SEED UNIT

Annual Report for 1995

About ICARDA

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is governed by an independent Board of Trustees. Based at Aleppo, Syria, it is one of 16 centers supported by the Consultative Group on International Agricultural Research (CGIAR), which is an international group of representatives of donor agencies, eminent agricultural scientists, and institutional administrators from developed and developing countries who guide and support its work.

The CGIAR seeks to enhance and sustain food production and, at the same time, improve socioeconomic conditions of people, through strengthening national research systems in developing countries.

ICARDA's mission is to meet the challenge posed by a harsh, stressful, and variable environment in which the productivity of winter rainfed agricultural systems must be increased to higher sustainable levels; in which soil degradation must be arrested and possibly reversed, and in which the quality of the environment needs to be assured. ICARDA meets this challenge through research, training, and dissemination of information in a mature partnership with the national agricultural research and development systems.

The Center has a world responsibility for the improvement of barley, lentil, and faba bean, and a regional responsibility in West Asia and North Africa for the improvement of wheat, chickpea, forage and pasture—with emphasis on rangeland improvement and small ruminant management and nutrition—and of the farming systems associated with these crops.

Much of ICARDA's research is carried out on a 948-hectare farm at its headquarters at Tel Hadya, about 35 km southwest of Aleppo. ICARDA also manages other sites where it tests material under a variety of agroecological conditions in Syria and Lebanon. However, the full scope of ICARDA's activities can be appreciated only when account is taken of the cooperative research carried out with many countries in West Asia and North Africa.

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

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a joint project of

The Government of the Netherlands
The Government of Germany

and

The International Center for Agricultural Research
in the Dry Areas (ICARDA)
P.O. Box 5466, Aleppo, Syria

This report was written and compiled by program scientists and represents a working document of ICARDA. Its primary objective is to communicate the season's research results quickly to fellow scientists, particularly those within West Asia and North Africa, with whom ICARDA has close collaboration. Owing to the tight production deadlines, editing of the report was kept to a minimum.

CONTENTS

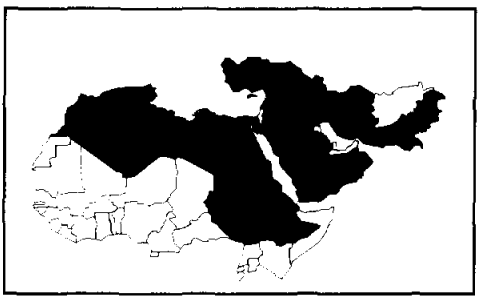
ICARDA's Seed Unit, with financial support from the governments of the Netherlands and the Federal Republic of Germany, assists national programs in West Asia and North Africa to strengthen their seed production and supply capabilities. Recently, USDA has provided support for the work on seed security in the region.

The present report discusses the 1995 work under the following headings: (a) WANA Regional Seed Network, (b) Seed Surveys, (c) Seed Security, (d) Research, (e) Training, (f) Workshops, (g) Consultancies, and (h) Production of Seed.

1. Regional WANA Seed Network

The WANA SEED NETWORK -established in June 1992- encourages: (1) stronger regional cooperation in the seed sector, (2) exchange of information, (3) regional consultation, and (4) inter-country seed trade. Eighteen countries from the region are participating in the network. The International Seed Trade Association (FIS), International Union for the Protection of New Varieties of Plants (UPOV), Association of Official Seed Certifying Agencies (AOSCA), and FAO are observers in the network.

In 1995, the Arab Organization for Agricultural Development (AOAD), The Inernational Seed Testing Association (ISTA), the Instituto Agronomico Mediterraneo de Zaragosa (CIHEAM), the German Foundation for International Development (DSE), the Seed Unit of the International Livestock Research Institute (ILRI), the German Agency for Technical Cooperation (GTZ) and the Institute of Ecology & Resource Management, School of Agriculture, the University of Edinburgh became observers in the network.



Each country in the network has appointed a senior seed program specialist as Country Representative who is the focal point for all network matters. A Steering Committee, elected during Network Council meetings, is composed of the Country Representatives of 5 network countries (Egypt, Cyprus, Morocco, Lebanon and Syria) and the Secretariat (ICARDA's Seed Unit). To achieve its objectives, the network carries out a large number of activities (Table 2). A Country Representative is responsible for implementation of an activity.

In March the second meeting of the Council of the WANA Seed Network was held in Antalya, Turkey. Except for those from Pakistan and Saudi Arabia, all Country Representatives participated in the meeting. Observers from FAO, UPOV and GTZ were present in addition to representatives from the GTZ seed projects in the region (Jordan, Egypt) and staff from Turkey's Ministry of Agriculture.

Activities

The progress/status of activities can be summarized as follows:

- Sudan has prepared a preliminary draft summary of information obtained regarding the different seed policies in the region.
- Turkey has prepared and distributed a questionnaire regarding seed certification systems in the region.
- Morocco has carried out two referee tests (to assess capabilities of WANA seed testing stations), i.e. for bread wheat and lentil.
- Egypt has prepared a Directory of Seed Industry Participants.

Table 1. List of WANA Seed Network Publications

Diekmann, M., 1993. Equipment and supplies list: Seed health testing. WANA Seed Network Publication No. 1/93.

Diekmann, M. and A.J.G. van Gastel, 1993. Disease descriptions for field inspection in seed production for (a) Loose smut of wheat and barley, (b) Common bunt of wheat, (c) Ascochyta blight of chickpea, and (d) Covered smut of barley. WANA Seed Network Publication No. 2/93.

Diekmann, M., 1993. Seed-borne diseases in seed production. WANA Seed Network Publication No. 3/93.

Bishaw, Z. and B. Gregg, 1993. Equipment and supplies list: Seed testing. WANA Seed Network Publication No. 4/93.

Gregg, B., S.A. Wanis, Z. Bishaw and A.J.G. van Gastel. 1994. Safe seed storage. WANA Seed Network Publication No. 5/94.

Gregg, B., S.A. Wanis, A.J.G. van Gastel and Z. Bishaw. 1994. Marketing seed. WANA Seed Network Publication No. 6/94.

Bishaw, Z., A.J.G. van Gastel, B. Gregg and S.A. Wanis. 1994. Inspecting seed fields of self-pollinating crops. WANA Seed Network Publication No. 7/94.

WANA Secretariat. 1995. WANA Catalogue of Field and Seed Standards. WANA Seed Network Publication No. 8/95.

WANA Secretariat. 1995. WANA Seed Directory of Organizations and Names. WANA Seed Network Publication No. 9/95.

Tourkmani, M. 1995. WANA Referee Test - Bread wheat. WANA Seed Network Publication No. 10/95.

Tourkmani, M. 1995. WANA Referee Test - Lentil. WANA Seed Network Publication No. 11/95.

Table 2. Seed Network Activities

LEAD COUNTRY	ACTIVITY
Egypt	WANA Directory of Seed Industry Participants
Ethiopia	Variety Release Mechanisms in WANA
Cyprus	WANA List of Important Weed Seeds
Iraq	Formal Seed Technology in WANA
Morocco	WANA Catalogue of Varieties Grown in WANA
Morocco	WANA Referee Tests for Seed Testing Laboratories
Syria	WANA Catalogue of Seed and Field Standards
Sudan	Seed Policies in WANA
Turkey	Seed Certification Systems in WANA
Algeria, Egypt	Study of Seed Industry Costs
Cyprus	List of Cultivated Species in WANA Countries
Jordan	Study of Rules & Regulations for Seed Imports and Exports
Lebanon	Develop and Share Technical Publications Share in-country Training Courses
Libya	Regional Variety Evaluation System
Pakistan	Regional Variety Security Database of Morphological Descriptions of WANA Varieties
Tunisia	Directory of Seed Imports & Exports
Yemen	Study of Rules and Regulations to establish Seed Companies
Secretariat	SEED INFO, FOCUS on SEED PROGRAMS, other publications

- Cyprus has prepared the first draft of the WANA Weed Seed List.
- Morocco has also presented the first preliminary draft of the WANA Variety Catalogue.
- Syria has presented the WANA Catalogue of Field & Seed Standards.

