ICARDA in Central Asia and the Caucasus

Ties that Bind















ICARDA

International Center for Agricultural Research in the Dry Areas

ICARDA in Central Asia and the Caucasus

A Decade of Achievements

Ties that Bind
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Kyrgyzstan — Center of Agricultural Research and Consulting Services (CARCS)
Tajikistan — Tajik Academy of Agricultural Sciences (TAAS)
Turkmenistan — Ministry of Agriculture (MA)
Uzbekistan — Uzbek Scientific Production Center for Agriculture (UzSPCA)

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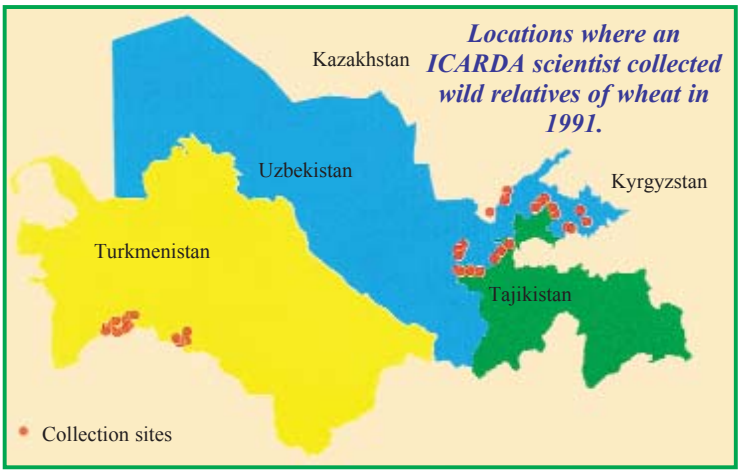
The Region

The Central Asia and the Caucasus (CAC) region is a vast area of desert, steppe and mountain. For centuries its people have battled against a difficult climate, characterized by low and unpredictable rainfall and extremes of temperature. During the Soviet era, the eight countries of the region served as a centralized system that exported produce within the USSR. However, the collapse of the Soviet Union resulted in the need for each country to develop a market-driven economy that promoted food security and ensured sustainability in the long term while responding to trends in global markets.

It has been more than 13 years since independence, but the CAC countries are still in the process of making a transition to 'stand alone' market economies. The future, however, looks promising. The region has held on to its rich biodiversity, has many qualified experts, and a good institutional infrastructure. Continued investment in collaborative research programs is vital to ensure that the region benefits from the many opportunities to improve the lives and livelihoods of its people.

ICARDA's Partnership with CAC

ICARDA's relationship with CAC began as early as the 1980s when the Center collaborated with VASKHNIL (The Soviet Union Academy of Agricultural Sciences) by exchanging germplasm and scientific visits. The first scientific visit from ICARDA took place in Kazakstan in 1987. A visiting scientist from Uzbekistan spent one year at ICARDA's Genetic Resources Unit in 1989-90. In 1991, an ICARDA Cereal Taxonomist together with local scientists made germplasm collections of wild relatives of wheat in Turkmenistan and Uzbekistan.



However, ICARDA's major commitment to CAC began in 1995 when a scientific mission visited the region. Based on the findings of the mission, the Center organized a workshop on "Identification of Needs for Agricultural Research and Seed Production for the Newly Independent Republics of Central Asia and the Caucasus," in collaboration with GTZ/BMZ (German Assistance Agency/German Ministry of Technical Cooperation) and the Uzbekistan Academy of Agricultural Sciences (UAAS) in Tashkent on 5-9 December 1995. In addition to a team of ICARDA scientists and managers, representatives of the eight CAC republics, three other CGIAR Centers — CIMMYT, ISNAR, and IFPRI — as well as GTZ and BMZ, the Aga Khan Foundation of Tajikistan, and TACIS (Technical Assistance for the Commonwealth of Independent Republics)-supported Cereals Project in Turkmenistan were present.

The first major workshop, held in Tashkent in December 1995, brought together participants from ICARDA and other CG Centers, and from donor organizations and CAC countries to identify areas of collaboration.

In 1996, a CGIAR Task Force on Central/Eastern Europe and the States of the former Soviet Union was formed to identify the agricultural research needs of these countries. ICARDA actively participated in, and contributed to the deliberations of this Committee. It was in view of ICARDA's comparative advantage in CAC and because of its on-going contacts in the region that the CGIAR asked it to assist in organizing a consultation meeting between the CGIAR and Central Asia and the Transcaucasian republics, in Tashkent, 5-7 September 1996. This was done in collaboration with UAAS. Several CG Centers were present at this consultation meeting.

