SEED UNIT ANNUAL REPORT 2004 - 2005

ICARDA

International Center for Agricultural Research in the Dry Areas

About ICARDA and the CGIAR

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is one of 15 centers supported by the CGIAR. ICARDA's mission is to improve the welfare of poor people through research and training in dry areas of the developing world, by increasing the production, productivity and nutritional quality of food, while preserving and enhancing the natural resource base.

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 (CWANA) region for the improvement of bread and durum wheats, chickpea, pasture and forage legumes, 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, regional and international agricultural research and development systems.

The Consultative Group on International Agricultural Research (CGIAR) is a strategic alliance of countries, international and regional organizations, and private foundations supporting 15 international agricultural Centers that work with national agricultural research systems and civil society organizations including the private sector. The alliance mobilizes agricultural science to reduce poverty, foster human well being, promote agricultural growth and protect the environment. The CGIAR generates global public goods that are available to all.

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 with a System Office in Washington, DC. A Science Council, with its Secretariat at FAO in Rome, assists the System in the development of its research program.

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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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1. INTRODUCTION

The primary objective of the Seed Unit of ICARDA is to strengthen national seed systems in Central and West Asia and North Africa (CWANA) with an overall goal of increasing agricultural production and productivity and ensuring food security through improved seed security. These objectives are achieved through supporting the formal public and private seed sectors and alternative seed delivery systems.

From January 2005, the Seed Unit became a part of ICARDA's Megaproject on Knowledge Management and Dissemination for Sustainable Development in Dry Areas.

Strengthening seed systems is demand-driven and includes a wide range of activities and implemented in partnership with the national seed programs across the region.

In this report, Chapter 2 describes the village-based seed enterprise program and related activities, including all in-country training courses and consultancy missions. Chapter 3 reports the activities in Iran, Sudan, Uzbekistan and Yemen in strengthening national seed programs. The activities of the WANA Seed Network are reported in Chapter 4. The International Seed Trade Conference (November 2005, Antalya, Turkey) was one of the highlights showing the future direction of the WANA Seed Network. Chapter 5 summarizes research on seed technology and seed supply carried out by the Seed Unit. Chapter 6 presents human resource development in the region whereas Chapter 7 reports the services (seed production, processing, storage, testing) that are provided to the commodity programs at ICARDA.

2. VILLAGE-BASED SEED ENTERPRISES PROGRAM

In many dry areas, the most pressing challenges are finding an innovative and alternative approaches not only to breeding improved crop varieties which truly meet farmers' diverse and complex needs, but at the same time organize a low-cost production and marketing system to optimize seed delivery and diffusion of new varieties both from conventional and non-conventional breeding programs.

In collaboration with the NARS in the CWANA region, ICARDA's variety development portfolio focuses on low value crops such as barley, wheat, lentil, chickpea, faba bean and feed legumes (vetchs, etc.) Except for wheat, the

national seed industries in the region do not produce significant amounts of quality seed of improved varieties; where they do, the seed often does not reach the farmers in the rainfed and/or marginal areas. Since the ICARDA strategy is to alleviate poverty in such dry areas, the Seed Unit of ICARDA is currently exploring an alternative approach for seed delivery targeting farmers in less favourable environments and remote areas by establishing pilot village-based seed enterprises (VBSEs) in selected communities.

The objective of the program is to develop, test and demonstrate a pilot model for organizing and improving the operations of farmer-managed seed supply, in a manner, which provides high-quality seed and develops skills, which should lead to a sustainable and profitable rural seed business (VBSE). Individual farmers/group of farmers willing to participate in local seed production and marketing are identified and organized through a multi-stakeholders process. They are provided with seeds, inputs facilities and technical advice to initiate seed production and marketing. This program is (or will be) implemented in some countries of the CWANA region (Afghanistan, Algeria, Eritrea, Morocco, Pakistan, Tunisia, Syria, Yemen).

The main purpose of the VBSEs is to help increase crop production and ensure food security at the local village level by (a) introducing and demonstrating improved crop varieties and associated technologies to farmers as a means to increase crop production and ensure food security; and (b) asssessing, multiplying and marketing the actual village demand for quality seed of improved and/or local varieties.

The village-based seed enterprise program is a strongly decentralized seed production and marketing program implemented at the village level; it links seed demand with seed production at the local level. Since all operations are carried out at the village level, transport, marketing and distribution costs are significantly reduced resulting in a lower seed price. The program brings enterpreneurial skills to on-farm seed production and assists in crop diversification to increase or stabilize rural income and improve farmers' livelihood strategies.

2.1. Afghanistan

By 2002, more than two decades of war and a prolonged drought had resulted in serious economic decline and had brought agricultural production to a stand still. Formal institutions had collapsed, infrastructure was devastated and skilled manpower was virtually non-existent. In 2002, following the end of the conflict, there was an urgent need to improve food security and rural livelihoods by raising agricultural production and productivity. Most farmers were using own-

saved seed of obsolete varieties with low productivity. To increase production, quality seed of improved adapted varieties was required immediately. However, the formal sector did not function and the private sector had no interest in entering the seed market.

With funding provided through USAID's RAMP (Rebuilding Agricultural Markets Program) project, ICARDA as a lead center of the Future Harvest Consortium to Rebuild Agriculture in Afghanistan (FHCRAA) initiated the process of rebuilding the seed sector. The Seed Unit is implementing one of the RAMP projects, namely; 'Village Based Seed Enterprise Development' in five target provinces (Ghazni, Helmand, Kunduz, Nangarhar, and Parwan). The project aims at setting up 20 VBSEs i.e. at least one VBSE in four selected districts each in five target provinces in Afghanistan. The main purpose of VBSEs is to:

1. Introduce improved crop varieties and associated technologies to farmers to increase crop production and ensure food security.
2. Demonstrate the technology required in producing quality seed within the village, under farmers' local management to meet local seed demand.
3. Assist farmers in multiplying varieties locally tested and selected based on their preferences.
4. Assist farmers in seed marketing in the surrounding areas and beyond and add value to farm products and generate additional income for farmers.
5. Assist farmers in acquiring the technical and managerial skills required to manage small rural enterprises.
6. Assist farmers in crop diversification and market information to increase rural income and improve farmers' livelihood strategies.
7. Strengthen the linkages between conventional and participatory plant breeding and seed supply systems.

In VBSEs farmer participation is the pillar of the program where they are empowered to play a key role in decision making about seed production and marketing without external influence. All partners including policy and regulatory agencies and technical institutions from formal (research, development, extension) and informal (farmers' groups, communities, NGOs) sectors are consulted through an all inclusive multi-stakeholders process to define their roles and responsibilities..

VBSEs are established following a series of consultation meetings and consensus building measures with farming communities and other stakeholders to identify the seed gaps and priority crops. The first step was to select and organize farmers who are interested in taking up seed production as a business.. The sec-

ond step includes preparing a simple business plan to assess the sustainability of the operations. The business plans often includes a seed demand survey to assess the potential market for the seed produced by the enterprises.

Farmers are closely monitored during seed production, cleaning and storage and advised to apply acceptable practices to produce and maintain the quality of seed produced. Assistance was also provided in promoting the seed and finding markets. An important part of the backup support is training. Training courses (including VBSE member farmers, development agents and extension workers of Ministry, NGOs) were conducted at regular intervals throughout the years, focusing on technical aspects of production, processing, quality control, marketing, financial management, record keeping and business/enterprise management.

The challenge is to further support these enterprises to develop into small private seed companies that provide seed of improved varieties to farming communities in marginal areas in a sustainable manner.

2.1.1 Baseline Survey

To collect information on crop varieties and management practices, a baseline survey was carried out in the five target provinces, covering 27 districts in 2004. The main objective of the survey was to determine benchmark indicators against which project achievements can be measured. The survey also provided important information regarding constraints to the adoption and diffusion of improved technologies and practices. In the first stage, a random sample of 81 villages (12%) was selected out of a total of 675 villages. Each district was divided into three clusters and one village from each cluster was randomly selected. In the second stage, one fifth of the farm households was selected and interviewed. On average 50 households per village were sampled, including a total of 810 farmers. The results related to seed are summarized below.

- With the exception of wheat, accessibility to seed of improved varieties, particularly of potato, rice, mung bean, onion and tomato is very poor.
- Generally yield of local wheat varieties is below that of improved varieties.
- There is a clear need to show the advantage of using quality seed of improved varieties to convince the farmers.
- Among farmers using improved varieties, more than half indicated that expectations were met.
- Farmers do not know the main sources of improved seeds.
- Unavailability, lack of awareness and resources were among the main reasons for not adopting improved varieties.
- The local market is the main marketing channel for agricultural products including seeds.

2.1.2. Business Plans

A business plan is considered the road map for an enterprise. The project supported VBSEs in the preparation of business plans from 12 June to 9 August 2005. In addition to the business plans for all VBSEs, the following documents were also prepared: (a) bylaws for trade association (the Afghanistan Association of Seed Enterprises - AASE), (b) publication to assist in educational promotion of farmers (promoting good seed use), and (c) guidelines for seed enterprise management (simple procedures for operating a successful enterprise). A summary of the recommendations is as follows:

1. Government must establish and implement a legal system to create legal entities of corporations, partnerships, etc. VBSEs should become legal entities as soon as possible to obtain credits and loans to enable them having a staff, operate with partner-farmers, and maintain operations and equipment.
2. To maximize the potential public image and political influence of the VBSEs, an 'Association of Afghan Seed Enterprises (AASE)' should be formed. This would enable the VBSE's to negotiate with government and the public as a group, and thus have a strong voice in getting needed legislation and government actions.
3. An effective agricultural extension technology transfer system should become operational as a priority.
4. Government must establish seed policy/law implementing agencies which must be independent of research, extension and production.

2.1.3. Seed Demand Assessment

The objective of this study was to assess demand for seed of improved varieties in the respective provinces as part of the VBSE project monitoring process in 2004. It also aims at identifying constraints to the adoption and diffusion of improved seeds. Results of the assessment are summarized as follows:

1. The effective demand for improved seed per farm household, on average, is estimated at 117kg for wheat seed, 80kg for rice, 10kg for mung bean, 200g for tomato seed, and 1kg for onion seed. There is a potential for increasing demand to more than 100% for wheat and rice seed, and triple that of mung bean. Similarly, demand for potato, tomato, and onion seed could increase by 79% to 82% respectively. When reliable household statistics on the number of farmers growing each crop become available, projections of effective demand could be made for each province based on sample results which will be useful for the VBSEs.
2. The majority (75%) of respondents used farmer-saved seed, which does not imply the use of local varieties. Many improved varieties of major crops have been introduced in Afghanistan over the years and farmers continued to

save and use preferred ones. About 25% of farmers purchased improved seed from ICARDA-supported VBSEs, NGOs or the local markets. The Government seed distribution system is not reaching farmers as only 2% of respondents enumerated it as a source for seed.