Furthermore, the Secretariat has produced (1) several issues of the network newsletter "SEED INFO" and of "FOCUS of SEED PROGRAMS", and (2) a substantial list of publications which has already been distributed (Table 1).

All other activities (Table 2) are at various stages of implementation, ranging from proposal preparation to data collection.

2. Seed Surveys

In the 1995 crop season wheat and faba bean seed surveys were conducted in Egypt, Lebanon, Sudan and Syria. The survey in Ethiopia was postponed. The objectives of the seed surveys were (a) to assess quality of seed used for planting by farmers, (b) to identify constraints at farmers' level, (c) to help formulating future management guidelines. The surveys will provide information on: (a) adoption of new technologies, (b) seed renewal rate, management of retained seed, (c) why farmers use Certified Seed/own-saved seed, (e) presence and distribution of seed-borne diseases, and (f) seed storage practices.

The seed surveys were carried out in a stratified manner from higher (zones, states or governorates) to lower (villages or farmers) administrative units in two major wheat and faba bean production areas in each country. The proportion of area planted with each crop in each administrative level (zone, state, governorate, district) determined the number of farmers to be randomly selected and interviewed (and samples collected). For the purpose of simplicity and ease of operation, samples of wheat and faba bean were collected from the same area (and even from the same farmers) provided the survey area was the same for both crops.

In addition to national seed programs, extension departments of the Ministries of Agriculture assisted in the surveys. This is particularly important in Ethiopia and Sudan where rural infrastructure is less developed and farmers are difficult to reach. Before the seed survey, the enumerators were given a one day seminar on the purpose and techniques of the survey.

2.1. Ethiopia

After reviewing the major production areas of wheat and faba bean and their relative importance in each zone, Arssi in south eastern Ethiopia and Shoa in central Ethiopia were selected for the survey. The joint seed survey planned for June 1995 with Ethiopian Seed Enterprise (ESE) was postponed to 1996.

2.2. Sudan

The seed survey in the Sudan was planned in a similar manner as that in Ethiopia. For wheat, Gezira scheme and Northern state, and for faba bean, Northern state and River Nile state were surveyed. Faba bean is grown in Gezira but not considered a main crop, hence Gezira was not selected for the faba bean survey.

In each state two to three governorates were identified. Based on the proportion of the area planted with each crop in each state and governorate, the number of farmers was determined. However, in Gezira scheme a more uniform sampling can be made from groups, blocks and villages once the number of farmers has been decided. The survey was conducted mid-September 1995.

2.3. Egypt

The seed survey in Egypt was conducted in two governorates, Dakhalaya and Sharkaya. The GTZ Seed Project was responsible for coordinating and conducting the survey. The survey was conducted in October/November 1995.

2.4. Lebanon

Since Lebanon is a small country and the infrastructure is rather good the seed survey covered the whole country and focused on two major crops, wheat and faba bean. The survey covered the Beqqa valley, north and south Lebanon. It was carried out as a joint activity of Seed Unit and the Agricultural Research Institute (ARI) during October and November 1995. A total of 74 and 40 samples of wheat and faba bean respectively were collected.

2.5. Syria

The wheat seed survey was conducted in Azaz and Jabal Saman districts of Aleppo province in northern Syria. A total of 113 farmers were interviewed and samples collected for further analysis. The survey period was October and November 1995.

3. Seed Security

The Seed Unit commissioned a report on seed security which concentrates on conceptual framework and broad strategies.

Seed security can be defined as 'the sustained ability of all farmers to have sufficient quantities of the desired types of seed at the right time' or, more restricted, 'the condition that disaster does not impede the availability to large numbers of farmers of sufficient quantities of the desired types of seed at the optimum planting date'.

Seed security has become a major issue in recent years. Indeed, it has always been a concern for farmers throughout the world. It becomes an issue after ecological disaster and in war situations. The following aspects are important: (1) the choice of varieties in relation to agro-ecology, socio-economics and biodiversity; (2) existing legislation: seed laws, phytosanitary laws; and (3) the possibility to link information on available seed stocks within the region.

3.1. *Strategies*

Strategies for seed security have to involve physical availability of sufficient quantities of seed of optimal quality, and delivery systems to reach affected farmers. They also include the capacity for immediate action and longer term approaches.

Seed security has to be considered at different system levels. Household seed security and community seed security aim at finding solutions at the local level, whereas national and regional seed security involve larger entities.

Household seed security

Household seed security is the condition that every farmer has access to farm-saved seed whenever needed. Strategies to improve household seed security therefore concentrate on the physical availability only, i.e. storage and security of stores. Compared to the conditions in the humid tropics, storage of seeds of the main food crops in the WANA region is relatively easy. Crops are generally harvested in a reliably dry season assuring a low seed moisture content during storage. The role of the government could be to include the issue of seed security in its extension efforts, i.e. to convince farmers, who normally store their own seed, to include an additional security by storing 3 or 4 times the required quantities. It could stress the importance of local seed systems and include messages to improve these wherever necessary.

In some cases insects such as weevils and bruchids need to be controlled. Local methods, such as mixing of ash, sand or oil with stored seed can be very effective. If insect infestation is a limiting factor, however, household seed security could be improved by the introduction of chemical measures against storage insects or the use of sealed containers.

Household seed security in war situations also includes the security of seed stores; i.e. to avoid looting. A good example of local measures in this field is the long-term underground storage of seed in secret places, reported from Ethiopia.

Comunity-based seed security

Community-level seed security is a common feature throughout the world. When individual farmers lose their seed for whatever reason, they can normally count on assistance from neighbors and relatives. It can however be very difficult for a whole community to withstand droughts occurring in a few consecutive years. A strategy to counteract such risks is the organization of village seed banks. These community-managed stores are filled during years with plentiful harvests, managed by village elders and used by farmers who lost their stocks of seed. Experience with such seed banks has been gained in the Sahel region, which bears some ecological similarity with large parts of WANA, but which may be culturally very different from most parts of the WANA region. Prerequisite is that such community approaches fit in the local culture.

The advantage of household- and community-based strategies for seed security is that the types of seed (varieties) are always adapted to the local conditions; disadvantage of relying on local sources is that disasters such as drought or war generally put many farmers over large areas at risk at a particular time. The system should supply seed when

the same commodity is in general short supply. Local seed security thus requires an important plasticity of the local system.

National seed security

National-level seed security strategies rely initially on the fact that most shortages are localized within particular regions of a country, whereas other regions may have produced surpluses of the seed during the same period. The task of the national government is then only to redistribute the available seed.

A problem may, however, be that any public action at the national level is bound by seed legislation, i.e. even when farmers would be happy with the use of grain as seed in conditions of acute shortages, the government may be hesitant to supply such grain. The result is that some countries maintain a large stock of certified seed as a safeguard against ecological disaster. This involves locking up of large amounts of money, which is very difficult taking into account the general trend of reducing public expenditures. An alternative is a 'deal' between the government and the largest seed producer, whereby the seed company has the obligation to maintain a security stock of seed in return for the free use of public varieties.

A very interesting solution is reported from Cyprus, where the establishment of security stocks of certified barley seed was considered too expensive. Different lots of barley (grain) are tested as soon as they are stored. The worst lots with regard to purity and germination are sold off for feed; the best lots are kept until sowing of the next crop is completed. In case the new sowing fails because of a sudden drought after planting, this (best quality) grain is then converted into 'emergency seed'. When grain marketing is handled by a public or parastatal organisation, this option is easy to operate compared to the situation where grain marketing is handled by large numbers of private dealers, all operating their own stores.

