

SUMMARY

A. OVERVIEW: HIGHLIGHTS OF 2001 RESULTS AND 2002 DEVELOPMENTS

In this overview ICARDA's Medium Term Plan 2003-2005 is presented according to the CGIAR's principal outputs of (1) Germplasm Improvement, (2) Germplasm Collection, (3) Sustainable Production, (4) Socioeconomics and Policy and (5) Enhancing NARS. In its MTP 1998-2000, following an in-house priority assessment, ICARDA identified research areas for increased research 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 by region and then by CGIAR output below.

1. Regional Highlights and Plans

1.1. Central and West Asia and North Africa (CWANA)

ICARDA together with AARINENA, and the CAC NARS Forum undertook a priority setting process for agricultural research in the CWANA region with NARS, sister Centers and other stakeholders, which included sub-regional brainstorming workshops and the widespread use of a questionnaire survey and culminated in a regional meeting in May 2002 at ICARDA.

In 2002 ICARDA will host a Regional Consultation on a Rural Development Strategy for CWANA, one of a series of regional workshops sponsored by the World Bank. The purpose of the workshop is to review the Bank's new strategy and provide a forum for dialogue and consultation among experts on rural development in the region and staff from CGIAR Centers, the World Bank and other agencies involved in the region.

ICARDA's extensive activities in West Asia and North Africa (WANA) are explained later under the CGIAR principal outputs. Activities in the Central Asia and the Caucasus (CAC) region of CWANA are highlighted because of the continued growth of ICARDA's engagement within the framework of the CGIAR Consortium for CAC. During 2001 projects continued 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 plant genetic resources with IPGRI - all within the CGIAR Program. In 1999 a senior barley breeder was transferred to the ICARDA CAC Office in Tashkent to work on winter cereal improvement in CAC and the highlands of WANA. In CAC there are on-going 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. A project funded by IFAD on 'Integrated Feed and Livestock Production in the Steppes of Central Asia' started in 2000 to expand livestock productivity research in Central Asia, and ICARDA has joined with ILRI in exploring and proposing new livestock research initiatives, including characterization of animal genetic resources, in the CAC region. Through funding from ACIAR and GRDC, major focus in agro biodiversity research in 2001 was on the CAC region with collections in two CAC countries and others planned for 2002 and assistance given to Uzbekistan in documentation. Additionally, in 2001 ICARDA continued its collaboration with the N.I. Vavilov Research Institute of Plant Industry in St. Petersburg, Russia.

During 2001, a pre-proposal for a Challenge Program for the CAC region was submitted by ICARDA to the iSC/CGIAR and subsequently reformulated for submission in 2002 in the light of comments received from the iSC.

Following the war in Afghanistan, ICARDA convened a meeting of stakeholders in Tashkent in January 2002 to launch the Future Harvest Consortium to Rebuild Agriculture in Afghanistan (FHCRAA), attended by representatives of 34 organizations. With support from USAID, FHCRAA led by ICARDA embarked on a major program of seed relief and seed sector development as well as needs assessments in Seeds and Crop Production; Livestock, Feed and Range; Soil and Water; and Horticulture. Moreover, IDRC has just granted additional funding for studies of the consequences for crop genetic diversity and local seed systems of the conflict and drought in Afghanistan. This major development in 2002 is clearly reflected in the distribution of the Center's current estimate of 2002 financing, and will continue to influence the distribution over projects of the Center's financing into 2003.

1.2. South and East Asia

ICARDA is providing major support to integrated research on dryland resource management within the IFAD-funded Barani Village Development Project in Pakistan. ICARDA's cooperation in South Asia on lentil improvement is supported by ACIAR through one project with Bangladesh concluded in 2001 and another in Nepal, which started in 2001 with the Centre for Legumes in Mediterranean Agriculture (CLIMA), Australia. Strong links with NARS in germplasm improvement of cereals (barley and wheat) and food legumes (lentils, kabuli chickpea, faba bean and low-neurotoxin grasspea) continue through germplasm exchange and training activities in Bangladesh, India, Nepal and Pakistan, and to a lesser degree with Bhutan, China, South Korea and Sri Lanka.

1.3. Sub-Saharan Africa

Focusing on the poor in sub-Saharan Africa (SSA) and in congruency with the evolving CGIAR Strategy in SSA, ICARDA initiatives include the following: research on enhancing food security in the Nile Valley region through the generation and dissemination of sustainable production technologies for cereals and cool season food legumes, supported by IFAD; continued support to Ethiopia in its research on grasspea with low neurotoxin content funded by DFID, UK; in Eritrea, in collaboration with DANIDA, barley improvement which has developed into a participatory mode and a project on integrated disease management to enhance wheat and barley production initiated in 2001. A project on the improvement of cool season cereals and legumes is planned in Eritrea for 2002. Kenya, South Africa and Zimbabwe participate in the 'Optimizing Soil Water Use' (OSWU) theme, coordinated by ICARDA and ICRISAT, of the System-wide Program on Soil Water and Nutrient Management (SP-SWNM). Several projects developed with the NARS of Mauritania on natural resource management and germplasm enhancement are planned to become operational in 2002. Burkina Faso, Mali and Niger participate in the 'Optimizing Soil Water Use' (OSWU) theme, coordinated by ICARDA and ICRISAT within SP-SWNM.

1.4. Latin America

ICARDA's cooperation in Latin America has focused on the provision of germplasm of its global mandate crops. In 1999 ICARDA posted a Regional Coordinator for Latin America at CIP, Lima to develop a joint program of research with Latin American NARS particularly through an expansion of natural resources research. However following a review of outreach in 2001, as recommended by our EPMR, it was decided to reduce activities in Latin America. The regional office was closed in early 2002 and the Coordinator re-located. However, a barley breeder operates from CIMMYT, Mexico for the genetic improvement of barley for the Andean region and for favourable environments globally.

2. Research Outputs

2.1. Germplasm Enhancement

- Farmer participatory plant breeding research continued to expand during 2001 and now includes collaboration with NARS in Egypt, Eritrea, Jordan, Morocco, Syria, Tunisia and Yemen on barley and in Bangladesh, Nepal, Syria, Turkey and Yemen on chickpea and lentil.
- The major thrust of germplasm enhancement in the mandate crops continues to be towards improving water use efficiency by exploiting our major holdings of dry-areas germplasm through selection and (pre-) breeding for drought tolerance. A wide range of approaches is employed including the use of molecular techniques and biotechnology. Increasingly this is recognized as contributing, together with thermo-tolerance, to adaptation to the anticipated effects of climate change. A proposal to screen our extensive germplasm collections to identify new sources of heat and drought tolerance has been submitted to BMZ for funding.
- Given the increasing attention to the important role of barley as a food of the poor in highland dry areas, ICARDA hosted an international workshop on food barley in Tunisia in January 2002. Within the proposed Biofortification Challenge Program, it is planned to improve the nutritional quality of ICARDA's mandate food crops - barley and lentil - for the benefit of the poor, particularly women and children.

- Research on the genetic transformation of food legumes continued in 2001 in partnership with ARIs: for chickpea in cooperation with the Universities of Hanover (funded by GTZ) and Naples, and for lentil with CLIMA, Australia (funded by ACIAR) through a scientist posted to the Agricultural Genetic Engineering Institute (AGERI) in Egypt, where biosafety legislation is enacted and containment facilities are available. Training for national biosafety officers in WANA was provided at AGERI in 2002. A major initiative to increase the capacity of NARS in biotechnology with support from the Arab Fund concluded in 2001 and a proposal for a second phase was submitted in 2002.
- In 2002 increased attention to functional genomics is anticipated through a new BMZ-funded project on legumes and in partnership with ARIs through the proposed Challenge Program on Genetic Resources. With the identification of more linkages between DNA markers and economic traits in several mandate crops, the use of marker-assisted selection increased in 2001.

2.2. Germplasm Collection

- ICARDA has the responsibility for the regional coordination of a collaborative project started in 1999 on 'Conservation and Sustainable Use of Dryland Agrobiodiversity in Jordan, Lebanon, Syria and the Palestinian Authority' with the NARS of the respective countries and with IPGRI, ACSAD (Arab Center for Studies of Arid Zones and Dry Lands) and UNDP/RBAS funded by GEF. A major thrust of the project is the development of *in situ* and on-farm conservation of the biodiversity of agriculturally useful species through the appropriate management of habitats.
- The holdings of plant genetic resources of mandate crops and their wild relatives at the Center exceeded 127,000 accessions in 2001, with the majority designated as 'In Trust' germplasm under the auspices of FAO. Activities in germplasm collection, characterization (including molecular characterization), evaluation, maintenance and distribution continued during the year, with collection activity focused in the CAC region during 2001.

2.3. Sustainable Production

- Since 1999 research on water harvesting and renewable groundwater resources, the 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 has increased. In 2001 ICARDA continued water research in the CAC region particularly through projects on on-farm water and soil management. A regional network on drought mitigation sponsored by ICARDA, FAO and CIHEAM was launched in 2001. ICARDA is a partner in the proposed Challenge Program on 'Water and Agriculture'.
- Small ruminant research in 2001 focused on the development of market-oriented production and on adding value to dairy products, on-farm adaptive research and breed characterization. Research on small ruminant productivity and feed resources in Central Asia supported by IFAD continued and activities in Syria on market opportunities and on-farm adaptive research for small dairy sheep producers also continued with Japanese support.
- Based on the strategy for rangeland research in non-tropical dry areas, research in 2001 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 and major efforts were made to transfer this technology within special projects with a rangeland component. Collaborative research with NARS within a major regional project in WANA has focused on developing technical and institutional rangeland management options in selected communities, particularly in SDC-sponsored initiatives in the arid margins of Syria and Morocco.
- ICARDA is developing a repertoire of participatory approaches in natural resource management. In 2001, participatory techniques continued to be applied in natural resource valuation exercises with farmers, particularly for soil erosion, water resource depletion, agro-ecological characterization and in estimates of water use efficiency. In 2001 we focused on the community development of natural resources in the Yemeni mountain terraces and the link with food security through IDRC support. A BMZ-financed project on developing an integrated approach to sustainable land management in dry areas has been established at an integrated research site in Syria and uses participatory community approaches and model building to assist decision-making on options for resource users and planners. The community approach is being further developed within the regional Maghreb and Mashreq Project in eight countries supported by IFAD and the Arab Fund.

- ICARDA is paying increased research attention to climate change in response to the increased magnitude and confidence of the predictions of warming and drying in dry areas in general and CWANA in particular. 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. ICARDA participates in the Inter-Center Working Group on Climate Change and is a partner in the Challenge Program pre-proposal on climate change. Many other aspects of the Center's research contribute to building the scientific knowledge base on mitigating the effects of climate change such as policy research, rangeland management and rehabilitation, water harvesting, conservation tillage, land use planning and watershed management. An international workshop was held in May 2002 on 'Agriculture, the Environment, and Livelihoods', which focused on climate as a major driver of a change in the region.
- In parallel the Center has increased its engagement with NARS and other regional and international organizations in preparing action plans for implementation under the UN Convention to Combat Desertification (UNCCD) to combat desertification and mitigate the effects of drought. ICARDA is the CGIAR focal point for UNCCD. In 2001 we initiated an inventory study for Thematic Network 1 (TN1) of the subregional program for West Asia, initiated plans for on-the-ground activities in pilot sites in six countries, and also participated in the preparation of national action plans. ICARDA participated in a Ministerial Meeting on *Opportunities for Sustainable Investment in Rainfed Areas of WANA* in Rabat in June 2001, which recommended that ICARDA, together with other specialized regional organizations, cooperate in preparing a proposal for a regional programme to deal with problems of poverty, desertification and natural resources degradation. In the interim ICARDA was nominated as the coordinating institute for follow-up and hosted a meeting in early 2002 to launch a rainfed agriculture network initiative. ICARDA with ICRISAT launched a Challenge Program pre-proposal on 'Agriculture to Combat Desertification and Poverty' in 2001. It was subsequently re-tooled for submission in 2002 in the light of comments received and following a stakeholders meeting held in August 2002 at ICARDA.
- On-farm evaluation of packages of practices for Integrated Pest Management was initiated in pilot sites in Morocco, Syria and Egypt in 2001. A new project on the integrated management of Sunn Pest in West Asia started in 2001 with DFID support.
- Agroecological characterization at ICARDA made substantial progress in 2001. 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 and agroecological zones was completed in 2001. Progress was made in the characterization of the Arabian Peninsula and the development of a land suitability map of Morocco.