3. None of the above sources provides seed to farmers freely. The prices paid for seed differ from one province to the other. Seed of recommended improved varieties carry a price premium over non recommended varieties, estimated at 12% for rice, 13% for wheat, 26% for potato, 40% for mung bean, and 81% for onion.
4. Estimated quantities of improved seed the representative farm households projected to buy during the upcoming season show substantial increase over current demand levels and provide evidence that farmers are willing to use improved seed. Whether they would plan accordingly, make financial provisions, accept market prices or actually find improved seed from different sources cannot be ascertained through this study.
5. The maximum price at which farmers would stop from buying improved seed is not very high compared to the current price levels. In fact, the average price farmers have declared they are ready to pay for improved seed in the coming cropping year are lower than the current price levels, ranging from 7% for potato, 11% for wheat, 14% for rice to 34% lower for mung bean. Given the relatively wide margin below current prices at which farmers are ready to purchase seed, it is not expected that demand for seed will increase tremendously in the next cropping year unless sales prices decrease. This demand may in fact decrease if seed prices increase next year compared to their current levels.
6. The implication for VBSEs is that they need to focus on reducing production and processing costs that would allow them to sell quality seed at low prices. In terms of marketing strategy it implies that VBSEs may have to relinquish from the current competitive pricing practice of selling seed with a margin between 15 to 50% above grain prices, or at least revise the margin downward. There is an urgent need to create awareness about the existence and availability of improved seed of crops other than wheat.

2.1.4. Performance and Profitability

The success of VBSEs can be measured by the performance and profitability of the seed business. Based on data gathered on areas cultivated, crop yields, and expected farm-gate seed prices at the time of sales, projected total revenues generated through seed operations were estimated for each VBSE for 2004/05 crop season. By-products of seed such as straw, fodder, and production sold as vegetables (tomato, potato, and onion) were also valued. Expected prices were determined by VBSE members and used in the estimation because fields were

just harvested and marketing had been limited except for vegetables. Production costs were estimated using quantities, prices of purchased inputs and opportunity costs of household-owned inputs. In all cases, 10% was added to the sum of variable costs to account for interest on operating capital and miscellaneous expenses not captured during the itemized data collection.

Profitability of seed activities was assessed using total production costs associated with inputs used and projected revenues. Gross margins determine the contribution of each seed production activity to the profitability of the whole farm managed by each VBSE. They measure the likely returns or losses of a particular crop, but do not account for fixed costs relating to building, machinery and equipment depreciation, administration, etc. This is a convenient way of measuring returns over variable costs without too much consideration to fixed costs that will be difficult to allocate to individual seed and other production activities on the farms. In the context of agricultural production, where VBSE members do not own farm machinery and processing equipment or buildings, but rent most of these services, fixed costs are minimized on the farms and the gross margins are approximate indicators of crop profitability. Furthermore, gross margin is a useful tool in farm management to address the issue of increasing returns by changing the combination of crops, which is very important for the VBSEs towards diversification and ensuring economic viability.

Total land cultivated, amount of seed produced, expected (realized for tomato and onion) farm -gate average prices for the 2004/05 cropping year and the number of VBSEs that engaged in the production of each crop are summarized in Table 1. During the 2004/05 cropping year all 17 active VBSEs in Afghanistan produced wheat seed; in addition 14 VBSEs produced potato seed, 9 of them produced rice, 7 produced mung bean or tomato, and 6 produced onion. Together they cultivated 1030 hectares of land over the winter, spring and summer seasons. The bulk of the acreage was allocated to wheat and mung bean productions in the proportions of 53% and 26% respectively. Rice accounted for 13%, while potato, tomato and onion covered only four, two, and one percent respectively.

The seed enterprises altogether produced 6,225 tons of seed and vegetables distributed among the crops as follows: 35% wheat, 23% tomato, 14% potato, 10% rice and onion, and 7% mung bean. From this output about 40 to 50% of potato productions (355 tons) were sold for consumption owing to large tuber sizes, and in most cases onion and tomato were commercialized as vegetables although small quantities were used as farmer-saved seed. In comparison with the 2003/04 cropping year, the current level of production represents a more

than four folds increase. Each VBSE, on average, produced more than 100 tons of seed, which is the performance target at project end.

Table 1: Area cultivated, seed production and expected average prices (2004/05)

Item	Wheat	Potato	Rice	Mung bean	Tomato	Onion
Number of active VBSEs	17	14	9	7	7	6
Total area (hectare)	542	45	139	264	25	14
Average area (hectare/VBSE)	32	3	15	38	4	2
Total Production (ton)	2,188	887	651	429	1,438	632
Average production (ton/VBSE)	129	63	72	61	205	105
Average price (farm gate Afs/ton)	12,941	13,878	17,460	26,122	11,429	2,857

Note: 1$=50Afs; 1 Jerib=2000m^2; Part of potato and all tomato and onion production were commercialized as vegetables.

Gross margins generated per unit of land during the cropping year are summarized in Table 2. These margins vary substantially across crops and locations of the VBSEs. Wheat and rice generated the lowest margins for the VBSEs. The margin on mung bean in Nangarhar province (by Kama VBSE) is at least three times what is obtained in Kunduz province. Therefore, Kama may have a comparative advantage in mung bean seed production. However, on average, tomato appears the crop that contributes most to overall profits (Afs 103,628/jerib) followed by potato, onion, and mung bean. The ranking of onion is affected by production losses recorded by Khan Abad and Imam Sahib enterprises in Kunduz. In descending order, tomato, potato, onion, and mung bean should be considered for enterprise diversification to reduce risk and increase returns. As a result of differential yields, production costs, and expectation about prices, there is a tremendous variation in the margins across VBSEs as shown by the coefficients of variation (CV) measured by the percentage deviations from the mean. The least variation is observed for tomato while the largest is observed for onion and mung bean. In other words, the VBSEs seem to perform more or less equally in the production of tomato as value-adding vegetable crop, and of rice and wheat seed, most of which are cultivated in limited geographic areas (Kunduz and Nangarhar provinces only).

Table 2: Gross margins (Afs) per jerib of land by VBSE and by crop

VBSE	Wheat	Potato	Rice	Tomato	Onion	Mung bean
Kunduz						
Ali Abad	6,021	33,372	6,858	113,282	13,590	6,773
Center Kunduz	3,621	42,772	5,608	145,282	18,120	9,473
Khan Abad	6,021	28,672	5,608	81,282	-1,880	4,073
Imam Sahib	5,221	47,473	5,608	145,282	-1,880	8,573
Chardara	6,021	47,472	13,108	105,282	18,120	4,973
Archi	6,821	42,773	8,108	81,282	18,120	6,773
Nangarhar						
Kama	7,184	17,765	16,707	53,704		31,259
Sunkhrud	15,984	6,110	8,706			
Beshoud	9,094	21,854	14,207			
Khewa	10,584	22,713				
Ghazni						
Qarnbajh	16,508	107,845				
K-Omary	14,266	52,845				
Helmand						
Nad-e-Ali	12,398	21,590				
Bolan	12,678	37,315				
Parwan						
Jabal Seraj	9,781					
Charikar	11,581					
Bagram	6,846					
Average	9,449	37,898	9,391	103,628	10,698	10,271
Standard dev.	3928	24215	4213	34295	9899	9442
CV (%)	41.6	63.9	44.9	33.1	92.5	91.9

Note: 1$=50Afs; 1 Jerib=2000m^2

VBSEs in Kunduz province are the most progressive and diversified units, all of which produced wheat, rice, mung bean, potato, tomato and onion. These were followed by Kama VBSE in Nangarhar province which also produced all these crops except onion. The least diversified VBSEs are in Ghazni, Parwan, and Helmand as they produced wheat only or in combination with potato seed. In comparison to Kunduz and Nangarhar provinces, most VBSEs in Ghazni and Parwan were newly established and only had their first year of seed production experience.

All VBSEs expect positive and in some cases substantial gross margins for seed and vegetable production they engaged in during the 2004/05 cropping year.

except for Khan Abad, Imam Sahib VBSEs that recorded losses in onion production, They should be able to cover fixed production costs which are deemed very low because of the nature of investment in buildings, machinery and equipment on the farms. VBSEs in Kunduz province have performed relatively better compared to those in other locations, in terms of area cultivated and having generated the highest gross margins per VBSE through diversified portfolios of activity. The top four VBSEs are Center-Kunduz (Afs 10.1 millions), Ali Abad (Afs 10.3 millions), Imam Sahib (Afs 8.9 millions), and Chardarah (Afs 6.9 millions). The least performing VBSEs are the newly established ones in Parwan province.

There is great potential for VBSEs to scale up their operations as demand for quality seed in some districts is not met. Based on the gross margins per unit of labor and capital to finance variable costs which are the major constraints for enterprise members, the VBSEs could increase the scale of seed production for mung bean, tomato and potato to increase the profitability of their farms. Improving storage and providing credit facilities will be instrumental to such expansions. Similarly, continued supports is required in the areas of seed cleaning, quality testing, packaging, labeling, and marketing which will certainly add cost as well as value to seed and the VBSEs as a whole.

2.1.5. Provision of Seed Processing Machines

Within the framework of the project 15 cleaning and treating machines, equipped with all the necessary features to upgrade the quality of seed produced, have been purchased from DARBAS Company in Syria. A mission consisting of ICARDA and DARBAS (24 June - 7 July 2005, Kabul, Afghanistan) was organized and visited Afghanistan to assemble, test and demonstrate the machines. Three ICARDA supervisors and seven representatives from VBSEs received training and participated in the assembling, testing and operation of the machines.

2.1.6. Appropriate Record Keeping

In another development efforts were made to improve the record keeping of the VBSEs. Accurate record keeping practices of enterprise members is important because it will facilitate decision making to improve seed operations, profitability analysis, and financial management. Given the limited knowledge of formal accounting procedures by the members, it was deemed necessary to initiate the process of records keeping at farm level without burdening the enterprises with complicated accounting systems. After discussions with the leaders of VBSEs, a simple record keeping document was designed for use by VBSEs and translated into local languages covering village based seed enterprise references, production records, disbursement records, processing records and sales records.

2.1.7. Training Courses

Within the framework of the Village Based Seed Enterprise Project a large number of training courses have been conducted in Afghanistan, both for VBSE member farmers and staff of the Ministry of Agriculture, NGOs, FAO, etc.

A VBSE member farmer inspecting wheat production fields for seed quality in Afghanistan.