National seed security strategies for local variety seed

Seed security strategies for large-scale disasters should concentrate on the supply of seed of locally-adapted varieties through an appropriate delivery system. Such deliveries are often part of large-scale relief operations. In the past, such operations has been experienced in WANA countries such as Ethiopia and Sudan, and more recently in central Africa (Rwanda) showing that relief organizations do lack specific knowledge about agriculture in general and seeds in particular. The lack of knowledge about seed quality aspects is compensated by the purchase of 'quality controlled' seed from any national or foreign source. The varieties thus supplied may not suit the needs of the disaster-struck farmers.

Strategies to supply locally adapted seeds involve the supply of locally purchased grain or multiplication from seedbank samples or genebank entries. The last stocks of food grain may be purchased within or nearest to the target areas. These stocks are then tested for germination and distributed to farmers within the area when viability is acceptable. For a relief agency this is a rather complicated method compared to the bulk purchase of certified seed, but it may reduce a number of risks associated with varietal adaptation.

A longer term solution to the problem is the multiplication under controlled conditions of stocks of local varieties. This can be done under a contract with a formal seed production organization, with farmers or with farmer groups in the less affected areas. The formal seed production organizations will need to get used to the idea of multiplying non-released and often heterogeneous materials. In many cases they will also have to apply for dispensation with regard to the certification requirements under the seed law. The initial quantity of seed then determines how many generations are needed to arrive at a sizeable quantity to distribute to the disaster-struck farmers.

Genebank samples are generally too small to serve as starting material for such large-scale exercises, and in the recent 'Seeds of Hope' program for Rwanda, the combination of seed banks at various levels and multiplication of landraces has been discussed.

Genebanks have a major task in supplying information for the 'matching' of regions in order to identify sources of seed that would suit the disaster-affected area, and the physical conservation of samples that may be multiplied after a disaster in a particular area. Documentation of landraces and careful multiplication of samples of these genetically diverse samples is a priority in this respect. Regional genebanks, such as the one at ICARDA could play a major role in coordination and technical assistance.

3.2. Regional Cooperation

Regional cooperation is important to exchange experiences in this field through workshops. Training of seed technologists, extension staff and NGO staff is necessary to link the technical and the social aspects of research on local seed supply systems and designing integrated seed supply systems.

National disaster preparedness can be greatly assisted by a number of regionally-coordinated activities. These involve the following:

- increasing knowledge of the performance of released varieties throughout the WANA-region;
- connecting national agroecological zoning systems within the region;
- making a start with a regional geographic information system, involving abiotic, biotic and socio-economic data;
- linking of genebank germplasm characterization data with a geographic information system. Moreover, genebanks could take a lead in developing methods to identify the effects of disasters on genetic diversity;
- developing a central information system on national seed regulatory systems in the region which may expedite the movement of seed in emergency situations; regional cooperation could also consist of an effort to harmonize seed laws and phytosanitary laws throughout the region;
- Strengthening regional cooperation which can facilitate training of emergency assistance staff in the importance of seed related issues for the rehabilitation of agricultural potential in disaster-affected areas.

Any regional activity in this field should be embedded in a global discussion on seed security, in particular because interest in the issue is rapidly growing and experiences from different parts of the world could prove useful for the region involved.

3.3. Recommendations

The study concludes that:

1. Seed security involves a number of socio-economic and technical issues that should be described in detail before the general issue of seed security can be discussed.

2. Seed security has to be discussed at different system levels. It can be quantitative and qualitative.

3. Disaster preparedness with regard to seeds should include a strong variety-aspect, which should take ecological, economic and cultural components of crop varieties into account. Geographic zoning on ecological parameters only is therefore insufficient as a disaster preparedness operation. Examples of zoning used by the different ICARDA breeding groups are provided in Table 3.

   There are basically two major strategies that take the variety aspect into account: (a) localizing seed security strategies, and (b) intensive information collection and management.

4. Seed security for commercial farmers, using officially-released varieties, can be improved by re-distribution of seed among affected and non-affected regions, national seed stocks, or selection of high quality lots of stored grain. National seed security stocks are costly.

5. International cooperation in seed security involves identification of synonyms in varieties- released in different countries under different names- and sharing information on suppliers of such seeds in the region, and on national legislation on international movement of seeds.

6. The formal seed production organizations will need to get used to the idea of multiplying non-released and often heterogeneous materials

7. Seed security for farmers who are using local selections of crops involves characterization, collection and preparation for multiplication of such landraces. Upgrading of food grain of local varieties to seed is to be preferred to importation of seed into disaster-struck areas. Strengthening local seed supply systems, including improving local seed storage techniques, is an important strategy for improving household seed security.

8. The preparation of maps on varietal adaptation and preferences, based on both ecologal and socio-economic factors may improve disaster preparedness only when available information can guarantee a 'fine grid'. Building a digitized GIS

for the WANA region which could be used for this purpose may require tremendous effort and time. Initially, localized knowledge on varieties with extension services and breeders in national agricultural research systems may be linked with germplasm characterization, performed by genebanks.

9. A concerted effort is needed to train emergency assistance personnel in seed quality aspects with particular emphasis on varieties. The target group includes members of national organizations, NGO's, and supra-national organizations.

Table 3. Zoning of the WANA region, used by various ICARDA breeding programs.

Barley
g x e interaction at short distance
makes agro-geographic zoning not useful

Durum wheat
1. temperate
2. continental
3. highland

Lentil
1. Morocco (rust)
2. Algeria (700-800 m)
3. Tunisia, Western Asia, S+E Anatolia
4. N-Egypt (irrigated)
5. S-Egypt, Sudan
6. Ethiopia, Yemen
7. Central Turkey, Iran (spring-planting)
8. Afghanistan, Highland Pakistan

zoning based on ecology, biotic stresses, and consumer preferences

Bread wheat
1. temperate dryland
2. continental dryland - moderately cold
3. continental dryland - very cold
4. highland - moderately cold
5. highland - very cold

zoning, based on ecology only;
preference for short straw types assumed

Chickpea (kabuli types)
1. mediterranean low-medium altitude
2. highlands of Turkey, Iran, Iraq, Morocco, Algeria
3. Sudan, Ethiopia

zoning based on ecology

10. Seed legislation, phytosanitary legislation and Plant Breeders' Rights (PBR) often restrict international movement of seeds. Proper knowledge of the national legislation is an important aspect of disaster preparedness (Tables 4 & 5). Rules on national seed trade also restrict the movement of non-certified seed (Table 6).

11. A central information system, keeping track of seed stocks (Table 7) and official national seed security stocks in combination with a profound knowledge of varietal performance in the various ecological conditions of the region, could be useful to counteract serious shortages of seed in particular countries.

Table 4. Existence of seed-related legislation in the WANA countries.

	Af	Al	Cy	Eg	Et	Iq	Jo	Le	Ly	Mo	Om	Su	Sy	Tn	Tk	Ye
Is there a seed law regulating variety release	n	y	n	y	y	y	y	n	n	y	y	y	n	y	y	n
Is there a seed law regulating certification/marketing	n	y	y	y	n	y	y	y	n	y	n	y	n	y	y	n
Is there a plant breeder's rights law	n	n	n	n	n	n	y	n	n	n	n	y	n	n	y	n
Is there a phytosanitary law	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Do these laws apply to all crops	n	y		n	y	n	n	y	n	y	y	y	y	y	y	y

Table 5. Legislation on international movement of seeds in the WANA countries.