2.4. Socioeconomics and Policy

- ICARDA's attention to the issue of poverty alleviation continued in 2001 and the foundations were laid for increased research efforts in 2002 to clarify the connections between the determinants of poverty and ICARDA's research. This is required to refine and strengthen the alignment of the Center's research agenda with the over-riding goal of poverty alleviation. A cooperative project with the University of Massachusetts on household food systems, poverty, and the nutritional status of women and children is nearing completion. 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 intensified through new technologies and increased exploitation of land and water resources to be published in 2002. ICARDA is developing project proposals for research on the potential for improving livelihoods through improving the quality, post-harvest processing and marketing of primary crop and livestock products.
- In 2001 in concert with the SPIA germplasm impact group ICARDA reported on the impact of its improvement research on barley and lentil and the resulting contribution to poverty alleviation. A study on the spillover to Australia of ICARDA-led research, requested and funded by ACIAR, was documented in 2001/02.
- ICARDA in cooperation with IFPRI is working with NARS in eight countries of WANA in implementing a community approach to the development of integrated feed/livestock management strategies. Research on increasing the role of women in resource management, household livelihood strategies and community level impacts of policy and property rights and technical options in the low rainfall areas of WANA continued in 2001.

- ICARDA is strengthening its capacity to address the human aspects of natural resource management at the farm and community levels. During 2001 partnerships with ESCWA (United Nations Economic and Social Commission for West Asia) and the University of Kiel (Germany) continued on research on 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. In 2002 focus will remain on water as the principal natural resource constraint in the dry areas.

2.5. Enhancing NARS

- 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. The situation in Afghanistan in 2001 has focused the Seed Unit's activities there in 2002. These include a 'Code of Conduct' workshop to provide a preliminary regulatory framework in the country, seed relief, seed system development and considerable human resource development.
- ICARDA's research outputs are incorporated within national development projects such as in the Barani area of Punjab, Pakistan, the Turkish South-East Anatolian Project and the Matrouh Resource Management project in Egypt.

B. HIGHLIGHTS OF CHANGES IN PROJECT PORTFOLIO FOR 2003

The Research Project Portfolio for 2003-2005 is presented in the attached Annex. In 2002, under the Future Harvest Consortium to Rebuild Agriculture in Afghanistan, ICARDA received substantial funding from USAID to support emergency seed relief and seed multiplication activities, and needs assessments of various agricultural sectors. This has had an effect on the distribution of the Center's funding over the 17 projects, with the bulk of these funds being attributed to Project 5.1 on Strengthening National Seed Systems (see attached financial table). This new initiative will continue to have a significant effect on the distribution of funding in 2003. However, beyond 2003, emergency seed relief activities are expected to diminish and the focus of ICARDA's activities in Afghanistan will shift to other projects in the research agenda (see attached financial plan for 2004 and 2005).

Beyond this, there are no major programmatic changes in the project portfolio compared with the MTP 2002-2004. With major structural changes made in 1998, in line with the thrusts laid out in the 1998-2000 MTP, the year 2003 will see a closer research focus at ICARDA on the determinants of poverty. The suite of projects has not changed (there are no new projects), but within projects there are shifts in emphasis or scale:

- Expansion in research on water management as a key limiting natural resource (Project 3.1). Major financing expected in 2002 has been delayed to 2003, when the funding level will approach that anticipated in our 2002 financing plan.
- Expansion of research on mitigation and adaptation to the anticipated effects of climate change (Projects 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.2. and 3.4).
- Increase in support for socioeconomic research on natural resource management (additional staff to be recruited).

C. MEASURES OF PROGRESS/ACHIEVEMENT

Project milestones to measure progress for 2003 through 2005 are given within the Research Project Portfolio for 2003-2005 in the attached Annex. With restricted funding now accounting for around two thirds of the budget, the timely attainment of milestones is increasingly contingent upon successful project funding. Some activities may be re-scheduled because funding did not materialize as anticipated, whereas new partnerships have led to specific activities being initiated within projects, which are indicated as new milestones. Examples of such new milestones are: quality characteristics of barley for food in Project 1.1; screening for adaptation to heat and drought stress as related to climate change in Projects 1.1, 1.2, 1.3, 1.4, and 1.6; the inventory and pilot studies for Thematic Network 1 in Asia under the UNCCD in Projects 3.1 and 3.2; and strengthening seed production in Afghanistan in Project 5.1.

D. COLLABORATION

ICARDA continues to participate in the seven systemwide programs listed in its MTP 2001-2003 (SGRP, SLP, SWIM, SP-SWNM, SP-IPM, CAPRi, and SP-PRGA). ICARDA is a partner in the proposed Challenge Programs (CP) on Water and Food, Genetic Resources, and Biofortification. ICARDA is convening a CP pre-proposal on Sustainable Agricultural Production Systems in Central Asia and the Caucasus and co-convening with ICRISAT a pre-proposal on Desertification, Poverty and Drought. The Center is also a partner in several other CP pre-proposals.

E. COSTING CENTER PROJECTS

ICARDA's current estimate of 2002 financing of US\$ 27.22 million is 27% higher than the previous estimate for 2002 of US\$ 21.39 million submitted in the financial plans in August 2001 (see attached financial table). This is primarily a result of the special project funding received in 2002 from USAID for emergency seed relief, seed multiplication and needs assessments in Afghanistan. This new initiative will continue to have a significant effect on the distribution of funding in 2003. Based on current estimates of anticipated funding, the research agenda requirement in 2003 is US\$ 28.049 million, which represents a 3% increase over our current proposed 2002 expenditure.

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

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

Non-financial contributions include two scientists out-posted to ICARDA from CIMMYT, 50% of one joint appointment with IFPRI and 50% of another with IWMI, a visiting scientist from France, and nine junior professional officers/associate experts.

F. 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 2001/2 staff turnover occurred in several scientific positions (Director of Germplasm Improvement Program, Director of Natural Resource Management Program, Head of Seed Unit, Soil Conservation and Land Management specialist; Rangeland scientist) without any overall change in emphasis. In 2002 ICARDA aims to recruit a senior natural resources economist and a legume pathologist to support changes in emphasis in the research portfolio, as also requested by the External Program and Management Review (EPMR). In 2002 ICARDA anticipates hosting a total of nine associate experts/junior professional officers from Australia, Belgium, Denmark, France, Italy and Japan.

Several 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 including faba bean breeding. Senior Scientific Advisors appointed as 'Mentors' provide support on biotechnology, water research, 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.

G. CENTER FINANCIAL INDICATORS

In submitting the agenda for 2003-2005, 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: SUMMARY OF FINANCING PLAN: 2001 Actuals, 2002 Estimates and 2003-2005 Plan

PROJECT NUMBER AND TITLE	2001		2002 Estimates				2003 Estimates		2004 Estimates		2005 Estimates	
	Actuals		Submitted Aug-01		Revised Aug-02		Revised Aug-02		Revised Aug-02		Estimate Aug-02	
	US\$ m	%	US\$ m	%	US\$ m	%	US\$ m	%	US\$ m	%	US\$ m	%
01. Barley Improvement	1.62	7.2%	1.26	5.9%	1.28	4.7%	1.20	4.3%	1.27	4.9%	1.32	4.9%
02. Durum Wheat Improvement	0.72	3.2%	0.79	3.7%	1.13	4.2%	1.21	4.3%	1.28	5.0%	1.33	5.0%
03. Spring Bread Wheat Improvement	0.53	2.4%	0.47	2.2%	0.34	1.3%	0.53	1.9%	0.56	2.2%	0.58	2.2%
04. Facultative Bread Wheat Improvement	0.75	3.3%	0.63	2.9%	0.57	2.1%	0.66	2.4%	0.70	2.7%	0.73	2.7%
05. Food Legume Improvement	2.02	9.0%	1.98	9.3%	2.69	9.9%	2.87	10.2%	3.01	11.7%	3.14	11.7%
06. Forage Legume Improvement	0.70	3.1%	0.55	2.6%	0.50	1.9%	0.48	1.7%	0.51	2.0%	0.53	2.0%
07. Integrated Pest Management	1.79	8.0%	1.24	5.8%	1.38	5.1%	1.40	5.0%	1.48	5.7%	1.53	5.7%
08. Agronomic Management	1.35	6.0%	1.45	6.8%	1.07	3.9%	0.96	3.4%	1.02	4.0%	1.06	4.0%
09. Sown Pasture and Forage Production	0.85	3.8%	0.80	3.7%	0.81	3.0%	0.59	2.1%	0.63	2.4%	0.65	2.4%
10. Rangeland Management	1.37	6.1%	1.58	7.4%	1.39	5.1%	1.71	6.1%	1.82	7.1%	1.89	7.1%
11. Small Ruminant Production	1.65	7.4%	1.34	6.2%	1.45	5.3%	1.30	4.6%	1.38	5.4%	1.43	5.4%
12. Water Resource Management	2.49	11.1%	2.93	13.7%	2.56	9.4%	2.80	10.0%	2.98	11.6%	3.10	11.6%
13. Land Management and Soil Conservation	0.51	2.3%	0.63	2.9%	0.90	3.3%	1.00	3.6%	1.05	4.1%	1.09	4.1%
14. Biodiversity Conservation	2.49	11.1%	2.77	13.0%	2.45	9.0%	2.85	10.1%	3.01	11.7%	3.13	11.7%
15. Agroecological Characterization	0.68	3.0%	0.70	3.3%	0.51	1.9%	0.72	2.6%	0.76	3.0%	0.79	3.0%
16. Socioeconomics of NRM	0.60	2.7%	0.61	2.8%	0.33	1.2%	0.52	1.8%	0.55	2.1%	0.57	2.1%
17. Socioeconomics of Production System	1.07	4.8%	0.98	4.6%	1.32	4.8%	1.52	5.4%	1.61	6.2%	1.67	6.2%
18. Policy and Public Management Research	0.66	2.9%	0.25	1.2%	0.27	1.0%	0.35	1.2%	0.37	1.4%	0.38	1.4%
19. Strengthening of National Seed System	0.58	2.6%	0.45	2.1%	6.27	23.0%	5.37	19.1%	1.76	6.9%	1.83	6.9%
TOTAL	22.43	100%	21.39	100%	27.22	100%	28.05	100%	25.74	100%	26.77	100%

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 adopted by 30% of the farmers in 10 countries in 10 years.

Output 1: Germplasm with higher and stable yield, better biotic and abiotic stress resistance, adaptation for global climate change and better quality.

Indicators: 30 different nurseries/year distributed to NARS

30% of lines selected by NARS

50% of lines use as parental material by NARS

Milestones:

2003: 80% of barley breeding for Latin America and 50% of barley breeding for China decentralized.
New barley lines with various combinations of abiotic and biotic stress resistance and with improved feed and food characteristics obtained and distributed.

2004: Decentralization for Latin America completed and 80% of barley breeding for China decentralized.

New barley lines with various combinations of abiotic and biotic stress resistance and with improved feed and food characteristics obtained and distributed.

Decentralized screening for specific diseases established in Morocco (net blotch), Tunisia (scald), and Eritrea (spot form-net blotch).

2005: New barley lines with various combinations of abiotic and biotic stress resistance and with improved feed and food characteristics obtained and distributed.

Decentralization for China completed.

Decentralized screening completed in Morocco and Tunisia

Output 2: Methodology to enhance adoption

Indicators: 50 farmers/country participating in selection

20 countries using participatory plant breeding (PPB)

Milestones:

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

Informal seed multiplication activities extended to all villages participating in the participatory plant breeding project in Syria and to Yemen, Jordan, Egypt and Eritrea

2004: 1000 farmers involved in participatory plant breeding.

Adoption of at least 15 varieties in 5 countries.

2005: Participatory plant breeding institutionalized in five countries.

Output 3: Breeding methodology for stress environments

Indicators: New design and techniques used by 10 NARS and at ICARDA

Milestones:

2003: 100% of International Barley Information System (IBIS) developed.

First improved barley lines produced with marker assisted selection (MAS).