Seed Production Technology and Enterprise Management: a Train-the-Trainer Course, 16-24 February 2004, Kabul. The purpose was to train staff from support-providing institutions (Ministry of Agriculture, Development Agencies, NGOs, etc) to acquire knowledge in seed technology and enterprise management to enable them provide support and guidance for establishing and operating local small seed enterprises with farmers. A total of 41 participants attended the course. The course was participatory in nature including a mix of introductory lectures, practical sessions and exercises on seed technology and financial management issues. Working group discussions were structured along four themes: (a) farmers' local knowledge in seed selection and management; (b) crop specific guidelines for quality seed production under the VBSE scheme; (c) opportunities and challenges in establishing and operating VBSE; and (d) technological and institutional support required for operating VBSE.

Seed Production Technology and Enterprise Management, Jalalabad (18-20 May 2004) and Kunduz (26-27 May 2004). Two follow-up courses were organized to train VBSE member farmers and district agricultural extension staff to acquire knowledge in seed production and enterprise management to operate small seed enterprises at the local level. A total of 53 and 47 participants in Jalalabad and Kunduz respectively, attended the course. Participating farmers came from Baghlan, Ghazni, Helmand, Kapisa, Kunduz, Nangarhar Parwan and Takhar provinces. The courses were practical-oriented and focused on simple and illustrative guidelines relevant to the needs of farmers engaged in small-scale village based seed enterprises. The course included introductory lectures, practical sessions on seed technology and exercises on financial management for establishing and operating a sustainable small seed enterprise. The working group discussions were focused on a questionnaire developed to assess constraints and challenges in establishing, operating and managing VBSEs.

Food Legume Crop Improvement and Management, 24-27 May 2004, Kunduz. During the same period, in Kunduz, a special training course was held on food legumes (24-27 May 2004) to train the research and extension staff in food legume crop improvement and management. A total of 21 trainees and three ICARDA personnel participated in the course. The course included the importance of food legumes in the dryland farming systems, breeding methods for improvement of food legumes with specific reference to biotic and abiotic stresses and various production and integrated crop management techniques. Field visits were organized to jointly evaluate the food legume crops for the agronomic traits and disease reaction.

Management and Financial Accounting in Village Based Seed Enterprises, Charikar (11-12 December 2004) and Jalalabad (14-15 December 2004). The main objective of the training courses was to improve knowledge and skills of the participants regarding seed business management, seed marketing, financial analysis and best agronomic practices. A total of 60 participants attended the training in Jalalabad and 67 in Charikar, which included three key farmers from each of 8 VBSEs (5 from Kunduz and 3 from Parwan) along with ICARDA field coordinators and technical staff as well as extension personnel from five provinces. Farmers from Ghazni, Helmand and Nangarhar provinces participated in Jalalabad course and those from Kunduz and Parwan provinces attended the course in Charikar/Parwan.

Quality Assurance and Seed Processing, Jalalabad (19-21 April 2005) and Kunduz (24-26 April 2005). Two separate courses were organized to provide VBSE members with skills for quality seed production. A total of 104 participants (51 in Kunduz and 53 in Jalalabad), mainly VBSE members and staff working with the MAAH, FAO, NGOs and ICARDA technical field staff attended the two courses. The participants came from Baghlan, Bamiyan, Ghazni, Herat, Kabul, Kunduz, Helmand and Nangarhar, Parwan and Takhar provinces.

Demonstrating a mobile seed cleaner and treater to VBSE member farmers during a training session in Afghanistan.

Seed Processing and Storage, Herat, 27-30 June 2005. ICARDA and FAO cooperate to promote the establishment of village based seed enterprises. The seed processing and storage course was organized within this framework to train seed plant operators and store managers. ICARDA provided the subject matter specialist and FAO provided financial support for course participants. The course was conducted at the Improved Seed Enterprise facilities in Herat. The course included theoretical lectures and practical sessions relevant to operation and management of seed processing machineries and storage facilities. Moreover, group sessions on practical aspects of seed processing and storage were organized to stimulate exchange of views and sharing of practical experiences. A total of 19 trainees participated in the course. The participants came from the FAO, Improved Seed Enterprise (MAAHF) and ISRA.

2.1.8. Protected Agriculture Mission

The Seed Unit economist assisted (25 September – 7 October 2005, Afghanistan) in monitoring the performance of the Protected Agriculture Project ('Introducing Protected Agriculture for Cash Crop Production in Marginal and Water Deficit Areas of Afghanistan'), which aims at contributing to improved agricultural productivity, market efficiency and rural incomes by promoting the adoption of affordable and sustainable protected agricultural systems to produce high value crops, using marginal or otherwise non-productive lands and water more efficiently.

The greenhouse technology is drawing substantial interest within farming communities in the six provinces and beyond as there were calls for its expansion and introduction to other provinces. Many farmers, technicians, and people who have been exposed to it have shown a lot of enthusiasm and are eager to adopt or at least to try it. Most of them would like to own more than one greenhouse structure, but requested some financial supports or at least a credit scheme to fund the venture.

A marketing study was also conducted to examine the dynamics of selected vegetable prices and quantities supplied to the main market in Kabul. It aimed to determine the appropriate timing of production under Protected Agriculture or greenhouse conditions that would allow producers to take advantage of supply deficiencies and maximize returns when prices are high. In addition, price forecasting models were developed to aid in vegetable marketing decisions using data collected from market commissioners that purchased and auctioned vegetables between August 2004 and December 2005.

Results show that there may be an opportunity for Afghan vegetable growers who adopted Protected Agriculture technology, to compete with Pakistan suppliers and increase market share for vegetables by extending harvests into November and part of December. Alternatively, an early spring planting strategy (in late February through March) could be adopted in order to harvest in May. Both strategies require an increase in efficiency of operations that minimizes production costs and confers to the local grower a competitive advantage over Pakistan rivals. If however, these growers can adequately equip and manage their greenhouses with a heating system, then most vegetables could be planted for timely harvest and marketing between November and April coinciding with high prices.

A comparison of price forecasting models developed for cucumber and tomato provide evidence of the necessity to continuously update market information on prices in order to project more accurate future price forecasts. These models predicted very well out-of-sample price forecasts and therefore, could be used by marketing extension agents as well as project staff to help vegetable growers improve their production and marketing decisions. Further analysis will evaluate alternative crop rotation schemes to maximize growers returns over time based on unit production costs, gross margins, and elements of risks associated with vegetable production in Afghanistan.

2.2. IRDEN Project in North Africa

The Integrated Research on Durum Economics Network (IRDEN) is a project aimed at fostering wider adoption of low-cost durum technologies for increased income and improved household food security of smallholders in less-favored areas of West Asia and North Africa. The Seed Unit was tasked to implement the seed component whose main objective is to develop an alternative mechanism to optimize seed delivery and diffusion of new durum wheat varieties to resource poor small-scale farmers in less favored areas of Algeria, Morocco and Tunisia where the formal sector failed to operate effectively. It calls for establishing efficient and sustainable local level seed production through strong partnership with private sector, NGOs and grass root organizations not only of drum wheat, but also other winter cereals (bread wheat and barley) and food legumes.

The implementation of the seed component in Algeria, Morocco and Tunisia was reviewed in March 2004 and it was recommended to follow a common approach and establish small seed enterprises using individual/group of farmers and improve the quality of cleaners to be supplied to farmers. In May 2004, national work plans were developed in a regional workshop and its implementation was initiated. While both on-station and on-farm seed production with

farmers continued during 2003 and 2004, the 'enterprise' approach was strongly recommended because it would lead to establishing a sustainable local seed production system, which in the future provides farmers with quality seed of improved varieties in those areas where the formal sector does not operate.

Pilot farmers for establishing seed production and marketing enterprises were identified in partnership with project coordinators in the respective countries in March 2005. Accordingly, one farmer from Rahouia community in Algeria and two farmers each from two communities in Morocco (Sidi El Aidi and Jemaat Shaim) and Tunisia (Sidi Aouidet and Siliana) were identified as potential entrepreneurs and suggested that national project coordinators work with them to develop business plans. Detailed information regarding seed production costs were collected and business plans are under development for entrepreneurs in Algeria and Tunisia.

A farmer entrepreneur (Mr Benelhadji Djelloul, third from right) involved in local wheat seed production and marketing in Rahouia community in Algeria.

Appropriate seed cleaning machines manufactured in Syria have been made available and training in operation and management conducted for technical staff and farmers. However, long-term sustainability will only be achieved if the seed-producing farmers will have the possibility to continuously sale seed in an open/free market to other farmers. Therefore, capacity building will go beyond technical issues and will include training entrepreneurial farmers in business and financial management and marketing.

During 2004/05 crop season, the potential entrepreneurs were engaged in local production, cleaning, treatment and marketing quality seed of new improved durum wheat varieties contributing to local diffusion and adoption in the project sites. In Algeria, a potential seed entrepreneur Mr. Benelhadj Djelloul from Rahouia community has produced and marketed 90 tonnes of cleaned seed and cleaned and treated 425 tonnes of seed for other farmers using the machine provided by the project. Moreover, on-farm seed production of new varieties was carried out by the project with 12 farmers producing 192 tonnes of seed for their own use and local exchange.

In Tunisia, Mr. Rejeb Rhaim from Sidi Aouidet produced 96 metric tonnes of wheat seed for marketing and cleaned 120 tonnes of seed as part of service provision to other farmers using the machine purchased under the project. Moreover, quality of on-farm seed was compared with certified seed, farmers were trained in quality seed production and manuals prepared by national counterparts.

In Morocco a large number of farmers were included in the multiplication of new improved Hessian fly resistant durum wheat varieties. The seed processing machine was used to clean and treat seed for further seed increase in participation with farmers. More than 40 tonnes of seed of new varieties have been produced and distributed to farmers. However, due to severe drought wheat yields were substantially affected and collaborating farmers recorded on average 4.6 quintals per ha. The national project team has initiated discussions with SONACOS to identify a private farmer and an equipment operator to establish a joint venture for the production and supply of quality seed to other farmers.

The entrepreneurs in Algeria and Tunisia has shown great enthusiasm and leadership and plan to expand their operation by increasing the amount of seed produced, cleaned, treated and marketed as well as provision of cleaning services to other farmers. Both farmers will be assisted in the preparation of business plans for their enterprises..

2.3. Eritrea Challenge Program 'Water for Food'

In the framework of the 'Water for Food' Challenge Program, a mission (December 2005) was conducted in Eritrea to assess the status of the seed industry both at formal and informal levels and understand how the seed industry is organized.

National seed program status: The National Agriculture Research Institute (NARI) in the Ministry of Agriculture is the umbrella under which crop improvement, agronomy research, extension, seed production and distribution are carried out. International Agriculture Research Centers (IARCs), Non-governmental Organizations (NGOs), Food and Agriculture Organization of the United Nations (FAO) and donor agencies such as DANIDA are (or have been) major partners in the agriculture development. In spite of the seed law and regulations that exist at national level, the Eritrean seed sector is still at a very early stage of development.

