of forage legumes and associated technologies.

Indicators:

- Improved germplasm with desirable 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.
- The use of improved underground vetch (*Vicia sativa* sub. *amphicarpa*, L) in marginal non-arable land rehabilitation increased.
- Improved grasspea (*Lathyrus sativus*) with low neurotoxin (B-ODAP) content in the seeds adapted to the areas where the crop is an important human food (Afghanistan, Bangladesh, China, Ethiopia, India, Nepal, and Pakistan).
- 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 making, grain & straw).

Indicators:

- NARS supplied with breeding population with sufficient diversity for use in different environments.
- Highly adapted cultivars and populations of forage vetches and chicklings used by NARS.
- High yielding non-shattering types of vetches free from anti-nutritional factors (ANFs) such as Beta-Cyanoalanin in common vetch and tannins in narbon vetch.
- Adapted lines of common vetch (*Vicia sativa*), Hungarian vetch (*Vicia panonica*), narbon vetch (*Vicia narbonensis*), and grasspea (*Lathyrus sativus*) introduced to Central Asia and Caucasian Countries (CAC).

Milestones:

Annually: 500 lines are tested annually in multi-location trials.

100 segregated population distributed to NARS.

10 international adaptation trials distributed to NARS.

3,000 in vitro tests per year.

Feeding trials using small ruminants.

2001: Wide crosses made between *V. sativa* and *V. amphicarpa* to incorporate genes for increased biomass in underground vetch and cold tolerance in common vetch.

2003: Cold tolerant woolly-pod vetch, Hungarian vetch and common vetch available for cold highlands.

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

Indicators:

- 150 target crosses/year followed by *in situ* selection for low neurotoxin B-ODAP in partnership with NARS.
- 10 variants/year from locally adapted land races of Bangladesh, Ethiopia, Nepal, and Pakistan.
- Improved lines of grasspea with minimal neurotoxin content in the grains & straw 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.
- The relationship between soil micronutrients (zinc and iron) and macro nutrients (phosphorus) status and neurotoxin content established.

Milestones:

- 2001: Selections for low neurotoxin content in segregated populations *in situ* by NARS; Improved land races with acceptable neurotoxin content (<0.2%); Seed multiplication of low neurotoxin lines.
- 2002: On farm testing of low neurotoxin lines; Performance of the crop under alternative cultural practices.
- 2003: Adoption of low neurotoxin cultivars by NARS, especially Bangladesh and Ethiopia.

Output 3: Improved lines of amphicarpic type legumes such as underground vetch (*Vicia sativa* sub. *amphicarpa*) for marginal non-arable land rehabilitation.

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

Milestones:

- 2001: Crosses between common vetch and underground vetch. Pilot sites established for in situ conservation and seed multiplication.
- 2002: In situ selection for high biomass.
- 2003: Distribution of improved underground vetch for testing in marginal lands rehabilitation and grazing trials by small ruminants.

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

Indicator: Number of trainees, M.Sc.

Milestones:

- 2001: Five individual trainees trained on forage legume germplasm enhancement and quality assessment.
- 2002: Two individual trainees from Ethiopia trained on methods of estimation of neurotoxin in grasspea grains and straw; Two individual trainees trained on germplasm enhancement and somaclonal techniques.
- 2003: Five individual trainees on germplasm enhancement. One M.Sc thesis finished.

Duration: Four years

Users: 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 the use of suitable adapted self-regenerating 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 evaluation & utilization: NARS associated with ICARDA's Regional Programs for North Africa, West Asia, Highlands, Central Asia and the Caucasus (CAC), Latin America (Brazil); China; Aleppo University.
- Low neurotoxin grasspea: National Programs of Bangladesh, China, Ethiopia, India, Nepal, Pakistan, University of Ghent, Belgium, University of Alberta, Canada.
- Anti-nutritional factors (ANFs) and nutritional aspects: International Food Policy Research Institute; International Livestock Research Institute; Center for Legumes in Mediterranean Agriculture; University of Addis Ababa, Ethiopia; Institute of Food Research, Norwich UK; University of Alberta, Canada; University of Ghent, Belgium; Washington State University; Indian Agricultural Research Institute, New Delhi, India.

Cost:

- 2001: US\$ 0.60 million
2002: US\$ 0.62 million
2003: US\$ 0.65 million

System Linkages

Output 1: Germplasm Improvement: 70%
Output 2: Germplasm collection: 10%
Output 3: Sustainable Production: 10%
Output 5: Enhancing NARS: 10%

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 improving nutritional quality of grasspea in Ethiopia.

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

Goal: Improved productivity of cereals and legumes and reduced variability in production attributable to disease and pest attacks.

Indicators: Increased yields and reduced variability of production; reduction in yield losses to disease and pest epidemics

Purpose: Adoption by farmers of integrated pest management practices.

Indicator: IPM options developed by ICARDA in collaboration with NARS partners are included in national extension and demonstration programs.

Output 1: Improved understanding of occurrence, spread, variability and losses caused by pests in WANA.

Indicator: Number of surveys conducted.

Milestones:

Annually: 5 pest surveys in 5 countries; yield loss experiments in 3 countries; variability of 5 pests in 5 countries characterized.

Output 2: IPM options for the different cropping systems and agroecological zones comprising (i) host resistance, (ii) crop rotation and other agronomic practices, (iii) chemicals, (iv) biological agents, and (v) healthy seed, developed.

Indicators:

- Establishment of IPM options by NARS and level of introduction at the farm level.
- Increased demand on 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.

Milestones:

Annually: Sources of resistance for 7 pests identified; effect of at least 3 practices on 5 pest populations in 3 countries evaluated; 4 IPM options available.

Output 3: IPM pilot sites, with farmers' participation developed at selected sites in WANA.

Indicator: Number of pilot sites developed.

Milestones:

2001: 2 pilot sites in 2 countries.

2002: 3 pilot sites in 3 countries.

2003: 5 pilot sites in 5 countries.

Output 4: 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.
- Number of NARS staff trained on site.

Milestones:

2001: 10 trainees in IPM and 2 farmers' field schools (FFS) established.

2002: 10 trainees in IPM and 3 farmers' field schools (FFS) established.

2003: 10 trainees in IPM and 5 farmers' field schools (FFS) established.