Genetic control of traits associated with outcrossing identified.

Candidate genes or gene complexes for adaptation to drought identified.

2004: IBIS used as standard information management system in the project.

2005: Field testing of first populations with a high frequency of outcrossing .

Output 4: New methodologies disseminated

Indicators: 20 NARS adopted methodologies

Number of better varieties generated

Milestones:

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.

- 2004: 50% of NARS have changed their methodologies.
 At least 10 new 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.
- 2005: 80% of NARS use methodologies developed at ICARDA in the national breeding program.
 Breeding methodologies presented in international conferences.
 Lectures on breeding methodologies for biotic and abiotic stresses at three training courses.

Output 5: NARS research capacity strengthened.

*Indicators: 50 NARS scientists trained in 5 years
 Post training employment assignment in NARS*

Milestones:

- 2003: 10 scientists trained in participatory plant breeding (PPB); 5 scientists trained in molecular marker technology; 5 scientists trained in residual maximum likelihood (REML) analysis; 5 scientists trained in IBIS; 5 scientists trained in breeding for stress environments; 10 scientists trained in breeding for biotic (diseases, insect, virus) stress resistance.
- 2004: 5 scientists trained in PPB; 10 scientists trained in marker assisted selection; 10 scientists trained in REML analysis; 10 scientists trained in IBIS and data management; 25 scientists trained in breeding for abiotic and biotic stress resistance.
- 2005: 5 scientists trained in PPB; 10 scientists trained in marker assisted selection; 10 scientists trained in REML analysis; 10 scientists trained in IBIS and data management; 25 scientists trained in breeding for abiotic and biotic stress resistance.

Duration: 5 years.

Users: National programs will benefit from improved efficiency of germplasm enhancement through a decentralized breeding program. The income of farmers, especially resource-poor farmers in marginal areas, will improve from improved varieties, specifically adapted to their conditions, either directly by the sale of seed, or indirectly by increasing animal products. Where barley is used for human consumption, nutritional status will also improve. 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, 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; All Russian Institute of Agricultural Biotechnology; National Laboratory Risoe, Denmark; University of Hamburg; Germany; University of Hohenheim, Germany; 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:

2003: US\$ 1.203 million 2004: US\$ 1.271 million 2005: US\$ 1.322 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. Donor attributed funding from Italy; restricted funding from the Arab Fund for biotechnology; germplasm enhancement in Iran financed by Iran; cooperation with USA supported by USAID linkage funds; restricted funding from IDRC for participatory plant breeding; restricted funding from Danida, Denmark, for disease management of barley in Eritrea; support from IFAD for cooperation with Nile Valley countries; collaboration with Central Asia and the Caucasus supported by restricted funding through CGIAR Collaborative Research Program. Anticipated support for barley research in Ethiopia; anticipated restricted funding from BMZ for research on adaptation to climate change; anticipated annual grant from the OPEC Fund; anticipated funding from Japan for strengthening germplasm enhancement research in Afghanistan.

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 biotic and abiotic stresses, adaptation for global climate change 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:

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

2004: Introgression of resistance to black point and scab.

2005: Introgression of high micronutrient status in durum grain.

Output 2: Efficient breeding methodology for Mediterranean drylands

Indicators: Stress physiological and molecular markers tools and marker assisted selection are adopted.

Milestones:

2003: Genome mapping of the population for continental and temperate dry lands accomplished. QTLs for grain quality determined.

2004: QTLs for parameters of abiotic stress tolerance.
QTLs for resistance to yellow and leaf rust.

2005: QTLs for high carotene and micro-nutrient (Zn, Fe, Cu, Mn) content in durum grain.

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

Indicators: New designs and tools adopted in the 3 main agro-ecological areas

Milestones:

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

2004: Genetic stocks with high yield and stability available.

2005: Genetic stocks with high grain content of B-Carotene, Zn and Fe.

Output 4: Identified improved varieties for commercial production

Indicators: On-farm trials established with NARS in the durum growing areas of five countries.
High yielding varieties in dry lands available

Milestones

2003: 5-10 genotypes with resistance to drought, cold and heat tested in on-farm trials with 5 NARS.

—5-10 genotypes with improved grain quality tested in on-farm trials with 5 NARS.

—5-10 genotypes with broadened genetic base for resistance to rusts, Hessian fly, Septoria and abiotic stresses tested per year in on-farm trials with 5 NARS

2004: 5-10 genotypes with resistance to drought, cold and heat tested in on-farm trials with 5 NARS.

—5-10 genotypes with improved grain quality tested in on-farm trials with 5 NARS.

—5-10 genotypes with broadened genetic base for resistance to rusts, Hessian fly, Septoria and abiotic stresses tested in on-farm trials with 5 NARS.

2005: 5-10 genotypes with biofortified grains developed.

Output 5: Enhancement of NARS research capacity

Indicators: NARS scientists trained over 5 years: 30 at HQ and 50-60 within NARS
Expertise in advanced breeding techniques (10 PhD)

Milestones for 2003-2005 (per year)

1 trainee from each of 5 NARS on breeding for broadening the genetic base for abiotic stress resistance. PhD students on quality, stress physiology or 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 to grow less inputs and no chemicals for diseases and pests control. The ultimate beneficiaries are consumers, both rural and urban consumers, from improved grain quality and agro-processing.

Collaborators: The Durum Improvement Program at ICARDA is conducted in collaboration with CIMMYT; a CIMMYT Durum Wheat Breeder is outposted to ICARDA headquarters.

- Resistance breeding for drought, cold, terminal stress, diseases, insects, viruses: ITGC, Algeria; ARC, Egypt; NCARTT, Jordan; INRA, Morocco; Morocco; ARC, Syria; University of Aleppo, Syria; University of Tichreen, Syria; INRAT, Tunisia; FCRI, Turkey; CCI-Tamworth, Australia; Plant Breeding Institute, Cobby, Australia; University of Sydney, Australia; Agriculture Canada; Laval University, Canada.
- Molecular markers, genome mapping, double haploids: CIMMYT; Cornell University, USA; Mc Gill University, Canada; Paris-Sud University, France.
- Grain quality: Hassan II University, Morocco; Tuscia University, Italy; Cordoba University, Spain.
- Moisture stress: Barcelona University, Spain; IRTA-Llerida, Spain; Grenada University, Spain; ENSA/INRA Montpellier, France.

Cost:

2003: US\$ 1.214 million

2004: US\$ 1.277 million

2005: US\$ 1.328 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. Donor attributed funding from Italy; germplasm enhancement in Iran financed by Iran; restricted funding from Arab Fund for biotechnology; restricted funding from IFAD for studies of adoption of durum technologies; restricted funding from IFAD for cooperation with Nile Valley countries; collaboration with Central Asia and the Caucasus supported by restricted funding through CGIAR Collaborative Research Program. Anticipated restricted funding from BMZ for research on adaptation to climate change; anticipated funding from Japan for strengthening germplasm enhancement research in Afghanistan.

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 bread wheat 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, resistance/tolerance to biotic and abiotic stresses in targeted environments, adaptation to global climate change 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:

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

2004: Elite germplasm combining high yield with resistance to Hessian fly and Septoria, tolerance to drought, cold and heat and improved grain quality developed.

2005: Elite germplasm combining high yield with resistance to Hessian fly and Septoria, tolerance to drought, cold and heat and improved grain quality developed.

Output 2: New breeding methodology for stress environments.

Indicators: Efficient designs and field plot techniques in use.
Stress physiological and morpho-physiological tools in use.
Utilization of biotechnological techniques in the breeding program.

Milestones:

—2003: Inheritance of resistance in selected yellow rust and Hessian fly resistant sources studied. Physiological and morpho-physiological adaptive traits associated with wheat adaptation under drought identified.

Commencement of the development of mapping populations for drought and heat tolerance by DH technique.

2004: Physiological and morpho-physiological adaptive traits utilized in the selection program. Mapping populations for marker-assisted selection (MAS) for resistance to Hessian fly and yellow rust and tolerance to drought and heat stress developed.

2005: Mapping populations for MAS for drought and heat tolerance developed.

Output 3: Improved breeding methodologies disseminated.

Indicators: New designs and tools used by three NARS programs.
Number of better varieties generated.

Milestones:

2003: Three NARS start using the improved designs and breeding methods.

Improved breeding methodologies will be presented in international conferences and workshops.

2004: Routine utilization of improved designs and breeding methodologies in National Programs.

2005: Experimental efficiency in National Programs increased

Output 4: Enhanced adoption of improved cultivars

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

Milestones:

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 three NARS.

2004: A new variety is released in each of at least three NARS.

2005: Farmers adopt new varieties.

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:

2003: One trainee per country for four NARS on breeding for broadening genetic base for abiotic stress resistance.

2004: One trainee per country for five NARS on breeding for drought, cold and heat tolerance.

2005: Trainees utilize mapping populations and marker techniques.

Duration: 4 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 to grow less inputs and no chemicals for diseases and pests control. The ultimate beneficiaries are consumers, both rural and urban consumers, from improved grain quality and agro-processing.

Collaborators: The Spring Bread Wheat Improvement Program at ICARDA is conducted in collaboration with CIMMYT; a CIMMYT Bread Wheat Breeder is out posted 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.
- On-farm and adoption studies: ARC, Syria and LARI, Lebanon.

Cost:

2003: US\$ 0.526 million

2004: US\$ 0.557 million

2005: US\$ 0.580 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. Restricted funding from Arab Fund for biotechnology; germplasm enhancement in Iran financed by Iran; restricted funding from Danida, Denmark, for disease management of wheat in Eritrea; restricted funding from IFAD for cooperation with Nile Valley countries; collaboration with Central Asia and the Caucasus supported by restricted funding through CGIAR Collaborative Research Program. Anticipated restricted funding from BMZ for research on adaptation to climate change; anticipated funding from Japan for strengthening germplasm enhancement research in Afghanistan.

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

Goal: Increased and sustainable productivity of wheat in highland and continental areas of Central and West Asia and North Africa (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:

2003: Delivery of six International Nurseries to NARS in CWANA

2004: Improved bread-making quality realized in new cultivars

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:

2004: Heat and salt tolerant segregating materials distributed to CAC and Iran.

2005: DNA marker for cold tolerance identified.

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

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

Milestones:

2003: Genes for yellow rust resistance identified

2004: Genetic stocks for Russian wheat aphid tolerance produced and made accessible to NARS.

2005: Genetic stock for yellow rust resistance distributed to NARS

Output 4: Strategies to improve technology adoption.

Indicator: Percent of farmers growing new cultivars.

Milestones:

2003: On-farm testing and demonstration conducted in collaboration with NARS and farmers in CAC countries

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:

2005: One scientist from each country of CWANA trained.

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. An important

component of ICARDA's breeding work is also conducted in collaboration with Iran, with a special emphasis on rainfed winter wheat in dry areas, and on resistance to yellow rust. Other cooperation includes:

- *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 Turkey and Iran.
- Drought tolerance: NARS of Iran, Uzbekistan, and Turkey.
- Yellow rust: NARS in West Asia and CAC.
- Root rot: NARS in Turkey and Iran.
- Nematodes: NARS in Turkey; INRA, France.
- International facultative and winter bread wheat nurseries: Oregon State University, USA; NARS

Cost:

2003: US\$ 0.661 million

2004: US\$ 0.702 million

2005: US\$ 0.730 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 Collaborative Research Program for CAC. Anticipated funding from Japan for strengthening germplasm enhancement research in Afghanistan.

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 and contributing to global climate change mitigation through increased organic soil carbon level.

*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.

Development and delivery to NARS of chickpea production technology, particularly genetic material with appropriate combinations of seed size, plant height and stress resistance for targeted environments with special emphasis on late winter or early spring sowing of chickpea in Mediterranean environments with mild winter and its extension 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.

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

Output 1: Improved methodologies for food legume breeding i.e. decentralized breeding, identification of DNA markers for key stresses, durable disease resistance breeding and automation.

*Indicators: Participatory breeding initiated and breeding decentralized to target areas.
Markers for key stresses identified and marker assisted selection (MAS) in use.
Key pathogen variability characterized.
Improved screens for selection for stress tolerance developed.*

Milestones:

2003: Screening methodologies for Ascochyta blight, Fusarium wilt, and cold improved and inbred line development for mapping in progress.