Seed delivery issues: The challenge program is carrying out variety development and evaluation of barley, wheat, 'hanfetze' (wheat-barley mixtures), chick-

pea, faba bean and lentil, using participatory approach, whereby in addition to local landraces advanced breeding lines are evaluated. Some of these lines are in their final stages of release and need to move into a sustainable seed production system. In the absence of a well established formal seed system an alternative seed delivery system is the only way forward.

Interest in VBSE: Discussions with stakeholders indicated that there is a keen interest at all levels (NARI, University of Asmara, Ministry of Agriculture, sub Zobas, farming communities, and NGOs) in building an appropriate seed supply system. The concept of Village Based Seed Enterprises was discussed with each stakeholder and everyone agreed that it could be an appropriate seed delivery system, well-adapted to the reality in Eritrea. However, aspects of profitability and sustainability need further investigation.

Stakeholders indicated that major agricultural constraints are drought, inappropriate crop management practices, occurrence of crop diseases and pests, lack of adequate farming technology and shortage of inputs, including seed. Crop management practices including inappropriate seeding rates (either high or low) and inadequate seed bed preparations are the most frequent problems. Insect pests attacking different crops also cause yield reductions or sometimes even crop failures. Wild oats in cereals is also a serious concern; many fields are infested.

Main activity suggested: It was suggested to initiate the process of setting up one pilot VBSE in the village of Tera Emni, Dubarwa district, involving the farmers who were involved in the participatory plant breeding and participatory evaluation of varieties under the Challenge Program. At a latter stage a VBSE may be set up in the Dekamhare and Serejeka districts.

2.4. Pakistan

The Seed Unit is backstopping the applied research component of the project 'Food Security/Poverty Alleviation in Arid Agriculture Balochistan' (GCP/PAK/095/USA) regarding seed production and marketing. It aims at setting up sustainable farmer-based seed enterprises that provide seed of improved varieties of wheat, lentil, barley and annual forages. It will also assist in the development of the capacity for seed multiplication. The activities will be started in 2006.

2.5. Lessons Learned and Issues of Wider Applicability

- In many developing countries, the majority of farmers still depends on informal seed supply and has no access to the results of national and international crop improvement.

- A village or community based seed supply system can fill this gap by assisting in the provision of new technologies (varieties) to a large number of communities in a relatively short period.
- The VBSE approach developed is technically feasible and economically viable; it provides high quality seed at a reasonable cost to farmers. Overhead costs are relatively low and transport costs are minimal.
- The VBSEs are client-oriented and demand-driven. They focus on the immediate seed needs of farming communities.
- The VBSEs empower the farming communities to play a leading role in addressing local constraints in institutionalizing local seed production, and in ensuring long-term sustainability without external support.
- The approach serves as a model that can be mainstreamed, up-scaled and out-scaled to address seed provision problems of small-scale resource poor farmers in situations, where both the public and the private sectors fail to deliver the outputs from agricultural research to the rural communities.

3. NATIONAL SEED PROGRAM SUPPORT

Apart from the VBSE program, the Seed Unit is also involved in a variety of activities strengthening the national seed sector through formulating policy and regulatory frameworks or providing backstopping on technical and organizational issues.

3.1 Afghanistan

The Seed Unit contributed to the development of the National Seed Policy of Afghanistan, which was issued officially by the Ministry of Agriculture, Animal Husbandry and Food at a signing ceremony on 13 September 2005. The National Seed Policy is consistent with a draft prepared by the Future Harvest Consortium and ICARDA in 2002.

3.2. Iran

3.2.1. Missions

Development of Seed Policy, Seed Law and Regulatory Frameworks: In 2003, the Government of Iran passed a Seed Act on Plant Variety Registration, Control and Certification of Seeds and Seedlings. Under the Seed Law (No. 33709) the Seed and Plant Certification and Registration (SPCRI) was officially established and became operational. In November 2003, a number of draft policies and by-laws were received from SPCRI for comments and inputs from ICARDA. The Seed Unit visited Iran (February 2004) to assist the SPCRI to finalize the national seed policy, by-laws and the organizational structure for the institute. A modified organogram for the SPCRI was developed, streamlining the technical

and administrative functions of the institute and amalgamated the two national seed policies (seed policy and planting material policy) into one. Moreover, the by-laws were revised and a draft plant variety protection act prepared.

Support to Accreditation of Seed Testing Laboratory: The establishment and management of a quality assurance system in seed testing is one of the steps towards establishing an effective and efficient seed program. In July 2004, a mission was made to Iran to provide technical advice to the SPCRI and an action plan was developed. The program is well underway and Iran will be re-accredited to the International Seed Testing Association in the near future.

Consultancy Mission on Seed Processing: A consultancy mission (November 2004) was made to appraise seed processing facilities and suggest improvements. Seed processing and storage facilities are inadequate in number, and some are outmoded. Modernization and improvement are necessary to support Iran's drive to achieve self-sufficiency. A full set of recommendations is made available to the national program.

3.2.2. Training Courses

Variety Description and Field Inspection, June 6-12, 2005, Karaj: The SPCRI has, in addition to quality assurance and seed certification, a mandate for coordinating and implementing national variety release system. Trained manpower is critical to establish an effective and efficient variety evaluation, registration, release and protection system. A training course on Variety Description and Field Inspection was organized in Karaj, Iran. The course aimed at improving the capability of the SPCRI and partner organizations in conducting variety description experiments (distinctness, uniformity and stability) required for variety registration, release and protection. A total of 29 participants from the SPCRI, agricultural research institutes and agricultural colleges attended the course.

3.3 Sudan

Quality Seed Supply in the Informal Seed Sector, 5-15 December 2004, Wad Medani, Sudan. To address issues of quality seed supply in the informal sector, the Nile Valley and Red Sea Regional Program (NVRSRP) and the Seed Unit organized a training workshop for participants from four countries (Eritrea, Ethiopia, Sudan and Yemen) in Wad Medani, Sudan. The workshop covered seed program components and functions, crop improvement strategies and methodologies, crop management practices for on-farm quality seed production, seed processing and marketing, simplified methods for assessing seed quality and field visits and demonstrations. Moreover, policy, regulatory, technical and institutional issues affecting the informal sector and its linkages with the formal sector was discussed. A total of 16 participants attended the workshop.

3.4 Turkey

Support to Seed Center, Dicle University, Diyarbakir. In July 2004 the Seed Unit provided training and technical support to Dicle University on the proper installation, operation and management of the seed cleaning machine purchased with support from the South Eastern Anatolia Development Project (GAP). The problems encountered were discussed and possible solutions recommended to improve the performance of the cleaning machine. Moreover, the crop improvement and seed production activities of the University were discussed and future directions were suggested to the staff.

3.5. Uzbekistan

3.4.1. Missions

National Seed Seminar, 27-28 September, Tashkent. The CAC Regional Office of ICARDA is implementing an FAO TCP Project 'Improvement of Cereal, Leguminous, Oil and Forage Crops Seed Production'. The Seed Unit of ICARDA participated and contributed to the National Seed Seminar held 27-28 September 2005 in Tashkent, Uzbekistan. The Seminar was attended by 41 senior managers and policy makers from the Ministry of Agriculture and Water Resources, National Agricultural Research Systems, State Variety Testing Committee, State Agricultural Seed Certification and Quality Control Center and Plant Quarantine Services. The Seminar reviewed the current status of the seed sector and suggested recommendations for future direction of the national seed industry in the following areas (a) national seed policy, seed law and regulations, (b) liberalization of the seed sector, (c) variety development and maintenance, (d) variety evaluation and release, (e) seed production and processing, (f) seed quality assurance, (g) quarantine service and customs, and (h) regional harmonization. A full set of recommendations was made available to the Ministry of Agriculture and Water.

Country Report and Other Support: The staff of the Seed Unit also significantly contributed to the following Uzbekistan reports: (a) Status of varietal development and seed sector activities in Uzbekistan, (b) Training needs for development of human resources in the seed sector, and (c) List of equipments for the seed industry.

3.4.2. Training Course

Integrated Quality Management in Seed Production, 29 September – 4 October 2005, Tashkent. Following the Seminar, the Seed Unit in collaboration with the CAC Regional Office organized a course on Integrated Quality Management in Seed Production from 29 September – 4 October 2005 at headquarter of the State Agricultural Seed Certification and Quality Control Center in Tashkent. A

total of 18 participants from the Ministry of Agriculture and Water Resources (dealing with variety development, super-elite and elite seed production), State Variety Testing Commission (responsible for variety testing and release), State Agricultural Seed Certification and Seed Quality Control Center (dealing with quality assurance), and Plant Quarantine Services (phytosanitary services) participated in the course. The course focused on technical aspects of quality seed production to ensure rapid adoption and diffusion of new crop varieties.

3.6 Vietnam

Consultancy Mission for Assembling and Testing Mobile Seed Cleaning Machines. The Seed component of the DANIDA Agriculture and Rural Development Project supports the development of both formal and informal seed sectors in Vietnam. Through the ICARDA Seed Unit, the program purchased three mobile seed cleaners manufactured by Darbas company in Syria. A consultancy mission was made in 2004 to assemble, test, demonstrate and operate the machines for cleaning rice. Modifications required for cleaning rice was identified and recommendations were made in consultation with national experts from Vietnam.

3.7. Yemen

Quality Seed Production in Informal Seed Sector, 4-13 September 2005, Dahmar. In Yemen, despite the introduction of formal seed sector 25 years ago, traditional varieties still cover large areas of cereal, legume and oilseed crops. The Agricultural Research and Extension Authority (AREA), in collaboration with General Seed Multiplication Corporation (GSMC) were implementing a pilot outreach program designed to sustain and improve the long tradition of community seed production. The pilot project was in the long-term, is expected to improve agricultural productivity of rainfed crops such as wheat, barley, maize, sorghum and millet by strengthening sustainable informal seed systems.

The approach to improve the traditional seed system was based on the results of survey from ten governorates which generated the basic information and recommended to implement a pilot program in five primarily rainfed locations in the country: Qa'a Balasan (Dhamar), Shamat (Mahweet), Turaibah (Zabeed), Desufal (Ibb) and Al-Araes (Lahj). The success achieved in these locations will be extended to other areas in the country. To address these issues, the Seed Unit of ICARDA, the General Seed Multiplication Corporation (GSMC) and Agricultural Research and Extension Authority (AREA) in Yemen conducted a training workshop for staff from GSMC, AREA, Agricultural colleges, NGOs, extension services and pilot farmers in Yemen.

