SEED UNIT
ANNUAL REPORT
2003

International Center for Agricultural Research in the Dry Areas

The primary objective of this report is to communicate the research results speedily to fellow scientists, particularly those within the Central and West Asia and North Africa (CWANA) region, with whom ICARDA has close collaboration. Therefore, the report was not subjected to rigorous editing. A CD-ROM version of this report is also available and can be requested, free of charge, from the Head, Seed Unit, ICARDA.

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About ICARDA and the CGIAR

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is governed by an independent Board of Trustees. Based in Aleppo, Syria, it is one of 15 centers supported by the Consultative Group on International Agricultural Research (CGIAR).

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

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

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

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

The World Bank, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), and the International Fund for Agricultural Development (IFAD) are cosponsors of the CGIAR. The World Bank provides the CGIAR System with a Secretariat in Washington, DC. A Science Council, with its Secretariat at FAO in Rome, assists the System in the development of its research program.

1. INTRODUCTION

The 2003 Annual Report of the Seed Unit is prepared in a slightly different format following the Logframe developed for the Medium Term Plan (MTP).

The primary objective of the Seed Unit of ICARDA (MTP project 5.1) is to strengthen national seed systems in Central and West Asia and North Africa (CWANA) with an overall goal to increase productivity and food security through improved seed security and access to quality seed. The actual purpose of the project is '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'.

To achieve this objective, 7 outputs are pursued. Output 1 aims at enhanced knowledge and expertise in national seed programs (Section 2 of this Annual Report), while Output 2 supports a regional seed network implemented by the national seed programs in the region. One of the important aspects of the network is harmonization of seed regulations to facilitate regional trade. The activities of the network are reported in Section 3.

Improving the economic efficiency of seed delivery systems is the focus of Output 3 (Section 4). Output 4 is aimed at improving the performance and integration of the informal seed sector as part of a national seed delivery system (Section 5).

During 2003, a major part of the work of the Seed Unit was directed towards seed security (Output 5) and the activities are reported in Section 6 of this Annual Report. It aims at enhancing coping mechanisms in disaster prone countries through knowledge disseminated and regional cooperation in seed security.

Finally, Output 6 (Section 7) is aiming at carrying out relevant applied research into practical seed-related issues and Output 7 (Section 8) helps to make available adapted germplasm for national programs.

2. HUMAN RESOURCES DEVELOPMENT FOR THE SEED SECTOR

Under Output 1 'Enhanced knowledge and expertise in national seed programs' the MTP Logframe lists the following general capacity building activities: (a) Organize training courses and meetings on relevant topics requested by national programs, (b) Organize an annual training course on variety management, seed

production and seed program management, (c) Identify suitable postgraduate research projects and students, and (d) Launch new training initiatives.

Almost all of the planned training courses have been conducted. The annual headquarters course on Variety Management was successfully organized, while four in-country seed-related training courses were held in Afghanistan (a seed quality assurance course, a seed health testing course, a course to help farmers take up seed production as a business, and a training for survey enumerators to carry out field surveys and focus group discussion under the IDRC project). In Lebanon, an in-country course was organized to help farmers produce quality seed of local landraces within the agrobiodiversity conservation project. A special Group Training on Seed Processing and Storage was organized at ICARDA for participants from the GAP region of Turkey.

During 2003, eight training courses/workshops were conducted with a total of 156 participants from seven countries (Table 1).

Table 1: Seed Unit training activities in 2003.

Type of courses	Course title	Beneficiary	Funding source		Total no. of participants
			Core	Special project	
In-country	Seed Quality Assurance	Afghanistan		13	13
	Seed Health Testing	Afghanistan		11	11
	Seed Production Technology and Enterprise Management	Afghanistan		20	20
	Enumerators for Household Surveys	Afghanistan		16	16
	Quality Seed Production for Farmers	Lebanon		56	56
Headquarters	Seed Processing and Storage	Turkey	6	6	
		Syria	2		2
	Variety Management	Afghanistan		4	4
		Algeria	1		1
		Ethiopia	1		1
		Jordan	1		1
		Lebanon	1		1
		Syria	3		3
		Turkey			2
Workshop	Quality Assurance in Seed Testing	10 countries		21	21
Total			9	147	156

New initiatives were undertaken concerning the development of a curriculum for capacity building in the area of Seed Enterprise Development and Management. The regional workshops on Seed Quality Assurance (Egypt) and the national workshop on Plant Variety Protection (Iran) are another aspect of the capacity building activities carried out under MTP Project 5.1.

In-Country Seed Courses

Seed Quality Assurance in Seed Testing and Seed Health Testing, Badam Bagh, Kabul, Afghanistan: 5-10 July 2003

The courses were organized as part of the action plan of the Future Harvest Consortium to Rebuild Agriculture in Afghanistan (FHCRAA). The work plan of FHCRAA included the installation of seed testing stations for quality control and quarantine purposes. Complete seed testing stations have been installed in Kabul and Jalalabad. The course was organized to provide the future staff of these laboratories with the managerial and technical skills required for efficient and effective execution of their tasks. The two courses attracted 24 participants from different provinces of Afghanistan. The course program covered introductions and comprehensive practical sessions in seed testing for quality control and quarantine purposes. All relevant equipment was operated to demonstrate seed testing and seed health testing activities. After general introductions, participants formed groups according to their background and future assignment into seed health and seed testing. Instructions and practical sessions in both groups were based on the International Seed Testing Association (ISTA) procedures. A set of these guidelines was made available to each of the stations for future reference and daily use in the laboratory.

Seed Production Technology and Enterprise Management, Kunduz, Afghanistan: 24-26 June 2003

According to the needs assessment survey, seed and crop improvement are considered the key elements for reestablishing the productive capacity in the short-term and to stabilize food production and rural livelihoods in the long-term in Afghanistan. Within this context ICARDA is assisting the Afghan farmers to produce seed at a local level through the establishment of community based Village Seed Enterprises (VSE). The purpose of the VSE scheme is to strengthen the linkage between conventional/participatory plant breeding and the seed supply systems, through formal and informal channels. A training course on Seed Production Technology and Enterprise Management was organized from 24-26 June 2003 in Kunduz province aimed at identifying potential farmer seed producers and providing them with technical knowledge and information on the management of small

seed enterprises at village level. The course was organized under the umbrella of the FHCRAA supported by USAID project for Afghanistan. A total of 20 farmers from major crop production districts of Baghlan, Kunduz, Kapisa, Nangarhar and Takhar provinces participated in the course. All participants were either farmer representatives or community leaders. The course was practical-oriented and focused on simple and illustrative guidelines relevant to the needs of small-scale farmers. The training course was structured along three main themes and included introductory lectures on seed technology and enterprise development, practical sessions/exercises and group discussions. The group discussions focused on how to establish and operate viable and sustainable seed enterprises at the local level through active involvement of farmers. The practical sessions provided the participants an opportunity to relate discussions in the course with normal practical activities on their farms. All lectures and practical sessions generated interesting discussions and could assist in formulating future courses.

One of the major achievements of the course was the opportunity of bringing together key community leaders and convincing them of the importance of Village Seed Enterprises. At the end of the training sessions, the farmers were divided into two working groups to deliberate possible steps in the establishment of viable village seed enterprises and other related issues. The two groups presented the outcomes of their discussions during which the following key issues were highlighted:

- Bringing together key community leaders and convincing them of the importance of Village Seed Enterprises was considered by all a major achievement of the course.
- The purpose of establishing VSE is not for providing long-term funding, but providing start-up capital for those farmers willing to undertake local level seed production and marketing as sustainable businesses. This was repeatedly emphasized and clarified during the group discussions.
- During group sessions, the farmers showed keen interest and desire in establishing their own Village Seed Enterprises that will be owned and managed by groups (private group cooperatives) of members rather than by individuals. A group framework would be more credible to outsiders and will provide the farmers a better opportunity to attract funding or credit under collective responsibility.
- The groups operate as independent private cooperatives, the formation of which appears not to be subject to legal impediments in Afghanistan. As independent organizations, there should be no interference by the public sector or by NGOs. The enterprises will operate and pay state taxes and dues as required.
- The membership of each unit would comprise a minimum of 10 farmers, who will each invest own capital between AFS 10,000 to 20,000 (US$ 200 to US$

400), which will be added to the ICARDA contribution to form the initial capital base of the enterprises.
- Under the guidance of ICARDA, each enterprise will formulate guidelines, rules, regulations and code of conduct for its membership and operations. Each enterprise will establish an office and elect a leader who will be the authorized key representative of the group.
- In consultation with and under the guidance of ICARDA, each enterprise will develop a business plan including a detailed work plan for its operations. A monitoring and evaluation system will be established.
- ICARDA will provide support in appropriate recording of all enterprise activities, particularly their financial performance and status.
- The initial crop portfolio will be seed of wheat and rice, with a possibility to diversify into food legumes in future.
- The main source of revenue will be the sale of seed and related outputs. Donations in cash or kind (e.g. inputs) from interested NGOs, etc. will be graciously accepted and added to the enterprise's capital base.
- The enterprises shall seek to establish a good reputation through fair dealings, while seeking to enhance profitability.
- The enterprises shall operate a revolving fund for future replacement of fixed assets at the end of their economic life.

Enumerators for Household Survey and Focus Group Discussions, Kunduz, Afghanistan: 24–26 June, 2003

Under the IDRC-supported project on "Strengthening Seed Systems for Food Security in Afghanistan", the Seed Unit conducted a training program for field teams that carried out household sample surveys and focus group discussions in northern Afghanistan as part of the seed system diagnosis component of the project. For participation in the training and subsequent implementation of the household survey and focus group discussions, the Afghan Survey Unit (ASU) had put together five teams, each comprising one supervisor and two enumerators and one field coordinator to supervise all five teams. The purpose of this training was to make the field staff thoroughly familiar with the questionnaires and discussion guides, and relevant techniques including methods of asking questions and recording of responses. The questionnaires and discussion guides were pre-tested in three locations within Madrase village and with separate groups of men and women in Qaram Quli village of Aliabad district.

Participants for the training comprised three teams, each consisting of one supervisor and two enumerators who would which will conduct the household surveys. There were two groups of similar composition, which carried out the focus group discussions. In addition, there was a field coordinator, who supervised all five

Trainers and teams for household survey and focus group discussions in a joint session

teams. The focus group teams included two females who conducted focus group discussions for female household members.

The training program focused on a stepwise review of all questions so that the field teams became thoroughly familiar with the questionnaires and relevant techniques including methods of asking questions and proper recording of responses. The questionnaires were pre-tested in three locations within the Madrase village community of Aliabab district.

Quality Seed Production, Tel-Amara, Lebanon: 28-29 May 2003

The Fertile Crescent (which includes Jordan, Lebanon, Palestine, and Syria) is considered a center of crop domestication and dryland agrobiodiversity. Some farmers still continue growing local landraces from ancient times and as a result ancestors of cultivated crops and their wild relatives are still found in the fields. ICARDA is implementing an agrobiodiversity project in partnership with NARS from four countries to promote conservation and sustainable use of dryland agrobiodiversity with the participation of local communities through formal (*ex-situ*) and informal (*in-situ*) approaches. Seed plays a key role in the maintenance of agrobiodiversity. The improvement of seed quality at farm level appears to be very important in

Training course in Lebanon

in-situ conservation approaches. To address these issues, the Seed Unit of ICARDA, the Lebanese Agriculture Research Institute (LARI) and the Lebanese Component of the GEF/UNDP-funded Agro-biodiversity project jointly organized a practical-oriented training program for pilot farmers, NGOs and extension workers in Lebanon (28-29 May 2003). The course was held at LARI in Tel Amara. The course program covered issues of seed program components and functions, crop improvement methods, the role of farmers in the sustainable use of local cultivars, crop management practices in seed production, simplified methods for seed quality assurance, field visits and demonstrations of seed cleaning and packaging. The training course attracted 56 participants from agriculture institutions (19 pilot farmers, six technical staff from LARI, 14 participants from the Technical Schools of Agriculture in AL Khayam and Nabatieh and 17 from NGOs).

The participation of farmers, NGO staff, plant breeders, agronomists, seed specialists, extension and agricultural education specialists under one working environment to discuss the role of quality seed supply in technology transfer and adoption, provided unique opportunities for all participants. The first day interaction helped the participants to better understand the field sessions on the second day.

Regional Training at ICARDA Headquarters

Variety Management and Seed Quality Assurance, ICARDA, Aleppo, Syria: 27 April – 8 May 2003

The course was designed and organized in response to the training requests from the national seed programs in the ICARDA mandate region in different disciplines of seed science and technology. The course program included short presentations, demonstrations, group discussions, and technical visits to a wide range of seed-related activities at ICARDA and outside. The course served as a forum of discussion and exchange of ideas for participants with variable levels of experience coming from seed programs that are at different levels of development and complexity. These types of refresher courses conducted under direct supervision and guidance of international seed experts are good forums for dialogue between the more- and the less-developed national seed programs. These courses provide the participants with good opportunities for exchange of expertise and exposure to new trends in seed program development and diversification.

Thirteen participants from seven countries attended the course. The participants were involved in a wide range of technical and managerial activities. The selection of participants was made with the aim of covering the real needs for human resources development and the variability across and within national seed supply

systems in the region. Seed production officers, field inspectors, heads of seed testing stations, teachers from agriculture colleges, NGOs and relief workers participated in this course.

The course was an attempt to cover the variations in the needs for assistance in human resources development in the seed sector expressed by many national seed programs in the region in an efficient and effective manner. The approach proved to be efficient and successful in addressing the issue of variation in national program needs for training.