	Af	Al	Cy	Eg	Et	Iq	Jo	Le	Ly	Mo	Om	Su	Sy	Tn	Tk	Ye
Imports allowed from some countries only without restrictions	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	y
Only allowed with international phytosanitary certificate	y	y	y	y	y	n	n	y	y	y	y	y	n	y	y	y
Only allowed after check and quarantine in your country	n	n	n	y	y	y	y		y	y	y	y	y	y	y	y
The law allows for quick importation in case of emergency	y	n	n	n	n	n	n	y		n	y	y	y	n	n	y
Only varieties released in your country may be imported	y	y	n	y	y	y	n	n	y	y	n	y	y	y	y	
Foreign varieties have to be field-tested before importation	y	y	y	y	y	y	n	n	y	y	y	n	y	y	y	y
Only officially tested seed (germination etc.) may be imported	y	y	y	y	n	n	y	y	y	y	y	y	y	y	y	
Only seed that is tested in your laboratory may be imported	n	n	n	y	y	y	y	n	y	n	n	n	n	y	n	
The law prohibits seed export	n	n	n	n		n	n	n		n	n	n	y	n	n	n
The law allows export only when the local demand is met	n	y	y	y		y	y	y		n	y	y	n	n	n	n
The law allows export of certified seed only	n	n	n	y		n	n	y		n	y	y	n	n	y	n
Exported seed has to meet the standards of your country	y	n	n	y		y	y	y		n	y	y	n	n	y	n
Your laboratory can issue international seed certificates	n	n	n	y	n	y	y	n		y	y	n	n	y	y	n
The law allows export of commercial seed	y	y	y	n		y	y	y		y	y		y	y	y	n

Table 6. Legislation pertaining to national seed trade.

	Af	Al	Cy	Eg	Et	Iq	Jo	Le	Mo	Su	Sy	Tn	Tk	Ye
Only certified seed may be produced in your country	n	n	n	y	n	n	y	n	y	n	n	n	y	y
The law allows for 'commercial' seed to be marketed (commercial seed is not certified, only laboratory-tested)	y	y	y	y	y	y	y	y	n	y	y	y	y	n
The law allows 'commercial' seed in emergency situations	y	y	y	y	y	y	y	y	y	y	y	y	y	y
Seed standards can be changed in emergency situations	y	y	y	y	n	y	y	y	y	y	y	y	y	n

Table 7. Basic information on national seed stocks.

	Af	Al	Cy	Eg	Et	Iq	Jo	Le	Ly	Mo	Su	Tn	Ye
Are seed stocks normally maintained?	y	y	y	y	y	y	y	n	y	y	n	y	n
Is there a target for seed stock maintenance (e.g. 20% of annual seed requirement, or only for basic-foundation seed)?	n	y	y	y	y	y	y	n	y	y	n	n	n
Is there a legal requirement to maintain seed stocks?	n	y	n	y	n	n	y	n	y	n	n	n	n
Are there often casual carry-over stocks?	y	y	y	n	n	n	n	y	n	y	n	y	n

Table 8 Country codes used in tables 3 - 7.

Af Afghanistan	Iq Iraq	Su Sudan
Al Algeria	Jo Jordan	Sy Syria
Cy Cyprus	Le Lebanon	Tn Tunesia
Eg Egypt	Ly Libya	Tk Turkey
Et Ethiopia	Mo Morocco	Ye Yemen
Om Oman		

4. Research

Research is carried out through MSc. and PhD. students. A number of MSc. students are supervised by Seed Unit staff, and the Unit is in the process of identifying additional students for the study of the economics of seed production and the informal seed supply system. In 1995, three MSc. students completed their MSc theses and three new students were identified.

A survey of wheat seed quality was carried out. The work resulted in two M.Sc. theses at the University of Jordan. Major results were reported in a previous Annual Report.

4.1. Seed Vigor in Lentil

One student successfully completed his MSc. at the University of Khartoum, Sudan in the area of evaluation of seed vigor in lentil. The purpose of this study was to: (a) evaluate various seed vigor tests, (b) determine the association between vigor tests and field emergence, and (c) determine the best tests that predict field emergence. The major results were reported in a previous Annual Report, the conclusions can be summarized as follows:

- The electrical conductivity is the best vigor test to predict field emergence in lentil.
- A combination of tests (electrical conductivity and 'between paper' standard germination) does often better explain field emergence than the electrical conductivity alone.
- Standard germination test is only correlated with field emergence when soil conditions are favorable and, thus, cannot be used to predict field emergence in all cases.
- The cold soil test and seedling growth rate test are also not very sensitive to measure seed vigor in lentil.

4.2. Informal Vetch Seed Sector in Turkey

A staff member from the Central Field Crops Institute will be studying at the University of Ankara to improve the seed system of resource-poor farmers in Central Anatolia. The objectives of the study are:

- to make a survey of seed mecrhants, using common vetch as a model, to describe the common vetch market and production area in Central Anatolia, the amounts and yearly fluctuations of vetch exported and potential to introduce improved varieties into the system.
- to assess physical quality and variability of vetch seed available in the market.
- to study how seed of forage legumes are grown, selected, harvested, treated, replanted or sold and marketed in the informal seed system.
- to assess the impact of demonstration trials in sensitizing farmers to the availability of new forage legume.

4.4. Informal Wheat Seed Sectors in the WANA Region

A PhD. student will study the different informal wheat seed sectors in the WANA countries. Generally, national seed industries are often cited as major constraints to spreading new crop varieties because of rigid government agricultural policies, lack of appropriate varieties, poor seed supply, inadequate infrastructure, poor organizational linkages, and lack of trained manpower in seed science and technology. Despite more than three decades of emphasis on and investment in agricultural research, seed production and supply programs through bilateral and multilateral assistance, still more than 80% of crops in developing countries are sown from seed stocks selected and saved by farmers. The local seed systems depend on indigenous knowledge of plant and seed selection, seed sourcing, retaining and management and local diffusion mechanisms.

Research objectives

There is a growing interest to maintain the resource base of farmers for sustainable agricultural development. Attention is being focused on understanding local knowledge of plant selection and maintenance as well as seed production and handling of agricultural crops at farmers' level. At present, though a great amount of information is available on variety development, seed production and quality control in the formal seed sector there is little information on the farmers' seed source and seed quality and their effect on crop performance; local knowledge in selection and handling of plants and seeds; farmers' adoption behavior and diffusion of new varieties and seeds; and the performance analysis of the formal seed system. The following research will be carried during the study:

(a) **Farmers' seed source and seed management practices.** The study will investigate the farmers' seed source and the reasons for choosing a particular seed source for planting. Farmers' local knowledge in selection and management of farm-saved seed in the field, during harvesting and storage, will be documented. The lessons learned can be used to strengthen both the formal (demand and supply) and informal seed supply systems to meet farmers' needs.

(b) **Adoption and diffusion of modern varieties.** The adoption of modern varieties appears to be limited at the farm level. Farmers' criteria for and constraints to adoption and the diffusion mechanisms of seed of modern varieties at community level will be investigated. Farmers' perception and criteria for modern variety and certified seed will be studied to develop decision models for variety replacement and seed renewal. The study will be used to assess the variety development procedures, varietal acceptability and may enable plant breeders to review their objectives and set priorities for crop improvement.

(c) **Performance analysis of seed systems.** The main objectives of the national seed program is to produce and supply seed of the required quantity, adequate quality, at the right place, at the right time and at a reasonable price. Apart from technical issues, government policy and services severely limit the performance of national seed programs. Thus the performance of the seed program in meeting these goals will be analyzed from secondary data and the questionnaires from farmers' perspective.

(d) **Farmers' seed quality**. The physical (analytical purity, species purity, thousand seed weight) and physiological (germination and vigor) seed quality will be assessed and compared from different seed sources. The relationship between seed vigor and seedling emergence and establishment will be investigated. The seed quality will be determined and farmers' criteria identified; and seed quality parameters of the formal sector checked.