Duration: 10 years

Users: 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 (DASR), Syria;
- Exchange of resistant germplasm: CIMMYT, ICRISAT, NARS of CWANA.
- Study of population dynamics of powdery mildew: Risoe 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; SPII, Iran; FCRI, Turkey.
- Yellow rust: University of Sydney, Australia; FCRI, Egypt; USDA/ARS, USA; DIAS, Denmark, INRA, France.
- Study of variability of lentil Fusarium wilt pathogen: DIAS, Denmark.
- Characterization of variability of chickpea Fusarium wilt pathogen: University of Cordoba, Spain.
- 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; Aphid Lab, USDA, ARS, Stillwater, Oklahoma.
- Wheat stem sawfly: Montana State University, Bozeman, USA.
- 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

Cost:

2001: US\$ 1.24 million

2002: US\$ 1.29 million

2003: US\$ 1.35 million

System Linkages

Output 1: Germplasm Improvement: 25%

Output 3: Sustainable Production: 60%

Output 5: Enhancing NARS: 15%

Linkage to the System-wide Programme on IPM (SP-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 and scald in barley by GRDC, Australia; support for IPM pilot sites by SP-IPM. Anticipated support for collaboration with Eritrea.

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

Goal: Increased productivity and productive capacity from improved soil and crop management and use of appropriate crop rotations, improved water use efficiency and soil fertility.

Indicators: Production levels; condition of natural resource base (soils and soil water).

Purpose: Adoption by farmers of locally adapted arable systems for the biophysically and economically sustainable production of field crops that make 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
- Efficient and conservative use of soil, water and external inputs.

Output 1: Management principles for choice of crop, crop rotation, input use and husbandry practices, 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.

Milestones:

2001: Long-term monitoring of farmers' dynamic systems with NARS expanded.

2002: Cropping systems options developed using results from on-station and on-farm trials.

2003: Analysis of long-term monitoring of farmers' dynamic systems with NARS for trends in changes in productivity and sustainability.

Output 2: Validated cropping systems simulation models for the spatial extrapolation and generalization of site-specific results 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.

Milestones:

2001: Evaluation of cropping systems simulation models for the spatial extrapolation of site-specific findings on the optimization of soil water use and management practices, initiated.

2002: Production risks quantified (in pilot areas) using cropping system models and GIS.

2003: Cropping systems simulation models evaluated for the spatial extrapolation of site-specific findings on the optimization of soil water use and management practices.
Production risks quantified in wider areas with more NARS involved.

Output 3: Field-tested technologies and strategies 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 that increase water use efficiency adopted by farmers.

Milestones:

2001: Efficient soil, crop and water management practices tested under farmers' conditions with selected NARS;

Implementation of SP-SWNM-OSWU projects by NARS.

- 2002: Crop cultivars and management systems that optimize WUE tested on-farm.
2003: Crop cultivars and management systems that optimize WUE tested on-farm and impact measured.

Output 4: Management strategies for the enhancement of soil fertility in cropping 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.

Milestones:

- 2001: Soil fertility network established.
2002: Review of N and P studies completed, soil N transformations quantified.
2003: Soil quality indicators available

Output 5: Distribution and severity of soil micronutrient imbalances identified and awareness increased

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.

Milestones:

- 2001: Distribution of micronutrient stresses mapped.
2002: Climate and soil-type patterns in micronutrient stresses identified
2003: Climate and soil-type patterns in micronutrient stresses identified in wider areas

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.

Milestones:

- 2001-2003: New NARS staff trained.

Duration: 5 years.

Users and beneficiaries: The project works directly with national research and extension personnel with responsibility for agronomic management of cropping systems. The ultimate beneficiaries are farm households through their participation in adaptive research on problem-oriented technologies. The project will promote greater awareness among decision-makers of the value of improved soil and crop management within cropping systems, with a view to removing constraints to their adoption.

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, CAC;
- 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-convener.
- 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

2001: US\$ 1.67 million

2002: US\$ 1.74 million

2003: US\$ 1.81 million

System Linkages:

Output 3: Sustainable Production: 85%

Output 5: Enhancing NARS: 15%

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; support for collaboration on soil water and nutrient management in Central Asia from Asian Development Bank. Anticipated support for collaboration with Eritrea.

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

Goal: Sustainable system productivity, maintenance of soil fertility, and improved small ruminant feed and nutrition by increased use of forage legumes and sown pastures in farming systems.

Indicator: Increased production of forage and pasture and its utilization in livestock production systems.

Purpose: 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.

Milestones

- 2001: 100 accessions collected and conserved in genebank and/or nursery;
A manual on the ecology/agronomy of annual legumes tested by ICARDA published;
5 cultivars of annual legumes and 1 cultivar of range species selected;
500 kg of vetch and 5 kg of range species distributed to NARS;
4 NARS trained in collection and selection of forage and pasture species.
- 2002: 100 accessions collected and conserved in genebank and/or nursery;
1 cultivar of range species selected;
1000 kg of vetch and 10 kg of range species distributed to NARS;
4 NARS trained in collection and selection of forage and pasture species.
- 2003: 1 cultivar of range species selected;
1000 kg of vetch and 20 kg of range species distributed to NARS;
100 accessions collected and conserved in genebank and/or nursery;
4 NARS trained in collection and selection of forage and pasture species.

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.

Milestones

- 2001: Consultations with farmers, Farmers Union, extension services and entrepreneurs in Syria and Iraq for manufacturing the roller and mower or acquiring them from abroad;
Neighboring farmers produce local forage or range seed/seedlings;
4 NARS trained in seed production.
- 2002: 1 machine for harvesting *Atriplex* species developed;
Several farmers at the village level produce local forage or range seed/seedlings;
4 NARS trained in seed production.
- 2003: 1 machine for harvesting *Artemisia* and *Salsola* species developed;
Sufficient quantity of local forage or range seed/seedlings are produced in the informal sector;
4 NARS trained in seed production.

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

Milestones

- 2001: A report on the current situation and prospects of feed resources in Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan;

Annually: Analysis of rotation trials;
At least 2 field days organized on rotation trials;
2 papers published on rotation trials;
4 NARS trained in rotation 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

Milestones

Annually: Analysis of 2 trials to assess the potential use of forage and pasture crops as hay, grazing or mature seed and straw to suit land use and market opportunities;
Analysis of 2 trials to assess the potential use of wastewater to irrigate forage crops established;
One rotation trial established in cooperation with NARS in three countries analyzed for economic ranking of treatments;
Analysis of one trial integrating rangeland into rotation trials
4 NARS trained in management of feed resources;
2 issues of Newsletter produced.