Seed Processing and Storage, ICARDA, Aleppo, Syria: 1–12 June 2003
Within the framework of cooperation with the Southern Anatolia Development Project (GAP), Turkey, ICARDA's Seed Unit organized a short-term training course on seed processing and storage for six participants from Turkey. Two participants from Syria also attended the course. The course was organized for two weeks from 1-12 June 2003.

Lack of high quality seed is a major constraint for adoption of improved varieties by farmers. To improve the supply of quality seed in the project area, GAP is mobilizing farmers' unions, state farms, agriculture colleges and agriculture research organizations to actively participate in these efforts. The Seed Unit of ICARDA is providing technical backstopping for GAP in quality seed supply issues.

Moreover, with technical backstopping from the Seed Unit of ICARDA, the University of Dicle in Diyarbakir is in the process of establishing a Seed Center to provide academic education, training, research and services. The first phase in the development of this Seed Center was to start a small seed multiplication program using university-owned land and the establishment of a small seed processing plant. The course provided staff with the necessary skills to operate and manage the post harvest facilities in the seed center. Three staff members from Dicle University, two staff members from Haran University, a member of the GAP pioneer farmers and two technicians from the General Organization for Seed Multiplication in Syria (GOSM) participated in the course.

Training Workshops

Regional Quality Assurance in Seed Testing Workshop, Cairo, Egypt: 30 November - 4 December 2003
Standard seed testing procedures and certificates, which are recognized from one country to another, are important tools to facilitate regional and international trade. In 1995, the International Seed Testing Association formally adopted ISO 9001 guidelines to reflect developments in the field of product inspection and

certification. In comparison to the traditional quality control approach, the new approach of Quality Assurance in Seed Testing puts more emphasis on the management of the process instead of on the product itself. The WANA Seed Network joined hands with the Secretariat of ISTA, the Central Administration for Seed Testing and Certification (CASC) in Egypt, GTZ and FAO to organize a Regional Workshop on Quality Assurance in Seed Testing. The main objectives of the workshop were:

- To inform and update participants on the new trends in quality control.
- To discuss the significance of quality assurance in seed testing for regional and international seed trade.
- To describe and demonstrate the procedure for (re)accreditation (including practical exercises).
- To create a forum for discussion and exchange of information on quality assurance in seed testing.

The workshop was held at the Giza Seed Testing Station of CASC in Cairo, Egypt and attracted 21 key staff members from 10 countries in the region (Afghanistan, Algeria, Egypt, Ethiopia, Jordan, Morocco Sudan, Syria, Turkey and Yemen). The status of (re)accreditation to ISTA in the participating countries is as follows:

- Egypt, Morocco and Turkey have successfully accomplished the task of ISTA reaccreditation and the national laboratories have acquired the skills and expertise to assist other laboratories in the region.
- Algeria, Sudan and Yemen expressed their interest in ISTA (re)accreditation (establishing a quality assurance system).
- Afghanistan, Ethiopia, Jordan and Syria are interested in establishing a quality assurance system (but not necessarily ISTA reaccreditation) in order to improve efficiency and effectiveness only.

Workshops

National Plant Variety Protection Workshop, Karaj, Iran: 29 - 30 November 2003, Iran

In October 2002, the Seed Unit of ICARDA in collaboration with Iran/ICARDA Project and the Seed and Plant Improvement Institute organized the First Iran/ICARDA National Seed Seminar. Among the key recommendations was the establishment of an independent seed certification institute and to consider the implementation of plant variety protection. Within this context, it was planned to organize a national seminar on plant variety protection in 2003 in collaboration with SPII and the UPOV office to create awareness among the national stakeholders in Iran. Upon the request of Iran, UPOV agreed to develop a joint program for a national seminar on PVP with the MoJA and ICARDA.

At the same time, the Government of Iran sanctioned a Seed Law and established a fully independent Plant Variety Registration and Certification Institute with an overall mandate for the implementation of the plant variety protection, seed and planting materials certification and adaptive research in seed technology. The seminar was organized under the newly formed institute which took over the responsibility from the SPII.

The seminar was divided into four sessions. The first session of the seminar comprised of introductory lectures on plant variety protection under UPOV Convention and was intended to clarify the relationship between the UPOV Convention and other relevant international agreements on crop genetic resources conservation (CBD and IUGRFA (FAO)) and the protection of intellectual property rights of new plant varieties (WTO/TRIPS). The second session was presentations on crop improvement of agricultural, horticultural and industrial crops in Iran, followed by the presentation from ICARDA. The third session focused on technical and administrative issues including DUS test procedures, examination of varieties for granting rights, arrangements for testing and the organization of PVP offices at national/regional levels. The last session was a panel discussion on clarifying outstanding issues raised during the seminar on the effects of PVP on genetic resources and intellectual property rights from national and international perspectives.

About 100 participants attended the seminar from relevant institutions including senior policy makers from the Ministry of Jihad-e-Agriculture, Directors of Agricultural Research Centers (over 30), senior staff of the newly established institute and other stakeholders. Moreover, two resource persons from UPOV (Vice Secretary-General and Senior Councilor) and two from ICARDA attended the seminar and made the presentations. The seminar was an ‘eye opener’ for the policy makers and agricultural researchers and plant breeders who presently work for the public sector and receive all their funding for crop improvement from the government. From the presentations and subsequent discussions it appeared that there was consensus and understanding among the participants, but continuous dialogue will be required to convince the policy makers about the importance of PVP.

Seed Congress, Ankara, Turkey: 18 September 2003

A one-day International Seed Congress was held on 18 September 2003 in Ankara, Turkey. The Congress was organized by the Turkish Seed Industry Association and attended by over one hundred participants from Turkey, France (GNIS), Spain (Eurosemillas) and the Netherlands (NAK) as well as by national,

regional and international organizations such as ISF (International Seed Federation), ICARDA, CIMMYT, etc. The meeting was part of a continuous dialogue among the stakeholders of the national seed industry aimed at forging stronger partnership between the public and private sector, and to solicit policy and regulatory support by the Government.

The meeting had three sessions where national and international experts made presentations. The first session dealt with opportunities and challenges of international seed trade aimed at informing the seed business community in Turkey. The organization and development of the seed industry in selected European countries were also presented to share experiences. The second session focused on national policy and regulatory framework of the Turkish seed industry. Presentations were made on common agricultural and seed policy, market regulation and variety protection, and the support available for business development from the relevant departments from the Ministry of Agriculture and Rural Affairs and the local technology development foundation. The third session was a panel discussion by national policy makers and international experts on the future of the Turkish seed industry.

ICARDA was invited to attend and contribute to this dialogue particularly in areas of private seed sector development. The meeting provided an opportunity to interact with colleagues from Turkey and international organizations. The Turkish Seed Industry Association is a partner for developing national seed associations in member countries of the WANA Seed Network. Discussion is already under way (if funding becomes available) the possibility of organizing a regional seed congress in Istanbul in 2004 to bring together the stakeholders of the seed industry in the CWANA region. Turkey has a dynamic emerging private seed sector and domestic seed industry valued at $250 million ($110 million in vegetables) and seed export worth $22 million.

Expert consultation 'Quality Declared Seed', FAO, Rome: 5-7 May 2003
In 1993, FAO's Seed and Plant Genetic Resources Service (AGPS) published a document 'Quality Declared Seed - Technical Guidelines for Standards and Procedures'. This document was developed to improve the quality of seed being offered for sale in countries where human and physical resources for quality control are limited. The 'Quality Declared Seed' system (QDS) makes use of resources already available in seed production organizations and was designed to provide quality control, which is less demanding on government resources than comprehensive seed certification, but is adequate to provide good quality seed for farmers.

The objective of the meeting was to review and update this publication in the light of the changes that have taken place with regard to seed industry developments in developing countries. A panel of experts drawn from different parts of the world reviewed the document (and other related documents) and made comments, suggestions and proposals for updating. These written contributions were further discussed in the meeting at FAO headquarters (5-7 May 2003).

The new edition of 'Quality Declared Seed' will be published in the near future and the most important issues to be addressed are:

- Since the publication of the first edition of the QDS guidelines, there has been increased recognition of the value of genetic diversity and the role of the informal seed system (Global Plan of Action for the sustainable PGRFA, Convention on Biological Diversity; International Treaty on PGRFA). In particular it is recognized that local/traditional/farmers' varieties may offer benefits to farmers. The first edition of the QDS system mainly addressed the production of seed of varieties developed through conventional plant breeding approaches. Local varieties were mentioned, but these varieties had difficulties to be eligible for the production of QDS seed, because of the very strict requirements for testing (for Value for Cultivation and Use and for Distinctness, Uniformity and Stability) and varietal purity.
- In the new edition of QDS not only landraces, but also 'varieties' developed through participatory plant breeding approaches can be eligible for the production of QDS seed. The requirements for formal varieties remain similar, but testing and varietal purity requirements have now been relaxed for local varieties and 'varieties' developed through PPB. This is the most important change that was made to the system.
- A large number of new crops (eligible for the production of QDS) have been added. For ICARDA, the addition of barley was important..
- GMOs have been discussed, but it was decided that – at this stage – there was no need to address this issue, since its relevance to seed production is rather limited and mainly concerns safety measures, isolation (in time and distance), zoning, etc.
- In terms of technical issues, the maximum field size for field inspection has been reduced for a large number of crops (often from 50 ha to 10 ha).

International Teaching

Participation in International Seed Course: The Seed Unit has been a regular contributor to the course on Seed Production and Seed Technology organized for three months by the International Agricultural Center (IAC), Wageningen, the Netherlands. The course provides participants with the broader knowledge and

skills to effectively manage national seed programs in their respective countries. During 2002, the Head of the Seed Unit participated in the course for one week as resource person providing lectures on seed enterprise development and business planning and management. Participants come from developing countries of Africa, Asia and South America.

3. WANA REGIONAL SEED NETWORK

From the outset, ICARDA has recognized the link between crop improvement and the national seed industries which help in diffusing varieties to farmers to realize the impacts of agricultural research. The WANA Seed Network was established in 1992, and now has 19 member countries within the region. It is also linked to 11 regional or international organizations dealing with agricultural and/or seed sector development. The Network, through its member countries, undertakes various initiatives to develop a common platform for the integration of national seed systems and thereby promote regional seed trade. These activities are focused on the following key areas:

1. Collection and dissemination of information through technical publications, review of national seed programs and a regular newsletter
2. Harmonization of technical procedures relating to seed production and quality control
3. Harmonization of policy and regulatory issues relevant to varieties and seeds
4. Linkage with regional and international organizations working on seeds and development

The main objective of the Network is to enhance cooperation, exchange of information and provide a mechanism for sharing experience, expertise and resources. One important function is to act as a catalyst to promote harmonization for the development of a strong and dynamic seed industry within the region.

Output 2 of MTP 5.1 supports the operations of this regional WANA Seed Network. This network is implemented by member countries and aims at stimulating regional trade within the region and beyond. Harmonization of seed regulations and the establishment and operation of national seed associations are important aspects.

The Network publishes: (a) a bi-annual newsletter (Seed Info), (b) a Seed Industry Directory, (c) Catalogues of Seed and Field Standard and Regional Varieties, and (d) documents comparing national seed policies, quality control procedures, import/export regulations, etc. in the region.

Harmonization Initiatives

The Regional Workshop on Review of National Seed Programs and Regulations in Central and West Asia Region was held on 2-3 November 2002 in Karaj, Iran. The meeting was attended by policy makers and senior managers from Afghanistan, Azerbaijan, Iran, Iraq, Lebanon, Kazakhstan, Kyrgzstan, Pakistan, Tajikistan, Turkmenistan, Turkey and Uzbekistan. The workshop participants endorsed regional harmonization and prioritized feasible policy and regulatory reforms at national and regional levels and made commitments to initiate the process in their respective countries. Each participant has agreed to serve as national resource person to undertake an extensive review and needs assessment of his respective national seed program. The WANA Seed Network Secretariat (in consultation with FAO) has developed a comprehensive guideline to review national policies, laws and regulations and technical procedures for varieties and seeds.

The guidelines were distributed to focal persons in Afghanistan, Iran, Iraq, Pakistan, and Turkey. Moreover, the guidelines were translated into Russian and distributed to focal persons in Azerbaijan, Kazakhstan, Kyrgzstan, Tajikistan, Turkmenistan and Uzbekistan. The focal persons are expected to develop a framework to undertake an extensive review and needs assessment of rules and regulations in each country relevant, but not limited to, variety release and registration, seed quality control and certification, international seed trade, phytosanitary regulations, biosafety regulations and plant variety protection in the country. In each country the study will be followed by a national consultative workshop to inform and consult all stakeholders to reach a consensus on policy and regulatory reforms required at national level and for possible collaboration/harmonization at the regional level.

ICARDA and FAO are working together to find alternative ways for merging the harmonization activities of the WANA Seed Network (ICARDA) and of the Consultative Forum on Seeds for NENA (FAO) and secure funding for the implementation of the harmonization process in CWANA region.

Network Publications

The WANA Seed Network encourages cooperation and exchange of information among member countries.

Seed Info Newsletter: A biannual regional newsletter, Seed Info (Issue No 24, January 2003 and issue No. 25 July 2003), were prepared, published and distrib-

uted to over 1500 subscribers within and outside the CWANA region. Moreover, the Arabic version of Seed Info No. 24 and No. 25 were also printed and circulated. Both the Arabic and English versions of the newsletter are also available at ICARDA website (http://www.icarda.cgiar.org/News/Seed%20Info/Press2.htm). The newsletter aims at exchanging information on agriculture in general and seed industry in particular from the regional and global perspective. Moreover, the newsletter addresses current issues in seed industry to encourage dialogue and understanding from the regional and global perspective.