The consultation recommended the CGIAR to support agricultural research in those areas which were identified in the December 1995 meeting. The CGIAR approved this recommendation at the International Centers Week (ICW) 1996 in Washington, DC, and encouraged the CG Centers to develop partnerships with the National Agricultural Research Systems (NARS) in CAC in their respective mandated areas of agricultural research. Nine CG Centers (CIP, CIMMYT, ICARDA, ICRISAT, IFPRI, ILRI, IPGRI, ISNAR and IWMI) agreed to form a Consortium to assist the eight CAC countries in agricultural research with ICARDA as the lead center.

By the end of 1996, ICARDA had successfully created a regional agricultural forum for CAC, which was considered a vital development in the post-Soviet era. The Central Asia and the Caucasus region is geographically and agroecologically a continuum of West Asia and North Africa (WANA) — ICARDA's traditional area of regional responsibility. For that reason, the CAC region became a part of ICARDA's geographic mandate

In May 1997, a Liaison Officer for CAC was appointed and based in Tashkent, Uzbekistan, where a temporary Liaison Office was established in June 1997. An agreement of cooperation on agricultural research was signed with the Government of the Republic of Uzbekistan on 8 May 1998, which also authorized the establishment of ICARDA's Regional Office for CAC in Tashkent with full diplomatic immunity. As a result, ICARDA's CAC Regional Program Office was formally established on 1 August 1998.

At the first ICARDA/CAC coordination meeting in September 1997, senior scientists and research managers from five CAC countries developed a number of joint research project proposals in priority areas. Such meetings have been very effective in strengthening the collaboration between ICARDA and the national programs. The CGIAR program is managed by a steering committee that meets annually to assess progress and promote future collaboration.

The first ICARDA/CAC coordination meeting was held at ICARDA headquarters in Aleppo, Syria, in September 1997.

Several memoranda of agreement have since been signed to formalize partnership between ICARDA and CAC research organizations and ministries.

Agriculture in CAC

The economy and prosperity of the CAC region relies heavily on agriculture, which provides employment for a third of the labor force. The contribution of agriculture to the Gross Domestic Product (GDP) has increased in many countries since independence, but this is due to a decline in other sectors rather than an increase in agricultural production. About 70% of the total area of 416 million hectares in the region is classified as agricultural land. Of this, only 15% is arable, while around 85% is rangeland, traditionally grazed by livestock. Wheat, cotton, and livestock are the three most important agricultural commodities. Farmers need better agricultural technologies and policies to increase productivity. Agricultural research can play an important role in revitalizing national economies.

Since independence, many farmers have been forced to resume their old agricultural practices.

Country	Total area (million ha)	Arable land (million ha)	Population (million)	Rural Population		GNI per capita (US$)	GDP (US$ billion)	Agriculture (% of GDP)
				%	(million)			
Armenia	2.9	1.4	3.1	32.5	1.0	950	2.8	24.1
Azerbaijan	8.1	4.2	8.2	49.3	4.0	810	7.1	16.4
Georgia	6.8	3.0	5.2	43.0	2.2	830	3.9	20.6
Kazakhstan	271.3	24.0	14.85	43.4	6.2	1,780	29.7	7.6
Kyrgyzstan	19.8	1.4	5.0	65.6	3.3	330	1.7	39.2
Tajikistan	14.3	0.8	6.3	72.0	4.5	190	1.3	23.4
Turkmenistan	48.0	1.4	5.8	55.0	3.2	1,120	6.0	28.8
Uzbekistan	44.7	5.0	25.3	63.1	16.0	420	9.9	35.2

Agricultural Statistics

Armenia

Armenia is predominantly high plateaus and mountains, and an average farm is less than 1 hectare in size. Wheat, fruits, especially grapes, and vegetable crops are grown on lower land, while forages, legumes and potatoes are cultivated in the mountains. Armenia was famous in the former Soviet Union (FSU) for its brandies and vegetables. Apart from small farm size, soil erosion, soil salinity, and lack of inputs are the major constraints to agriculture.