Duration: 10 years.

Users and beneficiaries: The immediate users are ICARDA's NARS partners; the ultimate beneficiaries are farm households, particularly those in mixed crop-livestock production systems, who will benefit from more sustainable productivity and diversification of their farming systems, maintenance of soil fertility, and improvement of small ruminant feed and nutrition.

Collaborators:

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

Cost:

2001: US\$ 0.78 million

2002: US\$ 0.81 million

2003: US\$ 0.84 million

System Linkages:

Output 2: Germplasm collection: 5%

Output 3: Sustainable Production: 80%

Output 5: Enhancing NARS: 15%

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; Dryland Pasture, Forage and Range Network Newsletter co-sponsored by IPGRI-CWANA, FAO (Near East Regional Office), CIHEAM, CLIMA (Australia), GL-CRSP, and IDRC.

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

Goal: Rehabilitation of native pastures and 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.

Indicators: Area of rangeland rehabilitation programs; biomass production in rehabilitated areas; contribution of rangelands to national livestock feed demands.

Purpose: Development of rehabilitation and management measures for range 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: Management plans for rangeland natural resources in two test sites in CWANA.

Indicator: National and community acceptance of management plan.

Milestones

2001: Report including recommendations on marginal land using native annual legumes;
Report including recommendations on the Barley/Atriplex technology;
Data on current use of rangeland natural resources in 2 sites analyzed and discussed;
Report on range productivity in Syria;
Direct seeding techniques for establishing fodder shrubs on rangeland tested in selected sites;
Report on use of GIS-RS facilities for range rehabilitation and management in Morocco published.

2002: Guidelines for proper management of fodder shrub plantations established with users.

2003: Develop and test a management plan for rangeland natural resources in these 2 sites.

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

Indicator: Techniques tested and utilized by NARS.

Milestones

2001: 2 range species increased; neighboring farmers produce local forage or range seed/seedlings.

2002: 3 range species increased;
1 machine for rangeland reseeding developed;
Several farmers at the village level produce local forage or range seed/seedlings;
4 NARS trained on machinery functioning.

2003: The machine for rangeland reseeding tested in a selected site;
4 range species increased;
Sufficient quantity of local forage or range seed/seedlings are produced in the informal sector;
4 NARS trained on machinery functioning.

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

Indicator: Documentation, database and herbarium of useful species.

Milestones

2001: Measurement of CO₂ in two sites in Central Asia completed (in collaboration with GL-CRSP);
Inventory and survey of range resources in 2 sites completed;
100 accessions collected and conserved in gene bank and/or nursery;
Networking/sharing of data bases initiated within the context of the SLP Shrub Project;
4 NARS trained in inventory, survey, and mapping of range resources.

2002: Mapping of range resources in 2 sites initiated;
100 accessions collected and conserved in gene bank and/or nursery;
Fodder shrubs for cold environments released;
4 NARS trained in inventory, survey, and mapping of range resources.

2003: Mapping of range resources in 2 additional sites initiated;
100 accessions collected and conserved in genebank and/or nursery;
Measurement of main vegetation types productivity in 2 sites completed.

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.

Milestones

2001: Literature gathered.

2002: Literature analyzed.

2003: Report published.

Duration: 10 years.

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:

- Nine countries where desertification is considered of serious concern are involved in the Systemwide Livestock Programme (SLP) project on Fodder Shrubs and Trees (Burkina Faso, Jordan, Mali, Morocco, Niger, Pakistan, Senegal, Syria and Tunisia), together with ILRI, ICRISAT and ICRAF.
- Geographic Information System (GIS): INRA-Oujda, Morocco, JICA-JIRCAS, Japan; Maison de l'Orient, CNRS, France; IUED, Switzerland.
- Fodder shrubs and trees: 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 Kazakhstan, 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; MARC, Egypt, GAP, Turkey.

Cost:

2001: US\$ 2.13 million

2002: US\$ 2.22 million

2003: US\$ 2.31 million

System Linkages:

Output 2: Germplasm collection: 10%

Output 3: Sustainable Production: 75%

Output 5: Enhancing NARS: 15%

Linkage to the Systemwide Livestock Programme (SLP).

Financing Plan: Unrestricted core funds. Allocated core funding from Japan. Restricted funding from Spain; financing from Egypt for technical assistance to north-west Egypt; collaboration within Barani Project in Pakistan supported by Pakistan government; collaboration in GAP Project in Turkey supported by GAP; collaborative research with NARS in Mashreq and Maghreb financed by IFAD and AFESD; collaborative work on fodder shrubs supported within SLP; 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. Anticipated financing within the sub-regional action program of the Convention to Combat Desertification (CCD); anticipated support for collaboration with Mauritania.

Project 2.5: Improvement of Small Ruminant Productivity in Dry Areas

Goal: Improved productivity of small ruminants, increased supply and improved quality of livestock products, and optimal utilization of feed resources and the resource base.

Indicators: National production and consumption of small ruminant products.

Purpose: Technologies and opportunities for improving small ruminant production and adding value to small ruminant products are developed with NARS and in participation with producers.

Indicators:

- Estimated number of research sites and farmers where technologies are adopted and used
- Production is improved in at least 20% among collaborating farmers in the research sites
- Product quality is improved among all collaborating farmers in the research sites
- Number of NARS that have increased their capacity to respond to research demands and to perform market-oriented participatory research

Output 1: Markets and market opportunities for small ruminant products, identifying niches where small ruminants have a comparative advantage, are assessed for a better orientation of the production systems.

Indicators:

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

Milestones:

2001: Regional databases with market information on small ruminant products updated and analyzed in CWANA.

2002: Market information and market opportunities for small ruminant products in CWANA completed and documented.

Output 2: Small ruminant production systems are characterized and production constraints identified for better understanding of problematic/processes involved and targeting improvement.

Indicator: Documents with results of characterization of small ruminant production systems and constraint analysis, allowing better targeting of small ruminant productivity improvement are available to NARS, the scientific community and development programs.

Milestones:

2001: Information from participatory surveys is available for design of adaptive research and technology testing.

2002: Characterization of small ruminant production systems and production constraints completed and documented in CWANA.

Output 3: Technologies to improve small ruminant productivity and farmers' income integrated in adaptive market-oriented research are tested and available. Technologies include efficient low-cost management strategies that optimize use of available feed resources, as well as reduce parasite loads, inbreeding and risks to the resource base.