Focus on Seed Programs: The focus on seed program series provides a concise profile of the national seed industries in member countries of the Network. The January 2003 issue covered the seed industry in Iran bringing the total of this series to 17. Moreover, efforts are underway to update earlier publications and make them available on the internet.

WANA Catalogue of Field and Seed Standards: The WANA Catalogue of Field and Seed Standards is printed and circulated for use as a reference document to national agricultural research systems and seed programs in the region and beyond. The Catalogue includes field and seed standards used for certification of most important agricultural and horticultural crops. The present document is a revision of the 1999 edition and it now includes standards for cereals, legumes, oilseeds, industrial crops (cotton, sugar beet), forage crops and selected horticultural crops (beans, cabbage, carrot, cucumber, egg plant, onion, pepper, potato, tomato, water melon). An AOSCA scheme used for varietal certification in Canada and USA and the Quality Declared Seed developed by FAO are included for selected crops to enable comparisons among different systems. The publication is also made available on ICARDA website (http://www.icarda.cgiar.org/ seed_unit/ SeedUnit/Activ/activ1.htm).

Updating other Network Publications: Most of the Network documents on the website have been updated regularly, including the WANA Seed Directory and WANA Variety Catalogue. The WANA Seed Directory provides a list of seed industry participants in member countries of the WANA Seed Network, whereas the Variety Catalogue provides a list of varieties of major food crops currently on the recommended list in respective countries. For more information the website can be accessed at http://www.icarda.cgiar.org/seed%20unit/file/home.htm.

Seeds for the Central Asia and the Caucasus (CAC) Region

Within the framework of the Network and with an aim to start up harmonization efforts in CAC, ICARDA collaborated in a joint mission with the FAO Plant

Genetic Resources Service (AGPS) to review the status of the seed sectors in Central Asia and Caucasus region (CAC). The mission visited Uzbekistan, Kazakhstan, Kyrgyzstan and Tajikistan, and in each country assessed the efficiency of the prevailing seed supply, distribution and marketing systems. A key outcome of the mission was an action plan for the improvement of seed trade between the different CAC countries.

During the mission, meetings were held with key stakeholders in each national seed program, which included officials of the Ministry of Agriculture, agricultural research institutes, seed multiplication farms, private farmers, seed companies and other enterprises, offices of CGIAR centers, relevant donor agencies, farmers' cooperatives and associations.

In order to promote regional collaboration and improve seed trade between the different CAC countries, the mission recommended a Regional Seed Conference that would bring together seed sector stakeholders in the region and international experts in regulation and seed program management. The Conference will establish a work program on harmonization of regulations. A Working Group will be formed, which will meet regularly after the Conference under the guidance of FAO/ICARDA to determine which regulations (and possibly which crops) should be given priority and which countries should be involved, and to plan a schedule of workshops that will formulate proposals.

This joint mission was a useful partnership with FAO in addressing seed sector development in CAC Region. Many of the seed issues in the Region are developmental in nature. Therefore, partnership with an international development organization such as FAO helps to link ICARDA's research efforts closely with development objectives. All the counties in Central Asia have recently become members of FAO and this mission provided some officials their first opportunity to learn about the functions of FAO. The ICARDA Seed Unit will have an active role to play in the action plan, given its leadership in initiating seed system studies in CAC countries. Certain aspects of this action plan may be useful for the WANA Seed Network as a means of transforming it into a sustainable regional seed association.

4. ECONOMICS OF SEED

One of the objectives of the Seed Unit is to help countries to operate their seed programs more efficiently and profitably. The Seed Unit is not only working very closely with governmental seed institutions, but more and more emphasis is

placed on the private sector, which is expected to produce and market the seed. Output 3 'Strategies and methodologies for improving economic efficiency of formal and alternative seed delivery systems' of the MTP project 5.1 is, therefore, looking at options for increased cost efficiency of seed systems and policy recommendations for improvement of the seed sector prepared and implemented by national seed programs. The activities are mainly reported under Human Resource Development (Section 2), Seed Security (Section 6) and Research (Section 7).

Potential Village-Based Seed Enterprises at Kunduz and Taloqan

The objective of this exercise was to identify and to carry out whole farm-analyses of representative units that could constitute typical small-scale seed enterprises. Data were obtained from individual farmers or groups of farmers currently engaged in farming operations that had such potential. The following are key points arising from the analyses:

- Several larger farmers are available in Kunduz and Taloqan areas who have access to productive resources (e.g. land and labor) and who would be prepared to invest in seed production. These farmers are well known in their communities and have close ties with the small farmers who generally rely on them for assistance including the provision of employment opportunities and credit facilities.
- One hundred jeribs, equivalent to 20 hectares, was identified as the average farm size for a village-based seed enterprise in both Kunduz and Taloqan. This area will be cultivated with wheat as the winter seed crop followed by rice as the summer crop. As the enterprises become established, they could expand into other summer crops such as maize and mung bean, in addition to rice. Small farmers could be contracted in such cases to produce seed for the village enterprises. Future involvement in the sale of agro-chemicals and hand tools would be an area of diversification for successful enterprises.
- Seed production will only be one component of the farmers' normal portfolio of enterprises, as they will be engaged in the production of wheat and rice grain for consumption, other crops and livestock.
- The farmers interviewed indicated various forms of possible institutional arrangements for seed production including one-person businesses, family units of mainly brothers coming together, and cooperative units in which the farmers would pool together resources and expertise.
- Potential village-based entrepreneurs will require start-up support, which should be mainly in the form of capital items (farm machinery), since these are in short supply and pose a severe constraint to crop production. The main capital items that will be required are outlined in terms of quantity needed, purchase price and economic life. Annual depreciation values have been calculated, which form the fixed cost components of these enterprises.

- There is a general lack of knowledge about basic technical aspects of seed production and business management. Potential entrepreneurs will require adequate practical training in these areas. Particular attention should be given to quality assurance, marketing strategies and skills and how these entrepreneurs will create effective demand for their seed. They should be seen in their communities as unique and reliable sources of quality seed of the best varieties available. Emphasis should also be given to the importance of storage between harvest and the following sowing season.
- Wheat is the main crop in the area and occupies most of the cultivated area in both irrigated and rainfed zones. The analysis presented below shows that wheat seed production this season is barely profitable or a loss for most farmers. This is mainly due to the drastic fall in the price of wheat grain from the level of AFS 80 per seer (7 kg) at sowing time in 2002 to the current low level of AFS 35. The results show that under present conditions, farmers can obtain a minimal profit margin of about 5% only. Assuming all cost levels remain the same, this profit margin would rise to a high level of 140% if wheat grain were sold at the same price of AFS 80. This would be comparable with the margin obtained in rice, the price of which has remained somewhat stable.
- The fluctuation in wheat price and the loss incurred by farmers show the importance of government policy in helping to maintain stable output price for farmers. This could be achieved through the operation of an effective buffer stock policy. In fact, many farmers indicated that unfavorable pricing for wheat could force many to switch over to more lucrative alternatives such as opium poppy much against their wish.
- It is widely believed that the present fall in the price of wheat grain is largely due to huge importation of wheat, which is distributed by WFP as food aid. Good rains have resulted in high yields even in the rainfed areas to the extent to be seems surplus production. Many farmers would wish to see WFP buying such surplus grain, which would help increase the farm-gate price for wheat. Such grain would be distributed to deficit areas in the place of imported grain.
- Despite the relatively high yields this year, much of the crop may suffer from shattering or even go unharvested because of the shortage and high cost of labor. Harvesting machinery is non-existent, again emphasizing the importance of farm mechanization to help boost productivity.
- The whole farm analysis for a combination of wheat and rice shows that potential enterprises could earn over 50% net margin under current conditions of low wheat price. Profitability would increase even more if the price of wheat remains stable or increases. This estimation also ignores other sources of revenue for the enterprises such as the provision of machinery services to other farmers.

- The results also show that at current price levels, successful enterprises would break even at about 7.5 hectares, showing that considerable economies of scale would be earned at the optimum farm size of 20 hectares. Those enterprises that would be capable of expanding their cultivated area and sell all the seed they produce would benefit even more.

Table 2: Wheat production cost and revenue.

Item	Unit	Quantity	Unit cost (AFS)	Unit cost (US$)	Total (US$/J)	Total (US$/ha)
Costs						
Disc plowing (fuel and lubricants, casual labor, etc)	J	1	200	4.14	4.14	20.70
Cultivator harrowing (fuel, lubricants, casual labor, etc)	J	1	200	4.14	4.14	20.70
Foundation seed	Seer	5	80	1.66	8.28	41.41
DAP fertilizer	Bag	0.5	900	18.63	9.32	46.58
Urea fertilizer	Bag	1	450	9.32	9.32	46.58
Fertilizer application, bird control, security, etc.	J	1	500	10.35	10.35	51.76
Weed control (cost of herbicide & application)	J	1	200	4.14	4.14	20.70
Roguing	J	1	100	2.07	2.07	10.35
Harvesting: fuel and lubricants, casual labor, etc.	J	1	200	4.14	4.14	20.70
Threshing (fuel and lubricants, casual labor, etc)	J	1	200	4.14	4.14	20.70
Transportation (fuel and lubricants, casual labor, etc)	J	1	100	2.07	2.07	10.35
Seed cleaning	J	1	150	3.11	3.11	15.53
Seed treatment (Vitavax 5)	J	1	50	1.04	1.04	5.18
Cost of bags	J	1	100	2.07	2.07	10.35
Storage (fumigation, inspection, etc)	J	1	100	2.07	2.07	10.35
Contingencies	J	1	100	2.07	2.07	10.35
Total cost		1			72.46	362.32
Revenue						
Yield/income	Seer	105	35	0.72	76.09	380.43
Net income or margin					3.62	18.12
Percentage margin					5%	5%

Table 3: Rice production cost and revenue.

Item	Unit	Quantity	Unit cost (AFS)	Unit cost (US$)	Total (US$/J)	Total (US$/ha)
Costs						
Disc plowing (fuel and lubricants, casual labor, etc)	J	1	200	4.14	4.14	20.70
Nursery preparation	J	1	50	1.04	1.04	5.18
Foundation seed	Seer	2.5	100	2.07	5.18	25.88
Disc plowing, leveling and ridging	J	1	600	12.42	12.42	62.11
Uprooting seedlings and carrying to planting site	J	1	400	8.28	8.28	41.41
DAP fertilizer	Bag	0.5	900	18.63	9.32	46.58
Urea fertilizer	Bag	1	450	9.32	9.32	46.58
Crop management (irrigation, fertilization, bird control)	J	1	1000	20.70	20.70	103.52
Weed control by hand	J	1	300	6.21	6.21	31.06
Roguing	J	1	100	2.07	2.07	10.35
Harvesting (fuel, maintenance and casual labor)	J	1	200	4.14	4.14	20.70
Threshing: (fuel, maintenance and casual labor)	J	1	200	4.14	4.14	20.70
Transportation (fuel, maintenance and casual labor)	J	1	100	2.07	2.07	10.35
Seed cleaning	J	1	150	3.11	3.11	15.53
Seed treatment (Vitavax 5)	Pack	1	50	1.04	1.04	5.18
Cost of bags	J	1	120	2.48	2.48	12.42
Storage (fumigation, inspection, etc)	J	1	100	2.07	2.07	10.35
Contingencies	J	1	100	2.07	2.07	10.35
Total cost	J	1			95.65	478.26
Revenue						
Yield/income	Seer	143	100	2.07	296.07	1480.33
Net income or margin	J				200.41	1002.07
Percentage margin	J				209.5	209.5

Table 4: Capital requirement (fixed assets).

Item	Purchase cost (US$)	Economic life (years)	Salvage value (US$)	Annual depreciation charge (US$)
Tractor	10,300	10	5,000	530
Accessories for tractor	2,500	10	1,000	150
Air compressor for tractor	380	10	100	30
Implements for tractor	2,390	10	1,000	90
Thresher	2,000	10	500	150
Seed drill	500	10	100	40
Harvester (windrower)	1,700	10	500	120
Seed cleaner	3,000	15	1,000	130
Ridging and ditch machine	240	15	100	10
Transport van	10,000	10	5,000	500
Motor cycle	600	5	200	80
Store	10,000	50	1,000	180
Furniture and fixtures	300	10	50	25

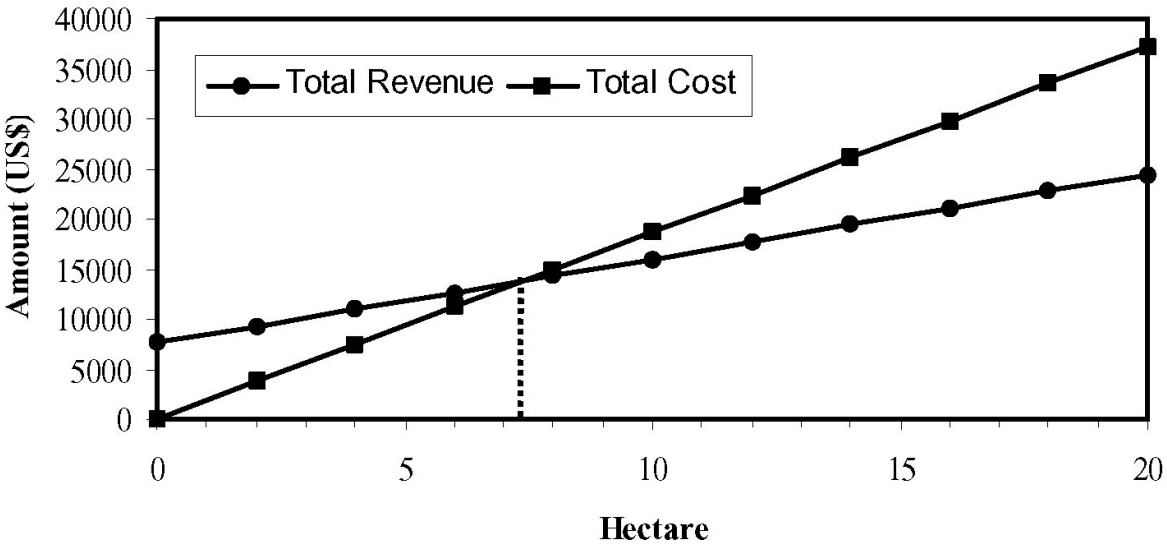


Figure 1: Break-even analysis for whole farm (wheat and rice).