Azerbaijan

Half of the population in Azerbaijan depends on agriculture. Azerbaijan was famous in FSU for wines and high quality vegetables. During the transition period, however, cropping structure changed significantly. Wheat became the most important crop while cotton lost its area. Fruits and vegetables continue to be important; the area under potato has increased dramatically while fodder crop production has declined. Small ruminant numbers have increased based on a switch from fine wool breeds to landraces of sheep and goat grazing on rangelands. Soil erosion and salinity, inadequate fodder production, and inefficient irrigation systems currently restrict agricultural productivity.

Georgia

Georgia is another mountainous country with a high dependence on agriculture. Georgia was famous in FSU for wines, oranges and tangerines. The major crops were grapes, fruit, and tea, but areas planted to these crops have declined dramatically since independence because of lost markets in the FSU. Livestock numbers have also gone down. Cereal production has increased but is not enough to meet domestic demand, while soil erosion and salinity, inefficient irrigation, and poor marketing channels are common problems.

Kazakhstan

The largest country in the region, Kazakhstan is 80% steppe and desert. Less than 10% of the land is arable. The climate is dry and continental with hot summers and very cold winters. Kazakhstan was famous in FSU for the best quality, hard red spring wheat. Rainfed spring crops predominate, especially spring wheat and barley, although the area under

cereals has reduced dramatically in the past 13 years as a result of discontinuing grain production on marginal lands. Livestock production has traditionally been the most important agricultural activity, but here too, productivity is falling. The population of small ruminants declined during the first seven years of transition from 35 to 10 million. However, during the last three years, thanks to improved governmental policies supporting agriculture, the farm sector including crop and livestock became profitable. Kazakhstan exports, on average, five million tons of grain.

Kyrgyzstan

Rugged mountain scenery is typical in Kyrgyzstan, with one-third of the country being over 3000 m above sea level. Rangelands cover almost half the land area, so livestock are an important source of livelihood here too, although the number of small ruminants has declined from 10 to 4 million since 1991. Stabilization has begun but poor access of small ranchers to remote rangelands is a major constraint to the recovery of the sheep industry. Cropping structure has changed dramatically driven by market demands. Wheat, maize, potato, sugar beet, and vegetables are grown in a larger area, which negatively affects the area available for forage. Kyrgyzstan traditionally exported seeds of maize and alfalfa to FSU.

Tajikistan

The majority of the arable land in this mountainous country is irrigated, and cotton remains an important cash crop. The area planted to winter wheat has increased during transition as a consequence of a reduction of area under forages. Agricultural production has been seriously affected by the recent civil war. In FSU, Tajikistan was an important exporter of fruit, especially high quality apricots, almonds and pistachios.

Turkmenistan

More than 80% of Turkmenistan is desert. The small area of arable land is almost entirely irrigated. Although the country has suffered the loss of inputs from FSU, cereal area and production have greatly increased in recent years, with wheat becoming one of the most important crops alongside cotton. Fruit production and numbers of small ruminants (predominantly Karakul and local Sarajeen sheep) have also increased. Turkmenistan is known for its sweet melons and pomegranates.

Uzbekistan

A country of steppe, desert and mountains, Uzbekistan has a large population and low rainfall. Before transition, this was purely a cotton country, but the main crops now include wheat, fruits, vegetables, melons, and potato, while the area under rice and fodder crops has reduced. Karakul sheep are common, but a decline in the market for their pelts has brought a change in the strategy for meat production. The population in the northwest has also been severely affected by the drying up of the Aral Sea, which formerly supported a productive fishery. Irrigation water drawn from the Amu Darya and Syr Darya rivers for large-scale cotton growing in the region is thought to be responsible for this environmental calamity.