Indicators:

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

Milestones:

2001: Two on-farm networks for market-oriented adaptive research are operational, undergoing active testing of technologies to improve production, in different agroecological sites of CWANA; Files with identified technologies to be tested in adaptive research sites are available for CWANA

2002: Reports and manuals on successfully tested technologies to improve small ruminant production in CWANA are documented; groups of farmers applying market-oriented resource-efficient technologies to improve productivity and income.

2003: Additional farmers applying market-oriented resource-efficient technologies to improve productivity and income.

Output 4: Potential of technologies involving transformation of primary products (i.e. to process milk into milk derivatives such as cheese and yogurt) that capitalize on added value, as a means to further increase the income of farmers, is assessed.

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.

Milestones:

2001: Groups of farmers test transformation technologies to produce milk derivatives that enhance income.

2002: More farmers test transformation technologies to produce milk derivatives that enhance income.

Output 5: Production and genetic characterization of small ruminant breeds in CWANA, along with characterization of their production and market environments, is achieved, documented and databased, to allow a better matching of breed potentials with those of the resource base and markets. Particular consideration is 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.

Milestones:

2001: On-farm and on-station characterization of main breeds of small ruminants is documented in CWANA.

2002: On-farm and on-station characterization of main breeds of small ruminants of CWANA is completed and documented.

Output 6: Biological and economic feasibility of the utilization of feeding/management strategies to improve small ruminant feeding systems and target better market opportunities assessed in West Asia.

Indicators:

- Tested technologies that involve the utilization of non-conventional feedstuffs and byproducts in small ruminant feeding made available to farmers in on-farm adaptive research environments and to NARS.
- Manuals on the use of non-conventional feedstuffs and byproducts in small ruminant feeding for different types of small ruminant production systems.
- Technologies for lambing out-of-season are available for adaptive research trials.

Milestones:

2001: Suitability of agroindustrial byproducts for small ruminant feeding in West Asia is documented, and tested and used by farmers in adaptive research trials; Suitability of lambing out-of-season of Awassi sheep is documented.

2002: Lambing out-of-season to target better market opportunities is tested and used by farmers in adaptive research trials.

2003: Farmers in Northern Syria incorporate the lambing out-of-season technology.

Duration: 3 years.

Users: 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 byproducts will reduce imports of feed concentrates.

Collaborators:

- Market studies: JICA, Japan.
- 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; JICA, Japan.
- Transformation of primary products: FAO; University of Wisconsin-Madison, USA; 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.
- Non-conventional feedstuffs and byproducts: FAO; CIHEAM, Spain.

Cost

2001: US\$ 1.70 million
2002: US\$ 1.77 million
2003: US\$ 1.84 million

System Linkages:

Output 2: Germplasm collection: 10%
Output 3: Sustainable Production: 75%
Output 5: Enhancing NARS: 15%

Linkage to the Systemwide Livestock Programme (SLP)

Financing Plan: Unrestricted core funds. Allocated core funding from Japan. 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; financing of sheep and range research in Central Asia from USDA; anticipated financing for integrated dairy sheep production in WANA from Switzerland and Japan.

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

Goal: Improved productivity and quality of the limited water resources currently and potentially available for agricultural use in dry areas.

Indicators: Improved productivity of water (from rainfall, conventional and non-conventional sources) in agricultural production; quantity and quality of water available to agriculture.

Purpose: Improved technologies and management options for rainfall, conventional and non-conventional water resources available to attain higher water use efficiency and sustainable agricultural production.

Indicators:

- Improved technologies, methodologies, and recommendations are available to national programs.
- Guidelines and recommendations for Improved on-farm water use efficiency published and available to NARS in CWANA

Output 1: Methodologies, recommendations and information on efficient capture, storage and utilization of rainwater available to the NARS, through water harvesting and integrated watershed management.

Indicators:

- Utilizing the improved packages of selecting appropriate sites and methods reduces effort, time and cost of planning water harvesting.
- At pilot demonstration sites greater part of rain is captured and utilized for improved water use efficiency.
- Information on the socioeconomic constraints and potential policies and actions to overcome them are accessible to decision-makers.

Milestones:

- 2001: Package on using GIS and remote sensing in planning water harvesting systems complete with hydrologic model integrated;
Conference on water harvesting and WUE
- 2002: Workshop on the methodologies and recommendations of the On-Farm Water Husbandry (OFWH) project.
- 2003: Conference on water harvesting and WUE organized in one of the countries of the region.

Output 2: Optimal strategies and practices for using limited water resources conjunctively with rainfall in rainfed agriculture.

Indicators:

- Major supplementary irrigation environments and their interaction with farm management documented.
- Technologies for efficient use of water in supplementary irrigation available to NARS who are able to implement them.
- Water productivity and total farm production level increased at farmer's demonstration sites established in representative areas.

Milestones:

- 2001: Trials initiated in Tunisia and Morocco. Research reports of Libya and Syria published.
- 2002: Regional workshop on supplementary irrigation held and proceedings published. . Research reports of Tunisia and Morocco published.
- 2003: Model for optimal management of supplementary irrigation evaluated and tested. Research reports of Tunisia and Morocco published.

Output 3: Water management packages for sustainably optimizing on-farm WUE particularly in irrigated areas.

Indicators:

- WUE increased at demonstration farms using developed packages.
- Recommended on-farm irrigation management strategies and techniques that improve WUE and environment are available to NARS.
- Research trials and monitoring sites for studying sustainability and improved water use efficiency established, in collaboration with NARS, in representative areas.

Milestones:

- 2001: Recommendations on improved strategies and technologies regarding on-farm WUE and seasonal irrigation efficiency published.
- 2002: Regional Workshop on WUE held in which promising and effective alternatives for cropping strategies and management practices to improve on-farm water use efficiency identified.
- 2003: Conference on WUE and water harvesting research results and recommendations held.

Output 4: Strategies, methods and techniques for the safe and sustainable use of non-conventional water resources in agriculture.

Indicators:

- Research trials established in collaboration with NARS in representative locations to adapt improved packages.
- Guidelines and recommendations for the safe, productive and sustainable use of non-conventional waters resources available to NARS.
- Awareness on the potential and limitations of the use of non-conventional water resources increased.

Milestones

- 2001: Guidelines published on the safe and productive use of treated sewage effluent
- 2002: Workshop on advanced management strategies that facilitate the sustainable use of low quality water in agriculture
- 2003: Database on available and potential non-conventional water resources in CWANA operative.