Table 5: Whole farm budget (wheat and rice).

Item	Value in US$
Annual depreciation charges (Fixed costs)	
Tractor	530
Accessories for tractor	150
Air compressor for tractor	30
Implements for tractor	90
Thresher	150
Seed drill	40
Harvesting machine	120
Seed cleaner	130
Ridging and ditch making machine	10
Transport van	500
Motor cycle	80
Store	180
Furniture and fixtures	25
Sub-total depreciation charges	2,005
Administration charges (Fixed costs)	
Office supplies	500
Salary for cashier/accountant	800
Salary for tractor driver/operator	800
Wages for office labor	1,000
Van operation	2,000
Promotion and marketing	500
Sub-total administration charges	5,600
Total fixed cost	7,605
Seed multiplication costs: Wheat (20 hectares)	7,246
Seed multiplication costs: Rice (20 hectares)	9,565
Sub total seed multiplication cost	16,811
Total production cost	24,416
Value of processed wheat seed:	7609
Value of processed rice seed:	29,607
Total value of output (processed seed)	37,216
Net margin (US$)	12,800
Net margin (%)	52 %

Table 6: Summary of crop margins.

Crop	Harvest yield (seer/ha)	Price in AFS per seer		Value of output (US$/ha)	Production cost (US$/ha)	Net income (US$/ha)	% Net income or margin/ha
		Sowing time	Current				
Wheat	105	80	35	380.43	360.32	18.12	5%
Rice	143	100	100	1480.33	478.26	1002.07	209.5%
Maize	110	40	40	455.49	399.59	55.90	14%
Mung bean	65	90	90	605.59	37.66	247.93	69.3%

Business Planning

As part of the USAID-funded seed project, the Seed Unit prepared model Business Plans for some research stations, potential village-based seed enterprises and the rehabilitated seed testing/seed health laboratories in Afghanistan. For the village-based seed enterprises, these plans were based on data collected for the start-up, operation and continued growth of the enterprises (see above). These included economic data on capital requirements, crop budgets, output levels and prices. Analysis for the Research Stations focused on potential income-generating activities that showed some degree of profitability. The data obtained at this level were, therefore, to enable gross margin analysis for key enterprises including seed production (wheat and various vegetable crops) and fruit tree nurseries (almond, apricot, pistachio, and walnut).

Seed Unit staff and leading farmers in Taloqan, Takhar Province, discuss business

Some of the data and results were discussed with farmers during a training course on village-based seed enterprises held in Kunduz, which involved many leading farmers who could serve as potential small-scale entrepreneurs. These farmers were well known in their communities and had close links with the resource poor farmers, for whom the larger farmers provided services including credit. It seemed clear that helping the larger farmers to establish viable seed enterprises would eventually benefit the small farmers. There was even a possibility that the small farmers could serve as contract growers for such seed

enterprises. However, changing the farmers' apparent dependence on aid, which they continuously requested, to establishing their own businesses when such opportunities existed posed a major challenge.

Business Planning for Research Stations in Afghanistan

Kunduz Agricultural Research Station: The Kunduz Research Station is a research site of the MOAL located in the city of Kunduz, in Kunduz Province of Northeast Afghanistan. As most such facilities in Afghanistan, it was completely looted during the period of conflict. ICARDA, through the USAID-funded Future Harvest Consortium, has initiated rehabilitation of the station and its subsidiary Chardarah Farm. A skeleton staff has been assigned, but without operating funds and equipment, little can be accomplished.

This station serves a rich farming region of much irrigated land, with adjoining rainfed cropping areas. It works with the primary field crops of this area (wheat, rice, maize, pulses, etc.) and also with a range of fruit and nut tree crops grown in the area. The research work of the station is necessarily of a public-service nature, and must be done as part of the government budget which, at this time, must be considered as bare minimum. Little of the needed research can be done.

However, analysis of the station, its facilities and its responsibilities, indicates that needed research will occupy only a small portion of the sizeable land area controlled by the station. The rest, which is fertile cropland with irrigation facilities from a nearby river, can be used for production of commercial or market-oriented crops. Crop budgets calculated with extensive participation of local farmers and station personnel indicate that the station has unusual financial potential in producing (1) commercial (market-destined) crops of wheat, rice, pulses, vegetables, etc.; (2) stock (breeder, basic/foundation) seed to support the national quality seed production and certification program; and (3) producing and selling young trees of the fruit and nut crops.

With its available land area, significant income could be generated, expected to be adequate to cover the costs of producing the market crops, to pay costs of the required research, and to finance reasonable overhead operating costs. However, present government regulations do not permit this; income goes into the general government treasury.

This station could become self-sustaining by:

1. Changing government laws and regulations so that earned income could be maintained. This would require an adequate financial management system and

installing competent station management trained to operate essentially a commercial operation, with careful accounting of funds.
2. Turning ownership of the station over to a private-sector enterprise (possibly including former, present, or retired government research staff?), letting it operate as a private-sector enterprise earning its income from commercial crops, and simultaneously conducting the required research under contract to the government. It is anticipated that even donating the station (free of charge but with certain general provisos regarding length of operations, contracting research, and use of the lands) to a private enterprise would be a financial advantage to government, in reduced overhead costs.

Business Planning for Seed Laboratories in Afghanistan

Badam Bagh, Main Seed & Seed Health Testing Laboratory: The Badam Bagh facility was rehabilitated and equipped in 2003 by ICARDA under the USAID-funded Future Harvest Consortium. Located in the Badam Bagh, Kabul, greenhouse and seed testing compound of the Improved Seed Enterprise (ISE), it is to be the Central National Laboratory for seed quality testing and seed health testing.

It is to be operated by the ISE, a government enterprise and the only official seed-producing agency in the country. Quality control should be separate from any production/marketing entity; it is hoped that as soon as possible, the MOAL can establish a suitable infrastructure.

The primary function of this laboratory is to provide seed quality and seed health testing, and to supervise, coordinate and standardize the operations of the network of 9 seed quality testing and seed health testing labs established/rehabilitated throughout the country by ICARDA/FHCRAA.

At this stage in the rehabilitation of Afghanistan, there is little testing work to be done. However, such testing is the basis, and first step, of developing a national system for producing and supplying higher-yielding seed to farmers. Because of transport and communication problems for the foreseeable future, a network of laboratories is essential to provide testing services within reach of seed producers/users. Regardless of its initial work load, such testing is critical to support the start of seed production and supply.

Despite its essential role in agricultural development, seed testing has little if any potential for financial self-sustainability. It must be considered as a necessary public-service role of government, supported by the government budget.

However, broadening the facility's responsibilities can lead to efficient use and increased contribution to agricultural development. Seed testing is seasonal; in the off-seasons, its highly-trained technical personnel can be used to great advantage by: (1) organizing this facility so that it (with additional facilities and staff as required) is also responsible for implementing the Seed Law, Seed Certification, and Plant/Seed Quarantine (when enacted); (2) playing a major role in supporting agricultural research and extension, and in training seed producers in seed production, seed enterprises in seed supply, and farmers in seed use.

Kunduz, Satellite Seed & Seed Health Testing Laboratory: The Kunduz Satellite Seed Quality and Health Testing Laboratory was installed by ICARDA, Future Harvest Consortium, in 2003 in the Kunduz Research Station, Kunduz city in Kunduz Province, of Northeast Afghanistan. ICARDA renovated the station building for the lab, procured and installed equipment, and trained lab personnel in its operation. Part of the building is now occupied by the Research Station administration, and part by the seed lab.

As do all laboratories of the national network of 9 labs established by ICARDA, this lab will work under the standardization and technical guidance of the Central Laboratory at Badam Bagh, Kabul, so as to ensure uniformity of testing results and seed quality evaluation throughout the country.

This laboratory is intended to provide seed and health testing services to farmers, seedsmen, and any other interested persons in this area. It will be operated by the MOAL Institute of Agricultural Research, which owns the Research Station. Reliable seed testing services are one of the first requirements of establishing a quality seed supply system.

The Station was completely looted during the conflict, and the one remaining building was left in derelict condition. Skeleton staff is now in place in the station (not the lab), but salaries are insupportable and there are no operating funds. No field equipment remains. ICARDA has provided equipment and office furniture, and has been handling the fieldwork on the station.

Presently, there is no market for seed testing on a fee basis; testing should be provided free of charge as a government public-service to agricultural and rural development. There are several possible "village-based seed enterprises" likely to develop (with adequate support of credit and technical assistance) in this area; this is a rich farming area and farmers (given the abysmal conditions of the last two decades) are progressive.

The laboratory should actively participate in local-area agricultural extension and research activities, farmer meetings, etc., to promote use of the laboratories' services as well as to help develop the seed supply and use situation in the area.

Presently, inadequate information exists to permit costing seed testing services on an individual-test basis. However, estimates of the overall lab costs were made.

Business Planning for Village-Based Seed Enterprises in Afghanistan
Business Plans were prepared for two enterprises, i.e. the United Brothers, Village-Based Seed Enterprise in Chardarah District (Kunduz Province) and the Taloqan Model, Village Seed Enterprise in the Takhar Province.

Experience gained through working with ICARDA has shown these farmers that seed production and supply can be a profitable agricultural business, giving them additional income and bringing them into local agri-business and in the words of one farmer "can help us produce a better product". Their own contacts with other farmers indicate that there is an adequate market of farmers willing to purchase seed and pay a premium (although small) for it. Seed has been sold directly to farmers (either delivered to them or collected by them).

Initial financial and economic analysis indicate that 100 jeribs (20 ha) would be a profitable size for a commercial seed operation based on wheat and rice cropping sequence. The seed enterprises plan to start at this level, as their market survey (gained by personal contact with farmers and merchants) indicates that this much seed can be sold in the neighboring area without difficulty. Then, as is possible within the partners' financial means, seed production of the basic crops of wheat and rice will be expanded, and additional crops added. They feel that there is good potential for production of seed of melons, tomato, okra, forages, maize, mung bean and other pulses, and cotton.

The major constraint is the lack of credit for purchase of equipment for farming and seed cleaning/handling, some of which would have to be imported. Credit is at the moment not available from local sources; if such credit could be supplied by an international agency, it would have a profound influence on agricultural development in Afghanistan. Several members of the planned Seed Enterprises composed a letter to the American Ambassador, requesting help not as a grant but as credit/loan for this purpose.

A further constraint is the need for technical training. ICARDA has begun to provide such training, but as seed enterprises develop and expand, more intensive

training is essential. It should also be focused on the approach of "technical assistance and guidance" to enterprise specific operations.

Crop budgets indicate that despite the decline in the price of wheat, a combination of wheat and rice production is profitable. It covers the extra costs of seed production, and the small premium for seed crops is additional income. Surprisingly, farmers in this area are accustomed to paying a premium for seed (e.g. maize grain AFG 25/seer, mung bean grain AFG 60/seer, seed AFG 90/seer). Production of seed of other crops appears even more profitable. The climate, fertile soils, and irrigation water are ideal for seed production of many crops.

These Seed Enterprises have the potential to be a profitable operation, worthy of credit and investment. And, there clearly appears to be profitable potential for other Village-Based Seed Enterprises serving their own local areas in this region. This would be an ideal beginning of developing rural agri-businesses and giving farmers the benefit of value-added operations.

- Taloqan Village Seed Enterprise Business Plan, Internal Report ICARDA
- United Brothers, Chardarah District, Kunduz, Village-Based Seed Enterprise Business Plan, Internal Report ICARDA
- Badam Bagh, Main Seed & Seed Health Testing Laboratory, Business & Operating Plan, ICARDA Internal Report
- Kunduz Agricultural Research station, Business Plan, ICARDA Internal Report

5. INFORMAL SEED SUPPLY

The seed supply system of any country consists of its formal (public and private seed sector) and informal activities. In many countries of the region the informal seed sector is still the major seed supplier, in spite of all the efforts that have gone into the development of the seed industry. Output 4 of the MTP project 5.1 'Informal seed sector concerns reflected in national seed system development as a result of awareness created on this issue' has been a major focus in 2003. All the work carried out with regard to setting up village-based seed enterprises, as well as the IDRC project aim at strengthening the informal seed supply systems. Furthermore, the work on wheat and barley seed systems (Section 6) aim directly at understanding the informal seed sectors in Syria and Ethiopia.