(e) **Occurrence and distribution of seed-borne diseases**. There are few systematic surveys to study plant diseases at the farm level, and seed-borne diseases get the least attention. There is little information on seed-borne diseases, but seed programs promote routine seed treatment without specific information on disease situation and its importance at the farmers' level. The study will assess the occurrence and distribution of important seed-borne diseases. This will enable the development and implementation of a seed-borne control strategy such as selecting areas of seed production, introducing seed health testing or designing simple practical guidelines to clean and treat farm-saved seeds.

(f) **Measurement of varietal deterioration (change)**. The varietal purity refers to its freedom from contamination with other varieties, other crops, noxious weeds and seed-borne diseases. The genetic purity refers to an inherent quality of the variety. It is anticipated that the modern variety will change in its composition due to genetic (crossing), physical (admixture) and pathological (infection) contamination over time when seed is retained by farmers. The degree and extent of varietal deterioration and physical contamination of modern varieties retained as own-saved seed under farmers' management practices and its effect on production of self-pollinated crops are not known. The study will measure the genetic purity in the laboratory and varietal purity in the field to determine the accuracy of field assessment. It will also measure the level of contamination (deterioration) and its effect on crop yield. The results will be used to evaluate the present procedures employed to measure contamination and the relevance of varietal certification schemes, the fundamental basis of varietal and seed replacement in the formal sector.

(g) **Genetic diversity of local landraces**. Farmers in diverse and less favorable environments are interested in varieties with broad genetic base with the capacity of individual and population buffering to stress environments. The local landraces are the product of agro-ecosystems and their adaptations are shaped by human and natural selection. The understanding of genetic diversity of local landraces will provide information on the mechanisms of adaptation and farmers' preference for varieties. Investigations will be made on the genetic and agronomic characteristics to measure the genetic diversity of local landraces.

5. Training

Human resource development is a continuous process where new knowledge and skills are acquired through theoretical and/or practical training to increase the competence and performance of staff working in the national programs. Therefore, training remains one

of the major activities of the Seed Unit for sustainable human resource development in the seed sector.

Moreover, as the seed program develops, specialized in-depth advanced training will be required to have a competent human resource base, well-trained and experienced technical and managerial staff, to meet the challenge. At present more specialized courses are being offered on specific topics upon requests from national programs (e.g. variety description, seed health, etc.).

In 1995, several courses were organized. Most of the courses are organized in close cooperation with national seed programs and/or seed projects (e.g. GTZ) in the region.

5.1. In-country Train-the-Trainer Courses

The effort of the last few years is gaining momentum and the train-the-trainer courses are becoming more appreciated. National seed programs are willing to commit resources to conduct follow-up courses to transfer acquired technical and practical knowledge. Two 'new' train-the-trainer courses on seed health were conducted.

Legume Seed Health Testing, Islamabad, Pakistan

The legume seed health testing was conducted from 14-20 March 1995 in close cooperation with the Federal Seed Certification Department (FSCD). The course covered the economic importance of seed-borne diseases, their identification and detection in the field and laboratory, as well as standards for certification (field inspection and seed health testing). Emphasis was given on different techniques of laboratory seed health testing. Moreover, field visits were made to conduct practicals on identification, field inspection and assessment of seed-borne diseases. The field visits provided an opportunity to detect disease problems in seed production fields.

The course was designed to acquaint senior professional staff with techniques of seed health testing of legume crops and was attended by 10 participants from FSCD (9) and PARC (1). The staff are expected to transfer this knowledge by conducting similar, but practical oriented courses.

Seed Health Testing, Ankara, Turkey

The Seed Health Testing train-the-trainer course was the first seed course to be organized by the Seed Unit in Turkey in cooperation with the Seed Registration and Certification Center (SRCC) from 24 April to 2 May 1995. The objectives were to provide a general background on production of disease-free seed and to strengthen capabilities of the national program in seed health testing. The course focused on the importance of seed-borne diseases in seed production and seed certification (field inspection, seed health testing, standards). Field visits were made to seed production fields of wheat and barley for detection, assessment and sample collection of seed-borne diseases. Thirteen senior staff attended the course: 11 from SRCC and 2 from the Plant Protection Research Institute.

5.2. Follow-up Train-the-Trainer Courses

During the report period three follow-up train-the-trainer courses were conducted in Egypt, Pakistan and the Sudan. The course in Egypt was attended by Seed Unit staff as course facilitators, whereas the Pakistan and the Sudan courses were exclusively run by the national program staff trained in the original train-the-trainer course.

Legume Field Inspection Methodology, Sakha and Sids, Egypt

The first series of the follow-up of the 'trainers' courses were carried out at two locations in Egypt from 12 to 16 March 1995. They were organized in Sakha and Sids in cooperation with the Central Administration for Seed (CAS) and the GTZ Seed Project in Egypt. A total of 20 trainees, 10 in each location, covering 13 governorates participated in the courses. The objective was to train the quality control staff in legume field inspection methodology. The course gave due attention to legume seed industry in general and field inspection methodology in particular. Apart from field inspection techniques for varietal certification, topics on variety maintenance, variety description and important legume seed-borne diseases were covered in detail. Both follow-up courses were run by the 'trainers' who took the lead in all arrangements and delivered all lectures and practicals with minimum support from ICARDA and GTZ staff. It is anticipated to organize at least three courses in 1996. During the courses the 'trainers' transferred the theoretical and practical knowledge acquired to field inspectors from different governorates.

Legume Seed Production, Islamabad, Pakistan

A follow-up course on legume seed production for field officers of the Federal Seed Certification Department (FSCD) was organized from 5 to 8 December 1994. The main purpose of the course was to disseminate practical knowledge acquired during the 'train-the-trainer' course on legume seed production organized by FSCD and ICARDA in April 1994 at Sahiwal, Pakistan. The lectures were delivered by the 'trainers' from FSCD. The course was followed by a one-day field visit to the Agricultural Research Center.

General Seed Technology

Although no report was received, a follow-up course was also organized by one of the 'trainers' who participated in the ICARDA-NSA (National Seed Administration) course in 1994 in Sennar, Sudan. The course was intended to increase the awareness of agricultural development and extension staff working in the Ministry of Agricultural of one of two Federal States.

5.3. Refresher Seminar

A one-day refresher seminar was organized on 11 March 1995 for participants of the wheat field inspection methodology (train-the-trainer) courses conducted from 1990 to 1993. The seminar discussed the role of variety description, field inspection and post control plots in quality seed production. Moreover, discussions were held on practical problems of field inspection in general and application of the methodology in particular. A total of 23 participants from 12 governorates attended the seminar.

5.4. Regional Courses

In 1995, three regional courses were conducted, i.e. on morphological variety description, seed processing and storage, and economics of seed.

A new addition to the Seed Unit course curricula was the Economics of Seed course. Many public seed production programs have appeared to be service-oriented and are mostly operating on subsidies. There is no adequate economic and financial analysis to see their relative efficiency. The course was planned to fill this gap and to acquaint participants in the area of economic and financial planning of seed production.

Morphological Variety Description

The morphological variety description course was organized from 17 to 27 April 1995 at ICARDA's headquarter in Aleppo, Syria. The objectives were to increase the awareness of the significance of variety description in the seed industry and train NARS and seed program staff to acquire technical knowledge in variety description. The course covered theoretical and practical aspects of morphological variety description of cereals, legumes and some pasture and forage crops. Moreover, it focused on the design, data collection and analysis of DUS experiments with background information on biometrical approaches, statistical methods and computer use in variety description. The course was attended by eight participants from Egypt (2), Ethiopia (1), Jordan (2), Syria (1), Lebanon (1), and Turkey (1). The trainess are expected to initiate variety description activities in their respective countries and transfer the acquired skills to the national staff by organizing a practical-oriented course.