4. REGIONAL SEED NETWORK

Currently, the Regional Seed Network primarily serves as a forum for information sharing forging cooperation and collaboration among national seed programs in CWANA region. However, from the outset, the ultimate objectives of the Network are aimed at integration of national seed programs to create a regional seed market for easy movement of varieties and seeds across borders. Within this context, the Network is increasingly involved in creating awareness among stakeholders (policy makers, NARS, public seed sector, private seed sector, etc) to address policy, regulatory, institutional and technical issues at the national and regional levels. Efforts are being made in creating awareness, reforming and harmonizing policy and regulatory frameworks to achieve the objective of 'common seed market' and integration of the national seed programs. Apart from a forum for information sharing, the organization of international seed trade conferences in partnership with the private sector and regional workshops for policy makers and senior mangers are some of the new directions vigorously pursued by the Network.

4.1 Networking and Information Sharing

The WANA Seed Network continues providing information to national seed program partners in CWANA region. In 2004 and 2005, four issues of the official newsletter of the Network were published (No 26, 27, 28 and 29) both in English and Arabic; a total of over 1500 English and 800 Arabic copies of each issue were distributed. The newsletter is also available at ICARDA's website (http://www.icarda.cgiar.org/seed_unit/SeedUnit/home.htm). Moreover, the Seed Unit website and web-based Seed Network publication such as the Seed Directory and the Variety Catalogue are regularly updated to reflect the changes that have taken place (http://www.icarda.cgiar.org/seed_unit/SeedUnit/Activ/activ1.htm).

4.2. Model Code of Conduct for Seed Trade Associations

The economic liberalization coupled with policy and regulatory reforms have brought many changes in the agricultural sector in general and the seed sector in particular. Consequently, national seed industries in the region and elsewhere are in a state of transition with growing private sector participation. These private sector seed companies are participating in national seed trade associations to represent the interest of its members. However, it is important for the members of the associations to develop guidelines for establishing ethical standards in seed trade to build confidence in the industry. To fill this gap a tailored model Code of Conduct for Seed Trade Associations has been prepared and published for use by member countries of the Regional Seed Network.

4.3. International Seed Trade Conference, 29 November - 1 December 2005, Antalya, Turkey

The Turkish Seed Industry Association in collaboration with ICARDA's Seed Unit organized an international seed trade conference in Antalya, Turkey to bring together the private sector from the CWANA region and beyond to stimulate regional contacts and to encourage seed trade. The conference: (i) reviewed the potential of the seed market in CWANA region; (ii) provided a forum to promote business contacts among seed companies; (iii) provided opportunities for stimulating regional seed trade; (iv) explored opportunities for regional seed trade association. The conference attracted a large number of participants from (i) private sector seed companies from the CWANA region; (ii) private seed and agricultural input suppliers from Africa, Asia, Europe and USA; (iii) seed equipment manufacturers from Asia, Europe and USA; (iv) international/regional/national seed trade associations representing private sector from Asia and Europe; and (v) international/regional development organizations working on seeds (CIHEAM, ICARDA, ISF, ISTA, OECD, UPOV,). A total of 223 participants (98 from outside Turkey) from 45 countries attended the conference making it a successful first seed trade congress in CWANA region. A total of 33 international, regional and national public and private seed companies, and equipment manufacturers exhibited their products. Moreover, a trading floor was set aside for business dealings for potential customers and suppliers. Such regional and international congresses are becoming increasingly important in international seed trade where a lot of business dealing is taking place.

The first International Seed Trade Conference (ISTC2005) in CWANA, Antalya, Turkey.

The conference was the first time for the Seed Unit of ICARDA to venture into organizing a Regional Seed Trade Conference. It was a unique experience and taken as an opportunity to explore options how to change the Network into a Regional Seed Association.

4.4. Regional Workshops

Regional workshops are organized to create awareness of important seed industry issues among senior seed industry personnel. Two workshops were organized, i.e., one workshop to address seed policy and regulatory reform and one on plant variety protection.

FAO-ICARDA Workshop on Technical Support to the IT-PGRFA – Creating an "Intersectoral" Dialogue on PGRFA Conservation, Breeding and Seeds for West Asia and Arabian Peninsula, 5-7 February 2005, Amman, Jordan: The workshop was convened by FAO in collaboration with ICARDA (WARP). Apart from NARS involved in genetic resources conservation, Country Representatives of the WANA Seed Network from West Asia and Arabian Peninsula countries were invited to attend the meeting and contribute to the dialogue along with staff of the Seed Unit of ICARDA. A total of 34 participants attended the workshop from Iraq (2), Iran (1), Jordan (4), Lebanon (3), Oman (2), Palestinian Authority (3), Qatar (1), Saudi Arabia (1), Syria (3), turkey (2), UAE (1), Yemen (2), IPGRI (1), GCDT (1), FAO (3) and ICARDA (4).

Seed Policy and Regulatory Reform, 12-17 February 2005, Aleppo, Syria: In many developing countries, the policy and regulatory environments are the major factors hindering the development of efficient and competitive national seed industries. There is a need for policy and regulatory reforms which take account of the more diverse seed sector particularly the emerging private sector and the local seed supply systems. These reforms may include 'conventional' seed regulatory frameworks such as: (a) variety regulations for testing, release and registration; (b) seed regulations prescribing standards for quality control and certification; (c) seed trade regulations setting procedures for seed import/export (normal or emergency situations); and (d) quarantine regulations for exclusion of exotic pests; (e) plant variety protection to protect intellectual proerty rights; and (h) creating an enabling policy environment. In recent years, however, biosafety regulations for the movement of living modified organisims (LMOs) and access to plant genetic resources become important with significant impact on the availability and access to genetic resources, improved varieties and seeds.

The workshop aimed at reviewing national policies and regulatory frameworks relevant to varieties and seeds in respective countries, identifying the constraints and exploring opportunities for harmonization initiatives within the CWANA region. From the outset, the workshop targeted both policy makers and senior technical managers from the CWANA region to: (a) create awareness of current trends in seed industry development; (b) provide opportunities to share experi-

ences from other countries; (c) use and adapt lessons learnt from elsewhere to national seed sector development; and (d) contribute to the dialogue and integrate national seed development programs within the context of regional initiatives.

Each participant prepared background paper on the agricultural sector in general and the seed sector in particular with emphasis on national policies and regulatory frameworks describing the status, constraints, recommendation for reforms and options for harmonization. The presentation gave an insight into key policy, regulatory, institutional and technical issues on varieties and seeds. Based on the key presentations, country presentation and ensuing working group sessions, the meeting prepared recommendation and action plans to be taken both at national and regional levels in three particular areas: (a) support for the informal seed sector; (b) privatization of the seed sector; and (c) harmonization of policies, laws, rules, regulations and procedures relevant to plant genetic resources, varieties and seeds. The working groups identified common constraints, made recommendations for improvements and highlighted options for harmonization. The workshop participants agreed to serve as focal persons in partnership with Country Representatives of the WANA Seed Network and other stakeholders to conduct an in-depth review of the: (i) national seed policy and regulatory frameworks and fill the gaps; (ii) the status and performance of the private sector; and (iii) the status and performance of the informal sector.

A total of 24 policy makers and senior managers representing different stakeholders of the national seed industry including the ministries of agriculture, agricultural research, public and private seed sector from 12 countries i.e. Afghanistan, Egypt, Ethiopia, Iran, Iraq, Jordan, Morocco, Kyrgyzstan, Pakistan, Syria, Turkey and Yemen participated in the meeting.

Central and West Asia: Plant Variety Protection, 8-10 May 2005, Karaj, Iran: The UPOV in collaboration with SPCRI of the Ministry of Jahad-e-Agriculture and the Seed Unit of ICARDA organized a West and Central Asia Regional Workshop on Plant Variety Protection. The purpose of the meeting was to inform and acquaint national policy makers and senior managers on issues of plant variety protection under UPOV convention and its relationship with ITPGRFA. A total of eight countries from west and central Asia i.e. Afghanistan, Azerbaijan, Jordan, Kyrgyzstan, Tajikistan, Turkey, United Arab Emirates and Uzbekistan attended the workshop where the status of the PVP in each country was reviewed during the workshop. The Seed Unit apart from being the co-organizer of the workshop also made presentations on the status of plant variety protection in the region and its implication in seed sector development.

FAO-ICARDA Workshop on Technical Support to the IT-PGRFA – Creating an "Intersectoral" Dialogue on PGRFA Conservation, Breeding and Seeds for North Africa and the Nile Valley, 19-21 June 2005, Cairo, Egypt: A similar workshop was also organized by FAO in collaboration with ICARDA (NVRSRP) for countries of North Africa and Nile Valley where NARS involved in genetic resources conservation and Country Representatives of the WANA Seed Network from the region were invited to attend the meeting. The Seed Unit of ICARDA participated and made a presentation on Integrating Plant Genetic Resources Conservation, Breeding and Seeds. A total of 41participants attended the workshop from Algeria (2), Djibouti (2), Egypt (21), Libya (2), Morocco (2), Somalia (1), Sudan (1), Tunisia (2), IPGRI (1), FAO (3) and ICARDA (4).

5. RESEARCH

5.1. Strengthening Seed Systems for Food Security in Afghanistan

The IDRC project focused on the rainfed areas of Northern Afghanistan, where the mountains and foothills agro-ecologies comprise 2.3 million ha of rainfed agriculture, representing 88% of total cultivated land. In this zone, the majority of medium to small-scale farmers, need improved access to better technologies and inputs. The purpose of the project is to provide a thorough understanding of local seed systems adaptations to stress and conflict conditions in Afghanistan with a view to identify suitable interventions that would strengthen seed aid interventions and farmers' production systems for food security. The project sought answers to some key questions including the following:

- How does the pattern of genetic resources and local seed systems changed over the years of conflict and drought?
- How do farmers currently obtain seed and varieties and in which ways do these differ from earlier methods?
- What are the strengths and limitations of different measures of intervention to rehabilitate the seed sector in Afghanistan?
- How best could the seed sector be strengthened on a sustainable basis to meet the location-specific needs of farmers?
- How could lost genetic resource base be re-established and in which way could this be linked to appropriate seed systems in the longer term?

These questions were addressed specifically in the rainfed areas of Northern Afghanistan and answers sought within two strategic components that are complementary: (1) diagnosis of the seed systems and related needs, and (2) analysis of the crop population structures.

5.1.1. Baseline Survey

A baseline survey has been completed in the target provinces of Badakshan, Baghlan, Mazar- e- Sharif, Samangan and Takhar, as a benchmark for assessing effects of interventions. The results can be summarized as follows.