Establishing Village-Based Seed Enterprises (VBSE) in Afghanistan
ICARDA planned establishing farmer-based seed enterprises in Afghanistan to increase the production and supply of better-quality seed at lower prices and at

convenient locations. The program develops, tests, and demonstrates pilot models using the latest concepts for organizing and improving the operations of a farmer-managed seed supply of system to provide high-quality seed and develop skills, which should lead to a sustainable and profitable agro-business. The program is aimed at:

1. Introducing and demonstrating improved crop varieties and associated technologies developed by agricultural research to the farmers to increase crop production and ensure food security.
2. Assisting farmers in producing and marketing, under local management, the seed required to plant crops.
3. Assisting farmers in learning the technical and managerial skills required to manage small agro-enterprises.

From the start, individual farmers/group of farmers or Shurahs (village councils) are being convinced of the ownership of the seed produced and responsibility for marketing.

Credit facilities will be made available to farmers to purchase all inputs required for seed production including seed, fertilizer, pesticides, etc and later on for seed handling (cleaning, treatment, bags, etc.) services. Farmers may be required to make a nominal down payment of 5% to assure commitment, but pay back all credit after marketing their seed.

Machinery for Kama VBSE Nangarhar Province, Afghanistan

In 2003, several VBSE have been initiated in 5 provinces (Baghlan, Kapisa, Kunduz, Nangarhar and Takhar) (Table 7). Discussions and training courses (Section 2) were held with the farmers'groups and in each province one VBSE was selected as 'fast track VBSE'. Fast track VBSEs were provided with a set of equipment, including a seed cleaner. A detailed description of the seed processing machines is provided below.

Table 7: Village-Based Seed Enterprises initiated.

Location VBSE	No of Farmers (Area in Ha)	Crops
Kapisa		
Central District	10 (20)	Wheat, Maize, Dry Bean, Grapes
Baghlan		
Khinjan District	10 (20)	Wheat, Rice
Doshi District	10 (20)	Wheat, Rice
Pul-e-Kumri District	10 (20)	Wheat, Rice, Watermelon, Potato, Mung Bean
Industrial Baghlan	10 (25)	Wheat, Rice, Potato, Mung Bean, Vegetables
Central Baghlan	10 (20)	Wheat, Rice, Potato, Mung Bean, Cotton
Central Old City	**10 (25)**	**Wheat, Rice, Mung Bean, Potato, Clover**
Third Region Baghlan	10 (25)	Wheat, Barley. Potato, Mung Bean, Clover, Flax
Kunduz		
Ali Abad District	10 (30)	Wheat, Rice, Barley, Mung Bean, Sesames, Flax
Central Kunduz	10 (30)	Wheat, Rice, Potato, Vegetable, Grapes, Mung Bean, Sesame
Chardara Ditrict	**10 (35)**	**Wheat, Rice, Cotton, Mung Bean, Sesame**
Khana Abad	10 (35)	Wheat, Rice
Nangarhar		
Kama District	**11 (100)**	**Wheat, Rice, Maize, Mung Bean, Potato,** Vegetables
Shewa District	24 (61)	Wheat, Rice, Maize, Mung Bean, Potato, Vegetables
Behsud District	10 (54)	Wheat, Rice, Maize, Mung Bean, Potato, Vegetables
Surhkorud District	21 (100)	Wheat, Rice, Maize, Mung Bean, Potato, Vegetables
Takhar		
West Taluqan	10 (35)	Wheat, Rice
Central Taluqan	**10 (25)**	**Wheat, Rice, Fruits, Flax**
North Taluqan	10 (30)	Wheat, Rice
Taluqan City	10 (20)	Wheat, Rice

Note: Bolded are VBSEs, which are supported in the first stage

Low-cost Seed Processing Machines for Village-Based Seed Enterprises
The Seed Unit has, in close cooperation with a private manufacturer, modified a grain cleaner into a seed cleaner. This machine is now widely used/requested for on-farm seed production work (Afghanistan, Jordan, Lebanon, North Africa, Palestine, Syria, and Vietnam).

This is a robust mobile cleaner/treater unit suitable for a wide range of crop seeds at the village/farm level. Being easy to clean, it is particularly suitable for small seed lots which need to be kept separate. For that reason it may also be useful for seed production plots on research stations. The main components are: an intake hopper and elevator, de-awner, cylindrical sieve, fan aspiration, indented cylinder, chemical treater and air compressor, all mounted within a single frame. The sieve cylinder has two separate replaceable screens and is provided with a brush to reduce blocking of the sieve slots during operation. The top of the machine is open, to facilitate cleaning of the sieve cylinder, the sides are enclosed by removable metal panels. All exterior parts of the machine are spray painted in grey, except for the sieves.

The overall dimensions are: height to top of elevator 310 cm; width to outside of tires 255 cm; length excluding towing arm 245 cm. The minimum ground clearance is 12 cm. The total weight is approximately 900 kg.

Seed cleaner with seed dressing facility

The throughput is 300 kg per hour depending on the material. Flow rate is regulated by a gate slide at the elevator intake. The intake hopper (25 cm above the ground) holds approximately 20 kg of wheat or barley. Cleaned seed is collected from an outlet spout low down on one side. Reject materials are collected from three spouts on the other side.

The treatment chemical is held in a reservoir of four liters capacity and the application rate is adjusted by a special tap connected to a horizontal mixing chamber. A spout filler is provided for adding chemical to the reservoir. Calibration and safety instructions are provided. The full reservoir holding one liter of liquid fungicide diluted in three liters of water is enough to treat one ton of seed.

To function properly the unit must be on level ground. The adjustable jack feet enable quick on-site leveling before use. In operation, the unit is quiet and stable due to the use of a rotating cylinder sieve instead of oscillating flat sieves. The exchangeable components are the two sieve panels, which are held on the rotating frame by clips, and the indented cylinder.

The standard sieves provided for wheat and barley are 1.9 # (oblong) as bottom sieve and 6.5 i (round) top screen. A range of additional sieves can be supplied according to the specifications.

The elevator is self-cleaning and there is a hinged bottom flap to remove residual seed. The treater unit also has a hinged semicircular lower panel. The sieve cylinder is accessible at the top of the machine and can be cleaned by a brush. The indented cylinder is self-emptying and its internal collecting trough can be tipped to empty if necessary. There is an integral side access ladder and platform to facilitate cleaning and inspection of the top of the unit. An air compressor and 5 m spiral hose is provided to assist cleaning after use. Total cleaning time between seed lots is approximately 30 minutes.

Power is provided by two single phase electric motors, one at the front driving the fan, treater, and compressor, the other at the back driving all other components. Separate power cables are connected to each motor. If no direct power supply is available, the unit can also be connected to a generator (estimated cost $200) driven by a tractor PTO. All power transmission within the unit is by rubber belts (total seven), which are enclosed by protective screens.

The unit has four rubber tires and can be easily maneuvered by hand or towed behind a vehicle by means of a towing arm. The axles have leaf springs to provide some suspension. It can be raised off the ground, and leveled if necessary by corner mounted screw jacks. No special preparations are required for road transport except placing a cover over the top in case of rain. Towing speed should not exceed 20 km per hour.

The main wearable parts are the bearings and drive belts, all are standard size and widely available. Sieves should last 2-3 years, depending on the throughput. The unit should be stored under cover to prevent corrosion of the sieves and other parts. During prolonged storage it should be raised off the ground to preserve the tires.

Table 8: Technical description of a processing machine.

Capacity:	300 kg/hr
Feeding:	Bucket elevator
Threshing:	De-awner
Weight separation:	Efficient and easily adjustable blower
Thickness separation:	Rotating perforated metal sheets (screens) with three sections to remove smaller and larger contaminants from good seed
Length separation:	Two cylinders to remove longer and shorter contaminants from good seed
Treatment:	Efficient chemical application and mixing chamber made of non-corrosive metal integrated to the cleaner.
Length:	3.5 m
Width:	1.5 m
Height:	3.0 m
Weight:	1.8 t
Accessories:	3 sets of screens with different perforation size 3 sets of cylinders with 10, 12 and 14 indent size 3 sets of chemical metering spoons of different sizes

6. SEED SECURITY

Both natural and man-induced disasters can have devastating effects on agricultural systems and the environment. There is an increasing trend in such disasters (e.g., war or civil strife) worldwide and emergency assistance to regions affected by such stresses. Among natural disasters, drought is a threat in many dry areas of the world including some countries of the WANA region. During such disasters, farmers may be forced to deplete their meager seed stocks, resulting in the loss of well-adapted farmers' varieties, which could lead to erosion of valuable genetic diversity that is the building block for rehabilitation and restoration of agricultural systems.

'Seed security' is an important component of food security and Output 5 'Coping mechanisms enhanced in disaster prone countries through knowledge disseminated and regional cooperation in seed security' is currently aimed at helping Afghanistan in this respect. Activities planned included support to the restoration of the seed and crop improvement systems.

In 2003, under a USAID-funded project, an array of activities have been undertaken, ranging from the initiation of farmer based seed production to the rehabili-

tation of research and seed testing stations. Preparation of a draft national seed policy and seed law, as well as supporting the establishment of a National Seed Board, were all part of the support to the restoration process.

A new IDRC project on seed systems in the rainfed North of Afghanistan has been initiated. This project, among others, aims at reviewing the effects of disasters on local seed systems.

USAID Seed Project for Afghanistan

Agricultural production capacity and food security in Afghanistan were greatly damaged by more than a decade of civil strife and several years of continuous drought. To help rebuild agriculture, the Future Harvest Consortium to Rebuild Agriculture in Afghanistan (FHCRAA), ICARDA, and its partners, have continued implementing an array of activities to fulfill the objectives of (i) multiplying and delivering quality seed of adapted varieties through effective delivery systems and (ii) providing technical assistance in the development of sustainable agricultural production systems in Afghanistan. In a very short period of time, several achievements have been made by FHCRAA, which form a firm basis for future development of agriculture in Afghanistan.

Major activities and achievements in 2003 are the following.

Seed Supply

- Pioneer schemes (Village-based seed enterprises) for sustainable seed systems initiated. These village-based seed enterprises aim at producing seed in a cost efficient manner for the village and beyond. So far, 'enterprises' have been initiated in Baghlan, Kunduz, Nangharhar, and Takhar and 260 MT of seed has been distributed to 821 farmers. Mobile seed cleaning machines, specifically designed for use at farmers' level, have been provided. Farmers were assisted and trained in seed production practices, including marketing. These farmers' seed multiplication fields will provide approximately 5000 MT seed of adapted varieties. To asses the profitability and sustainability of such enterprises, business plans have been prepared for two selected farmers' groups. These business plans show that seed enterprises have the potential to be a profitable operation, worthy of credit and investment.
- A successful potato seed program initiated. This sub-project was implemented by the International Potato Center and aims at producing and supplying potato seed to Afghan farmers.

Regulatory Functions for Seed Industry Development

- Seed laboratories, which are able to carry out tests for seed quality and quarantine purposes, rehabilitated and equipped. The FHCRAA is assisting the Government of Afghanistan to carry out its regulatory function with regard to assuring that quality seed reaches the farming communities. Essential is a series of seed testing stations, which monitor the seed that is produced and assure that the seed that is marketed to farmers is of high quality. Two main seed testing laboratories (Badem Bagh, Kabul Province and Jalalabad, Nangarhar Province) and two satellite stations (Baghlan, Kunduz) have been put in place and seed testing work resumed. The Consortium also supported equipping other seed testing stations (Herat).

Rehabilitation of Research Capability

- Research stations rehabilitated and normal research work resumed. Several research stations (Baghlan, Jalalabad, Kabul, Kunduz and Takhar) and substations have now been rehabilitated and farm equipment has been provided. Normal research activities have resumed at the field level. Experimental plots have been harvested for the first time in many years. During the 2002/03 season, wheat, barley, chickpea, lentils, faba bean, tomato, onion and pepper research experiments were planted. Several international nurseries have been sent to Afghanistan for testing (trials) yield, drought- and cold tolerance, and disease resistance.
- An international nursery program will identify adapted germplasm for Afghanistan's varied agro-ecological zones. A variety maintenance program has been initiated in Darul Aman, Baglan, Kunduz, and Taloqan to maintain varietal purity and to initiate the seed multiplication cycle of existing varieties.
- One main meteorology station (Badem bagh, Kabul) and a number of smaller units (Bagah-e-zakhera, Chardarah, Jalalabad, Kunduz; Leghman Madam Shaher, Talaqan, and Wardak) have been established.

Human Resources Development

- In addition to the training reported in Section 2, several other training activities have taken place (Table 9).

Short-term, High-impact Projects: Overcoming Barriers to Crop Improvement

This Short-term High-impact Grants program provided support for 8 projects. The results of the seed-related activities are outlined below.

- The International Potato Center (CIP), based in Peru, is rapidly increasing the supply of virus-free potato seed in Afghanistan for local needs as well as future export to neighboring countries, by stimulating the development of a farmer-

Table 9: Training for Afghanistan in 2003.

Type	Location	No. Participants
Sustainable Irrigated Agricultural Production on Degraded/Saline Land	ICARDA	3
Soil- borne diseases	Turkey	1
Water Resource Management and Water Use Efficiency	ICARDA	8
Experimental station operations Management	ICARDA	7
Experimental station operations Management	Afghanistan	8
Plant Protection	ICARDA	10
Meteorology	Afghanistan	13
IPM Sunn Pest	Afghanistan	34
Farmers training in seed potato production	Afghanistan (Kabul, Bamyan, Wardak)	54
Potato seed production	Afghanistan	29
Advanced radio production, format development, and audio editing	Afghanistan	1
Agricultural journalism training/production workshop	Afghanistan	17
Computer training	Afghanistan	10
Digital audio recording and editing	Afghanistan	6
Total		**201**

based seed multiplication system. The highly successful training of farmers and testing of new varieties is expanding from Jalalabad to Kabul and Bamyan districts. The appropriate equipment has been ordered and new farmer-candidates have begun training. Virus-free seed produced in Jalalabad has been grown in Bamyan for the summer 2003 harvest.