Seed Processing and Storage

The seed processing and storage course was organized from 18 to 29 June 1995 at ICARDA's headquarter in Aleppo, Syria. The course covered theoretical and practical aspects of seed processing and storage of cereals, legumes, and pasture and forage crops. It focused on the principles, machines, internal quality control and management to optimize the efficiency of seed processing plants. During practicals, machine adjustments for various crops demonstrated how to increase operational efficiency consistent with high seed quality. The course was mainly designed for agricultural research centers where breeder and foundation seed is produced and for national seed production programs. Eleven participants from Algeria (5), Jordan (4) and Syria (2) attended the course.

Economics of Seed Production

The Economics of Seed Production course, the first of its kind, was organized from 1 to 5 October 1995 at ICARDA's headquarter, Aleppo, Syria. It was a joint exercise of the Seed Unit of ICARDA and the GTZ Seed Project in Egypt. The course covered the management and operation of a profit-oriented seed production program focusing on capacity analysis of seed plants, accounts management, operating costs, seed pricing, financial analysis, break-even analysis, calculation of gross margin, etc. A half-day lecture on economic and financial analysis of seed projects (a case study on wheat) was also presented with emphasis on project identification, criteria for selection, investment costs, operating costs, analysis of projects (benefit-cost ratio; marginal and internal rate of return, etc). Apart from economic and financial issues, other topics on seed program

components, seed policy, seed marketing, and seed quality control were covered to increase awareness. The lectures based on the operation of profit seed-centers in Egypt were of very practical relevance to countries engaged in restructuring their national seed industry through creation of profit seed-centers in the public sector or the privatization of the seed sector. The course was attended by seven participants one each from Egypt, Ethiopia, Pakistan, Sudan, Syria, Turkey, and Yemen.

5.5. In-country Courses

Although regular in-country courses are increasingly replaced by train-the-trainer courses, three in-country courses were conducted during 1995 on the request of national seed programs.

Morphological Variety Description, Islamabad, Pakistan

The in-country morphological variety description course was organized from 28 March to 3 April 1995 in close cooperation with the National Seed Registration Department (NSRD) and Federal Seed Registration Department (FSRD). The course was designed to acquaint selected staff from agricultural research, variety evaluation and registration department and universities with new and practical techniques in variety description. The course covered morphological variety description of major cereals, legumes and pasture and forage crops, including biometrical approaches, statistical methods and computer use in variety description. Moreover, the issues of plant breeder's rights and variety protection were discussed in detail. The course was attended by 11 senior staff from NSRD (3), FSCD (1), agricultural research centers (6) and the university (1).

Seed Processing and Storage, Asella, Ethiopia

The seed processing and storage course was organized from 28 August to 8 September 1995 in close cooperation with the Ethiopian Seed Enterprise (ESE). It was conducted at Asella Regional Seed Processing and Storage Center- one of the nucleuses of autonomous seed centers in Ethiopia. The course focused on design, operation, adjustment, and management of seed plants and principles of seed processing for efficient and effective use of cleaning capacity consistent with high seed quality. Moreover, the principles of seed storage, design of storage facilities, seed storage pests and their control were covered from the Ethiopian perspective. Considerable time was devoted to practical seed cleaning and adjustment of different machines to clean cereals and legumes. Laboratory seed testing methods (purity and germination) were also included to train staff on how to determine seed quality during and after processing. During the course every effort was made to emphasize the efficiency of machine operation and maintenance of seed quality through effective internal control system to maximize output and minimize processing costs. Study tours were made to the ESE Basic Seed Farm and the main research stations of the Institute of Agricultural Research (IAR) and Alemaya University of Agriculture (AUA). The participants were exposed to the ongoing variety development programs and toured seed production facilities for early-generation materials on ESE, IAR and AUA farms.

A total of 15 participants attended the course: 10 from public institutes [ESE (8), National Seed Industry Agency (1), MoA (1)], three from private organizations [Ethiopia Amalgamated Ltd (1), Ambasel Trading House (1), Wondo Trading Ltd (1)] and two from

NGOs [ODA (1), REST (1)]. The trainees are either heads of seed plants and seed storage from ESE, agronomists from newly emerging private sector involved in agricultural inputs supply (including seeds), or agricultural development workers from NGOs.

Seed Testing Techniques, Sakha, Egypt

The course on seed testing techniques was organized from 15 to 24 October 1995 at Sakha, Egypt in cooperation with the Central Administration for Seeds (CAS) and GTZ Seed Certification Project in Egypt. It was organized to strengthen the existing and newly established seed testing stations in Egypt to implement the GTZ Seed Certification Project. The main objective was to train senior seed testing officers to acquire theoretical and practical knowledge in laboratory seed testing techniques. Lectures covered various aspects of seed quality and related topics covering recent developments as well as organization and management of seed testing stations. International Seed Testing Association (ISTA) rules were used as a basis for lectures and practicals. Twenty-three seed testing officers from eight governorates representing 10 seed testing stations (three old and seven new) attended the course.

5.6. Short-term Individual Training

In 1995 five short-term individual training courses (two in cooperation with other programs in ICARDA) were organized in Aleppo, Syria. These include general, legume, and forage seed production as well as seed health testing and virology.

General Seed Production

One participant from the Agricultural Research and Extension Authority (AREA) in Yemen was trained for 11/2 month in general seed production. The training acquainted the staff with cereal and legume seed industry and expose him to different aspects of seed programs and other related disciplines. The trainee worked closely with the Seed Unit staff to acquire the practical skills.

Legume Seed Production

One staff member from the General Organization for Seed Multiplication (GOSM) in Syria was trained for two weeks in the principles and procedures of legume seed production with emphasis on chickpea and lentil. The course focused on the technical and practical aspects of crop-specific agronomic requirements for quality seed production. The significance of high-quality breeder seed in subsequent generations was emphasized.

Forage Seed Production

One staff member from the General Organization for Seed Multiplication (GOSM) in Syria was trained for two weeks in the principles and procedures of forage seed production (medics, vicia, lathyrus). The course focused on the technical and practical aspects of crop-specific agronomic practices for seed production.

Virology

A one-month training in virology was offered for one staff from CAS in cooperation with Virology Laboratory of Germplasm Program. The purpose was to acquaint the staff with

modern techniques used for detection of seed-borne viruses. Practical training was given with emphasis on cereal (barley) and legume (lentil).

Seed Health Testing

The course was offered by the Seed Health Laboratory (GRU), but coordinated by the Seed Unit. Two staff members from CAS participated in one-month training in seed health testing. The training covered field inspection and laboratory seed health testing techniques of cereals and legumes for fungi, bacteria, and nematodes.

Table 9. Training courses of the Seed Unit, 1995.

Name	Location	Date	No of partici-pants
A. Regional Courses			
Morphological Variety Description	Aleppo, Syria	17/04-27/04	8
Seed Processing and Storage	Aleppo, Syria	18/06-29/06	10
Economics of Seed Production	Aleppo, Syria	01/10-05/10	7
B. In-country Train-the-Trainer Courses			
Legume Seed Health Testing	Islamabad, Pakistan	14/03-20/03	10
Seed Health Testing	Ankara, Turkey	24/04-02/05	13
C. Follow-up Train-the-Trainer Courses			
Legume Field Inspection Methodology	Sakha and Sids, Egypt	12/03-16/03	20
D. In-country Courses			
Morphological Variety Description	Islamabad, Pakistan	28/03-03/04	11
Seed Processing and Storage	Asella, Ethiopia	28/08-08/09	15
Seed Testing Techniques	Sakha, Egypt	15/10-24/10	23
E. Individual Trainees			
General Seed Production	Aleppo, Syria	15/05-30/06	1
Legume Seed Production	Aleppo, Syria	28/05-08/06	1
Forage Seed Production	Aleppo, Syria	28/05-08/06	1
Seed Health Testing	Aleppo, Syria	30/04-31/05	2
Virology	Aleppo, Syria	30/04-31/05	1

6. Workshops

6.1. Privatization of Seed Industry Workshop

The workshop was organized from 16 to 20 November 1995, by ICARDA's Seed Unit, GTZ and the Ministry of Agriculture (Tunisia) to assess the experience, progress, and constraints of privatization/liberalization of the seed industry in the WANA region. It was attended by senior decision-making public and private seed sector officers from the WANA region. GTZ staff, the private sector from France, Germany and the Netherlands, as well as the FAO, FIS, and UPOV participated in the workshop.