1. The older generation is mainly involved in agriculture (with experience of 26 years or over).
2. Many respondents have informal and primary education.
3. Extended family (11 members or more) is still common.
4. Limited access to extension services and/or NGOs for agricultural advice.
5. Farmers do not borrow, rent and or share-crop their land.
6. Average land used for cultivation is 26 jeribs.
7. Farmers have not been contract seed growers for NGOs or other organizations.
8. Farmers use improved rice varieties, improved and local varieties of wheat and only local barley varieties.
9. Wheat is most widely cultivated and the majority has not cultivated chick-pea, sesame, flax, potato, melon, onions and tomato.
10. Main constraints associated with improved seeds use are unavailability of improved seeds, high price of seeds, lack of information on seed, uncertainty about the quality of seeds and low output prices.
11. Main source of income include livestock, fruit production, farming, trade/business and civil service.

5.1.2. Seed System Diagnosis

The following are the main findings and conclusions drawn from the household survey, focus group discussions, and key informant interviews.

- War and drought have severely affected agricultural activities in the rainfed areas in Northern Afghanistan where a significant proportion of farmers (more than a quarter of 500 farmers interviewed) stopped their activities. Research and other interventions need to focus immediately on increasing productivity of those farmers remaining active to meet the food demand of a growing population.
- Pests and diseases, lack of quality seed, and lack of fertilizer were classified as very important constraints to agriculture by the majority (70-91% depending on population displacement levels) of farmers in the rainfed areas; seed issues were equally important (75-77%) in both low and high displacement villages. These constraints require adequate attention.
- There is limited crop biodiversity at the farming household level. Most farmers planted only one variety of the crops grown, whether local or improved.

The existing pool of local and improved crop varieties from research institutions and elsewhere has not been tapped on as a way to increase productivity and well-being of farmers. Greater crop improvement efforts should be made in developing new varieties that are specifically adapted to the rainfed areas through conventional or participatory evaluation and selection from the existing germplasm pool by farmers.

- Farmers have limited access to high quality seeds amid seed interventions that were carried out during the 2002/03 cropping year. The majority of them (70% of farmers in low and 80% in high population displacement villages) is not very satisfied with these interventions and assessed them as somewhat effective or not effective. About 5.4% and 7.2% of seeds sown in low and high displacement areas, respectively in 2002/03 were obtained from seed aid interventions.
- Farmers depend mostly on the informal seed system that has been resilient to the conflict and drought. However, the system may be unable to produce and distribute high quality productivity increasing improved seeds necessary to achieve and sustain long-term food security in these areas.
- Farmers are aware of seed quality attributes and are not as much satisfied with the quality of seeds obtained from local seed systems as those obtained from seed aid agencies. At the same time, they lack knowledge regarding improved seed production and distribution systems. Their concerns about varietal purity, germination, presence of weeds, diseases and pests suggest that future efforts should focus on training both field-level seed production and handling after harvest to ensure seed quality are maintained.
- There has not been a large scale loss of crop varieties following the war and drought that occurred in Afghanistan. However, studies are required to clarify the genetic nature and diversity of many local varieties currently used by farmers in the rainfed areas. Crop biodiversity could be maintained and food production increased if best adapted new varieties occupy specific niches in the diverse Afghan farming systems.
- Recent literature neither suggest emergency seed and tool aid interventions have measurably improved long-term food security nor contributed significantly to the reconstruction of Afghanistan's agricultural sector for reasons such as continued conflict and drought or absence of accurate need assessment initially.

5.1.3. Genetic Resources Collection and Analysis of Crop Population

Structure

A total of 677 samples were collected (2003/04) of which 166, 211, 150 and 150 accessions were from Baghlan, Badakshan, Kunduz and Takhar, respectively. Wheat (391 samples: 57.8 %), barley (65; 9.6 %) and chickpea (58; 8.6 %) con-

stitute the majority of the collections. A significant number of collections were also made of flax (17; 2.5 %), mung bean (29; 4.2 %) and melon (14; 2.0 %). Preliminary morphological analysis of the new collections was carried out within Afghanistan. From the analyses of the accessions and the discussions with farmers two preliminary conclusions can be drawn: i.e. (a) there is still a large array of genetic resources present in the rainfed areas of North Eastern Afghanistan and, (b) in the rain-fed area, farmers are still using their own local land races.

Genetic diversity of durum wheat, bread wheat and chickpea was analysed for collections originated from 1920 to 1970 (pre-conflict collections) and collections from 2003/04 (post-conflict collections). The collections were unbalanced with respect to the number of accessions and their geographic origins. In durum and bread wheat EST derived SSRs and in chickpea genomic derived SSRs markers were used for analysis. In the study 50 alleles of durum and 68 alleles of bread wheat were detected with the six SSR primers. The genetic diversity ranged from 0.41 to 0.73 for the pre-conflict durum wheat collection and from 0.98 to 1.00 for the post-conflict collection. In case of bread wheat the gene diversity ranged from 0.0 to 0.73 for the pre-conflict collection and from 0.54 to 0.90 for the post-collection. In chickpea, the total number of alleles detected in the whole collections for the six loci was 173, in the pre-conflict collection it was 160, while it was 92 for the post conflict collection. Although the number of accessions in the post-conflict collection was small, many new alleles were detected and considered as new alleles occurring over time in the new collection. The number of missing or lost alleles was higher than that of the new alleles, which could be largely due to the higher number of accession in the pre-conflict as compared to the post-conflict collections.

5.1.4. Impact of Interventions

This study analyzed literature on seed relief interventions to identify methodologies affecting successful implementation. Essential components for successful interventions include: (1) availability of advance warning system; (2) an effective and competent implementing agency; (3) the need and acceptance of seed locally; (4) sources of good seed; (5) ability to deliver seed aid accurately to affected households; (6) manage, operate, monitor, evaluate operations to keep them moving in a timely, effective and honest manner; and (7) close, ongoing communication and cooperation among stakeholders—beneficiaries, local groups, implementers, government officials, vendors, and others.

Often, the required seed is available locally within the region, but just not accessible to those farmers at risk. Effective seed intervention involves providing

beneficiaries with ability to buy (creating their access to) local seed (locally adapted, known and accepted) from local merchants (securing local community support, developing the local economy). The most successful method was giving beneficiaries vouchers to purchase seed from selected vendors at local seed fairs. This also, to a certain extent, develops local seed supply and addresses the need to transition from emergency aid into long-term development.

In terms of seed relief in Northern Afghanistan, it appears that combining vouchers and seed fairs would be most effective in supporting agricultural development with local modifications to (1) develop and support local good seed suppliers; (2) hold seed fairs to market seed from these suppliers; (3) give needy farmers vouchers to permit them to purchase good seed; (4) allow all farmers to purchase seed at the fair, and (5) develop the local seed market and introduce all farmers to good seed of new and better varieties.

Local farmer assistance would be much more effective if the seed relief intervention provides sufficient seed to plant their entire crop, rather than a small uniform token amount of seed given to all needy farmers.

In Afghanistan, the concept of Village Based Seed Enterprises has been promoted. Seed relief intervention should use/promote seed from these VBSEs, in order to help develop local seed sources, add to local economic activity, ensure supply of locally adapted varieties, and help ensure adequate seed to all farmers.

5.2. Wheat and Barley Seed Systems in Ethiopia and Syria

A study on wheat and barley seed systems was concluded, with award of a PhD at the Wageningen University and Research Center in The Netherlands.

5.2.1. Introduction

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 agriculture-based new technologies to farmers.

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.

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. The wheat and barley seed systems study gives an insight into the functioning of formal and informal seed sectors in Ethiopia and Syria.

5.2.2. 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 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 farmer's use and perception of new varieties, adoption of improved agricultural technologies, indigenous on-farm seed management practices and quality of seeds used by farmers.

5.2.3. 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 Systems 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 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 wheat farmers surveyed (>90%) are aware of modern varieties, fertilizers, herbicides, agronomic prac-

tices 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 farmer's 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 result unable to derive the best possible economic benefits of the technological packages for wheat and barley production.

5.2.4. 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 6 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 modern durum wheat variety whereas 13.3% of farmers grew a wide range of local 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 fewer farmers 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 with 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.

5.2.5. 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 distinc-

tion 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, almost all 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 and manage them accordingly. 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 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 four 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.

5.2.6. 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 exchanges.

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 which is 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.

5.2.7. 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. 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 durum landraces. In contrast, a single landrace was grown throughout the major barley growing areas of Syria 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 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 at the same time to increase on-farm diversity and maintenance of the valuable genetic resources.

5.2.7. Synthesis

The synthesis describes the main findings of the wheat and barley seed system study in an integrated fashion and suggests alternative ways for the development of an 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, regulatory, technological, institutional and socio-economic factors were emphasized from generation to transfer of technology to farmers.

5.3. Study on Seed Longevity of *Salsola vermiculata*

Salsola spp are important fodder shrubs in the rangelands. The major problem with salsola is that under ambient storage conditions, the seed looses its germination within 6-9 months after harvesting. A study was designed to investigate the reasons for poor seed longevity.

Freshly harvested salsola seeds collected from the ICARDA germplasm site were used and the following effects on storability studied: (a) threshed and non-threshed pods, (b) dried and non-dried pods, (c) packaging in vacuum (aluminium envelops) and in paper bags, (d) storage at –21°C, 4 °C and ambient conditions, and (e) all possible combinations. Monthly germination tests were carried out. Results can be summarized as follows:

Direct seeding of Salsola vermiculata *seed in Syria.*

- Germination of de-winged pods is significantly higher and faster than of winged pods.
- At low moisture content regardless of storage temperature, packaging material and presence or absence of wings, salsola seeds maintained viability throughout the 24 and 12 months of storage in the first and the second trials, respectively.
- At -21 and 4°C and regardless of the type of packaging material used, both winged and de-winged pods maintained acceptable levels of seed viability when stored for 24 and 12 months in the first and the second trials, respectively.
- Under ambient storage conditions both in winged and dewinged pods, the viability of seeds with high moisture content packed in paper bags dropped to zero within the first 6 to 7 months of storage in the first and the second trials.
- Under ambient storage conditions and regardless of the presence or absence of wings, the viability of seeds with high moisture content packed in aluminium bags significantly declined at the end of the first year of storage in both trials and dropped to zero at the end of the second year.
- Seed viability declined much faster in high moisture content seeds packed in paper than in aluminium bags.

The results of this experiment indicate that the poor seed longevity in *Salsola vermiculata* is mainly physiological and influenced both by storage temperature and moisture content.

5.4. New Degree Related Research

Two new PhD studies (Seed bank dynamics in range species in Syria; Wheat seed system in Iran) have been initiated in collaboration with the Wageningen University and Research Center in the Netherlands. Furthermore, in collaboration with the Tishreen University, an MSc study (Seed treatment on integrated disease management of Ascochyta blight on chickpea) was started in Syria.