Output 5: Methods for assessing the safe utilization of renewable groundwater resources in agriculture.

Indicators:

- Guidelines available to NARS for the assessment and the management of renewable groundwater resources in agriculture.
- Recommendations for improved management of renewable ground water resources made available to decision-makers.

Milestones

- 2001: Assessment of existing ground water management and publish methodologies for improved strategies.
- 2002: Guidelines for model application for sustainable ground water management developed and published.
- 2003: Recommended methodologies combining technical and socio-economical parameters for sustainable use of groundwater in irrigation published.

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:

- NARS personnel's capability of conducting research on water management issues and application of results increased.
- NARS research quality in water management problems improved.
- Collaborative research and demonstrated sites produce required data and analysis.

Milestones:

- 2001: Regional training courses on the use of treated effluent water in agriculture and on WUE.
- 2002: Training courses on watershed management and non-conventional water resources
- 2003: Training course on soil and water management in dry areas

Duration: 6 years

Users and beneficiaries: The ultimate beneficiaries are farm households in rainfed, marginal areas and irrigated areas. The main users are national researchers; technicians, policy makers and others concerned with water issues.

Collaborators:

- Water harvesting systems: Continue linkages with 9 countries through the Ecoregional Programme: On-farm Water Husbandry in WANA: Egypt, Iraq, Jordan, Libya, Morocco, Pakistan, Syria, Tunisia, and Algeria. Also with IRD France, NRMP Egypt,
- Supplemental irrigation: University of Mosul, Iraq; DIWU of Syria, IPA of Iraq, Turkey, Tunisia, Iran, Morocco and Central Asian states.
- On-farm water use efficiency: IWMI, ICRISAT, ESCWA, Ein Shams University, Egypt; collaboration through Nile Valley and Red Sea Regional Program; NARS of Morocco, Syria, Turkey, 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. Cemagraph and IRD France.
- Non-conventional water sources: Collaboration with the Gulf States, Jordan, Tunisia; CIHEAM-Bari, McGill University, Canada; INRA-France, NCARTT, Jordan; Jordan University for Science and Technology; Aleppo University, Syria and Central Asian states.

Cost:

2001: US\$ 2.61 million

2002: US\$ 2.71 million

2003: US\$ 2.82 million

System Linkages:

Output 3: Sustainable Production: 80%

Output 5: Enhancing NARS: 20%

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 Japan. Collaboration with NARS in Egypt financed by EC; technical backstopping provided to NARS financed by IFAD; funding for activities in Central Asia from the Asian Development Bank; grants from IDRC. Anticipated funding for a regional program from AFESD; anticipated funding for activities within SWIM (Systemwide Program on Water Management convened by IIMI); anticipated financing within the sub-regional action program of the Convention to Combat Desertification (CCD); anticipated support for collaboration with Mauritania.

Project 3.2: Land Management and Soil Conservation to Sustain the Agricultural Productive Capacity of Dry Areas

Goal: Sustainable management and conservation of land resources is improved in the dry areas of WANA.

Indicator: Adoption by producers of specific improved technologies and land management practices; reduced erosion.

Purpose: An integrated and transferable multi-scale approach to sustainable and productive dryland management is available for utilization by NARS.

Indicator: Approach is utilized by NARS, in participation with rural communities, in developing site-specific land management and conservation practices.

Output 1: Appropriate degradation hazard assessment methodologies developed

Indicators:

- Land evaluation available for two pilot areas
- Methodologies applied in two pilot areas

Milestones:

2001: Site characterization and land evaluation completed for first pilot area.

2002: Degradation hazards assessed for first pilot area.

2003: Site characterization, land evaluation and degradation hazard assessment completed for second pilot area.

Output 2: Participatory and integrated approaches for dryland-management and research developed

Indicators:

- Farmers trained in two pilot areas.
- Approaches available for use by NARS.

Milestones:

2001: First pilot area (integrated research site) established and functional.

2002: Interdisciplinary research and management teams -including land users- developed and operational.

2003: Second pilot area (integrated research site) established and functional.

Output 3: Options for sustainable dryland management developed and tested.

Indicator: Options available and described for two pilot areas.

Milestones:

2001: Preliminary 'land-use systems-package' developed for first pilot area.

2002: Preliminary 'land-use systems-package' developed for second pilot area.

2003: Preliminary land-users' assessment of packages available.

Output 4: Decision-support tools for dryland management developed.

Indicator: Results of scenario simulations available for one pilot area.

Milestones:

2001: Conceptual model of land-use dynamics for first pilot area developed.

2002: Links between biophysical and socioeconomic system model components established.

2003: Conceptual model of land-use dynamics for second pilot area developed; Preliminary system's model developed.

Output 5: Strengthened capacity of NARS in dryland degradation assessment and integrated dryland development research.

Indicators:

- NARS scientists of five institutions trained.
- Functional professional exchange between scientists of different institutions in the mandate region.

Milestones:

- 2001: Short-term training program on integrated dryland management and research for all stakeholder groups developed.
2002: Dryland Management Exchange Forum functional.
2003: Two collaborative research proposals developed.

Duration: 5 years.

Users: Counterpart researchers in national research institutions and extension agencies (primary users and multipliers). Land users in marginal drylands (beneficiaries).

Collaborators: ICRISAT, FAO, UNEP, WOCAT Consortium (Switzerland), CIHEAM (Spain), CIDA (Spain), DRC (Egypt), IRA (Tunisia), RSRI (Turkey), University of Aleppo (Syria), Olive Bureau (Syria), Atomic Energy Commission of Syria (Syria)

Cost:

- 2001: US\$ 0.83 million
2002: US\$ 0.87 million
2003: US\$ 0.90 million

System Linkages:

Output 3: Sustainable Production: 80%

Output 5: Enhancing NARS: 20%

Planned linkage with Systemwide Program on Collective Action and Property Rights (CAPRI) watershed development initiative

Financing Plan: Unrestricted core. Donor allocated core from DFID, UK. Land conservation supported by grant from INIA, Spain. Anticipated restricted project funding from BMZ/GTZ.

Project 3.3: Agrobiodiversity Collection and Conservation for Sustainable Production

Goal: Conservation and utilization of the biodiversity of ICARDA's mandate crops: wheat, barley, lentil, chickpea, faba bean and pasture and forage species and their associated rhizobia.