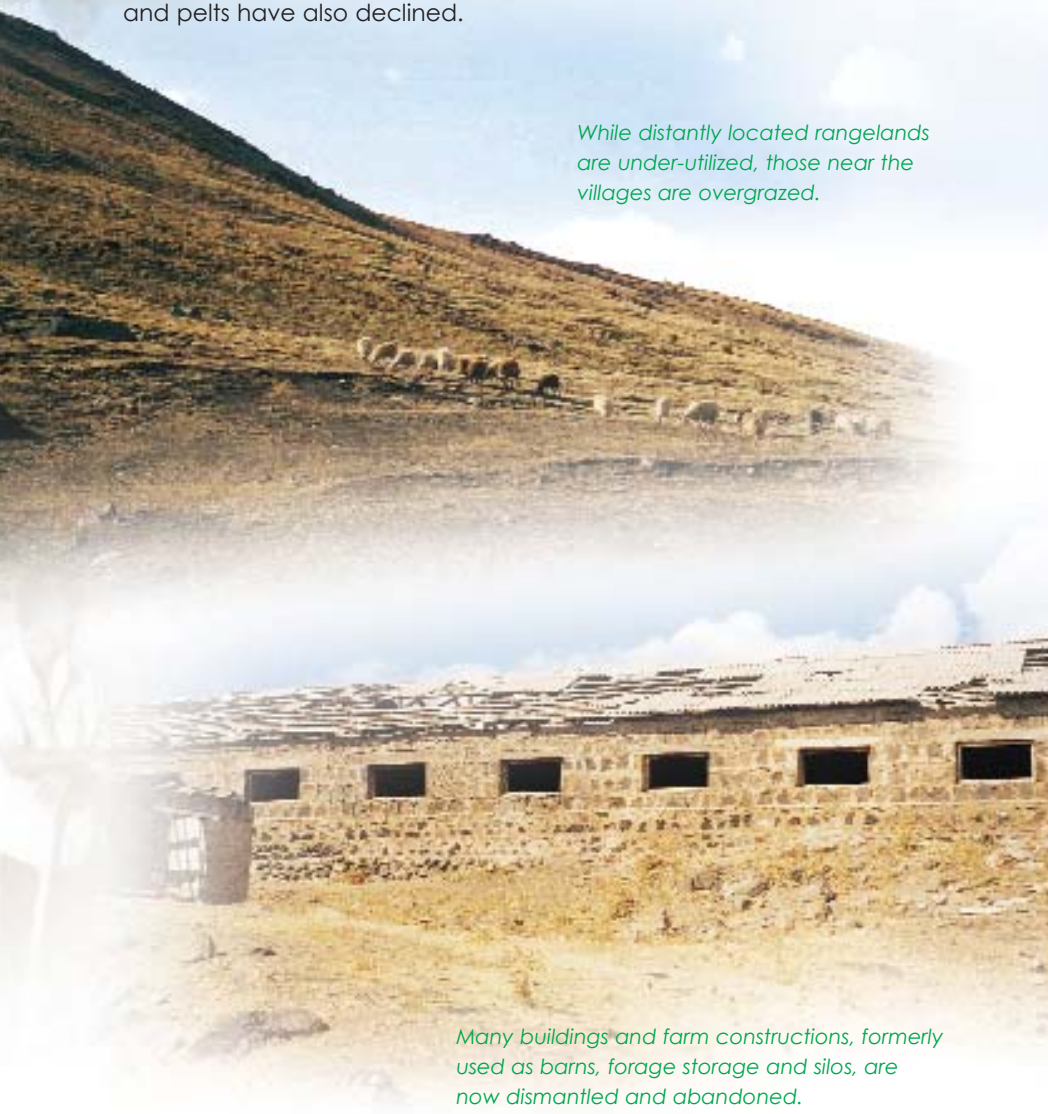
The Aral Sea: where there were fish, now there is only salt.

Challenges

The CAC republics were developed by the former Soviet Union as specialized commodity producers, relying on import and export markets for their inputs and produce within one large country. Since independence, each country has had to face the challenge of developing a "stand alone" economy, a process that requires enormous political and economic effort. Structural adjustment, particularly the privatization of large-scale state agricultural enterprises, has also had a detrimental effect on agricultural production and productivity, leading to poverty and a threat to food security in many areas.

The Soviet legacy of intensive production is no longer sustainable, and crop yields are far below those achieved in similar agro-ecologies elsewhere in the world. Salinity and waterlogging in irrigated areas have made vast tracts of land unusable. Water-use efficiency has also been adversely affected due to poor maintenance of vast irrigation systems. Inappropriate dryland farming practices have led to extensive

soil erosion and declining soil fertility. Large-scale monoculture has left crops highly vulnerable to pests and diseases. Livestock producers are facing problems due to the degradation of the vast steppe and desert rangeland. Areas cultivated with forage have reduced, feed is in short supply, and imported feed is expensive. Prices and demand for wool and pelts have also declined.



While distantly located rangelands are under-utilized, those near the villages are overgrazed.

Many buildings and farm constructions, formerly used as barns, forage storage and silos, are now dismantled and abandoned.

The CAC region is the center of origin of a number of important crops and has a wealth of genetic diversity. Varieties of pomegranate (Turkmenistan), apple (Kazakhstan), grapes (Georgia), walnut (Kyrgyzstan), and cotton and melons (Uzbekistan) are among the best in the world. However, these valuable genetic resources are in danger of being lost.