Seed Bank Dynamics in Rangeland Rehabilitation in Syria

Rangelands occupy the largest proportion of land mass in CWANA region. The rangelands were and still are degrading at an alarming rate throughout the region. The most important reasons are the random exploitation of rangelands through over-grazing, opportunistic cultivation and excessive use of the scarce green cover as firewood leading to poor self regeneration. The key to stop and reverse rangeland degradation is believed to be the control of access and rational use of resources. However, for advanced degradation levels, associated with severe soil and genetic erosion, direct and/or indirect reseeding is believed necessary to initiate and foster the system's restoration process. Large areas of degraded rangelands in CWANA, including Syria falls within this category. The aim of study is to investigate (a) effects of range restoration methods on active soil seed bank, (b) seed quality aspects (components and constraints) of range species, (c) effects of quality enhancing methods on seed storability of range species, and (d) effects of quality enhancing methods on field establishment of range species.

Wheat Seed Supply System in Iran

In the mid-1970s, governments and donors recognized the critical role of seed in agricultural development and began to provide substantial support for seed system development. Today, nearly 60% of the country's arable land is planted with wheat and about 22% of the country's seed requirement is provided by the formal sector (certified seed), while the remainder is informal farmer produced seed. Information regarding informal seed sector is, however, very limited. The research will specifically look at: (a) on-farm wheat management practices, (b) farmers' seed sources and management, (c) farmer perception and criteria for using improved cultivars and certified seed, (d) accessibility of modern varieties, (e) performance of the formal seed system, (f) seed quality in the informal sector, (g) varietal deterioration, and (h) genetic diversity of local varieties and landraces.

Seed Treatment in Integrated Disease Management of Ascochyta Blight on Chickpea
The research is studying the combined effect of: (a) sun drying and systemic fungicides dressing on seed viability and pathogen survival, and (b) long term storage regimes and seed treatment on germination. Furthermore, the effect of accelerated ageing on seed viability and pathogen survival, and the role of seed dressing in reducing sprays to control ascochyta in chickpea will be studied.

6. HUMAN RESOURCES DEVELOPMENT

Human resources development is an important part of the work of the Seed Unit since its inception and consists of in-country training courses and national workshops (both reported under individual countries) and degree training (reported under research). Some of the workshops are reported under the network activities. This section deals only with the remaining training activities, which were not reported above.

During 2004 and 2005 the number of course participants was 361 and 258, respectively (Table 3). The large number of training and trainees is mainly attributed to the fact that in Afghanistan there was, and still is, a huge demand for human resource development.

6.2. Regional Training Courses

Variety Management and Seed Quality Assurance, 12-22 April 2004, ICARDA, Aleppo, Syria: This course was organized in response to the training requests of NARS. The course addressed different disciplines of seed science and technology emphasizing seed program components and current issues/trends, variety management (description, maintenance and breeder seed production), seed production, seed processing, quality assurance, economics of seed production, and thematic discussions. The course included presentations, demonstrations, group discussions, and technical visits to NARS in Syria.

A total of 12 participants from six countries attended the course. The participants were drawn from a wide range of NARS (agricultural research centers, agricultural colleges, national seed programs, extension services). They were technical as well as managerial staff including seed production officers, quality control officers, extension officers, agronomists and plant breeders.

Table 3 Human resources development activities

Training Type	Title	Beneficiaries - Countries	Number of Participants
2004			
Headquarter/Regional Course	Variety Management and Seed Quality Assurance	Algeria, Lebanon, Palestine, Pakistan, Syria, Turkey	12
Headquarter/ Individual	Wheat Quality	Iraq	8
	Seed Production		
	Quality Assurance in Seed Testing	Afghanistan, Syria	4
In-country Course	Seed Production Technology and Enterprise Management	Afghanistan	41
	Seed Enterprise Management	Afghanistan	100
	Development and Food Legume	Afghanistan	21
	Management and Financial Accounting in VBSE	Afghanistan	127
Regional Workshop	Quality Seed Supply in the Informal Seed Sector	Ethiopia, Eritrea, Sudan, Yemen	16
National Workshop	National Seed Seminar	Uzbekistan	41
PhD Degree	Wheat and Barley Seed System in Ethiopia and Syria	Ethiopia	1
Total 2004			**361**
2005			
Headquarter/Regional Courses	Variety Description and Maintenance	Afghanistan, Jordan, Lebanon, Syria	15
	Seed Enterprise Development and Management	Afghanistan, Iraq, Pakistan, Turkey	19
In-country Course	Quality Assurance and Seed Processing	Afghanistan	104
	Variety Identification and Field Inspection	Iran	29
	Seed Processing and Storage	Afghanistan	19
	Quality Seed Production for the Informal Seed Sector	Yemen	28

Table 3. continued

Training Type	Title	Beneficiaries - Countries	Number of Participants
	Integrated Quality Management in Seed Production	Uzbekistan	18
Regional Workshop	Seed Policy and Regulatory Reforms	Afghanistan, Egypt, Ethiopia, Iran, Iraq, Jordan, Kyrgyzstan, Lebanon, Morocco, Pakistan, Syria, Turkey, Yemen	24
	Plant Variety Protection	Afghanistan, Azerbaijan, Iraq, Jordan, Kyrgyzstan, Tajikstan, Turkey, UAE, Uzbekistan	12
MSc Degree	Seed treatment in Ascochyta Control on Chickpea	Syria	1
PhD Degree	Seed Bank Dynamics in Range Rehabilitation	Senegal	1
	Wheat Seed System in Iran	Iran	1
Total 2005			**259**

Variety Management and Seed Quality Assurance, 3-14 April 2005, ICARDA, Aleppo, Syria: The course was organized with financial support from the Japan International Cooperation Agency (JICA) and in collaboration with the Syrian State Planning Commission. The course aimed at improving the capacity of national seed programs to evaluate agronomic performance of varieties and distinctness, uniformity and stability (DUS) tests required for variety and release registration. A total of 17 trainees with five participants from Afghanistan, 10 from Syria, one each from Lebanon and Jordan participated in the course.

Seed Enterprise Development and Management, 13-24 November 2005, ICARDA, Aleppo, Syria: ICARDA organized a specialized training course on Seed Enterprise Development and Management as part of its effort to support and promote the development of a vibrant and dynamic seed industry through the financial support of the Japanese International Cooperation Agency (JICA). The main objective of the course was to enhance skills for developing cost-effective seed enterprises for low margin crops such as cereals and legumes. The course included theoretical lectures, presentation of country reports and experiences, and practical excercises relevant to seed enterprise development and management. The curriculum covered all areas of seed enterprise development and management, as well as practical session and experience sharing. The

number of participants was 19, coming from five countries (Afghanistan, Iraq, Pakistan, Syria, Turkey).

7. SEED PRODUCTION AND DISTRIBUTION

Improved varieties are major outputs of agricultural research and quality seed is the only means to transfer new technologies to farmers. The aim of the seed production activities of the Seed Unit is to produce and maintain limited stocks of high quality seed of ICARDA related varieties, as well as of promising lines, that would eventually be released in one of the national programs.

7.1. Seed Production

In 2003/04 and 2004/05 cropping seasons, 30.2 and 43.2 metric tons (MT) of seed were produced from 77 and 542 varieties of 7 crop species. Details are provided in Table 4a and b.

Table 4a. Quality seed production in 2003/2004 crop season

Crop	Breeder Seed		Pre-basic Seed		Basic Seed		Quality Seed		Total	
	Lines	MT	Lines	MT	Lines	MT	Lines	MT	Lines	MT
Bread wheat	4	0.14	-	-	-	-	-	-	4	0.1
Durum wheat	3	0.14	3	0.90	3	5.05	2	2.20	11	8.3
Barley	1	0.03	5	4.60	-	-	8	9.43	14	14.1
Chickpea	5	0.05	5	0.53	4	1.19	11	1.78	25	3.5
Lentil	6	0.02	3	0.26	1	0.05	3	1.40	13	1.7
Vetch	-	-	-	-	-	-	8	2.40	8	2.4
Faba bean	-	-	-	-	-	-	2	0.02	2	-
Total	19	0.37	16	6.29	8	6.29	34	17.22	77	30.2

Table 4b. Quality seed production in 2004/2005 crop season

Crop	Breeder Seed		Pre-basic Seed		Basic Seed		Certified Seed		Quality Seed		Total	
	Lines	MT	Lines	MT	Lines	MT	Lines	MT	Lines	MT	Lines	MT
Bread wheat	3	0.07	1	1.0	2	0.2	-	-	434	13.0	440	14.3
Durum wheat	23	0.48	2	0.4	2	1.4	-	-	7	1.1	34	3.4
Barley	6	0.09	2	3.5	1	1.7	-	-	19	10.8	28	16.1
Chickpea	5	0.05	2	0.1	4	2.1	1	0.3	5	0.6	17	3.2
Lentil	9	0.05	1	0.04	2	2.0	-	-	2	2.1	14	4.1
Vetch	-	-	-	-	-	-	-	-	7	2.1	7	2.1
Faba bean	2	0.01	-	-	-	-	-	-	-	-	2	0.01
Total	48	0.75	8	5.1	11	7.43	1	0.25	474	29.8	542	43.2

MT = Metric Tons

7.2. Seed Processing

A one ton/hour seed processing line was used to clean and treat the seed produced in the center by different Programs and Units. The total amount of seed cleaned in the 2003/04 and 2004/05 season was 28.6 and 435 MT, respectively. Details are provided in Table 5a and 5b.

Table 5a: Large-scale seed processing in 2004 crop season

Program	Wheat		Barley		Lentil		Chickpea		Vetch		Cumin		Oat		Safflower		Total	
	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT
St. Op	4	18.7	3	102.6	2	167.7	3	81.0	2	13.7	1	6.3	1	4.1	1	2.5	396.6	18.7
Seed Unit	5	10.0	12	15.2	2	1.4	1	0.2	7	3.3	-	-	-	-	-	-	30.0	10.0
GP	-	-	1	11.0	3	3.0	2	10.3	-	-	-	-	-	-	-	-	24.3	-
NRMP	-	-	-	-	-	-	-	-	1	1.0	-	-	-	-	-	-	1.0	-
Total	9	28.6	16	128.9	7	172.1	6	91.5	10	18.0	1	6.3	1	4.1	1	2.5	451.9	28.6

Table 5b: Large-scale seed processing in 2005 crop season

Program	Wheat		Barley		Lentil		Chickpea		Vetch		Cumin		Oat		Safflower		Coriander		Total	
	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT	V	MT
St. Op	4	14.9	3	107.1	1	125.5	4	95.6	4	10.0	2	15.0	1	1.1	1	2.0	1	1.3	21	372.5
Seed Unit	11	9.3	9	16.5	2	4.9	2	2.4	5	2.2	-	-	-	-	-	-	-	-	29	35.2
GP	-	-	6	9.5	3	15.2	-	-	-	-	-	-	-	-	-	-	-	-	9	24.7
NRMP	2	1.4	-	-	-	-	2	0.6	2	0.8	-	-	-	-	-	-	-	-	6	2.7
Total	17	25.5	18	133.1	6	145.6	8	98.5	11	13.0	2	15.0	1	1.1	1	2.0	1	1.3	65	435.1

V = Number of Varieties; MT = Metric Tons, St.Op = Station Operations Department, GP = Germplasm Program, NRMP = Natural Resource Management Program

The seed-cleaning laboratory equipped with a wide range of small machines provides cleaning services for ICARDA's commodity programs. Table 6a,b provides details of the number of samples that are annually cleaned in the laboratory.