The major result of the meetings was the establishment of a Committee that will help countries in the WANA region to privatize their seed industries.

During the workshop the following issues were discussed: (a) identification of constraints to liberalization/privatization, (b) recommendations for the removal of constraints, (c) approaches to liberalize/privatize the seed sector, and (d) possibilities for regional cooperation.

Identification of Constraints

The major constraints to privatization of the seed sector are listed below in order of importance:

- Unfair competition between public and private sector; subsidy for public sector; lack of incentive as well as land for basic seed production for private sector.
- Lack of government policy; old agriculture laws; inadequate legislation for seed business.
- Absence of clear guidelines and political will for privatization; too much government interference.
- Difficulty to liberalize the cereal seed sector which is not attractive to the private sector.
- Lack of trained manpower, managers, and knowledge in the private seed sector.
- Inadequate seed certification system; absence of seed quality control; insufficient separation of certification from production.
- Inadequate price policy; high initial investment and cost of production.
- Lack of plant breeder's rights and variety development.
- Lack of well-organized commodity market; financial laws, taxation, royalty; weak financial system to support private investment.

Removal of Constraints

The following was recommended to privatize the public seed sector for self-fertilizing crops:

- Enact comprehensive seed laws including variety registration, variety protection, and quality control; establish clear seed policy; organize national seed program and seed council.

- Develop legal structure that ensures fair competition and stimulate public and private activities; enact laws and develop guidelines for privatization; establish implementation Committee.
- Separate production from quality control activities; create quality control service to eliminate fraud and ensure seed quality.
- Provide incentives to privatize seed industry; create special status for private investment in the seed sector; lease state land to the private seed sector; allow them to use public marketing channels, rent public processing and storage facilities.
- Maintain strong research base with free access for private companies; make available public varieties, breeder and foundation seed to both sectors.
- Introduce an investment law (tax holiday period, etc.); remove obstacles for foreign investment.
- Reduce subsidies; give similar subsidy to the private sector; introduce direct subsidies for seed price.
- Create free capital market; initiate rural credit programs; make credit available at reasonable rates and collateral requirements; establish a cash credit line for seed business.
- Introduce a free marketing and pricing system; impose minimum sales price.
- Train private and public sector staff in all aspects of seed industry (and management); introduce seed technology courses in universities.
- Establish seed associations; make available good agricultural statistics.
- Government should finance seed security stocks; ensure that remote areas have access to seed; continue basic and applied research; promote use of certified seed; plan employment for excess staff.

Steps to privatize large public seed sector entities

The change from public to private sector should be gradual: reduce control of state-owned companies, increase price to cover costs, lower threshold for private entrepreneurs to enter seed business.

- Separate public seed production from official certification.
- Decentralize public seed sector into small independent units operating on commercial basis.
- Value all assets; issue tenders; ensure continuous seed supply for a given period; investigate joint venture and other options.
- Continue to operate public sector on commercial basis if there is no interest from the private sector.
- Reform the structural, financial and management of the seed sector to create an environment of market economy before state-owned enterprises can be privatized.

Regional Cooperation and Actions

The participants agreed to aggressively promote public awareness at government level, to recommend polices to support the private sector, to stimulate the establishment of national seed companies, and to establish a Working Group on Privatization.

6.2. Seed Production Needs in Central Asia

ICARDA organized a workshop in Uzbekistan from 5 to 9 December 1995 to assess the needs for research in agriculture and seed production in the eight Newly-Independent Republics of West and Central Asia. In addition to participants from the three Caucasian Republics of Armenia, Azerbaijan, and Georgia, and the five Central Asian Republics of Kazakhstan, Kyrgyzistan, Tadjikistan, Turkmenistan, and Uzbekistan, ICARDA, GTZ, BMZ, ISNAR, and CIMMYT participated in the workshop. The recommendations of the seed working group were:

- Set up a regional center to help strengthening the regional seed sector; organization of a coordination center for seed marketing.
- Help reviewing and restructuring the seed systems in the different republics; assist in reorganization of seed production.
- Help to set up national seed boards; initiate a Regional Seed Committee.
- Help to set up regional variety testing system; initiate a regional variety catalog.
- Help to organize and train seed staff of the region i.e. in management and marketing; re-training of national seed staff.
- Provide information on all aspects of the seed sector; seed production seminars.
- Assist in procurement of equipment.
- Set up regional/national seed health testing laboratories.
- Initiate plant breeder's rights.

7. Consultancies

7.1. Sudan

The Arab Authority for Agricultural Investment and Development (AAAID) initiated a proposal to establish a stockholder-owned Company for production, processing and distribution of improved seed in the Sudan. A feasibility study was prepared by a team of Sudanese experts. The Seed Unit was asked to provide an unbiased external evaluation of the feasibility study of the proposed Company. A mission visited Sudan from 1 to 11 September 1995.

This project–establishing a Company for production, processing, and distribution of improved seed in the Sudan–is the first step toward moving seed supply into the private sector. It will privatize seed operations previously handled by the National Seed Administration (NSA) of the Government of Sudan, and improve, expand, and modernize overall operations. The Company will be managed as a private firm owned by stockholders who are a consortium of Government, parastatal (SDC) and regional organizations (AAAID). It will operate in a market which in recent years has shown many inefficiencies and distortions, some caused by the fact that NSA, which so far owns and runs most seed production units in the country, is a Government organization focused on implementing policy guidelines rather than behaving as a commercial market-oriented organization.

The project appeared to be feasible with good potential for success. The proposed market share of the total seed supply appears feasible, given the reported seed use and purchasing capability and habits of Sudanese farmers. While rates of return will not be as high as included in the feasibility study, the Company is expected to be profitable, given (1) realistic market-oriented management; (2) adequate operating capital; (3) dedicated and trained staff; (4) modern cost-efficient procedures, facilities and operations; (5) market orientation (as opposed to production-oriented); (6) Government policy support and freedom to make and implement operational/management decisions; (7) privileges, facilities and guarantees provided by the Sudan Investment Act for investors; (8) adequate supply of inputs; and (9) a stable economic and political environment prevails.

7.2. Yemen

On the request of the World Bank, the Seed Unit participated in a World Bank identification mission for an agricultural project in the Republic of Yemen. The main objective of the mission was to investigate the possibility for an agricultural services and seed sector project for Yemen. The mission identified the following constraints: (a) inadequate research, (b) poor extension, (c) poor water use efficiency, (d) expensive agricultural inputs (fertilizers, spare parts, pesticides), (e) limited farmers' cash flow, and (f) absence of quality seed. A project would address the following issues: (a) agricultural inputs (not fertilizers), (b) seeds, (c) credit, and (d) IPM. Regarding seed, the project will aim at restructuring the seed sector, appreciating that a large proportion of the seed is produced in the informal sector. Support will be given both to the formal and informal sector. Formal sector support will be aimed at commercialization of the seed centers and stimulation of the private seed sector, while the support to the informal sector will aim at the introduction of improved landraces/cultivars.