Agrarian reforms and attention to socioeconomic problems have progressed at different rates in different countries. Where land privatization has moved ahead, problems are arising from fragmentation, particularly in the management of large-scale irrigation systems. Farmers face multiple issues of land tenure, access, use rights, and agricultural employment. Strong governmental control over crop production makes farming a less attractive business. The collapse of large-scale seed production from state farms has caused seed shortages. Many farmers are inexperienced in operating a farm business. They need help in developing farming strategies and guidance in sustainable use of natural resources. Technology transfer through extension and farmer advisory services, credit facilities, and marketing arrangements have received inadequate attention.

Finally, since independence, each country has been faced with the problem of restructuring agriculture to meet national goals and needs. The dissolution of the Soviet Union has not only disrupted production and trade but also had considerable impact on research systems. Scientists in CAC need increased experience in formulating agricultural research strategies for the emerging private farm sector, and in assessing the efficiency of improved technologies at the farm level. The level of coordination and the linkages between institutions are weak. Although research systems are staffed with highly trained scientists, a shortage of funds is leading to an exodus of young researchers. Lack of contact with the international scientific community, mainly due to language barriers and lack of communication facilities, is depriving scientists from keeping abreast of current developments.

Regional Research Priorities

Stakeholders representing national and international agricultural research, donor organizations, NGOs, the private sector, and farmers have been involved in identifying the research priorities for the region. In line with the bottom-up priority setting approach adopted by the

CGIAR under "Plank 4" of the CGIAR's vision and strategy, the CAC Regional Forum and ICARDA organized a brainstorming meeting with NARS leaders and representatives of the concerned CG Centers and donors on 20 September 2001 in Tashkent in order to revisit earlier priority-setting. According to the broad consensus, the following research priorities were identified:

- Productivity enhancement of crops and thrust on seed development, with major emphasis on cereals, legumes, oilseeds, fruits and vegetable crops; breeding high-yielding varieties with resistance to diseases, pests, drought and salinity; also, search for genotypes that can better withstand low-input conditions.
- Soil and water management for sustainable agriculture, including focus on nutrient- and water-use efficiency, on-farm water management, marginal water utilization, salinity, drainage, and conservation tillage.
- Conservation of genetic resources (crops and livestock) in view of the existing rich diversity in the region.
- Livestock improvement and management with emphasis on market-oriented breed improvement, health, feed management and range rehabilitation.
- Crop diversification, with greater emphasis on incorporating legumes in cropping systems for long-term sustainability, better income generation, and household nutrition security.
- Post-harvest management, storage and value addition of crops, livestock, fruit and vegetable products that can help small and marginal farmers in rural areas.
- Socioeconomic and policy research for infrastructure development, economic feasibility of technologies, resource evaluation, marketing, finance, and policy interventions for required adjustments in market economy.
- Strengthening NARS and human resource development with greater emphasis on training, including learning the English language.

Subsequently, these priorities were reassessed in a global context when researchers and research administrators from throughout Central and West Asia and North Africa (CWANA) met at ICARDA headquarters on 8-10 May 2002 to integrate the regional agricultural research priorities into the CGIAR agenda. Based on revised analysis of constraints and

Researchers and research administrators from throughout CWANA met at ICARDA headquarters to integrate regional agricultural research priorities into the CGIAR agenda.

opportunities for agricultural research and development in the CAC region, the following research priorities were identified for CAC:

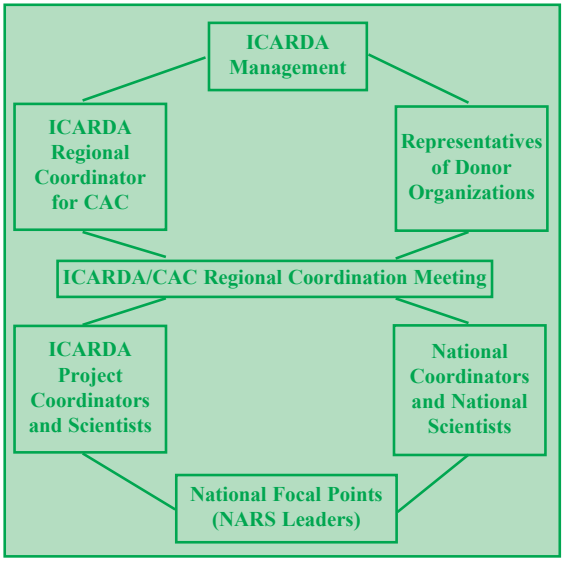
Research Priorities for Central Asia and the Caucasus