Indicators: Number and area of target species sustainably conserved; utilization of genetic resources in national crop improvement programs.

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 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.
- Number of accessions distributed to users at ICARDA and worldwide.
- 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%.

Milestones:

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.

2002: 90% of accessions held at ICARDA meets the international standards of seed quantity and viability.
90% of accessions are held in the long-term base collections.

2003: The first viability monitoring of GRU long-term collections completed.

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.
- Number of accessions and traits documented in the GRU database.

Milestones:

2001: Wild Triticum catalog available in paper and CD-ROM format.

Wild barley core collection characterized by molecular markers.

2002: Germplasm collected in CAC countries characterized and evaluated in partnership with CAC NARS.

Revised core collection of cultivated barley characterized by molecular markers.

2003: Lentil core collection characterized by molecular markers.

Output 3: Special purpose collections with multiplied seed for distribution.

Indicators:

- Number of collections.
- Number of accessions.

Milestones:

2001: Lentil core collection.

2002: Wild Triticum core collection.

2003: Durum wheat core collection.

Output 4: Wheat germplasm with new genes from wild relatives.

Indicators:

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

Milestones:

2001: Durum wheat lines with new disease resistance genes introgressed from wild relatives.

2002: Bread wheat lines with genes introgressed from hexaploid synthetics developed by ICARDA.

2003: Genetic basis of the new stripe rust resistance derived from *Triticum dicoccoides* identified.

Output 5: Conservation and sustainable use of dryland agro-biodiversity in GEF/UNDP project sites in Jordan, Lebanon, Palestinian Authority and Syria.

Indicators:

- No. of target species conserved in pilot areas.
- No. of pilot sites.
- Area of natural habitat in which wild species are conserved and sustainable managed *in situ*.
- Area of agricultural land on which landraces of crops and fruit and nut trees are conserved on farm.

Milestones:

2001: Factors affecting agro-biodiversity in project sites identified;
Joint publications;
GIS/RS and documentation regional training course conducted;
Tripartite review.

2002: Regional workshop on policy, economics and property rights;
Regional course on in situ conservation and field genebank management;
Tripartite review.

2003: Tripartite review.

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.

Milestones:

2001-2003: One short-term group training course conducted per year.

Output 7: Documentation of ICARDA plant genetic resources collections available to users worldwide.

Indicators:

- Access to databases on-line via internet/local network and offline through CD-ROMs and printed catalogs
- Number of records in the documentation system.
- Accuracy and completeness of the data.

Milestones:

2001: Printed catalogs and CD-ROMs for Vicia and wild Triticum.

2002: Central Asia genetic resources database.

2003: Molecular marker data integrated into GRU documentation system.

Output 8: Healthy seed introduced to and distributed from ICARDA.

Indicators:

- Number of seed samples tested
- Efficiency of the seed health testing methods and procedures.

Milestones:

- 2001: 100% of incoming and outgoing seed samples tested.
2002: 100% of incoming and outgoing seed samples tested.
PCR tools for seed health testing developed (conditional).
2003: 100% of incoming and outgoing seed samples tested.

Duration: 5 years

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; Uzbek Research Institute of Plant Industry (UzRIPI), Uzbekistan.
- Assessment of threats to gene pools: NARS; ICRISAT; CIMMYT.
- Germplasm collection: NARS; ICRISAT; CIMMYT; CLIMA, Australia.
- Germplasm acquisition from donor institutions: NARS; VIR; other major genebanks.
- Safety duplication outside ICARDA: National Board for Plant Genetic Resources (NBPGR), India; ICRISAT; CIMMYT; Federal Institute of Agrobiolgy (FIA), Austria; Federal Research Station for Plant Production (RAC), Switzerland.
- Germplasm characterization and evaluation: VIR, Russia; NARS; NSW Agriculture, Australia; CLIMA; University of Bristol, UK; University of Birmingham, UK.
- Passport, site and evaluation database: NARS; ICRISAT; CIMMYT; CLIMA; NSW Agriculture, Australia; University of Adelaide, Australia.
- Classification, catalogs, information dissemination: NARS; IPGRI (SGRP); CLIMA, Australia.
- Gene transfer from the wild progenitors and relatives: University of California, USA.

Cost:

- 2001: US\$ 2.90 million
2002: US\$ 3.02 million
2003: US\$ 3.14 million

System Linkages:

- Output 2: Germplasm collection: 85%
Output 5: Enhancing NARS: 15%

Financing Plan: Unrestricted core funds. 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 agro-biodiversity in the Near East; SGRP grant supports ICARDA's participation in SINGER.

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

Goal: Improved land use planning and environmental management of the agricultural production systems of Central and West Asia and North Africa (CWANA) guided by a better understanding of the specific potentials and constraints of agricultural environments.

Indicators: Productive and diversified land use management based on potentials and constraints of local 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 multi-scale approaches, methodologies and procedures for the quantitative assessment of agricultural environments.

Indicators:

- Approaches, methodologies and procedures for agroecological characterization adopted by NARS. 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:

- CWANA climate database system developed
- CWANA land use/land cover spatial database established
- CWANA digital spatial datasets on land and climate resources compiled or generated

Milestones:

- 2001: All available digital data loaded;
Client-server database established;
Intranet home-page developed;
Meta-database available as Internet enabled system.
- 2002: Digital archive of country-level climate parameter maps established.
- 2003: Digital archive of country-level land use/land cover maps established.

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

Milestones:

- 2002: Quantitative land suitability assessment for different crops in representative agroecological zones of Syria completed

Output 3: Comprehensive physical frameworks of CWANA

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.

Milestones:

- 2001: Land degradation assessment of CWANA completed;
Land cover/land use map of CWANA completed.

Output 4: Case studies and methodologies for multi-scale agroecological characterization.

Indicators:

- Case studies available in the form of GIS projects.
- Guidelines for multi-scale agroecological characterization.

Milestones:

2001: Local-level characterization of research sites in NW Syria completed.

2002: Integrated research sites characterized;
Agroecological Atlas of Syria completed.

2003: Guidelines for multi-scale agroecological characterization prepared.

Output 5: Methodologies and procedures for informal local-level agroecological characterization.

Indicator: Manual on guidelines for participatory agroecological characterization

Milestones:

2001: Draft guidelines prepared

2002: Final guidelines prepared

Output 6: Strengthening of NARS capacity in agroecological characterization.

Indicators:

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

Milestones:

2001: Regular agroecological characterization training course institutionalized by ICARDA;
Training manual manuscript prepared.