7.3. West Africa

On the request of GTZ the Seed Unit participated in a mission to West Africa. The Federal Republic of Germany will support IITA in setting up a project to strengthen the seed and planting material sector in West Africa. The objective of the project is to support the supply of seed and planting material, and to promote further regional development and dissemination of professional know-how in the seed sector. The terms of reference for the mission were: (1) identification of project location, (2) evaluation of training facilities at the different locations, (3) discussions with IITA in Ivory Coast, Ghana, and Benin regarding the implementation of the project, (4) arrangement of project cooperation with IITA Headquarter, regarding the implemention of the project, (5) preparation of job description for senior project staff, and (6) drafting of Project Agreement.

7.4. Jordan

The National Center for Agricultural Research and Transfer of Technology (NCARTT) in Jordan has requested the Seed Unit to assess the possibility of organizing a seed health laboratory at NCARTT, to start seed health testing for seed certification and quarantine. The Head of ICARDA's Seed Health Laboratory visited NCARTT and reviwed- jointly

with a committee - the available facilities at NCARTT; suggested additional facilities; and assessed training needs. The proposal (in Arabic) was approved by DG, NCARTT for immediate action.

8. Production of Seed

Seed production of promising lines is a routine activity aiming at producing limited quantities of seed for distribution to national programs and for research purposes. The seed production activities also play an important role in the training program of the Unit.

8.1. Production

The quantities of Breeder Seed, Pre-basic Seed, Basic Seed, and Quality Seed produced in 1995 are indicated in Table 10. In total, 24 t of seed were produced i.e. Breeder Seed (100 kg), Pre-basic Seed (930 kg), Basic Seed (12.6 t), and Quality Seed (10.2 t). Of the total, 18.8 t were cereals (78.7%) and 5.1 t legumes (21.3%). Small quantities of vetch (145 kg) and medic (520 kg) were produced. Table 11 shows the production of seed since 1988.

Table 10. Quantity of seed harvested per multiplication category in 1995 (kgs).

Seed Category	Crop						Total
	Wheat	Barley	Chickpea	Lentil	Medic	Vetch	
Beeder	25	35	25		15		100
Pre-basic	700		60	40	130		930
Basic	5050	7300	280				12630
Quality	4975	700	1000	3000		520	10195
Total	10750	8035	1365	3040	145	520	23855

Table 11. Quantity of seed produced since 1988 (tons) by the ICARDA Seed Unit.

Crop	Year								Total
	1988	89	90	91	92	93	94	95	
Breeder	1.5	0.4	0.3	0.5	0.2	2.5	0.1	0.1	5.6
Pre-basic		6.1	8.7	6.8	3.7		0.2	0.9	26.4
Basic			4.3	17.0	21.6	9.7	6.0	12.6	71.2
Quality	79.0	25.0	7.4	14.5	21.1	15.2	19.7	10.2	192.1
Total	80.5	31.5	20.7	38.8	46.6	27.4	26.0	23.8	295.3

8.2. Distribution

Table 12 presents the data on distribution of seed. In 1995, 21.5 t were distributed i.e. 7.4 t wheat, 11.0 t barley, 1.3 t lentil, 1.0 t chickpea, 0.4 t vetch, and 0.4 t of medic for the following purposes:

- 3.0 t for next year's plantings of the Seed Unit,
- 1.0 t to the countries of the ICARDA region, and
- 17.5 t for research and large-scale testing purposes.

Table 12. Seed distribution in 1995 (kgs).

	Wheat	Barley	Lentil	Chickpea	Vetch	Medic	Total
Seed Unit	1900	500	200	300	80		2980
Region	775		100	150			1025
Research	4750	10500	1000	600	300	350	17500
Total	7425	11000	1300	1050	380	350	21505

8.3. Quality Control

All production, processing and storage activities of the Unit are carefully followed by seed quality tests to ensure that the seed produced and distributed is of good quality. Tests are also carried out for research, variety description work and other purposes (Table 13). In 1995, 1444 samples were analyzed for monitoring the quality of the seed produced, storage, and distribution activities. The tests carried out included germination (1169 samples), physical purity (102 samples), varietal purity mainly phenol test (108 samples), and moisture content determination (65 samples).

Table 13. Number of samples tested in the seed testing laboratory since 1988.

	1988	1989	1990	1991	1992	1993	1994	1995
Physical purity	158	283	149	28	70	106	166	102
Germination	290	822	531	1069	833	1018	1005	1169
Varietal purity	304	165	178	117	125	84	302	108
Moisture	8	148	178	143	153	26	20	65
Vigor			21	356	68	1001	261	
Seed weight			802	883	335	54	48	
Total	760	1418	1859	2596	1584	2289	1802	1444

9.4. Services

The seed cleaning laboratory became operative in mid 1990 and has ever since been extensively used as a service to ICARDA's commodity programs. In 1995 for instance, the Genetic Resources Unit (GRU) cleaned 4312 of barley samples, 2254 samples of **Triticum**, 2200 samples of chickpea, and 1700 samples of lentils. For GP and PFLP 7549 samples of barley and 6 samples of *Trifolium* were cleaned, respectively. Table 15 provides information on the services provided by the laboratory to other programs and units.

A 1 ton/hour seed cleaning plant plays an important role in the activities of the Unit. In addition to cleaning the production of the Unit's seed production fields, it assists ICARDA's commodity programs in cleaning seed. In 1995, a record amount of 400.6 t of was cleaned, i.e. 28.2 t for the Unit, 220.3 t for commodity programs, and 152.1 t as a service to Syrian seed organization, GOSM (Table 14).

Table 14. Seed processed since 1988 (tons).

	1988	1989	1990	1991	1992	1993	1994	1995
Seed Unit	80.6	31.5	20.8	42.0	65.7	35.0	29.3	28.2
ICARDA Services								
CP		1.6	5.8	0.3	1.8	28.8	3.2	11.5
PFLP	10.5	6.5	16.7	18.1	12.7	42.5	11.0	13.9
LP	3.1	4.3	1.8	8.9	14.7	5.6	19.0	05.0
FRMP	16.2	20.1	25.5	35.4	33.9	45.1	18.5	13.8
St. OP	21.6	6.4	29.0	47.6	75.7	123.0	116.0	176.1
Others	0.9							
GOSM			108.3	218.7	94.7	206.2	40.0	152.1
Total	52.3	38.9	187.1	329.0	233.5	446.2	207.7	372.4
TOTAL	132.9	70.4	207.9	371.0	299.2	486.2	237.0	400.6

Quantities of seed produced since 1988 (tons) by the ICARDA Seed Unit.

Crops	Years								Total
	1988	89	90	91	92	93	94	95	
Breeder	1.5	0.4	0.3	0.5	0.2	2.5	0.1	0.1	5.6
Pre-basic		6.1	8.7	6.8	3.7		0.2	0.9	26.4
Basic			4.3	17.0	21.6	9.7	6.0	12.6	71.2
Certified					17.8	6.8	9.2		33.8
Quality	79.0	25.0	7.4	14.5	21.1	15.2	19.7	10.2	192.1
Total	80.5	31.5	20.7	38.8	64.4	34.2	35.2	23.8	329.1

Quantities of Seed distributed since 1988 by the ICARDA Seed Unit.

	Years								Total
	1988	89	90	91	92	93	94	95	
Seed Unit	2.3	1.4	1.1	3.2	2.4	2.0	1.2	3.0	16.6
Region	23.6	5.8	14.7	9.4	27.8	8.1	4.7	1.0	95.1
GOSM	2.6	0.9		0.2	6.0	4.0	3.8		17.5
Research	14.3	6.9	7.9	8.5	14.1	21.3	16.6	17.5	107.1
ICARDA Farm	3.4	4.4	1.1	1.4	0.4	0.4	0.7		11.8
Farmers	11.1	2.3							13.4
Total	57.3	21.7	24.8	22.7	50.7	35.8	27	21.5	261.5

GOSM: The General Organization for Seed Multiplication of Syria.

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