	Priority 1	Priority 2	Priority 3
Germplasm Management	• Germplasm improvement and biotechnology • Genetic resource conservation	• Seed production • Crop diversification	• Integrated pest management
Natural Resource Management	• Water • Soils • Rangelands	• Biodiversity	• Integrated crop management
Socioeconomics	• Marketing, commerce and trade • Post-harvest technologies	• Quality and added value • Institutional policies	• Impact assessment
Cross-cutting Issues	• Human resource development • Capacity building • Information and communication technology	• Intellectual property rights • Crisis and risk management	• Biosafety and quarantine • Indigenous knowledge

Coordination Mechanism

Efforts have been made to develop coordination mechanisms for different collaborative programs in different countries. Monitoring by stakeholders has proved beneficial in strengthening partnerships for agricultural research and development. On-going activities and future plans are presented and discussed at the annual regional coordination meeting, and detailed in annual workplans. Eight such meetings have been organized since 1997, providing a platform for NARS leaders to cooperate, discuss, share, and address regional problems.

Coordination of specific projects is addressed at the national and regional level, as well as by the Steering Committee. The National Coordination Committee consists of the National Coordinator, the Research Activity Leaders, and a liaison scientist from ICARDA's regional office. Coordination at the regional level is ensured by a Regional Coordination Committee, which consists of the National Coordinators, ICARDA Project Coordinator, and ICARDA scientists from headquarters and CAC. The overall supervision of the program is the responsibility of the Steering Committee, which approves the annual workplans and budgets.



ICARDA Regional Program Coordination Mechanism

Research Highlights

ICARDA and the Central Asian and the Caucasian countries are now collaborating in a wide range of research programs under five themes: (1) germplasm enhancement; (2) natural resource management; (3) feed and livestock management; (4) genetic resource conservation; and (5) strengthening national systems. The significant achievements in these areas are briefly enumerated here. Various organizations, such as the Food and Agriculture Organization (FAO) of the United Nations, the United States Department of Agriculture (USDA), the Global Mechanism (GM), Centre for Legumes in Mediterranean Agriculture (CLIMA), and N.I. Vavilov Institute of Plant Industry (VIR); and donor agencies, such as the Australian Center for International Agricultural Research (ACIAR), Asian Development Bank (ADB), GTZ of Germany, International Fund for Agricultural Development (IFAD), United States Agency for International Development (USAID), and the World Bank are also involved.

1. Germplasm Enhancement

Varietal improvement

Wheat is the main grain crop in all countries of the region. ICARDA has been sharing the improved germplasm of wheat (through a joint Turkey-CIMMYT-ICARDA collaborative program), barley, chickpea, lentil, vetches (*Vicia* spp.) and grasspea (*Lathyrus* spp.) with all eight CAC

Winter wheat variety, 'Bitarap,' released in Turkmenistan has a potential productivity of 6.5 t/ha and is heat and drought tolerant.

countries since 1996. About 4500 entries in the form of 80 different international nurseries of cereals and legumes are tested annually. The national programs have benefited from enriched crop germplasm and streamlined their breeding programs. They have also identified a number of varieties/lines for testing and seed multiplication. So far, eight promising varieties of winter wheat, and one each of spring barley, chickpea, and lentil have been released in different CAC countries based on their consistently higher yield and better disease resistance over local checks. These are 'Dostlik,' 'Bitarap,' 'Mtskhetis-1,' 'Azametli-95,' 'Nurlu 99,' 'Jamin,' 'Zubkov,' and 'Azibrosh' of winter wheat, 'Mamluk' of spring barley, 'Elixir' of chickpea, and 'Pablo' of lentil. In addition, around 47 bread and durum wheat, barley, chickpea, lentil and forage legume varieties are being tested for their potential release in all eight countries of the region.

Launching of a new initiative on malting barley breeding by Prof. Dr Adel El-Beltagy, Director General of ICARDA (left), and Dr Robert Babajanov, Cereal Breeder, Turkmenistan.

ICARDA international barley nursery at the Uzbek Research Institute of Plant Industry.

Varieties of winter and spring barley suitable for growing in rainfed and irrigated conditions are being tested for release in CAC.