CAC Legume Network nurseries initiated

2004: Decentralization of activities for North Africa in progress.

Mapping populations for various stresses developed.

CAC Legume Network nurseries operative.

2005: Breeding for Fusarium wilt resistance for North Africa decentralized.

Gene mapping for various stress traits initiated and DNA markers identified for MAS.

Output 2: NARS research capabilities improved: 20 researchers/year trained on breeding methods, selection and screening techniques, data management and analysis.

Indicator: Number of researchers trained

Milestones:

Annually: 20 persons per year from different national programs trained.

Output 3: Lentil: Improved genetic stocks with increased biomass for food and feed and resistance to key stresses (winter-hardiness, drought, vascular wilt, rust, Ascochyta blight, viruses and Sitona).

*Indicators: Elite breeding material and nurseries with stress resistance sources supplied to NARS.
Development of populations for molecular marker studies.
Winter-hardy materials with resistance to Ascochyta blight developed for winter sowing in highlands.
Weed control and mechanical harvest system adopted by the farmers in Syria.
New sources of resistance to wilt, rust, Ascochyta blight, Sitona, winter-hardiness and drought identified.
Promising lines identified through participatory breeding.
Micronutrient-rich genetic stocks identified.
International Lentil Information System (ILIS) developed.*

Milestones:

- 2003: Elite lines, targeted segregating populations and stress nurseries with suitable combinations of agronomic and phenological traits distributed to NARS for local selection.
Farmer participatory breeding operating in Bangladesh, Nepal, Pakistan, Turkey and Syria.
Development of mapping populations for cold, drought, rust and Ascochyta blight is in progress.
MAS initiated for winter-hardiness.
Improved methods of weed control and harvest mechanization documented and in use in CWANA region.
New sources of resistance for drought, winter-hardiness, viruses, wilt, rust, Sitona weevil identified.
Adoption of winter sowing technology in highlands of Turkey, Iran, Afghanistan and Pakistan.
Initiation of development of micronutrient-dense lentil germplasm.
Development of ILIS in progress.
- 2004: Development of germplasm for various agro-ecological conditions and delivery to NARS.
Suitable genetic stocks with combined resistance to key stresses identified by NARS and used in national trials for future release.
Farmer participatory variety selection in full operation in Syria, Bangladesh, Nepal, Pakistan, Ethiopia, and Turkey.
Development and tagging of molecular markers for rust, drought and Ascochyta blight.
MAS for winter-hardiness in operation.
Adoption of weed control and harvest mechanization in CWANA region documented.
Winter lentil production expanded in highlands of Turkey, Iran, Afghanistan and Pakistan.
Micronutrient-dense germplasm identified.
ILIS is in place and distributed to the collaborators.
- 2005: Development and delivery to the national programs of germplasm with suitable combinations of characters for various agro-ecological conditions.
Visible impact of improved technology/variety in major lentil-producing countries.
National programs release varieties identified through participatory selection.
MAS in operation for winter-hardiness, drought, rust and Ascochyta blight.
20% replacement of spring planting by winter cultivation in highlands.
Delivery of micronutrient-dense elite lines to national programs.

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

*Indicators: Production, testing and use of transgenic lentils through collaboration with other institutes.
High yielding varieties with resistance to Sitona and Orobancha.*

Milestones:

- 2003: Transgenic lines for control of Sitona under development.
2004: Transgenic lentils to control Sitona tested.
2005: Transgenic lentils to control Sitona [tested](#) available.

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

*Indicators: DNA markers used to tag genes for Ascochyta blight resistance.
Transformation and regeneration protocol for ascochyta blight resistance developed with other institutes.
Screening techniques to identify durable resistance to Ascochyta blight developed
Newly developed breeding materials and genetic stocks shared with NARS in a targeted breeding approach.
Improved techniques to screen for resistance to leaf miner.
Activities decentralized to NARS with high capacity.*

Milestones:

- 2003: Farmers start growing late winter-sown or early spring-sown chickpea and increase the seed for their own use.
Transformation and regeneration protocol tested.
Decentralization to Tunisia of breeding for Fusarium wilt resistance in North Africa initiated.
International nurseries with large seed size and stress resistance made available to NARS.

- 2004: Breeding materials with combined resistance to Ascochyta blight and Fusarium wilt developed and demonstrated to farmers in different countries.
Mapping populations for Ascochyta blight, Fusarium wilt, cold and drought developed and ready for mapping.
- 2005: Late winter/early spring sowing technology in use.
Breeding materials with combined resistance to Ascochyta blight and Fusarium wilt developed and demonstrated to farmers in different countries.
Inbred populations for Ascochyta blight, Fusarium wilt, cold and drought used for mapping and markers identified for MAS.

Output 6: Kabuli chickpea: Widening the genetic base of chickpea cultigen and introgression of desirable traits from wild to the cultigen.

*Indicators: Transfer of genes for resistance to biotic and abiotic stresses from wild to the cultigen.
Genetic stocks with winter vigor and the ability to flower and pod at low temperatures.
Genetic stocks with high biomass and other important traits.*

Milestones:

- 2003: Genes for large seed size from cultigen and cyst nematode resistance from wild combined in Kabuli background.
Hybridization between cultigen and wild annual species continued and new breeding materials developed.
Seed of the desirable mutants increased.
- 2004: Widely diverse advanced chickpea breeding materials with high level of tolerance from wild species developed.
Hybridization between cultigen and wild annual species continued and new breeding materials developed.
- 2005: Hybridization between cultigen and wild annual species continued and new breeding materials developed.
The elite lines from derived crosses shared with NARS for direct and indirect use.

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

*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 resistance germplasm (including multiple stress resistance) developed in a decentralized, pre-breeding system.
Identified sources of resistance for Orobanch, 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, Orobanch and stem nematodes*

Milestones:

- 2003: Gene pools with adaptation to sub-regions established for use in development of sub-regional nurseries.
- 2004: Lines with low tannin content and improved level of resistance to foliar diseases developed for use by NARS.
- 2005: Development of faba bean tolerant/resistant to high dose of glyphosate.
Development of faba bean lines with improved level of heat tolerance.

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

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

Milestones:

- 2003: Elite materials with stress resistance identified for testing in sub-regional programs.
- 2004: Development of genotypes with resistance to diseases and improved water use efficiency.
- 2005: Development of faba bean tolerant/resistant to high dose of glyphosate.
Development of faba bean lines with improved heat tolerance.

Output 9: Knowledge management in food legumes research and development.

Indicator: Research findings in food legumes disseminated through publications, conferences, leaflets, mass media, farmers days, networks, training etc.

Milestones:

2003-05: Information on food legumes disseminated through publications, conferences, leaflets, mass media, farmer days, networking, training, traveling workshops, etc.

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 the Caucasus, and Nile Valley and Red Sea; NARS in South Asia and China; North America, Southern Europe, Caribbean countries.
- Marker assisted selection: Washington State University, USA; University of Frankfurt, Germany.
- Lentil transformation and chickpea for Mediterranean environments: CLIMA, Australia.
- Transformation with chickpea: University of Hannover, Germany.
- Transformation protocols: AGERI, Egypt.
- Mapping WANA chickpea wilt races: University of Cordoba, Spain.
- Food legume nematology: Institute of Nematology Bari, Italy.
- Lentil adaptation: Victorian Institute of Dryland Agriculture, Australia.
- Faba bean improvement: New South Wales Department of Agriculture, Australia.

Cost

2003: US\$ 2.873 million 2004: US\$ 3.015 million 2005: US\$ 3.135 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. Donor attributed funding from UK; donor attributed funding from Italy for chickpea; restricted funding from GRDC and ACIAR supports collaboration with Australian institutes and research on lentil in Nepal; restricted funding from Arab Fund for biotechnology; germplasm enhancement in Iran financed by Iran; restricted funding from IFAD for cooperation with Nile Valley countries; cooperation with USA supported by USAID linkage funds; collaboration with Central Asia and the Caucasus supported by restricted funding through CGIAR Collaborative Research Program; restricted funding from BMZ for legume genomics. Anticipated restricted funding from BMZ for research on adaptation to climate change; anticipated funding from Japan for strengthening germplasm enhancement research in Afghanistan.

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 introduced into cereal-based systems and utilized in the development of integrated crop-livestock production systems.

Improved grasspea (Lathyrus sativus) with low neurotoxin (β -ODAP) content adapted to the areas where the crop is an important human food (Afghanistan, Bangladesh, China, Ethiopia, India, Nepal, and Pakistan).

Increased use of improved underground vetch (Vicia amphicarpa) in marginal non-arable lands.

Increased genetic diversity of cultivated forage legume species.

Output 1: Improved cultivars and populations of forage vetches (*Vicia* spp.) and grasspea (*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 grasspea 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 the Caucasus (CAC).

Milestones:

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

2004: On-farm feed production improved and promoted in monoculture cereal rotation.

Community-based on-farm production and distribution of seed of improved germplasm promoted.

2005: Adapted lines of vetches and grasspea for CWANA, Iran, Afghanistan and China identified and selected.

Improved lines of vetches and grasspea used in run-off strip water harvesting in 2 sites in Syria.

Salt tolerant lines identified and selected.

Quality parameters of herbage, grain and straw assessed.

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

Indicators: 50 target crosses/year followed by in situ selection with NARS for low neurotoxin β -ODAP.

10 somaclones variants/year from locally adapted land races of Bangladesh, Ethiopia, Nepal, and Pakistan.

Laboratory techniques for the estimation of the neurotoxin.

Improved lines of grasspea with minimal neurotoxin content in the grains & straw and improved amino acid complement, adapted to zero or 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:

2003: Low neurotoxin lines tested by NARS in Bangladesh, Ethiopia, Nepal, Afghanistan and China.

2004: Number of NARS using improved lines increased.

Study of the socioeconomic factors affecting farmer's practices, use of improved germplasm, processing, consumption patterns of grasspea completed.

Seed multiplication of adapted low neurotoxin lines.

2005: Molecular markers for low neurotoxin identified and incorporated.

Regional varietal trials of promising low neurotoxin varieties established.

Appropriate strategies developed for maintenance of genetic purity of low neurotoxin lines.

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

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

Milestones:

2003: Improved underground vetch lines with high biomass and reasonable number of underground pods selected and tested in selected site in marginal lands.

2004: Grazing trials, natural reseeding, survival under grazing and seed-bank dynamics studied. Natural self-regeneration monitored.

2005: High herbage yield and drought tolerant underground vetch lines developed. Assessment of the tolerance of *Vicia amphicarpa* to grazing at integrated research site in Syria. Use of *Vicia amphicarpa* in marginal land improvement extended.

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

Indicator: Number of trainees and MSc and PhD research students

Milestones:

2003: Five individual trainees on germplasm enhancement and quality assessments.

Contribution to other ICARDA training courses such as seed production and variety tests.

2004: Number of in-country training courses, and visiting scientists for CWANA increased.

2005: Training for CAC in forage germplasm evaluation, enhancement and quality assessments. Number of graduate students increased.

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 suitably adapted self-regenerating forage legumes in rehabilitated non-arable grazing lands. Deployment of grasspea germplasm with safe neurotoxin content that will reduce the incidence of neurotoxicity will benefit small farmers relying on grasspea land races as a major component of their diet in times of famine when other legume crops fail.

Collaborators:

- Germplasm evaluation & utilization: NARS associated with ICARDA, Regional Programs, West Asia Regional Program, Highlands Regional Program, Central Asia and Caucasus Countries (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 (CLIMA), Australia; University of Addis Ababa, Ethiopia; Institute of Food Research, Norwich UK; University of Alberta, Canada; University of Ghent, Belgium; Washington State University, Grasslands Research Lab, USDA-ARS; Indian Agricultural Research Institute, New Delhi, India.

Cost:

2003: US\$ 0.481 million 2004: US\$ 0.510 million 2005: US\$ 0.530 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; germplasm enhancement in Iran financed by Iran; collaboration with CAC supported through the CGIAR Collaborative Research Program. Anticipated funding from Japan for strengthening germplasm enhancement research in Afghanistan.

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 Reduction in the yield losses and the variability of production currently due to disease and pest epidemics

Purpose: Adoption by farmers of integrated pest management practices.