- The Center for Wheat and Maize Improvement (CIMMYT) managed two high-impact projects. The first project is the CIMMYT 'Seeds for Peace' open-pollinated maize improvement project. CIMMYT scientists identified nursery locations and seed for nurseries at 20 locations was provided. Farmer survey documents were prepared and a manual for use by farmers and extension agents was translated into Pashto and Dari. In addition, farmer-cooperators were trained to observe production problems and to identify maize populations for on-farm commercialization.

- The CIMMYT "Rehabilitating Wheat and Maize Science Human Resource Capacity in Afghanistan" project was devoted to training Afghan scientists. Five Afghan scientists participated in the CIMMYT wheat improvement training course in Mexico, and two agronomists attended the advanced agronomy course in Mexico and studied raised bed wheat projection. One maize breeder attended the advanced maize improvement course and two wheat scientists joined the CIMMYT-Turkey office for training. An in-country training course was held for 20 Afghan scientists.
- The number one biological constraint of wheat production in Afghanistan is the insect known as "Sunn Pest". A joint project of ICARDA and the University of Vermont is addressing the Sunn Pest problem through training and providing information to growers and NGOs. The indiscriminate use of pesticides has created resistance and killed the natural enemies of this destructive insect. Crop yields in wheat were diminished between 50% and 90% in 2002. ICARDA trained 10 Afghan scientists in IPM techniques for Sunn Pest management and conducted an in-country training course in August. Crop production guides focused on insect management were translated into Dari and Pashto. The course at ICARDA headquarters included training on biological control, including methods for mass rearing of important natural enemies. This group delivered a Sunn Pest Management Guide to the Central Asian Development Group in March. Use of this guide enabled local farmers to save 32,000 ha of irrigated wheat production. The project helped reestablish the Kabul University Entomology Laboratory, furnished with equipment purchased through this grant.

Business Plans

Simple Business Plans to assess the potential of (a) research stations, (b) seed testing stations and (c) village-based seed enterprises schemes have been developed. The summaries of these business plans are reported in the Economics Section of this report.

IDRC Project (Strengthening Seed Systems for Food Security in Afghanistan)

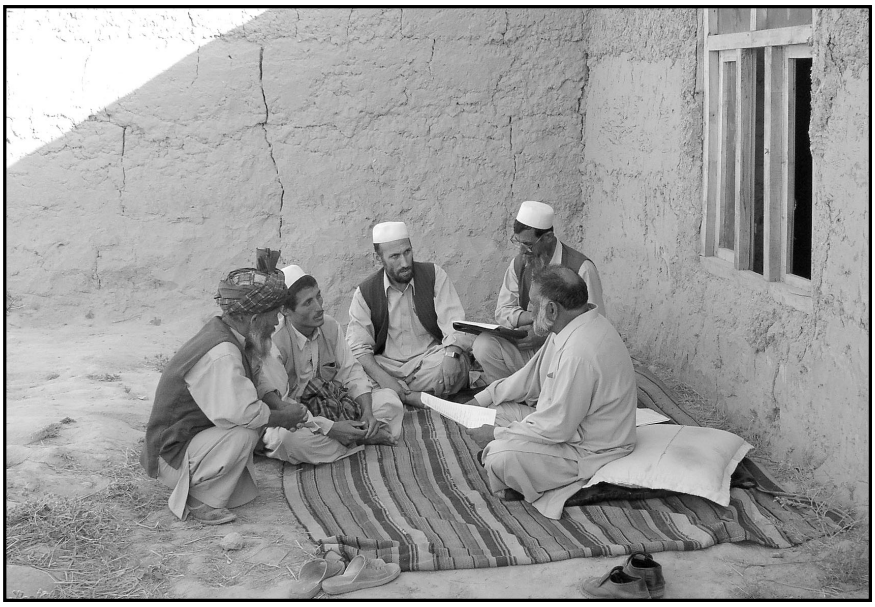
Diagnosis of seed systems in rainfed areas of Northern Afghanistan

The purpose of the diagnosis was to fully understand the dynamics of seed systems and crop diversity in rainfed areas of Northern Afghanistan, to evaluate the impact of ongoing seed intervention efforts, and to provide a meaningful analysis and interpretation so as to identify a program of external assistance that addresses both short-term priorities and options for longer-term recovery and development.

Two methodologies were used in carrying out the diagnosis namely household sample surveys and focus group discussions. While the surveys collected mostly quantitative data that were subjected to simple statistical analysis, the focus group discussions were designed to obtain complementary qualitative information that would be used for more detailed interpretation of the survey data.

The questionnaire for the household survey was divided into two parts to collect data on (i) household features, and (ii) crop-specific issues relating to land, varieties, seed and other inputs, and farming practices. The focus group discussions were carried out separately for village elders, and groups of male and female farmers.

A purposive sampling based on set criteria was used to select provinces, districts and villages where the main crops were predominant, and which were within the project areas of the partner agencies (AKDN, KRA and Afghan Aid). At village level, household lists were compiled and used as a sampling frame from which the survey team drew random samples of households to be included in the survey.



CoAR Survey Unit enumerators pretest household survey questionnaires in Madrase village in Aliabad Province

Data were collected by enumerators and facilitators from the Coordination of Afghan Relief (CoAR) Survey Unit, which led the household survey and focus group discussions in collaboration with the respective NGOs, MOAL and ICARDA-Afghanistan as facilitator. The Survey Unit organized 3 teams, each comprising 1 supervisor and 2 enumerators who conducted the household surveys. Two groups of similar composition carried out the focus group discussions.

The focus group teams included two females who conducted group discussions for female household members. A field coordinator supervised all five teams. Data

collection took place in 9 districts and 69 villages and covered five main crops namely wheat, barley, chickpea, flax and sesame. A total of 500 household interviews were carried out in 69 villages (Table 10). The number of household interviews in each district included both wheat and barley and other key crops grown in that district as outlined in Table 11. Twelve villages among the sample of 69 were selected for focus group discussions (Table 11), and three focus group discussions took place in each of these villages; one with village elders, one with male farmers and one with female farmers.

Table 10: Selected districts and villages.

Province	District	Number of sample villages
Takhar	Dashtekala	6
	Eshkamesh	7
	Kalafgan	10
	Taloqan	13
Baghlan	Nahrein	8
	Doshi	3
	Dahana-I-Ghori	8
Kunduz	Aliabad	8
Badakshan	Argu	6
Total		69

Table 11: Number of household interviews and focus group discussions.

Province/ District	Number of crop interviews						Number of household interviews	Number of focus group discussions
	Wheat	Barley	Chickpea	Maize	Flax	Sesame		
Baghlan								
Dahana-i-Ghori	39	16	-	-	-	-	55	1
Doshi	39	16	-	-	-	-	55	1
Nahrein	39	16	10	-	-	-	55	2
Badakshan								
Argu	39	16	-	-	15	-	55	1
Kunduz								
Aliabad	39	16	-	-	15	25	55	1
Takhar								
Dashtekala	39	16	-	-	-	-	55	1
Eshkamesh	38	18	10	-	-	-	56	1
Kalafgan	38	18	10	50	-	-	57	2
Taloqan	39	18	10	-	20	25	57	2
	350	150	50	50	50	50	500	12

Analysis of the data revealed that contrary to views of mass displacement of farmers from most communities in the rainfed areas of Northern Afghanistan, a majority of households continued uninterrupted agricultural practices during the past ten years, although activities in some places were adversely affected by insecurity and drought. The focus group discussions revealed considerable variation in the levels of displacement in different villages, ranging from no displacement at all in one village in Kunduz Province to total displacement in another village in Takhar Province. The farmers who discontinued their agricultural activities were those who were displaced either by war or drought or both.

Survey results revealed a loss of wheat varieties over time, but this was mainly attributed to replacement by new varieties, not due to war or drought. The farmers generally depended on traders and farmers in neighboring communities as the sources of new varieties. Similarly, about half of the focus group discussions reported a loss or abandonment of local varieties and a small number of old improved varieties for reasons including low yields, changing agro-ecological conditions, low resistance to disease, drought, or replacement by newer varieties. In particular, high incidence of pests and diseases and increasing susceptibility could have been a strong force in promoting varietal replacement and diversity.

The farmers estimated their own production to provide their household food needs for up to 11 months of the year, in comparison with seven months of the previous year. This indicated a substantial improvement in household food security that was largely due to good rainfall and the cessation of drought. One would have, therefore, expected that any significant improvement in crop productivity through the use of better varieties and good seed or efficient input use would have closed the food gap and provided households with a surplus for commercial purposes.

For most farmers, drought has not been a major factor during the cropping season of 2002/2003 as was the case in the past four years. However, other constraints became more important such as high incidence of pests and diseases and limited access to good seed or other productive inputs. It was likely that the persisting drought and low yields in previous years had weakened the farmers' affordability of commercial inputs.

A majority of households used only one crop variety at a time. In fact, the results of this study showed over 70% of households that used one local wheat variety, while more than 40% used one improved variety. For other crops such as barley, chickpea, flax and sesame, each locality seemed to be identified by a predominant 'local' variety and it was not clear whether such location-specific varieties were

actually genetically distinct from each other. The high average age of varieties and predominance of few varieties indicated low biodiversity, which could have limited overall crop production.

On the whole, the seed systems in the rainfed areas of Northern Afghanistan are entirely informal in nature and characterized by few location-specific local varieties for each crop, no improved varieties for other crops apart from wheat and barley, low yields, and unsatisfactory seed quality. This study, therefore, recommended a range of measures that could create a wider variety choice for farmers, enhance quality through effective seed systems and improve crop productivity. Of particular importance was a second phase during which some form of participatory varietal selection could be introduced as a means of identifying new varieties that farmers prefer. Adoption of such varieties by farmers would increase on-farm varietal biodiversity. Biodiversity would also be maintained through this method if new varieties occupied specific niches in the diverse Afghan farming system, and overall production would increase as each niche becomes occupied increasingly by the best-adapted new variety.

FAO Workshop on Effective and Sustainable Seed Relief Activities

The Seed Unit participated in a Workshop on Effective and Sustainable Seed Relief Activities organized by FAO. The workshop was organized jointly by FAO's Division for Emergency Operations and Rehabilitation (TCE) and the Seeds and Plant Genetic Resources Service (AGPS), of the Plant Production and Protection Division.

The purpose was to bring together stakeholders from FAO, relief agencies, donors, technical organizations, and emergency-prone countries in Africa to exchange lessons learned in the area of seed relief, identify gaps and needs in the development of tools, guidance and methodologies, and agree on recommendations for further collaborative work. About 60 participants attended the workshop.

The Seed Unit participated fully in the workshop including two working group sessions on (i) Intervention Options and Implementation, and (ii) Reviewing Outstanding Items and Identifying Next Steps at the Field Level. The Unit distributed information materials on ICARDA's work in seeds including 30 pamphlets and 25 CDs on the work of the Future Harvest Consortium in Afghanistan. Separate discussions were held with interested persons to explain ICARDA's activities in post conflict and disaster situations to restore sustainable seed systems through appropriate research tools and methodologies. These were well received.

It was a useful experience for the Unit to participate and represent ICARDA at this workshop. It increased awareness of seed activities other organizations are currently engaged in and threw light on those areas in which ICARDA could collaborate or even take a lead depending on our comparative advantage.

7. RESEARCH

Output 6 'Relevant new information available through applied research into practical seed-related issues' of MTP Project 5.1 aims at carrying out practical seed technology research which improves the operations of national seed industries/programs. This section brings together all aspects of the Unit's research work. An interesting development in the research agenda of the Seed Unit has been the work on business plans for seed and research stations in Afghanistan. The work (PhD) on seed system in Syria and Ethiopia has also come to a conclusion and a PhD awarded from the Wageningen Agricultural University in the Netherlands. Finally, the seed system research that is carried out in Afghanistan (IDRC project) is reported in the Section on Seed Security).

Research Highlights on Wheat and Barley Seed Systems
Agriculture is the main economic activity both in Ethiopia and Syria with varying proportion in its contribution to GDP, employment generation, export earning and provision of raw input to the industrial sector. In both countries, wheat and barley belong to the most important principal cereal crops grown since ancient times. In traditional agriculture, plant improvement and seed selection were carried out as an integral part of crop production with no functional specialization. With the development of modern agriculture, plant breeding and seed production evolved into separate disciplines. Seed becomes a key in delivering all agriculture-based new technologies to farmers. In Chapter 1, the general evolution of the seed industry with particular emphasis on developing countries has been outlined and their origins, components, functions and their linkages have been described. This wheat and barley seed systems study gives an insight into the functioning of formal and informal seed sectors in Ethiopia and Syria.

The national seed industry development: The development and performance of the national agricultural research systems and national seed programs in Ethiopia and Syria should be studied as 30 to 40 years' history following their formal establishment in the 1960s and 1970s, respectively. The evolution and organizations of national seed industry in Ethiopia and Syria, respectively, were reviewed with emphasis on national policy and regulatory support for the agricultural sector in

general and the seed sector in particular. The current status and performance of the seed industry has been reviewed based on field level surveys and secondary data taking into account wheat and barley crops grown in contrasting environments. The studies revealed interesting and contrasting situations in terms of farmers' use and perception of new varieties, adoption of improved agricultural technologies, and indigenous on-farm seed management practices.