Chickpea variety, 'Narmin,' with a potential productivity of 3.0 t/ha has a large seed size and is particularly suited to rainfed conditions in Azerbaijan.

Seed production

The need to develop and streamline seed production systems for faster adoption of improved varieties in CAC was identified by ICARDA in 1994. The constraints to efficient seed production were also identified at the December 1995 Tashkent workshop. Special emphasis is being placed on seed development activities in the region. On-farm trials and demonstration plots have proved important for increased agricultural production. Farmers are now keen to test new varieties. To have an impact on farmers' fields, efforts have been directed towards seed multiplication in collaboration with NARS partners.

Second national workshop on "Strengthening the wheat program in Uzbekistan," held on 12 September 2003, Tashkent.

Seed production of newly released varieties.

Variety	Country	Seed available (ton)
WHEAT		
'Dostlik'	Uzbekistan	5500
'Bitarap'	Turkmenistan	3000
'Mtskhetis-1'	Georgia	240
'Azametli-95'	Azerbaijan	200
'Nurlu 99'	Azerbaijan	200
'Jamin'	Kyrgyzstan	25
'Zubkov'	Kyrgyzstan	10
'Azibrosh'	Kyrgyzstan	10
BARLEY		
'Mamluk'	Armenia	40
CHICKPEA		
'Elixir'	Georgia	3.0
LENTIL		
'Pablo'	Georgia	0.9
GRASS PEA		
'Ali Bar'	Kazakhstan	0.17

Winter wheat variety "Dostlik"

Integrated disease and pest management

Integrated disease and pest management is an important part of germplasm improvement. Scientists from ICARDA have studied the overall situation for controlling yellow rust, the most important wheat disease. Identification of physiological races of yellow rust was undertaken in Azerbaijan, Kyrgyzstan, and Uzbekistan. Data for mapping the distribution frequency of new races and the effective resistance genes to yellow rust have been generated. Recommendations for replacement of varieties susceptible to yellow rust have been made in view of release of new high-yielding disease resistant winter wheat varieties in different countries.

ICARDA and Uzbek scientists during a field survey on cereal diseases and insects, including Sunn Pest, in Syrdarya region of Uzbekistan.

A considerable area of Central Asia is affected by Sunn Pest, which decreases yield and spoils grain quality. In partnership with the University of Vermont, USA, a biological control method, using fungi collected from affected insects, has been developed and tested with 90-100% success. The Second International Conference on Sunn Pest, held at ICARDA, in July 2004, included scientists from Azerbaijan, Kazakhstan, Tajikistan, and Uzbekistan.

For the first time in the region, a Wheat-Cereal Leaf Beetle Nursery (WCLBN) has been established at Kyrgyz Research Institute of Agriculture and the Galla-Aral Branch of Andijan Research Institute of Grain, Uzbekistan, where 144 selected wheat lines are being tested for resistance.

A regional training course on integrated pest management was organized in Tashkent, Uzbekistan on 18-23 May 2004, and was attended by 22 participants from seven countries.

First Cereal Leaf Beetle nursery: Jal station in Kyrgyzstan.

Crop diversification

Effective management of cropping systems on small farms, along with agricultural diversification, is important for sustainable production in CAC countries, helping to maintain soil fertility and avoid monocropping. ICARDA is studying both irrigated and rainfed farming

systems in the region, introducing new crops, and investigating alternative management systems.

In spring wheat based cropping systems, there are good opportunities for crop diversification. Field pea, chickpea and lentil are the best food legumes to include into crop rotations with cereals. Buckwheat is a good alternative for increased benefit to farmers. Oat, occupying much smaller areas, produced higher yields than barley. Under improved crop production technologies, summer fallow can be replaced by oat or food legumes such as chickpea, field pea or lentil.

Adoption of sunflower as an oilseed crop has been quite successful. Its area in northern Kazakhstan has increased by 50,000 hectares in the last three years. The major reason for this is the demand in the domestic market for edible oil, which is otherwise imported. Sunflower seeds are also being processed on farms and sold. Safflower is another new crop, which was never before sown in the north but now covers several hundred hectares. Among food legumes, field pea is now grown on about 5000 ha, and chickpea on 2000 hectares. Buckwheat area is also increasing but is still smaller than during the Soviet Union times when the government procured entire crop produce.

In drylands of southern Kazakhstan and Kyrgyzstan, safflower was found to be the most reliable crop for diversification under small farm conditions.