2002: Manual published.

2003: At least 15 NARS Scientists trained in agroecological characterization techniques through joint project activities.

Duration: 5 years.

Users: NARS of CWANA by the provision of (i) new methodologies and technology transfer through training and joint projects, and (ii) the provision of essential and multi-scale frameworks for the extrapolation of site-specific research. The international research community by provision of geo-referenced information on types and severity of abiotic stresses, land degradation, suitability for specified production systems, and recommendations for land management.

Collaborators:

- Meteorological Services of Syria, Morocco, Uzbekistan, Kazakstan; INRA, Morocco; DPV of the Ministry of Agriculture, Morocco;
- Cropping system simulation: University of Hohenheim, Germany
- Yield forecasting and land evaluation: Space Applications Institute of Joint Research Centre of the European Commission, Ispra, Italy
- Agroclimatology: Texas A&M University, Texas
- Remote sensing: Center for Earth Observations, Yale University
- Participatory agroecological characterization: Katholieke Universiteit Leuven, Belgium; LARI, Lebanon, North African NARS partners of the Mashreq-Maghreb Project.
- Training: CIHEAM, Zaragoza

Cost:

2001: US\$ 0.97 million

2002: US\$ 1.00 million

2003: US\$ 1.04 million

System Linkages:

Output 2: Germplasm collection: 10%

Output 3: Sustainable Production: 75%

Output 5: Enhancing NARS: 15%

Financing Plan: Unrestricted core.

Project 4.1: Socioeconomics of Natural Resources Management in Dry Areas

Goal: Conservation and sustainable use of the natural resource base for agricultural and livestock production in CWANA.

Indicator: Increased use of natural resource conservation practices.

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.
- Increased 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.

Milestones:

2001: Comparative study of the economics and organization of individual, community and public management of groundwater.

2002: Models for the economic evaluation (impact assessment) of the changes in ground and surface water utilization and irrigation technologies in Syria, Yemen and Pakistan.

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 transferred to NARS in conjunction with other Projects involved.

Milestones:

2002: Case studies on the effects of unsustainable land management practices completed in two agro-ecologies.

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.

Milestones:

2001: Case studies on the socio-cultural and institutional factors affecting NRM completed at two countries.

2002: Characterization of resource users' perceptions and attitudes toward natural resources conservation technologies completed in one agro-ecological zone in Latin America.

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.

Milestones:

2001: Case study on action research on NRM completed at two sites.

Community collective action initiated and documented in one research site.

Research results transferred to all stakeholders (farmers, researchers, extensionists, NGOs and policy decision-makers) through workshops and seminars.

2003: Guidelines on participatory NRM research developed and provided to NARS.

Output 5: Knowledge of NARS social scientists on the socio-economic research in NRM enhanced.

Indicator: Increased social science research capacity on NRM within CWANA NARS

Milestones:

2001-2003: One training course in applying natural resources valuation methodologies conducted every two years.

On the job individual training and training workshops organized every year.

Duration: 3 years.

Users and beneficiaries: Immediate users of the valuation of natural resources and the social and economic costs of their degradation are ICARDA 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 Developpement de la Steppe. Tunisia: INRAT; Institute des Hautes Etudes Commerciales; 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, Authority of Barani Agricultural Development (ABAD).
- 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

2001: US\$ 1.18 million

2002: US\$ 1.23 million

2003: US\$ 1.28 million

System Linkages:

Output 3: Sustainable Production: 80%

Output 4: Policy: 10%

Output 5: Enhancing NARS: 10%

Linkage with the two Systemwide Programmes: Participatory Research and Gender Analysis (SP-PRGA) convened by CIAT, and Collective Action and Property Rights (CAPRI) coordinated by IFPRI.

Financing Plan: Unrestricted core funds. Restricted funding from Spain; collaboration with NARS in Egypt supported by EC; grant for participatory research in natural resource management in Yemen from IDRC; collaboration with Barani Village Development Project (BVDP) supported by Government of Pakistan; anticipated financing from the BMZ; anticipated financing from the AFESD for regional program on water resource management; anticipated financing within sub-regional action program of Convention to Combat Desertification (CCD).

Project 4.2: Socioeconomics of Agricultural Production Systems in Dry Areas

Goal: Sustainable improvement of agricultural productivity and the welfare of poor people in dry areas through the identification of problems and the development, transfer and adoption of appropriate farm technologies.

Indicators: Increased productivity, sustainable farming practices, and higher returns to farm resources.

Purpose: A better understanding of the economic and social dimensions of rural poverty through micro-economic and social analysis of farm households and rural poverty improved targeting of technology transfer efforts.

Indicators:

- Increased use of multi-disciplinary problem diagnosis by ICARDA and NARS scientists
- Increased use of farmer participatory research methods in technology development and evaluation by ICARDA and NARS researchers and targeting of technologies
- 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

Milestones:

2001: Problem identification and farm typologies study completed in Central Asia.

2002: Production problems diagnosis and farm typologies study completed in the dry land farming systems of Punjab province, Pakistan.

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.

Milestones:

2001: Case study of local community participation in evaluation of technology options completed. Guidelines and methods for farmer participation in research developed.

2002: An economic evaluation of technologies completed in Egypt

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

Milestones:

2001: Study on farmer-to-farmer diffusion of new barley varieties in Syria completed.

2003: Adoption studies completed in Egypt, Pakistan, Central Asia and Latin America.

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

Milestones:

2001: Study on the determinants of child malnutrition in different food systems completed in Syria. Gender analysis network for CWANA established by year.

2002: Determinants of rural poverty in selected areas of WANA (including western Anatolian region of Turkey, Khanassir valley of Syria, mountains of Yemen) analyzed

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.

Milestones:

2001: Study on the determinants of agricultural productivity changes in WANA completed.

2002: An *ex ante* impact study on one technology completed in one agro-ecology.

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.

Milestones:

2001-2003: Socio-economic training (including on-the job individual and group training and training workshops) organized for NARS in collaborating projects.

Output 7: Evaluation of the economics of livestock production in the low rainfall areas of West Asia and North Africa.

Indicators:

- Development of a database of the livestock surveys and experiments conducted by ICARDA.
- Report of the preliminary analyses conducted and gaps in knowledge identified.
- Synthesis report on the economics of livestock production.

Milestones:

2001: Completion of a synthesis report of the survey and experimental results.