Table 6a: Small-scale seed processing in 2004 crop season

Crop	GRU	GP	Seed Unit	NRMP	Total
Barley	199	9,721	565	72	10,557
Wheat	3,500	9,408	2,906	-	15,814
Chickpea	1,811	-	2,166	-	3,977
Lentil	1,633	-	2,172	-	3,805
Vetch	-	-	-	14	14
Atriplex	-	-	-	-	-
Triticale	-	-	-	-	-
Total	7,143	19,129	7,809	86	34,167

Table 6b: Small-scale seed processing in 2005 crop season

Crop	GRU	GP	Seed Unit	NRMP	ST.OP	Total
Barley	2,932	16,794	3,868	3	-	23,597
Wheat	5,000	24,619	3,310	-	2	32,931
Chickpea	-	3	1,190	-	3	1,196
Lentil	-	-	1,009	-	-	1,009
Vetch	-	-	-	2	-	2
Oat	-	2	100	-	-	102
Atriplex	-	-	3	-	-	3
Triticale	900	2	-	-	-	902
Total	8,832	41,420	9,480	5	5	59,742

7.3. Quality Control

The seed testing services (number of samples) provided by the seed quality control laboratory are summarized in Table 7a and b.

Table 7a: Seed testing activities during 2004 crop season

	No. of tests /Programs					
Tests	SU	NRMP	GP	Station Operations	NARS	Total
Viability	383	122	224	4	138	871
Specific weight	681	-	1,144	4	138	1,967
Moisture content	11	-	-	8	138	157
Total	1,075	122	1,368	16	414	2,995

Table 7b: Seed testing activities during 2005 crop season

	No. of tests /Programs					
Tests	SU	NRMP	GP	Station Operations	NARS	Total
Viability	503	65	46	2	47	663
Specific weight	800	-	750	4	-	1,554
Moisture content	10	-	-	-	-	10
Total	1,313	65	796	6	47	2,227

7.4. Seed Storage

The Seed Unit manages the medium term seed store of ICARDA in which 53,523 samples and 68.7 tons of seed and breeding material from commodity programs were stored (Table 8).

Table 8: Number of samples and quantities of seed lots (in tons) for breeding materials kept in the ICARDA medium term seed store during 2004/2005

	GP		NRMP		SU		St.Op	Total	
Crops	Samples	Lots (MT)	Samples	Lots (MT)	Samples	Lots (MT)	Lots (MT)	Samples	Lots (MT)
Barley	40,000	5.9	-	-	320	9.0	3.0	40,320	17.9
Faba bean	5,300	8.3	-	-	6	0.1	-	5,306	8.4
Chickpea	2,500	5.3	2	0.2	-	1.5	-	2,502	7.0
Lentil	2,200	1.4	-	-	2	0.1	1.0	2,202	2.5
B/wheat	560	9.0	2	-	1,600	0.1	1.0	2,162	10.1
Medic	-	-	138	3.1	-	-	-	138	3.1
D/wheat	-	-	4	0.4	27	1.0	1.0	31	2.4
Vetch	800	17.0	-	-	-	-	-	800	17.0
Trifolium	-	-	62	0.4	-	-	-	62	0.4
Total	51,360	46.9	208	4.1	1,955	11.7	6.0	53,523	68.7

7.5. Seed Distribution

From the total seed production, 50 and 109 metric tons were distributed, during 2005 and 2005, Details are provided in Table 9a and 9b.

Table 9a. Seed distribution in 2004 crop season

	Production	Seed Distribution				
Crops	**kgs**	**NARS**	**Research**	**Participatory Research**	**Multiplication**	**Total**
Bread wheat	0.14	-	0.45	-	0.12	0.70
Durum wheat	8.29	1.50	0.18	7.30	0.19	17.46
Barley	14.06	-	4.45	3.35	0.25	22.11
Chickpea	3.54	0.30	1.13	0.05	0.38	5.40
Lentil	1.73	0.05	0.02	-	0.17	1.96
Vetch	2.40	-	-	-	0.04	2.44
Faba bean	0.02	-	0.06	-	-	0.08
Triticale	-	-	-	-	-	-
Total	30.16	1.85	6.29	10.70	1.14	50.1

Table 9b: Seed distribution in 2005 crop season

Crops	Production (MT)	Seed Distribution (MT)				
		NARS	Research	Participatory Research	Multiplication	Total
Bread wheat	14.3	2.5	5.5	2.7	0.2	27.2
Durum wheat	3.4	1.8	0.5	4.8	0.3	11.8
Barley	16.1	2.3	1.4	18.1	0.2	38.1
Chickpea	3.2	1.1	0.6	0.8	0.3	5.9
Lentil	4.1	1.3	0.4	2.7	0.3	5.1
Vetch	2.1	0.6	1.2	-	0.4	4.2
Faba bean	0.01	0.05	0.03	-	-	0.1
Triticale	43.2	-	-	-	-	16.4
Total	14.3	9.6	9.7	28.9	1.6	108.7

8. SEED UNIT STAFF, CONSULTANTS AND PUBLICATIONS

Seed Unit Staff

Antonius van Gastel	Head of Seed Unit
Koffi Amegbeto	Seed Economist (joined September 2004)
Zewdie Bishaw	Seed System Specialist and WANA Seed Network Coordinator
Abdoul Aziz Niane	Seed Production Manager and Training Coordinator
Lamis Makhoul	Senior Secretary

Students

Zewdie Bishaw (PhD)	Wageningen University: Wheat and Barley Seed Systems in Ethiopia and Syria (PhD, com pleted in 2004)
Abdul Aziz Niane	Wageningen University: Seed Bank Dynamics in Rangeland Rehabilitation (PhD, started in 2005)
Samad Mobasser	Wageningen University: Study on Wheat Seed System in Iran (PhD, started in 2005)
Barakat Al-Rahmon	University of Aleppo: Seed Treatment in Integrated Disease Management of Ascochyta Blight on Chickpea (MSc, started in 2005)

Publications

Journal Article

Kugbei, S., B.R. Gregg, N. Wassimi and A.J.G. van Gastel. 2005. Socioeconomic features, food security status, and seed needs of farming households in Afghanistan. *Journal of New Seeds*, Vol (7(1), 53-70.

PhD Thesis

Bishaw, Z. 2004. Wheat and Barley Seed Systems in Ethiopia and Syria, PhD thesis Wageningen University. 383 pp.

Network Publications

Noaman, Mohammed S., Bill R. Gregg, Anthony J.G. van Gastel and Zewdie Bishaw. 2005. Code of Conduct for Seed Associations. WANA Seed Network Publication No. 29/05. ICARDA, Aleppo, Syria. 17 pp.

Seed Info Newsletter

ICARDA, Aleppo, Syria. January 2004. Seed Info [En & Ar]. No. 26.
ICARDA, Aleppo, Syria. July 2004. Seed Info [En & Ar]. No. 27.
ICARDA, Aleppo, Syria. January 2005. Seed Info [En & Ar]. No. 28.
ICARDA, Aleppo, Syria. July 2005. Seed Info [En & Ar]. No. 29.

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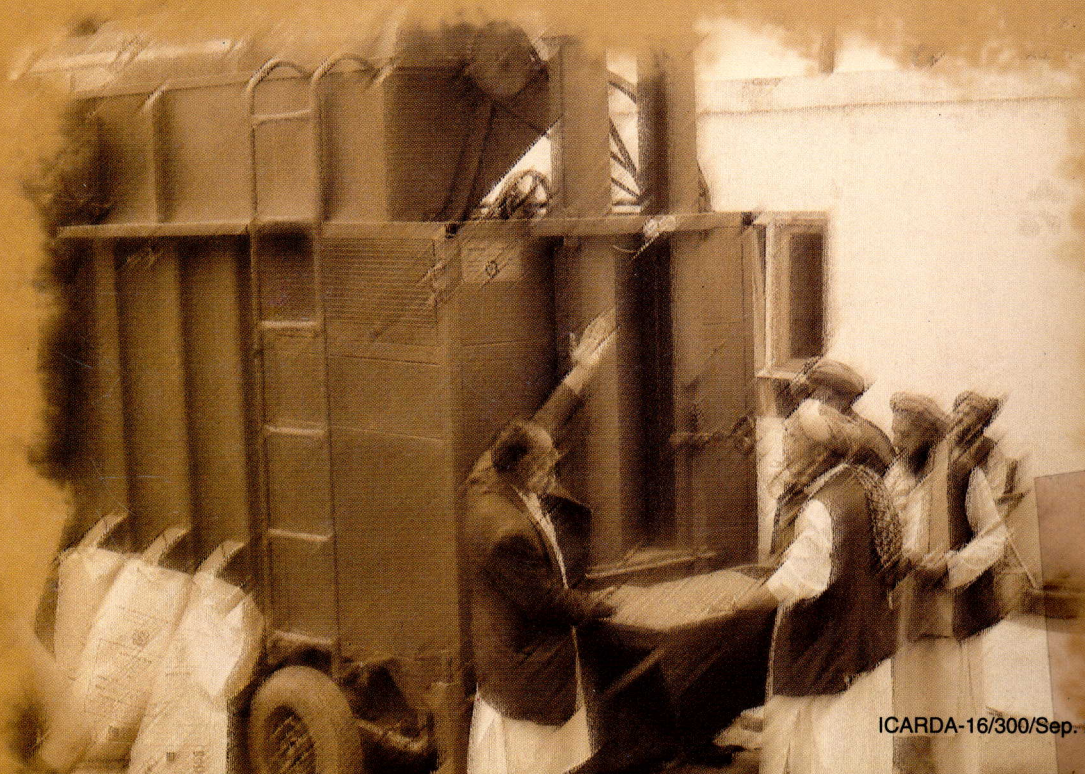

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