Indicator: Integrated pest management (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 CWANA.

Indicator: Number of surveys conducted.
Number of studies conducted on pest variability and yield loss

Milestones:

- 2003: Six pest surveys in six countries.
Yield loss experiments in five countries.
Variability of five pests in five countries characterized.
- 2004: Five pest surveys in five countries.
Yield loss experiments in four countries.
Variability of five pests in five countries characterized.
- 2005: Five pest surveys in five countries.
Yield loss experiments in four countries.
Variability of five pests in five 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.

Indicators: Establishment of IPM options by NARS and their adoption at the farm level.
Increased demand for treated seed of improved crop cultivars from seed supply systems.
Diversification in farming systems through varied cropping patterns and management practices

Milestones:

- 2003: Sources of resistance for seven pests identified.
Effects of at least four practices on three pest populations in three countries evaluated.
- 2004: Sources of resistance for seven additional pests identified.
Effects of at least five practices on five pest populations in five countries evaluated.
- 2005: Sources of resistance for seven additional pests identified.
Effects of at least five practices on five pest populations in five countries evaluated.

Output 3: IPM options for the different cropping systems and agroecological zones developed.

Indicators: IPM options developed for more than two of the components
Verification of IPM options by NARS

Milestones:

- 2003: Five IPM options evaluated.
- 2004: Six IPM options evaluated.
- 2005: Six IPM options evaluated.

Output 4: IPM pilot sites established with farmers' participation at selected sites in CWANA

Indicator: Number of pilot sites developed

Milestones:

- 2003: Six IPM pilot sites in six countries.
- 2004: Seven IPM pilot sites in seven countries.
- 2005: Seven IPM pilot sites in seven countries.

Output 5: Expertise of national scientists and farmers in IPM research and implementation improved.

*Indicators: Increase in number of NARS scientists collaborating with ICARDA in developing and testing IPM packages in their respective countries.
Number of NARS staff that receives IPM training at ICARDA and number of NARS staff trained on site
Number of Farmer Field Schools established.*

Milestones:

2003: 20 NARS scientists and 300 farmers trained in IPM practices.

2004: 30 NARS scientists and 400 farmers trained in IPM practices.

2005: 30 NARS scientists and 400 farmers trained in IPM practices.

Output 6: Information on IPM research disseminated

*Indicators: Number of scientific articles published
Number of manuals/brochures published
Number of regional/international workshops/meetings held*

Milestones:

2003: 10 journal articles; 10 abstracts; 8 field days; one international workshop.

2004: 10 journal articles; 10 abstracts; 10 field days; one international conference.

2005: 10 journal articles; 10 abstracts; 10 field days; one international/regional meeting/workshop.

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 adapting these where necessary to different locations and cropping systems. The main beneficiaries of the IPM technology are the resource-poor farmers of the different agro-ecological zones of CWANA.

Collaborators:

- Testing options of IPM in selected sites in WANA: 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; Directorate of Agricultural Research and Human Resources Development (DARHRD), Eritrea; Exchange of resistant germplasm: CIMMYT, ICRISAT, NARS of CWANA.
- Study of population dynamics of powdery mildew: Risoe Laboratory, Denmark
- Viral pathogens and virus resistance: ARC, Egypt; NSW Agriculture, Australia.
- Monitoring of leaf and stem rust variability: IAVHII, Morocco; ARC, Egypt; University of Aleppo, Syria; SPII, Iran; CREFCI, Turkey.
- Yellow rust: University of Sydney, Australia; FCRI, Egypt; USDA/ARS, USA; DIAS, Denmark, SPII, Iran; CREFCI, Turkey.
- Characterization of pathogenic variability in Scald: University of Adelaide, Australia; Risoe Laboratory, Denmark.
- Hessian fly resistance and molecular biology: INRA, Morocco; Kansas State University, USA; Purdue University, USA.
- Screening for scab resistance in barley and wheat: North Dakota State University and Minnesota State University, USA.
- Study of blotch diseases in barley: Agriculture & Agri-Food Canada, Winnipeg Manitoba, Canada
- Study of blotch diseases in wheat: University of Manitoba, Canada
- Cereal Cyst Nematode (CCN) ecology and control in cereals: INRA-Rennes, France; University of Adelaide, Australia; CIMMYT; University of Aleppo.
- Russian wheat aphid; legume pests: Washington State University, USA; Colorado State University, USA; ARC, Egypt; Aphid Lab, USDA, ARS, Stillwater, Oklahoma.
- Wheat stem sawfly, cereal diseases: Montana State University, USA.
- IPM of Sunn Pest: Plant Protection Research Institute, Turkey; Cukurova University, Turkey; University of Aleppo, Syria; University of Vermont, USA; CABI, NRI, UK; Plant, Pest and Diseases Research Institute, Iran; Simon Fraser University, Canada.
- Nematode control in legumes: CNRS/Bari, Italy
- Integrated Cereal Disease Management (ICDM): DIAS, Denmark; Risoe National Laboratory Plant Biology and Biogeochemistry Department, Denmark; and DARHRD, Eritrea
- NSW Agriculture, AGWEST, DNRE Horsham and the University of Adelaide, Australia on Improved understanding and management of faba bean, chickpea and lentil diseases

Cost

2003: US\$ 1.397 million 2004: US\$ 1.475 million 2005: US\$ 1.534 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: Unrestricted core funds. Support for collaboration with University of Vermont from USAID linkage funds; restricted funding from DFID, UK, for IPM of Sunn pest; restricted funding from Danida, Denmark, for integrated cereal disease management in Eritrea; support for IPM pilot sites from SP-IPM; restricted funding from ACIAR and GRDC for collaborative research with Australian institutes on legume disease management; cooperation with Iran financed by Iran; cooperation with Nile Valley countries supported by IFAD.

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

Goal: Increased productivity and productive capacity, and mitigation of the effects of climate change, through improved soil and crop management, appropriate crop rotations, improved water use efficiency, and the maintenance of 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 and mitigate the effects of climate change.

*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.*

Milestones:

- 2003: Assessment of long-term monitoring of farmers' production systems with NARS for trends in changes in productivity and sustainability (Egypt)
Relationship of monitored C and N values to crop production identified and modeled with a view to transferring technology to mitigate climate change.
Analysis of the dynamic nature of C and N in complex agroecosystems and with respect to climate change.
Role of oilseed crops in the region reviewed.
- 2004: Extent of greenhouse gas emissions identified and quantified.
Criteria for ongoing and future long-term trials refined and a mechanism for the extension of findings to target agroecological zones identified.
- 2005: Continued refinement of criteria for ongoing and future long-term trials and development of a mechanism for extension of findings to target agroecological zones.
Effects of compost use and contrasting tillage practices on productivity and C sequestration reported.

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:

- 2003: Production risks quantified in additional countries in CWANA
Cropping systems simulation models evaluated for the spatial extrapolation of site-specific findings on the optimization of soil water use and related management options in Syria.
- 2004: Evaluation and reporting of crop and cropping system simulation models tested in selected sites in CWANA.
Production risks quantified in additional countries in CWANA
- 2005: Continued evaluation and reporting of crop and cropping system simulation models in selected sites in CWANA.
Production risks quantified in additional countries in CWANA.

Output 3: Field-tested technologies and strategies for more efficient water use in dry-area cropping systems.

Indicators: Improved technologies for soil water conservation and its efficient use developed with NARS.
Promising techniques in soil, water and crop management that increase water use efficiency adopted by farmers.

Milestones:

2003: Reports on efficient soil, crop and water management practices tested under farmers' conditions with NARS.

Reports on SWNM-OSWU projects implemented by NARS in Morocco, Niger, South Africa, Zimbabwe.

2004: Evaluation of the impact of tested technologies on productivity, profitability and sustainability.
Paper on the use of Phosphogypsum to improve soil properties.

2005: Further papers on SWNM-OSWU projects (3 WANA and 3 SSA countries of OSWU).

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 recommendations developed.
Biological, chemical and physical soil quality indicators developed.
Training manuals and guidelines in soil quality produced.

Milestones:

2003: Monograph on long-term trials at ICARDA.

2004: Effective Soil Fertility Network established.

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:

2003: Climate and soil-type patterns in micronutrient stresses identified.

2004: Climate and soil-type patterns in micronutrient stresses identified in additional areas in CWANA.

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:

Annually: Relevant training provided in CWANA.

Dissemination of knowledge to researchers, extensionists and farmers through workshops/conferences/field days in CWANA

Duration: 5 years.

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

Collaborators

- Long-term trials for resource management: NARS of Algeria, Egypt, Jordan, Lebanon, Iran, Morocco, Syria, Turkey, CAC;
- Farm surveys and on-farm experimentation: NARS of Algeria, Egypt, Jordan, Iran, Morocco, Syria and Turkey, CAC;
- Optimizing Soil water Use: NARS of Egypt, Jordan, Iran, Morocco, Syria, Turkey, Niger, Zimbabwe, Mali, Kenya, Burkina Faso, South Africa; and ICRISAT as co-convenor.

- Soil fertility trends; systems modeling and use of ¹⁵N: University of Reading, UK; Atomic Energy Commission of Syria; International Atomic Energy Agency (IAEA), Austria.
- Testing and validation of simulation models: NARS of Egypt, Iran, Jordan, Morocco, Syria and Turkey; Washington State University, USA; Hohenheim 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

2003: US\$ 0.960 million 2004: US\$ 1.017 million 2005: US\$1.057 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) with CIAT, TSBF: Optimizing Soil Water Use (OSWU), with ICRISAT.

Participation in Inter-Center Working Group for Climate Change (IWG-CC) with the lead on the project on “Carbon and nitrogen dynamics in long-term trials”.

Financing Plan: Unrestricted core funds. Collaboration with NARS in Egypt in long-term trials and farm monitoring supported by Egypt; support to consortium on Optimizing Soil Water Use through the SP-SWNM; collaboration with Iran financed by Iran; cooperation with Nile Valley countries supported by IFAD; anticipated support for collaboration on crop diversification, soil water and nutrient management in Central Asia from Asian Development Bank.

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

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

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

Purpose: Development of options for adoption by farmers of forage and pasture species in crop rotations or to rehabilitate native pastures.

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

Output 1: Identification of species and selection of adapted cultivars of pasture and forage species (in cooperation with Projects 1.6 and 3.3)

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

Milestones

- 2003: 100 medicinal plants species collected and conserved.
1 cultivar of range species selected.
Assessment of the biodiversity of the Khanasser Valley Integrated Research Site in Syria published.
- 2004: Significant diversity of forage and range species native to CWANA collected and conserved in gene bank and/or nursery.
At least one cultivar of forage crop released by NARS.
A CD-ROM including photos and description of major useful forage and range species for CWANA produced and distributed.
A list of herbaria specimen of major useful forage and range species collected in CWANA published.
- 2005: Adapted range germplasm tested by NARS.
1000 kg of new forage germplasm and 10 kg of range species distributed to NARS.
A list of major medicinal plants native in CWANA published.
Four NARS scientists 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

- 2003: A low-cost technology for harvesting Artemisia species tested on-farm.
- 2004: Solutions to overcome shortage in forage seed in Pakistan, Central Asia and the Caucasus identified.
A low-cost technology for harvesting *Salsola* species developed.
- 2005: A low-cost technology for harvesting seed of Atriplex species adopted by NARS.
A low-cost technology for harvesting *Salsola* species adopted by NARS.
At least four NARS scientists 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:

- 2003: Results on plant productivity from the long-term trials in Lebanon and Syria published..
- 2004: Results on plant productivity from the long-term trial at Tel Hadya published.
At least four NARS scientists trained in rotation trials.
- 2005: At least 10 field days organized to promote use of forage crops.

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

- 2003: The potential use of wastewater to irrigate forage crops assessed.
Rotation trials analyzed for economic ranking of treatments.
The environmental role of fodder shrubs and their contribution to animal feeding determined.
Two NARS scientists trained in management of feed resources.
Two issues of Dryland Newsletter produced.
- 2004: The potential use of drainage water to irrigate forage crops and range species assessed.
The potential use of forage and pasture crops as hay, grazing or mature seed and straw to suit land use and market opportunities assessed.
Two NARS scientists trained in management of feed resources.
Two issues of Dryland Newsletter produced.
- 2005: Carbon sequestration in the different rotations assessed.
Two NARS scientists trained in management of feed resources.
Exchange of information and germplasm of oat and vetch between NARS of North Africa.
Two issues of Dryland Newsletter produced.