Farmers' knowledge and use of wheat and barley technologies: There are many factors that influence the technology development including the perception of the scientist, appropriateness to the farming conditions, economic benefits to the farmers and then the means for transferring the technology itself. Since their inceptions in the 1960s, the National Agricultural Research Stations of Ethiopia (Ethiopian Agricultural Research Organization) and Syria (General Commission for Scientific and Agricultural Research) have made a significant contribution in generating new technologies aimed at raising farm productivity to increase farm income, improve farmers' livelihood and achieve national food security. Apart from modern varieties, several crop production packages have been generated, evaluated and recommended including time, method and rate of sowing; fertilizer types, rates and application methods; physical and chemical crop protection practices; frequency and scheduling of irrigation water (where applicable) for use by farmers. Farmers use multiple sources of information such as the formal sector (extension services, development agencies, research, media broadcast) or from informal sources (own experience, relatives, neighbors, other farmers, traders) to get the right information on varietal or agronomic packages for crop production. It is imperative to note that the majority of Ethiopian farmers surveyed (> 90%) are aware of modern wheat varieties, fertilizers, herbicides, agronomic practices and less so on insecticides and on-farm grain storage. In Ethiopia, the agricultural extension service appeared to be the major source of information and as a result most farmers applied fertilizers (96.7) and herbicides (63.5%) to their wheat crop. In Syria, wheat farmers had better access to information (>96%) regarding modern varieties, agronomic packages, fertilizers, herbicides and chemical seed treatment in comparison to barley growers. Fellow farmers (relatives, neighbors and other farmers altogether) were the major sources of information for varieties, agronomy and fertilizers. Most wheat farmers apply fertilizers (100%) and a variety of herbicides (93%). In comparison, only 56% of barley farmers use fertilizers and apply herbicides (4%). In Ethiopia, the wheat production guidelines lack variety specific recommendation and are based on altitude and rainfall patterns, although in recent years more detailed advice is emerging on varietal adaptation, agronomic management practices, use of chemical inputs and their economic threshold for wheat production. In Syria, agricultural production technology

packages are targeted according to crops and the crop production zones where use of high inputs is encouraged for modern varieties and favorable environments. Use and application of fertilizers, irrigation and pesticides have been recommended for wheat production based on the target environments and less so for barley. In general, most farmers fail to apply specific research recommendations and as a result they are unable to derive the best possible economic benefits of the technological packages for wheat and barley production.

Farmers' adoption and perception of modern varieties: The EARO (Ethiopia) and GCSAR (Syria) have made remarkable progress in developing several modern varieties of wheat and barley associated with high and stable yield, responsive to inputs, tolerant to biotic and abiotic stresses and adapted to the agricultural zones of their respective countries. EARO developed and released 39 bread and 9 durum wheat varieties from 1970 to 1997, at the rate of 1.7 varieties per year for a very diverse agro-ecology of the country. Likewise, GCSAR has developed and released six bread and 8 durum wheat varieties over the same period i.e. 0.5 varieties per year for highly variable, but limited agro-ecological zones of Syria. The adoption and diffusion of modern bread wheat varieties was high in Ethiopia where 76% of the sample farmers grew modern bread wheat varieties from the recommended list and 10% 'obsolete' varieties. This figure will increase to 88% if regions that are growing bread wheat only are considered. In contrast, the number of modern durum wheat varieties released from formal research is limited and commercial seed from the formal sector remains insignificant. Most farmers in traditional durum wheat growing areas of central and northwestern Ethiopia are shifting to bread wheat because of high yield and better agronomic performance including grain color, grain size and tolerance to pests. As a result only 0.7% of sample farmers planted a modern durum wheat variety whereas 13.3% of farmers grew a wide range of local durum wheat landraces, mostly in West Shoa, North Shoa and East Gojam regions.

In Syria, adoption of both bread and durum wheat varieties is very high where almost 87% of the farmers plant varieties from the recommended list (excluding obsolete or modern varieties not officially released). In case of barley only one farmer planted a modern barley variety (0.5%). The remarkable success of bread wheat in Ethiopia and bread and durum wheat varieties in Syria, however, did conceal the poor performance of the formal sector in meeting the diverse need of durum wheat growers in Ethiopia and barley growers in Syria. Despite an impressive list of released modern varieties on the recommended list none of them were widely adopted; they were possibly rejected because of lack of adaptability and farmers' preferences.

Farmers have identified as many as 26 technological and socio-economic criteria for adopting and continuously growing a particular wheat variety on their farm. However, grain yield, food quality, marketability, grain color and grain size appear to be most important criteria and transcend all zones. Ethiopian farmers' experience with devastating rust epidemics predispose them to look for varieties resistant to pests. Interestingly high yield, lodging resistance, drought tolerance (yield with less water) and frost tolerance appeared to be varietal characteristics farmers are seeking from new bread and durum wheat varieties in Syria. There is a strong desire for alternative varieties responding to higher inputs and at the same time maintain good agronomic characters such as tolerance to lodging and shattering.

Farmers' seed sources and management: Varietal and seed replacement is a dynamic process affected by farmers' perception about the costs and risks associated with these changes. Small-scale farmers grow as many diverse crops as possible dictated by their domestic circumstances including the various end uses of the crops and provision of household food security. The alternatives to source seed for a mix of crops and varieties grown are challenging and part of a complex decision-making process. In general farmers have four major sources of seed for planting wheat and barley: (i) own saved seed from the previous years; (ii) seed obtained from other farmers (relatives, neighbors); (iii) seed purchased through local trading (markets or grain traders); and (iv) seed purchased from the formal sector. A clear distinction should be made between demand for variety and demand for seed as well as a difference between transient and regular demand for seed.

Farmers may seek seed from outside sources as a means for acquiring new crops or varieties, but not necessarily regularly buy certified seed from external formal sources. The informal sector remained the major initial seed source for modern varieties of bread and durum wheat crops through a local network of seed exchange and remained the major supplier of seed for planting in any crop season. Although the majority of wheat farmers in Ethiopia adopted new varieties, they rely less on the formal sector for their yearly seed supply. The informal sector was an initial source of modern wheat varieties for 58% of the farmers and during the 1997/98 crop season 91.2% of respondents used retained seed or seed obtained from neighbors and traders for planting wheat. In comparison Syrian wheat farmers have better access to seed from the formal sector where nearly sixty per cent of farmers get their initial seed of new varieties; but only 24% of farmers purchased seed from the formal sector in 1998/99 crop season. However, the informal seed acquisition from relatives, neighbors and other farmers or local trading still

played a significant role in diffusion of modern wheat varieties (40.4%). More importantly, most of the barley seed for planting comes from the informal sector. Acquisition of seed from external sources particularly from the formal sector is one of the strategies farmers use for replacing 'old variety or seed'. Most farmers were satisfied with the quality of seed they obtained from formal or local sources. Almost all wheat and barley farmers had a long established culture and experience of exchanging seed among themselves informally on various transactional arrangements contributing to the local flow of seeds.

Farmers' perception of seed quality and on-farm seed management was analyzed for wheat and barley in Ethiopia and Syria. The majority of wheat and barley farmers recognized the difference between seed and grain (92-99%) and linked these differences mostly to the physical quality of seed such as freedom from inert matter, weed contamination and seed size. The perception for physiological (4-18%) and seed health quality (3-10%) is generally low except in Syria where most wheat farmers use chemical seed treatment. Farmers' positive appreciation of seed induces them to practice specific on-farm seed management approaches to maintain the quality of their wheat and barley seed through selection, cleaning, treatment, storage or assessment of seed quality. The responsibility to manage and execute these operations on the farm is shared between men and women, who have a distinctive role to play.

Ethiopian wheat farmers use a variety of options for on-farm seed management including seed selection (67.1%), cleaning (82.8%), separate storage (64.8%) and informal physiological quality assessment (33.9%). Similarly, wheat farmers in Syria also select (53.9%), clean (90.3%), treat (90.3%) and store seed separately (64.1%). Selection of plants or seeds is a dynamic process adapting the variety or a local landrace to a continuously changing crop production environment. It also requires continuous monitoring of the entire life cycle of the crop coupled with regular observation of the characteristics that farmers consider very useful. Farmers practice empirical selection of plants or seeds through critical observation using crop performance criteria although these do not involve specific physical measurements. Plant or seed selection could take place at least in three stages during crop production cycle: selection of the whole field or parts of the field; selection of plants or ears in the field of standing crops before or at harvest; selection of ears/grains on threshing floors; and selection of grains from threshed grain in a storage or at planting time. The most striking difference between wheat and barley seed management was the extent of chemical seed treatment used by wheat farmers in Syria.

Farmers' seed quality: Wheat and barley seed samples collected from different regions and seed sources were analyzed and compared in terms of seed quality. It appeared that the physical and physiological quality of seed did not differ significantly between different sources for individual crops in respective countries except for germination of wheat in Ethiopia and barley in Syria. The formal sector seed occasionally had higher average quality compared to seed from informal sources such as retained seed or seed obtained through local exchange mechanisms. In Ethiopia, the quality of wheat seed from the informal sector was comparable to that from the formal sector both in terms of physical purity and germination where most of the samples (93%) matched the minimum standards set for commercial seed. In Syria, slightly more than half of the wheat seed samples (54%) reached the minimum commercial seed standard. The physical purity of wheat seed from the informal sector (retained seed and from other farmers) was low whereas the germination of formal sector seed appeared to be slightly lower than that of the informal sector. The seed quality of barley seed was the lowest particularly in terms of physical quality where only 9% of the samples met the minimum requirement for commercial seed. However, as most samples were marginally lower than the minimum requirement of the formal sector seed, adjusting the standard slightly downward would make all samples to meet the requirement. However, there is an underlying weakness in the physical quality of seed from the informal sector where traditional cleaning techniques are ineffective in removing most of the contaminants. Contamination with weed seed remains a major problem where most of the samples failed to reach the quality standards prescribed by the national seed program. Introducing appropriate on-farm cleaning techniques could improve quality and minimize contamination particularly with noxious weeds. Moreover, identifying and improving traditional practices of seed quality assessment would help in improving the seed quality at the farm level.

The health quality of wheat and barley seed samples was analyzed; it showed significant differences between regions and seed sources particularly for some pathogens in Ethiopia. Interestingly, more seed health quality problems were observed in wet or high rainfall areas compared to the drier regions showing the influence of the environment on diseases infection. Several fungal pathogens have been isolated from wheat and/or barley seed samples across the country with varying proportion in the number of samples infected (frequency) and the percentage infection (intensity). In Ethiopia 84, 31, 74, 13, 52 and 31% were infected by *Drechslera sativum, Fusarium avenaceum, F. graminearum, F. nivale, F. poae* and *Septoria nodorum*, respectively and more frequently with more than one species. Eighty four percent of samples were infected with *Drechslera sativum* at an average infection level of 1.85%. *F. graminearum* appeared to be predominant among

Fusarium species where 74% of the samples were infected with a mean infection rate of 1.54%. The number of samples infected (31%) and the level of infection (0.5%) was the lowest with *Septoria nodorum* compared to other pathogens. Infection with common bunt (*Tilletia* spp.), loose smut (*Ustilago tritici*) and ear cockle (*Anguina tritici*) appeared sporadic but was found across all the regions surveyed. In general the percentage infection was low except for common bunt and smut infection in excess of the standard. In Syria, the health quality of wheat seed was found to be better than that of barley seed. In the case of wheat 68% of the samples were contaminated with common bunt (more than or equal to 5 spores/400 seeds) and 13.6% of the samples were infected with loose smut all in excess of the lowest standard set for seed health in the West Asia North Africa region. In contrast, 85 and 83% of barley seed samples were contaminated with covered smut (*Ustilago hordei*) or infected with loose smut, respectively. The average percentage infection rate of loose smut of barley was 18% with all samples in excess of seed health standards in the WANA region. It is believed that the wide spread use of chemical seed treatment in wheat might have contributed to such difference in seed health quality between the two crops.

On-farm varietal diversity of wheat and barley crops: Syria is the center of origin and domestication for tetraploid wheat and barley whereas the Ethiopian highlands are considered the centers of diversity of tetraploid wheats and barley where a considerable wealth of genetic variability and diversity still exists on the farm. The spatial diversity, temporal diversity, coefficient of parentage analysis and measurements of agronomic and morphological traits were employed to explain the diversity of wheat and barley varieties or local landraces grown by farmers. The spatial and temporal diversity of wheat and barley were low as only a few dominant varieties were grown widely and the majority of farmers planted these varieties. The wide spread adoption of modern varieties led to a total replacement of traditional durum wheat landraces in Syria. In Ethiopia the expansion of bread wheat into traditionally durum wheat growing areas appeared to threaten the on-farm diversity of landraces. In contrast, a single landrace was grown throughout the major barley growing areas showing the versatile genotypic plasticity of the barley crop. Tremendous agronomic and phenotypic traits diversity was observed particularly among local durum landraces collected from farmers. It was suggested that desirable agronomic characters from locally adaptable landraces should be incorporated into new breeding lines using alternative crop improvement strategies to increase the choice of varieties available to farmers to counter the effects of genetic erosion and increase on-farm diversity and maintenance of the valuable genetic resources.