2002: Completion of a PhD thesis.

2003: Publication of the synthesis report.

Duration: 3 years.

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

2001: US\$ 1.14 million

2002: US\$ 1.18 million

2003: US\$ 1.23 million

System Linkages:

Output 3: Sustainable Production: 50%

Output 4: Policy: 40%

Output 5: Enhancing NARS: 10%

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 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; activities in Central Asia supported by grants from USDA and IFAD; activities in Egypt supported by EC; collaboration with Barani Village Development Project (BVDP) supported by Government of Pakistan. Anticipated support for collaboration with Eritrea and Mauritania.

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

Goal: Improved policy and public management that promotes sustainable production systems and livelihood strategies in the dry areas of Central and West Asia and North Africa regions.

Indicator: Policy and public management options adopted by policy-makers

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;
- Improved information base to guide national policy formulation;
- Research findings are included in the design of rural development policies, policy reforms and public management systems.

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, production and livelihood strategies

Indicators:

- Two synthesis documents and 6 monographs analyzing the current policy environment in WANA and discussing the implications of policy reforms in terms of welfare changes and sustainability in the region.
- Two synthesis documents and 8 monographs analyzing property rights policies and their effects on land improvements, productivity, and incomes in the low rainfall areas of WANA.

Milestones:

2001: Published book

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 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.
-

Milestones:

2001: Publication of the three monographs;
Synthesis report on the effects of the above research.

Output 3: Identification and evaluation of property rights and local institutional options for sustainable management of rangeland resources in Jordan, Morocco, and Tunisia

Indicator: Three synthesis reports evaluating the likely welfare effects of different rangeland management institutional options on subgroups within the community (gainers and losers under each option) and the importance of institutional and market based feed access options for sustaining production and livelihood strategies

Milestones:

2001: International conference on institutional options for rangeland management in WANA.
2002: Publication of the conference proceedings.

Output 4: Assessment of women's resource access and use, and household livelihood strategies in selected sites in Syria

Indicators:

- Report of the Rapid Rural Appraisal (RRA) and focus groups of selected communities.
- Synthesis report on women asset building strategies and access to productive resources and identification of the women's constraints in conducting their activities.

Milestones:

- 2001: Completion of the household surveys and analyses on the growing role of women on household livelihood strategies in the rural areas of Syria
- 2002: Completion of the collaborative research with the School of Rural Development and Planning, University of Guelph, Canada.

Output 5: Updates of ICARDA commodities, resources and system trends for more effective research targeting and priority assessment

Indicators:

- Brief on barley production in WANA
- Brief on wheat production in WANA

Milestones:

- 2001: Published briefs
- 2002: Synthesis report on commodity and system trends

Duration: 2 years.

Users: 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, and Hassan II University, Morocco; INRAT, University of Mognane, Tunisia; Lebanese Agricultural Research Institute (LARI), Lebanese University, and American University of Beirut, Lebanon; NCARTT, the University of Jordan, and the Jordan University of Science and Technology (JUST), Jordan; Directorate of Agricultural Scientific Research and University of Aleppo, Syria; IPA Agricultural Research Center, Iraq; Station Experimentale ITGC, Algeria; ARC, Libya
- Other research partners: Environmental and Production Technology Division of IFPRI; School of Rural Development and Planning, University of Guelph, CANADA; Centre International de Recherches Agricoles pour le Developpement (CIRAD), France; Land Tenure Center, University of Wisconsin-Madison, USA.

Cost:

- 2001: US\$ 0.48 million
- 2002: US\$ 0.50 million
- 2003: US\$ 0.52 million

System Linkages:

- Output 4: Policy: 90%
- Output 5: Enhancing NARS: 10%

Linkage to Systemwide Programme on Collective Action and Property Rights (CAPRi), convened by IFPRI.

Financing Plan: Core funds. Collaborative research with NARS in Mashreq and Maghreb regions financed by IFAD, AFESD, and IDRC, Ford Foundation and the System-wide Program on Collective Action and Property Rights (CAPRi). Collaboration with the University of Guelph supported by a grant from the CGIAR-Canada Linkage Fund (CCLF).

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.

Indicators: Improved seed production and distribution.

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.

Milestones

2001: Publication of 2 training manuals English and one in Arabic;
Regional meeting organized for University teaching staff;
Publication of information on Seed Quality Assurance.

2002: Publication of two training manuals in Arabic

2003: Preparation of a teaching module for University courses

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.

Milestones

2001: Review of regional seed certification scheme by national authorities;
Hold 4th Network Council meeting to review progress of activities;
Draft seed legislation circulated to governments for comment.

2003: Review status of National Seed Associations and consider options for establishing a seed regional association.

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

Milestones:

2001: Country studies on seed system collated; results of Syria seed studies published

2002: Meeting held to review country studies and results published

2003: Monitor adoption of seed system recommendations in WANA countries

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

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

Milestones:

2001: Country studies collated

2002: Policy recommendations made to governments and NGOs on the informal seed system and its integration with the formal sector

2003: Monitor adoption of recommendations and provide specific guidance

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.

Milestones:

2001: Develop contacts with relief agencies to collect information and hold a workshop to review

2002: Prepare practical recommendations for seed supply in emergencies and for resettlement areas

Output 6: Relevant new information available through applied research into practical seed-related issues, with particular reference to forage seeds.

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.

Milestones

2001: Results published depending on progress of research projects

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.
- Procedures and facilities for producing high-quality breeder seed established within NARS to support the national seed sector.

Milestones

2001: All seed requests from ICARDA programs and NARS will be supplied;
Fully commission 'Seedman' database for production/stock records.

Duration: 5 years.

Users and beneficiaries: In strengthening national seed systems, the immediate target groups are policy makers, managers and staff of formal sector seed organizations, as well as alternative seed producing groups such as NGOs, seed growers, cooperatives, and farmers' organizations. The ultimate beneficiaries are farmers who will benefit from access to, and use of, quality seed, farmers and consumers who use crops 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). University departments that include seed topics in their teaching curricula and graduate research, e.g., University of Jordan; University of Khartoum,; Cukurova University, (Turkey)

Cost

2001: US\$ 1.09 million

2002: US\$ 1.14 million

2003: US\$ 1.18 million

System Linkages

Output 3: Sustainable Production: 35%

Output 4: Policy: 45%

Output 5: Enhancing NARS: 20%

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. Support currently being sought for WANA Seed Network and continuation of training activities