Duration: 10 years.

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

Collaborators:

- Pasture/forage rotation trials with cereals: American University of Beirut/Agricultural Research and Extension Center, Lebanon; Syrian Ministry of Agriculture and Agrarian Reform; Aleppo University, Syria.
- Forage and pasture management: NARS of Algeria, Egypt, Iraq, Jordan, Lebanon, Libya, Morocco, Pakistan, Syria, Tunisia, Turkey, Caucasus and Central Asia; USDA-ARS; GL-CRSP (Global Livestock Collaborative Research Support Program).
- Pasture rehabilitation and vetch in Turkey: South Eastern Anatolia Project; Field Crops Research Institute, Ankara.
- Feed resources in Central Asia and the Caucasus: National Programs of Armenia, Azerbaijan, Georgia, Kyrgyzstan, Kazakhstan, Turkmenistan and Uzbekistan; ILRI.

Cost:

2003: US\$ 0.593 million 2004: US\$ 0.628 million 2005: US\$ 0.653 million

System Linkages:

Output 2: Germplasm collection: 5%
Output 3: Sustainable Production: 80%
Output 5: Enhancing NARS: 15%

Financing Plan: Unrestricted core funds. Financing from Barani Village Development Project in Pakistan and GAP Project in Turkey; Dryland Pasture, Forage & Range Network Newsletter co-sponsored by FAO; restricted funding from USDA-ARS for research on medicinal plants in Tunisia; support from FAO for the Oat & Vetch Network in the Maghreb. Anticipated funding for collaborative research on integrated crop livestock systems in WANA from IFAD and the Arab Fund and in Central Asia and the Caucasus from IFAD.

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

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

Output 1: Management plans for rangeland natural resources in CWANA.

Indicator: National and community acceptance of management plans.

Milestones

2003: Develop and test a management plan for rangeland natural resources in two Protected Areas in northern Syria.

2004: A rotational grazing scheme with community involvement to restore seasonal rotational grazing in Central Asia developed and tested.

2005: Principles of rangeland management to control livestock grazing extended to areas in neighboring countries of West Asia.

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

Indicator: Techniques tested and utilized by NARS.

Milestones

2003: Machine for rangeland reseeding tested in selected sites.

Trials initiated to test suitability of perennial species for establishment by low-cost methods in low-lying high-potential areas of the steppe.

2004: The pitting machine is used at large scale by the Badia Project in Syria for rangeland reseeding. Perennial vegetation established on 2 low-lying high-potential test sites.

Description of production-system context for the management of rehabilitated low-lying high-potential areas.

2005: Management plans developed and tested for sustainable management of rehabilitated low-lying high-potential areas.

Output 3: Inventory of rangeland vegetation and key species for feed, fuel-wood, or erosion control.

Indicator: Documentation, databases and number of trained NARS personnel.

Milestones

2003: Mapping of range resources in two sites initiated.

Measurement of main vegetation types completed in two Protected Areas in northern Syria.

Species trials for rehabilitation of the degraded sandy semi-arid zone in the Arabian Peninsula.

20 NARS scientists trained in inventory, survey, and mapping of range resources.

2004: A CD-ROM on rangeland management and assessment methods prepared.

Management practices developed for rehabilitated rangelands in the Arabian Peninsula.

A standardized course offered on range management principles and methods.

2005: Procedures developed for rangeland management strategies based on a production systems approach.

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

2003: Literature reviewed.

2004: Report published.

2005: Measures formulated for revegetation of rangelands in Central Asia and the Caucasus.

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

- Project 2.4 focuses considerable effort on the rehabilitation and improved management of rangelands in northern Syria, and therefore a key collaborator is the Steppe Directorate within the Syrian Ministry of Agriculture and Agrarian Reform, along with the new Directorate for Agricultural Research and the Badia Project.
- Characterization of range-dependent livestock production systems, and the development of sustainable improved resource management practices, will require the collaboration of NARS in Jordan, Iran, Turkey, Lebanon, Tunisia, Morocco, and the Central Asian countries participating in the project on Integrated Feed and Livestock Production in the Steppes of Central Asia.
- A wide-ranging training program is envisaged to strengthen the range research components of all the NARS in ICARDA's mandate region, with the exception of several NARS such as those in North Africa and Jordan that can supply instructors for a standardized course.

Cost

2003: US\$ 1.714 million

2004: US\$ 1.818 million

2005: US\$ 1.891 million

System Linkages

Output 2: Germplasm collection: 5%

Output 3: Sustainable Production: 75%

Output 5: Enhancing NARS: 20%

Financing Plan: Unrestricted core funds. Donor attributed funding from Japan; restricted funding from SDC Switzerland for research on agro-pastoral systems in North Africa; collaborative research with NARS of Arabian Peninsula funded by IFAD, the Arab Fund and the OPEC Fund. Anticipated funding for rangeland management research in WANA from IFAD and the Arab Fund and in Central Asia from IFAD.

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: Development of technologies and opportunities for improving small ruminant production and adding value to small ruminant products in partnership with NARS and with participation of producers.

*Indicators: Estimated number of research sites and farmers where technologies are adopted and used.
Production is improved by at least 20% among collaborating farmers in the research sites.
Product quality improved by at least 50% among 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 of market information on small ruminant products 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 national programs and policy makers.*

Milestones:

2003: Analysis of information on markets of small ruminant products is completed and market opportunities documented in Central Asia and Syria.

2004: Methodology of market analysis of sheep milk products is expanded to Jordan, Lebanon and Turkey.

2005: Market analysis for Jordan, Lebanon and Turkey completed and reported.

Output 2: Small ruminant production systems are characterized and production constraints identified for better understanding of the processes involved and for improved targeting of research.

Indicator: Results of the characterization of small ruminant production systems and constraint analysis, which will allow better targeting of small ruminant productivity improvement, are available to NARS, the scientific community and development programs.

Milestones:

2003: Report on local knowledge and constraint analysis in sheep milk transformation in Syria

Report on local knowledge and constraint analysis in lamb fattening systems in Syria.

Study of local knowledge and constraint analysis on sheep milk transformation expanded to Jordan, Lebanon, and Turkey.

Formulation of models for greater market orientation of smallholders in Central Asia (Uzbekistan and Kazakstan).

2004: Typologies of small ruminant production systems in Central Asia and Syria documented.

International symposium on the new trends and changes in small ruminant production systems and their associated markets in the dry areas.

Report compiling information on local knowledge and constraints in sheep milk transformation in West Asia (Syria, Lebanon, Jordan and Turkey).

Models for market orientation of smallholders in Central Asia.

Output 3: Technologies to improve small ruminant productivity and farmers' income integrated in adaptive market-oriented research are tested and available, with emphasis on transformation of primary products (i.e. to process milk into milk derivatives and fattening) that capitalize on added value.

Indicators: Results of on-farm performance of monitored pilot farms, where small ruminant productivity increasing and resource conserving technologies are being tested, are accessible to the scientific community, development programs, and end-users.

Tested low-cost technologies that improve small ruminant productivity made 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:

- 2003: International seminar on livestock production in Central Asia.
Technologies to produce new milk derivatives with market opportunity developed in Syria.
- 2004: International seminar on value added production technologies for small ruminants.

Output 4: Production and genetic characterization of small ruminant breeds in CWANA, along with characterization of their production and market environments, 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:

- 2004: International seminar on the breed characterization of CWANA.
On-farm characterization of main breeds of small ruminants in Central Asia and the Caucasus completed.
- 2005: Genetic characterization of targeted breeds completed.

Output 5: 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 by-products for small ruminant feeding made available to farmers in on-farm adaptive research and to NARS.
Manuals on the use of non-conventional feedstuffs and by-products in small ruminant feeding
Technologies for out-of-season lambing are available for adaptive research trials.
Technologies involving the use in feeding strategies of the capacity to deposit fat of fat-tail sheep*

Milestones:

- 2003: Out-of-season lambing technology tested on-farm.
Technologies based on the use of fat deposits in reducing feeding costs documented.
- 2004: On-farm testing of technologies that use in feeding strategies the capacity of fat-tail sheep to deposit fat started.

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 by-products will reduce imports of feed concentrates.

Collaborators:

- Market studies: JICA, Japan
- Characterization of production system: University of Gottingen, Germany; KVL, Denmark.
- Adaptive research: NARS of Central Asia, West Asia,; FAO; GL-CRSP (Global Livestock Collaborative Research Support Program), University of California, Davis, and University of Wisconsin, USA; JICA, Japan.
- Transformation of primary products: FAO; Univ. of Wisconsin, USA; Jordan Cooperative Corporation.
- Breed characterization: ILRI; IPGRI; Univ. of Wisconsin, USA; University of Gottingen, Germany.
- Animal health: ILRI; JICA, Japan.
- Non-conventional feedstuffs and by-products: FAO; CIHEAM (International Center for Advanced Mediterranean Agronomic Studies).
- Strategic research on biological feasibility of new production strategies: McCaulay Institute, UK; FAO; International Atomic Energy Agency.

Cost

2003: US\$ 1.303 million 2004: US\$ 1.377 million 2005: US\$ 1.432 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)

Linkage to the Systemwide Program for Genetic Resources (SPGR)

Linkage to Global Animal Genetic Resources Program (FAO).

Financing Plan: Unrestricted core funds. Donor attributed funding from Japan; Junior Professional Officers supported by Danida; collaboration with ILRI in Tunisia supported by USDA. Anticipated funding for integrated crop-livestock systems in WANA from IFAD and the Arab Fund and in Central Asia from IFAD.

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.

Indicator: Improved technologies, methodologies, and recommendations are available to national programs

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

*Indicators: Improved methods for selecting appropriate sites reduce effort, time and cost of planning water harvesting.
At pilot demonstration sites a greater part of rain is captured and utilized in improved water use efficiency.
Information on the socioeconomic constraints and potential policies and actions to overcome them are available to decision-makers.*

Milestones:

2003: Conference on water harvesting and water use efficiency in the region.

2004: Book on ICARDA's research on water harvesting published.

2005: Assessment of water harvesting potential and consequences in the dry areas completed within the Central Asia program.

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.
Water productivity and total farm production levels increased at farmers' demonstration sites in representative areas.*

Milestones:

2003: Model for optimal management of supplemental irrigation evaluated and tested.
Proceedings of the supplemental irrigation workshop published

2004: Research on supplemental irrigation in Tunisia and Morocco completed.
Recommendations on the management of supplemental irrigation of legumes published.

2005: Assessment of the consequences of implementing water saving strategies on water and the environment completed within the Central Asia program.

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

*Indicators: On-farm water use efficiency increased at demonstration farms using developed packages.
Recommended on-farm irrigation management strategies and techniques that improve water use efficiency and natural resource management 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:

2003: Conference on results and recommendations from research on water use efficiency and water harvesting.

2004: Proceedings of the conference on water use efficiency and water harvesting published.

2005: Regional workshop on water use efficiency held in which promising and effective alternatives for cropping strategies and management practices to improve on-farm water use efficiency identified.

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 water resources available to NARS.
Awareness of the potential and limitations of the use of non-conventional water resources increased.

Milestones

2003: Database on available and potential non-conventional water resources in CWANA operative.
2004: Proceedings of the workshop on the use of low quality water published.
2005: Recommendations on the cropping systems feasible under various qualities of water in the dry areas published.

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

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

Milestones

2003: Recommended methodologies combining technical and socio-economic parameters for sustainable use of ground water in irrigation published.
2004: Model for evaluating the sustainability of groundwater use in supplemental irrigation evaluated and adapted to Syrian conditions.
2005: Review of groundwater management success stories in WANA prepared.

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: Capacity of NARS personnel to conduct research on water management issues and application of results increased.
Quality of NARS research in water management problems improved.
Collaborative research and demonstrated sites produce required data and analysis.