Synthesis: The main findings of the wheat and barley seed system were used to recommend alternative ways for the development of an integrated, efficient, competitive and sustainable seed industry responsive to the needs of farmers. Moreover, alternative strategies and approaches for the development and/or improvement of local seed systems and its integration with the formal sector has been suggested as a viable option for small-scale resource poor farmers in marginal environments or less accessible isolated and remote areas of the developing countries. The role of policy and regulatory, technological, institutional and socio-economic factors were emphasized from generation to the transfer of technology to farmers. This study combined formal farmer surveys, laboratory analysis, field experiments and secondary data on seed supply to better understand the functioning of the national seed system.

The Role of Seed Quality and Longevity in Rangeland Rehabilitation
Rangelands are a major component of the ecosystems. During the last few decades, rangelands have been degraded at an alarming rate in the WANA region. The most important reasons are the random exploitation of rangeland resources (over-grazing, opportunistic cultivation, excessive use of the scarce green cover as firewood) and poor self regeneration. The key to stop and reverse rangeland degradation resulting from the human induced factors is in restriction of access and rational use of resources. For advanced degradation levels, associated with severe soil and genetic erosion, direct and/or indirect reseeding is required to initiate and foster the system's restoration process. Significant areas of the degraded rangelands in WANA fall in this category.

For most range plant species, seed is the major organ of rejuvenation and dispersion. Hence, the physical and physiological quality and genetic diversity of seeds in the natural soil seed bank and in seed stocks used for reseeding play a crucial role in sustainable range management and rehabilitation. Optimum field establishment of plant populations under harsh conditions can only be achieved with the use of high quality planting material. High quality refers to the physical and physiological quality of the seed at the time of planting. Therefore, the supply of quality seed of rangeland species is a key element for the success of range rehabilitation. Nevertheless, securing a reliable and stable supply of good quality seed under the highly variable climatic conditions of the WANA rangelands is a bottleneck for most of the important rangeland plant species.

During the last few years the Seed Unit has been investigating the seed quality associated constraints in the reseeding-based range rehabilitation projects in the Arabian Peninsula and Syria.

The objectives of the study are:

- Assessment of physical and physiological quality of seed (pure life seed) of range plant seed lots used in direct seeding of severely degraded range lands.
- Development of a practical method for promoting seed longevity during storage.

For pure life seed assessment, one sample of each of Atriplex pollycarpa and Atriplex lentiformes, three samples of A. leucoclada and two samples of Salsola vermiculata were received from the Syrian steppe directorate branches in Deir ez Zor and Raqa through the Syria-FAO Range and Wildlife Rehabilitation Project in Palmyra. All samples were analyzed for physical purity and germination capability with and without threshing and cleaning. The tests were carried out based on the standard procedures of the International Seed Testing Association (ISTA). Paper and soil substratum were used for germination tests. The germination tests with filter paper were carried out in a germination room with a fixed temperature regime of 20 ±2 °C and 16:8 hours alternating light and darkness. The samples planted in soil were kept in a plastic house during the test period. For threshing and removal of bracket the Kamas Westrup Laboratory Brush, followed by a grinding mill and a precision air fractionating blower were used.

The percentage of physical purity before threshing and cleaning ranged from 6.0% to 40.1% for Atriplex and 58.0 and 71.7 for the two Salsola samples analyzed. After threshing (bracket removal) and cleaning, the purity percentages ranged between 84.8 and 99.9% for Atriplex and between 99.7 and 99.6 for the two Salsola samples analyzed (Table 12).

Table 12: Purity (%) of Atriplex spp. (R = non threshed seed; T = threshed seeds).

Source	Species	Initial weight		Inert matter		Pure seed		% Pure seed	
		R	T	R	T	R	T	R	T
Deir ez Zor	*A. polycarpa*	312.1	2.979	293.4	0.454	18.71	2.525	6.0	84.8
	A. lentiformes	310.4	2.976	186.0	0.003	124.4	2.973	40.1	99.9
	A. leucoclada	389.5	2.998	287.0	0.296	102.5	2.702	26.3	90.1
	S. vermiculata	10.0	3.139	2.83	0.008	3.4	3.129	71.7	99.7
Raqqa	*A. leucoclada*	56.0	3.009	245.5	0.197	110.5	2.812	31.0	93.5
	A. leucoclada	291.0	2.489	221.2	0.143	69.8	2.346	24.0	94.3
	S. vermiculata	10.0	3.213	4.18	0.071	5.78	3.135	58.0	97.6

The germination capacity of the uncleaned material of *Atriplex* tested on filter paper was between 0 and 82% and germination in sand ranged between 3 and 15% (Table 13). After threshing, the percentages of germination ranged between 32 and 97% for *Atriplex* and between 75 and 79% for the two *Salsola* samples.

Table 13: Percentage of physical purity and germination of Atriplex spp. and Salsola vermiculata.

Source	Species	Physical purity	%Germination				Pure life seed[2] at	
			Non threshed		Threshed[1]		Lowest	Highest
			Paper	Soil	Paper	Soil	%germ	%germ
Deir ez Zor	*A. polycarpa*	6.0	11	5	37	14	0.3	4.1
	A. lentiformes	40.1	82	15	97	83	6.0	79.5
	A. leucoclada	26.3	0	3	32	5	0.0	8.4
	S. vermiculata	71.7	8	-	75	-	5.7	53.8
Raqqa	*A. leucoclada*	31.0	2	6	8	22	0.6	25.1
	A. leucoclada	24.0	1	5	85	37	0.2	20.4
	S. vermiculata	58.0	4	-	79	-	2.3	45.8

-: not tested; [1]: removal of brackets; [2]: based on physical purity of raw material

Except for *A. lentiformes* with 6.0% germination, the pure life seed calculated using the percentage physical purity of the raw material was low (0.0 to 0.6% PLS). For the threshed samples, the percentage pure life seed was considerably higher (4.1 to 79.5%).

Conclusions: The results of the study clearly indicated that testing the seed of *Atriplex* and *Salsola* for purity and germination provides valuable information on the planting values of these important fodder shrub species which are widely used in rangeland rehabilitation. Threshing and removal of fruit brackets significantly improved both physical purity and germination capability (pure life seed) especially in the *A. leucoclada* and the highly palatable species *S. vermiculata*.

Removal of fruit brackets will, therefore, be very beneficial when the seed will be used for hand-planted fodder shrub nurseries.

Threshing and removal of fruit brackets also reduced the volume (mass) of the planting material which is necessary to optimize the storage conditions and minimize the storage costs. However, it makes the planting material too fine to be planted using the locally available seed drilling facilities.

Cleaning of Vegetable Seed Samples

Jordan had requested to investigate the possibility of using cleaning machines to remove weeds from black cumin, fennel, anise and fenugreek. The major problem in the seed samples were inseparable weed seeds and it appeared that an ordinary air-screen cleaner is not very effective in removing these weed seeds. A gravity table (and brushing machine in anise) can successfully upgrade the seed (Table 14). Bigger seed samples, will even lead to higher physical purity percentages. However, such problems are better and easier handled in the field through proper weed control and improved harvesting technology. For example, both the wild coriander seed in anise seed and *Cephalaria syriaca* weed seeds in fenugreek, can be controlled by mechanical weed control (at the correct time).

Table 14: Cleaning of some selected vegetable seed species.

Species	Contaminants	Machine used	Physical purity (%)
Black cumin	Weed seeds, chaff	Gravity table	99.6
Fennel	Immature seed, chaff	Gravity table	99.7
Anise	Chaff, weeds	Brushing machine + gravity table	99.4
Fenugreek	Weed seeds	Gravity table	93.0

8. PRODUCTION AND DISTRIBUTION OF SEED

Output 7 aims at accelerating the availability of improved varieties to national programs to promote the transfer of promising lines or varieties. The Seed Unit is producing limited quantities of high quality seed of ICARDA-related promising lines. The availability of such material should help NARS to quickly start up seed multiplication. Also, small quantities of seed of released varieties are produced for use by research programs.

Iraq: Ultimately, the larger quantities of seed produced could also be used for emergency purposes. In 2003, for example, 20 MT of high quality seed was distributed to Iraq for use for technology demonstration purposes. ICARDA provided

Preparing seed to be sent to Iraq

seed of four varieties of barley, two varieties of bread wheat, three varieties of durum wheat, one variety of lentil and two varieties of chickpea.

Seed Services

During the 2003 crop season, the quality seed production, processing, storage and quality control services of the Seed Unit to commodity programs continued. These activities generated 64 MT of quality seed from 145 lines of seven ICARDA mandate crops (Table 15).

A total amount of 42 MT representing 65% of the 64 MT produced has been distributed to NARS (17%) or used for research (11%), participatory activities (30%) and further multiplication (7%) (Table 16).

Moreover, the seed processing plant has been extensively used to clean and treat 403 MT of seed for ICARDA programs (Table 17). In the seed processing laboratory, 8600 samples for genetic resources and international nurseries have been cleaned and treated (Table 18).

In the central ICARDA store 93,000 samples of breeding material and 70 MT of quality seed are stored. Monitoring and control of rodents and storage insect pests using fumigation and pesticide spraying continued (Table 20).

In the seed testing laboratory, 4600 samples have been analyzed for research and quality control purposes (Table 19).

Table 15. Quality seed production in 2002/03 crop season.

Crop	Breeder Seed		Pre-basic Seed		Basic Seed		Certified Seed		Quality Seed		Total	
	Lines	Kgs	Lines	Kgs	Lines	Kgs	Lines	Kgs	Lines	Kgs	Lines	Kgs
Bread wheat	9	119	3	1,200	3	827	1	2,800	176	7,040	192	11986
Durum wheat	7	109	6	2,050	3	6,420			48	11,910	64	20,489
Barley	12	356	2	250	3	7350	1	600	4	7,300	22	15,856
Chickpea	6	47	4	785					15	2,520	25	3,352
Lentil	3	70		2	1150				1	1,300	6	2,520
Vetch									8	1,864	8	1,864
Faba bean	2	4							2	43	4	43
Total	**39**	**705**	**15**	**4,285**	**11**	**15,747**	**2**	**3,400**	**78**	**24,937**	**145**	**64,003**

Table 16: Seed distribution in 2003.

Crops	Production kgs	Seed Distribution				
		NARS	Research	Participatory Research	Multiplication	Total
Bread wheat	19,879	2,000	3,450	1,950	100	7,500
Durum wheat	20,489	4,140	1,060	9,865	1,770	16,835
Barley	15,856	3,100	1,600	4,200	918	9,818
Chickpea	3,352	1,250	1,155	0	561	2,966
Lentil	2,558	750	8	1,650	150	2,558
Vetch	1,864	0	0	1,314	550	1,864
Faba bean	43	0	0	0	22	22
Triticale	324	0	0	0	306	306
Total	**64,365**	**11,240**	**7,273**	**18,979**	**4,377**	**41,869**
Percentage		17.6	11.4	29.7	6.8	65.4

Table 17: Large-scale seed processing (V = Number of Varieties; MT = Metric Tons, St.Op = Station Operations Department, GP = Germplasm Program, NRMP = Natural Resource Management Program).

	Wheat		Barley		Lentil		Chickpea		Vetch		Cumin		Oat		Saf flower		Total	
	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT
St.Op	3	8.1	4	97.3	3	156.1	2	31	1	5.6	1	4.2	1	1.5	1	2.9	16	306.7
Seed Unit	12	24.9	9	16.7	4	3.1	6	4.1	5	2.3							36	51.1
GP			16	27.3	4	4.4	3	8.5									23	40.2
NRMP	1	1.7	1	2.4					1	1.2							3	5.3
Total	**16**	**34.7**	**30**	**143.7**	**11**	**163.6**	**11**	**43.6**	**7**	**9.1**	**1**	**4.2**	**1**	**1.5**	**1**	**2.9**	**78**	**403.3**

Table 18: Small-scale seed processing.

Crop	GRU	GP	Seed Unit	Total
Barley	558	3335	15	3908
Wheat	690	2606	49	3345
Chickpea	1341	18	1359	
Lentil			3	3
Atriplex		4	4	
Triticale		7	7	
Total	**2589**	**5941**	**96**	**8626**

Table 19: Seed testing activities during 2003.

Tests	No of tests/Programs					Total
	SU	NRMP	GP	Station Operations	NARS	
Viability	491	333	75	6	14	919
Specific weight	2461		606	6	12	3085
Moisture content	12		40	6	12	70
Total	**2964**	**333**	**721**	**18**	**38**	**4074**

Table 20: Number of samples and quantities of seed lots in tons kept in the ICARDA medium term seed store for breeding material during 2003.

Crops	GP		NRMP		SU		St.Op	Total	
	Samples	Lots (MT)	Samples	Lots (MT)	Samples	Lots (MT)	Lots (MT)	Samples	Lots (MT)
Barley	80,000	6.8		1.0	341	20.2	1.0	80,341	**29.0**
Faba bean	5,000	9.0		0.2	33	17.7		5,033	**26.9**
Chickpea	2,675	9.7			13	6.5		2,688	**16.2**
Lentil	1,950	10.0		0.1	22	5.7	3.0	1,972	**18.8**
B/wheat	430				501	20.7	2.0	931	**22.7**
Medic			138	4.0				138	**4.0**
D/wheat					22	20.6	2.0	22	**22.6**
Vetch	2,500	11.2		1.0		1.8		2,500	**14.0**
Trifolium			45					45	**0.0**
Triticale					6			6	**0.0**
Total	**92,555**	**46.7**	**183**	**6.3**	**938**	**93.2**	**8.0**	**93,676**	**154.2**

9. SEED UNIT STAFF, CONSULTANTS

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Osam Al-Deen Obedo	University of Aleppo: *A Study of the Factors Causing Vigor Variability of Barley Seeds and Seedlings and Their Effects on Grain Yield* (Defended his theses in 2003).

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