Milestones:

2003: Training course on water use efficiency in dry areas.
Regional workshop on managing scarce water resources for combating desertification in Asia within UNCCD TPN4 and TN1.
2004: Training course on water use efficiency in dry areas.
2005: Training course on integrated watershed 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: linkages through the Ecoregional Programme: On-farm Water Husbandry in WANA in Algeria, Egypt, Iraq, Iran, Jordan, Libya, Morocco, Pakistan, Syria, Tunisia, and Yemen. Collaboration with IRD (Institut de Recherche pour le Développement), France.
- Supplemental irrigation: national institutes of Iran, Iraq, Morocco, Syria, Tunisia, Turkey and the Central Asian states.
- On-farm water use efficiency: IWMI, ICRISAT, ESCWA (UN Economic and Social Commission for West Asia); collaboration through ICARDA's Nile Valley and Red Sea Regional Program and NARS of Morocco, Sudan, Syria, Turkey and the Central Asian states.

- Use of remote sensing, GIS and the modeling of rainfall and water harvesting: University of Karlsruhe, Germany; Cemagref and IRD, France; General Organization for Remote Sensing, Syria; NARS of Jordan and Turkey.
- Non-conventional water sources: Collaboration with the Gulf States; NCARTT (National Centre for Agricultural Research and Technology Transfer) and Jordan University for Science and Technology, Jordan; Aleppo University, Syria; Tunisia; the Central Asian states; CIHEAM-Bari; INRA-France; McGill University, Canada; USDA; IWMI.

Cost

2003: US\$ 2.803 million 2004: US\$ 2.982 million 2005: US\$ 3.101 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. Restricted funding from JICA for training in Syria; restricted funding from USDA-ARS for research on GIS in water management in Tunisia; collaboration with NARS in Egypt financed by Egypt; collaboration with NARS in the Arabian Peninsula funded by the Arab Fund, IFAD and the OPEC Fund; restricted funding from the Arab Fund for a regional program in on-farm water management; funding from Barani Village Development Project in Pakistan. Anticipated funding for activities in Central Asia from the Asian Development Bank; anticipated funding from IFAD for a regional program in on-farm water management; anticipated financing within the sub-regional and regional thematic networks of the UNCCD.

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 in the dry areas of Central and West Asia and North Africa (CWANA).

*Indicators: Adoption of sustainable land management practices and approaches by land-users and/or communities.
Reduced land degradation.*

Purpose: An integrated multi-scale approach and technologies for sustainable and productive land management for degrading dry areas is available for utilization by NARS in CWANA.

Indicator: NARS, in close participation with rural communities, utilize the approach for developing site-specific conservation strategies and land management practices.

Output 1: An integrated multi-scale research approach for land degradation assessment and analysis for degrading dry areas.

*Indicators: Conceptual framework for land degradation in dry areas available.
Participatory and multi-scale land resources and land degradation assessment methodologies developed.
Method for integrated analysis for land degradation developed.*

Milestones:

- 2003: Conceptual framework for land degradation finalised.
Land degradation processes assessed at two sites in Syria.
First version of integrated land degradation analysis method developed.
Contact made with three CWANA NARS interested in land degradation analysis.
- 2004: Land degradation analysis method finalised.
Land degradation test sites identified in CWANA region and methodology tested.
- 2005: Cross-environmental evaluation of the land degradation analysis methodology.
Long-term evaluation of land degradation at the Syrian test sites.

Output 2: Approach for identifying different scenarios and technologies for sustainable land management.

*Indicators: Approach for participatory development of land management technologies available.
Identification of critical physical, socio-economic and cultural criteria for identifying sustainable land management technologies.
Approach for identifying different scenarios to obtain sustainable land resource use available.*

Milestones:

- 2003: Participatory development of land management technologies tested at two Syrian test sites.
Critical criteria for sustainable land management technologies and possible scenarios identified for the two Syrian test sites.
Contact made with three CWANA NARS interested in analysis for land management solutions.
- 2004: Land management options methodology finalised.
Methodology tested at the CWANA land degradation test sites.
- 2005: Cross-environmental evaluation of the land analysis management options methodology.

Output 3: A toolbox for sustainable land management for dry areas.

*Indicator: Land management options available and described for two pilot sites in Syria.
Inventory of sustainable indigenous and introduced land management methods for the CWANA region available.*

Milestones:

- 2003: Land management options for Yakhour tested, documented and evaluated by land users and other stakeholders.
Network for indigenous and introduced land management methods for dry regions established.
- 2004: Inventory of land management methods for dry regions available.
- 2005: A toolbox for sustainable land management for dry areas available.
Long-term evaluation of land management options at the Syrian test sites.

Output 4: Strengthened capacity of NARS in land degradation assessment and integrated land development research for dry areas.

Indicator: Active cooperation with 2 Syrian NARS established.
NARS scientists of five institutions in the CWANA region trained.
Functional research network between scientists of different institutions.
Approaches of Outputs 1, 2 and 3 available for use by NARS.

Milestones:

2003: Network for indigenous and introduced land management methods for dry regions established.
Farmers' training at Syrian test sites.
Training of staff of two NARS agencies in the CWANA region.
Project proposals for cooperation with three NARS for land management.

2004: Staff of three other NARS agencies in the CWANA region trained.
Workshop on land degradation and rehabilitation in the dry areas.

2005: Approaches of Outputs 1, 2 and 3 available for use by NARS.

Duration: 5 years

Users: Primary users are researchers in national research institutions and extension agencies. Ultimate beneficiaries are land users in marginal dry lands.

Collaborators: University of Bonn, Germany; UNEP; WOCAT Consortium; DRC (Egypt); IRA (Tunisia), RSRI (Turkey); Olive Bureau (Syria); Atomic Energy Commission of Syria (Syria); Extension Directorate (Syria); Directorate of Soils (Syria).

Cost:

2003: US\$ 1.0 million 2004: US\$ 1.053 million 2005: US\$ 1.095 million

System Linkages:

Output 3: Sustainable Production: 80%
Output 5: Enhancing NARS: 20%

Financing Plan: Unrestricted core. Donor attributed funding from UK. Restricted funding from BMZ/GTZ. Anticipated funding from Belgium for land use planning in Ethiopia.

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, kabuli chickpea, faba bean and pasture, forage and rangeland 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, kabuli chickpea, faba bean and pasture, forage and rangeland 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 or in ecosystem restoration.

Development of approaches to the successful *in situ* conservation of the biodiversity of agriculturally useful plant species within the agricultural landscapes of CWANA.

Indicators: Number of accessions conserved, characterized and documented in the GRU/ICARDA gene bank.
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 or in ecosystem restoration.

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

Milestones:

- 2003: 120 accessions collected in strategic plant collection mission in second CAC country. Acquisition of further 200 unique landrace accessions from CAC collections and the Vavilov Institute (VIR).
The first viability monitoring of ICARDA's long-term collections 50% completed.
- 2004: 120 accessions collected in strategic plant collection mission in third CAC country. Acquisition of further 200 unique landrace accessions from CAC collections and VIR.
The first viability monitoring of ICARDA's long-term collections completed.
- 2005: 120 accessions collected in strategic collection mission in fourth CAC country

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:

- 2003: 350 accessions from CAC countries or VIR characterized and evaluated in partnership with CAC NARS and VIR.
Lentil core collection characterized for agro-morphological traits and by molecular markers.
100 CAC wild relative/landrace materials screened for disease resistance/abiotic stress tolerance.
500 *Vicia* accessions characterized.
- 2004: 350 accessions from CAC countries or VIR characterized and evaluated in partnership with CAC NARS and VIR.
Molecular characterization of wheat landraces from VIR, ICARDA and Australia germplasm collections.
100 CAC wild relatives and landraces screened for disease resistance/abiotic stress tolerance.
500 *Vicia* accessions characterized.
Chickpea core collection characterized for agro-morphological traits and by molecular markers.
Eco-geographical characterization of 5000 bread wheat accessions from VIR, ICARDA and Australia collections completed.
- 2005: Faba bean core collection characterized for agro-morphological traits and by molecular markers.

Output 3: Special purpose collections with multiplied seed for distribution

Indicators: Number of collections and number of accessions.

Milestones:

2003: Durum wheat core collection developed.

Kabuli chickpea core collection developed.

2004: Faba bean core collection developed.

2005: Bread wheat core collection developed.

Output 4: Wheat germplasm with new genes from wild relatives

Indicators: Number of useful traits transferred; number of lines with useful genes introgressed.

Milestones:

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

2004: Identification of introgressions from wild species using molecular markers.

2005: Abiotic stress tolerant germplasm with genes from wild relatives 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:

2003: Tripartite review.

2004: 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 gene banks.

Milestones:

2003-05: One short-term group training course.

Scientists from CAC to visit and work at GRU for short period

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:

2003: Molecular marker data documented in a computerized system.

2004: CD-ROM catalog 'Durum wheat II'.

Database of wheat landraces conserved by VIR, ICARDA and Australia.

2005: *Vicia* catalog published in CD-ROM format.

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:

2003: 100% of incoming and outgoing seed samples tested.

2004: 100% of incoming and outgoing accessions tested.

PCR tools for seed health testing developed.

2005: 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, to utilize germplasm in breeding programs or to use it in eco-system restoration efforts.

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; University of Western 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; VIR; USDA; Agriculture West Australia, Agriculture South Australia.
- Germplasm acquisition from donor institutions: NARS; VIR; other major gene banks.
- 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.
- Gene transfer from the wild progenitors and relatives: University of California, USA.
- *In situ* conservation: IPGRI Global *in situ* conservation project.
- Molecular characterization: Southern Cross University, Australia; University of Birmingham, UK; University of Kyoto, Japan; INRA-ENSAM, France; University of California, Davis, USA; VIR.
- Global Register of Barley GR: IPK, Gatersleben, Germany; USDA; Australian Winter Cereal Collection, Tamworth; other major gene banks.

Cost:

2003: US\$ 2.847 million 2004: US\$ 3.006 million 2005: US\$ 3.126 million

System Linkages:

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

Financing Plan: Unrestricted core funds. Restricted funding from ACIAR, GRDC and USDA for collection and conservation of plant genetic resources of Central Asia and the Caucasus; restricted funding from GDRC supports preservation and utilization of the genetic resources of the Vavilov Institute (VIR); restricted funding from the Global Environment Facility (GEF) supports collaboration with NARS on conservation of agro-biodiversity in the Near East; collaboration with NARS in the Arabian Peninsula supported by the Arab Fund, IFAD and the OPEC Fund; restricted funding from IDRC for studies of biodiversity in Afghanistan. Anticipated restricted funding from BMZ for research on adaptation of genetic resources to climate change.

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:

2003: Digital archive of country-level land use/land cover maps at 1 km resolution established.

2004: Digital archive of improved soil maps for CWANA available.

2005: Digital archive of country-level agroecological zones maps at 1 km resolution 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:

2003: Land suitability assessment for different crops in different parts of CWANA.

2004: Land suitability maps for major crops of CWANA, covering entire region at 1 km resolution.

2005: Methodology for assessing climate change impact in CWANA at 1 km resolution.

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.
Maps of production systems and agroecosystems.*

Milestones:

2003: Soil-landscape framework for CWANA at 1 km resolution completed.

2004: Agroecological zones study of CWANA completed.

2005: Land degradation assessment of CWANA completed.

Agroecosystems study 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:

2003: Guidelines for multi-scale agroecological characterization prepared.

Characterization of the agricultural systems in Syria completed.

2004: Poverty mapping in Syria completed.

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

Indicator: Manual on guidelines for participatory agroecological characterization

Milestones:

2003: Publication covering characterization procedures for dryland areas.

Output 6: Strengthening of NARS capacity in agroecological characterization.

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

Milestones:

2003-2005: Training through joint research activities with several NARS.

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 Iraq, Kazakstan, Morocco, Syria, and Uzbekistan.
- Agroclimatology: USDA-ARS, Lubbock, USA
- Remote sensing: Center for Earth Observations, Yale University
- Poverty Mapping: FAO, CIAT
- Participatory agroecological characterization: Katholieke Universiteit Leuven, Belgium; North African NARS partners of the Mashreq-Maghreb Project.
- Characterization of agricultural systems and training: CIHEAM, Zaragoza

Cost:

2003: US\$ 0.721 million 2004: US\$ 0.762 million 2005: US\$ 0.792 million

System Linkages:

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

Financing Plan: Unrestricted core. Activities in the Arabian Peninsula supported by the Arab Fund, IFAD and the OPEC Fund; collaborative activities with CIHEAM supported by CIHEAM; collaborative activities with Yale University supported by USAID Linkage Funds. One Junior Professional Officer supported by Belgium. One Post-doctoral Fellow supported by USDA. Anticipated funding from FAO for poverty mapping in Syria; anticipated funding from Belgium for agroecological characterization in Ethiopia.

Project 4.1: Socioeconomics of Natural Resources Management in Dry Areas

Goal: Conservation and sustainable use of the natural resource base for improving the welfare of people both in current and future generations.

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:

2003 Economic analysis of water management options in Kyrgyzstan completed.

2004: Analysis of social and economic benefits of marginal water use in agriculture in Kazakhstan (MSc. thesis) completed.

Economic analysis of the land use options and conservation practices of mountain terraces in Yemen completed.

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:

2003: Bio-economic modeling of the land use options in the Khanasser valley integrated research site in Syria completed.

Economic modeling of micro-dams in the Barani area of Punjab province, Pakistan, completed.

2004: Decision support tool for land use developed.

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:

2003: Characterization of resource users perceptions and attitudes towards resource use, associated institutional factors and natural resource conservation technologies completed in Barani area of Pakistan.

2004: Characterization of resource users perceptions and attitudes towards resource use, associated institutional factors and natural resource conservation technologies completed in Kyrgyzstan.

2005: Characterization of resource users perceptions and attitudes towards resource use, associated institutional factors and natural resource conservation technologies completed in Egypt.

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:

2003: Farmers' participation in testing new income generating and land conserving practices in mountains of Yemen evaluated.

Guidelines on participatory NRM research developed and provided to NARS.

2004: Results of participatory NRM research transferred to all stakeholders (farmers, researchers, extensionists, NGOs and policy decision-makers) through workshops and seminars. Adoption and impact of improved water management technology in selected CWANA countries assessed.

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:

Annually: On-the-job individual training and training workshops.

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 Developement 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: University of Aleppo. Yemen: Aden University; Agriculture Research and Extension Authority. Pakistan: Water Resources Research Institute, Authority of Barani Agricultural Development (ABAD). NARS of Central Asia.
- Christian Albrecht University, Kiel, Germany; Systemwide Programme on Participatory Research and Gender Analysis (SP-PRGA) convened by CIAT.

Cost

2003: US\$ 0.518 million 2004: US\$ 0.549 million 2005: US\$ 0.571 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; cooperation in Pakistan supported by Barani Village Development Project; restricted program funding from BMZ. Anticipated funding from Asian Development Bank for activities in Central Asia.

Project 4.2: Socioeconomics of Agricultural Production Systems in Dry Areas

Goal: Sustainable improvement of the welfare of poor people in dry areas through the identification of problems and the development, transfer and adoption of viable options.

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 by ICARDA and NARS researchers in technology development and evaluation 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 and their production systems characterized.

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

Milestones:

2003: Production problem diagnosis and characterization of farm and households typologies in three watersheds in Yemen completed.

2004: Production problem diagnosis and characterization of farm and households typologies of Punjab province, Pakistan, completed.
Technological and management options described for the Khanasser Integrated Research Site in Syria.

Output 2: Rural households and their livelihood strategies characterized and the circumstances that constrain or enhance the adoption of technologies and management practices identified.

Indicator: Household studies

Milestones:

2003: Study of the effects of socio-economic factors on the incidence of Lathyrism in Ethiopia completed.

Determinants of rural poverty in the dry areas of WANA (including western Anatolian region of Turkey, Khanasser valley of Syria, mountains of Yemen) analyzed.

Analysis of the socio-economic factors affecting lysine deficiency in rural areas of Syria completed.

2004: Study of determinants of rural poverty in selected cases in the dry areas of WANA completed.
Analysis of the gender dimension of rural poverty by disaggregating rural livelihood systems in selected area in the CWANA region completed.
Analysis of the spatial distribution of poverty (poverty mapping) in Syria completed.

Output 3: Quality of farmer participation in agricultural research improved.

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:

2003: Guidelines and methods for farmer participation in research developed.
Analysis of farmers' decisions on land use changes using five years monitoring data in different agro-ecologies in Egypt and the effects of these changes on the environment.

Output 4: Documented adoption, and feedback of user evaluations into the technology generation process.

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

Milestones:

2004: Adoption study on lentils in Ethiopia conducted.

2005: Studies of adoption of technologies in Egypt, Pakistan, and Central Asia completed.

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:

2003: An *ex ante* impact study of one technology completed in one agro-ecology.

An *ex ante* impact study of the IPM of sunn pest of wheat in Iran, Syria and Turkey completed.

2005: An *ex ante* impact study of chickpeas in Turkey completed.

Output 6: Evaluation of the economics of livestock production in the low rainfall areas of CWANA.

Indicators: Development of a database of the livestock surveys and experiments conducted by ICARDA

—Report of the preliminary analyses are conducted and knowledge gaps

—Synthesis report on the economics of livestock production

Milestones:

2003: Analysis of livestock marketing channels in the changing institutional and policy environment of Central Asia completed.

Analysis of the economics of livestock production in the changing agricultural systems in WANA published.

Output 7: 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:

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

Contribution to training courses organized by other projects.

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 CWANA.

Cost

2003: US\$ 1.521 million

2004: US\$ 1.609 million

2005: US\$ 1.673 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 SPIA (formerly IAEG).

Financing Plan: Unrestricted core funds. Donor attributed funding from DFID, UK; studies on the adoption and impact of specific technologies supported under the respective projects; research on nutrition financed by International Nutrition Foundation, USA; restricted program funding from BMZ; activities in Egypt funded by Egypt; cooperation in Pakistan supported by Barani Village Development Project. Anticipated funding from IFAD and Asian Development Bank for activities in Central Asia.

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.

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

Purpose: Influence reforms of national and regional policies and institutions to promote agricultural investments 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 six 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 eight monographs analyzing property rights policies and their effects on land improvements, productivity, and incomes in the low rainfall areas of WANA.

Milestones:

2003: Published book on Property rights

2004: Synthesis paper on the effects of property rights on biodiversity conservation and land degradation in selected CWANA countries

2005: Paper on the development of land markets in selected CWANA countries

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

Indicators: Three studies identifying the feasibility of policy, property rights and technological options in selected communities in Morocco, Tunisia and Syria

Five 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:

2003: Community modeling methodology documented and developed into a user-friendly framework. Training provided on the community approach.

2004: Training provided on community modeling.

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

Indicator: 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:

2003: Chapters published in the property rights book.

Review paper on resource tenure and dynamics for the World Bank.

2004: Pastoral organizations Conflict management in the dry areas.

Monographs on rangeland management in Algeria, Iraq, Lebanon and Libya.

Monograph on rangeland management of selected countries in Central Asia

2005: Book on institutional options and rangeland development in CWANA countries

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:

2003: Published report, journal articles and methodology paper on evaluating the role of women in household livelihood strategies.

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

Indicators: Briefs on commodity and system production trends in West Asia and North Africa

Milestones:

2003: Synthesis report on commodity and system trends

Duration: 2 years.

Users: The primary clientele are policy makers in the target countries of CWANA; 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 Mograne, 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; Land Tenure Center, University of Wisconsin-Madison, USA.

Cost:

2003: US\$ 0.346 million 2004: US\$ 0.368 million 2005: US\$ 0.383 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: Unrestricted core funds. Joint appointment with IFPRI of senior scientist. Anticipated funding from IFAD and the Arab Fund for collaborative activities with NARS in WANA.

Project 5.1: Strengthening National Seed Systems in Central and 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.
Accelerated introduction of new varieties from NARS*

Purpose: Strengthened capacity of formal and informal seed systems of CWANA 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:

2003: Annual training course on Variety Management, Seed Production and Seed Program Organization, Seed Enterprise Development, Marketing, Preparation of Business Plans.
Specialized training courses based on requests from specific national programs.

2004: Annual training course on Seed Enterprise Development, Marketing, Preparation of Business Plans.
Specialized training courses based on requests from specific national programs.

2005: Annual training course on Seed Enterprise Development, Marketing, Preparation of Business Plans.
Specialized training courses based on requests from specific national programs.

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 Network Newsletter, variety catalogues and other working documents using material compiled by member countries and widely distributed in the region.
Establishment and operation of national Seed Associations with private sector participation.
Integration of seed system in the region based on common certification scheme and regulations*

Milestones:

2003: Draft seed legislation circulated to governments for comment.
4th Network meeting to review progress of activities.

2004: One National Seed Association initiated in the region and options for establishing regional associations formulated.

2005: Seed systems in the region integrated on the basis of a common certification scheme and regulations.
WANA Seed Network transformed into a Regional Seed 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:

- 2003: Articles on forage seed economics study in NE Syria published.
Economic input into Afghanistan seed project provided.
Technical input into other research-development projects in the region provided.
Technical input into annual HQ courses and in-country training courses.
- 2004: Articles on economics studies prepared and published.
Technical input into other research-development projects in the region provided.
Technical input into annual HQ courses and in-country training courses.
A model seed systems project for forages developed in collaboration with the Syrian General Organization for Seed Multiplication.
Review of recent seed policy changes published.
- 2005: Articles on economics studies prepared and published.
Experiences from model forage seed system project in NE Syria applied to other countries.
Technical input into other research-development projects in the region provided.
Technical input into annual HQ and in-country training courses.

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:

- 2003: Information from informal seed sector studies and initiatives published
Seed systems component of the barley participatory breeding project. monitored
The establishment of model alternative seed delivery systems in specific countries explored on the basis of information and knowledge from various studies and projects.
- 2004: Information from informal seed sector studies and initiatives published
The establishment of model alternative seed delivery systems in specific countries explored on the basis of information and knowledge from various studies and projects
- 2005: Information from informal seed sector studies and initiatives published
The establishment of model alternative seed delivery systems in specific countries explored on the basis of information and knowledge from various studies and projects

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:

- 2003: Technical input in the production of foundation seed provided as part of the restoration of seed centers in Afghanistan.
Technical input in seed systems development in Afghanistan.
Support to other disaster affected areas provided where necessary.
Effect of disasters on local seed systems reviewed.
Practical recommendations for seed relief during emergencies prepared.
- 2004: Support to rebuilding Afghanistan's seed system continued.
Support to other disaster affected areas provided.
Information from seed security studies and initiatives published
- 2005: Support to rebuilding Afghanistan's seed system continued.
Support to other disaster affected area provided.
Information from seed security studies published.

Annex

Research Project Portfolio

Theme 1: Germplasm Enhancement

- Project 1.1 Barley Germplasm Improvement for Increased Productivity and Yield Stability
- 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 Highlands and Cold Winter Areas of Central and 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 Central and West Asia and North Africa

Theme 5: Institutional Strengthening

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

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:

- 2003: Information from research projects published.
Research findings applied in seed systems.
- 2004: Information from research projects published.
Research findings applied in seed systems.
- 2005: Information from research projects published.
Research findings applied in seed systems.

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:

- 2003: 40 tons quality seed provided to meet requests by ICARDA programs and NARS.
Technical backstopping in further multiplication of foundation seed supplied during 2002 in Afghanistan provided.
Processing, storage and testing services provided for 200 tons of seed produced by ICARDA.
SeedMan database system made operational.
- 2004: 40 tons quality seed provided to meet requests by ICARDA programs and NARS.
Processing, storage and testing services provided for 200 tons of seed produced by ICARDA.
- 2005: 40 tons quality seed provided to meet requests by ICARDA programs and NARS.
Processing, storage and testing services provided for 200 tons of seed produced by ICARDA.

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

2003: US\$ 5.368 million 2004: US\$ 1.764 million 2005: US\$ 1.835 million

System Linkages

Output 3: Sustainable Production: 35%
Output 4: Policy: 45%
Output 5: Enhancing NARS: 20%

Financing Plan: Unrestricted core funds. Anticipated continued funding from USAID and IDRC for seed system development in Afghanistan; restricted funding from IDRC for studies of local seed systems in Afghanistan. Anticipated funding for collaboration with Central Asia and the Caucasus; anticipated funding from Japan for strengthening seed production systems in Afghanistan; support is currently being sought for the WANA Seed Network and training activities.