There are also good opportunities to diversify crop production in rainfed winter wheat based cropping systems. Food legumes are the best option for sustainable and economical farming. The best results were obtained in south Kazakhstan with chickpea, and in Kyrgyzstan with field pea and chickpea. Among spring cereals, oat was found to be most productive in southeast Kazakhstan. In rainfed cropping

systems, the most successful crop is safflower which now covers around 100,000 hectares in southern Kazakhstan. This crop is also becoming popular in Kyrgyzstan. Food legumes such as field pea and chickpea have great potential but are not widely adopted because of low market, lack of good seed, and technical knowledge. The area under alfalfa in semi-arid regions of southern Kazakhstan is increasing because of high prices for quality hay associated with increased livestock population in recent years.

In winter wheat based irrigated cropping systems, there are a number of alternatives for more economical and sustainable farming. The most beneficial are food legumes. Success was achieved in southeast Kazakhstan with soybean and grass pea, and in Kyrgyzstan with field pea, common pea, and soybean. Safflower can be grown under supplemental irrigation. The most economical crop is sugar beet, followed by maize and food legumes. Nitrogen and phosphorus fertilizers at the rate of 60 kg/ha provided best returns.

The most successful alternative crop adopted on a rather large scale under irrigation is soybean. In southeastern Kazakhstan, its area increased from 3000 hectares in 2002 to 35,000 hectares in 2004. The major reasons for this are locally organized market and a large-scale soybean processing factory. Soybean is also spreading in Kyrgyzstan. Common bean produced on several thousand hectares in Chu Valley is being exported to Turkey. Sugar beet is another success story. It was rejected by the large farms in the past but is now widely adopted by small-scale farmers in Kyrgyzstan and southeastern Kazakhstan. The area under maize is gradually increasing due to availability of improved hybrid seed in the region.

In irrigated cotton-wheat based cropping systems, double cropping using alternative crops after harvest of winter wheat is very profitable under the existing price scenario and will remain profitable in a free market economy. Various crops may be profitably used for double cropping including food legumes, melons, forages and vegetables. Short duration food legumes are particularly preferred as they provide a good source of income for farmers and improve soil fertility. Cotton can be used for double cropping after the harvest of winter wheat only in the south of Tajikistan and Uzbekistan, provided adequate soil and water management practices are implemented and early-maturing

varieties of both wheat and cotton are used. Wheat planted in standing cotton using minimum tillage proved to be the best option. In southern Uzbekistan and Tajikistan, cotton is grown after winter wheat on 20,000-30,000 hectares in each country.

Mungbean and soybean are promising for double cropping in Tajikistan and Uzbekistan.

In Fergana Valley, Uzbekistan, the most widespread crops are maize, mungbean, melons and carrots due to their demand in the local market. Common bean is even marketed to Georgia. Rice is also used for double cropping using drainage water if its salinity content is not high. In Termez area, southern Uzbekistan, maize and mungbean are widely accepted by farmers for double cropping covering 7000 and 5000 hectares, respectively. Other alternative crops used by farmers are sesame, melons, groundnut and vegetables but on a smaller scale. In Tajikistan, double cropping is widely adopted by small-scale farmers. Maize and mungbean are widespread, followed by common bean, soybean, vegetables, buckwheat, millet, tobacco, groundnut, sesame. Rice is also grown where water availability is good.

Crop diversification studies were initiated in the Caucasus. In Azerbaijan, encouraging results were obtained with soybean and sugar beet in irrigated systems, and chickpea under rainfed conditions. In Georgia and Armenia, there is potential for double cropping using common bean, forages, and vegetables.

2. Natural Resource Management

To address the major problems of natural resource management in CAC, in 2000, ICARDA initiated a three-year applied research project entitled "On-farm soil and water management," supported by the Asian Development Bank (ADB). The project aimed to increase agricultural production through maintaining soil fertility, enhancing nutrient-use efficiency, and improving water productivity. Results demonstrated that adoption of improved technologies of soil and water management could enhance productivity, and provide higher rural incomes and household food security, as well as contribute to the conservation of natural resources and the sustainability of agricultural production in the region. In view of the success achieved, a new three-year project — "Improving rural livelihoods through efficient on-farm water and soil fertility management in Central Asia," — was approved for funding by ADB in 2004. The immediate objective of this project is to promote the adoption of sustainable technological and institutional innovations that conserve soil and water, are input-use efficient, and generate greater economic returns to rural households. Research is being conducted under four themes: efficient and sustainable use of available water; conservation tillage, soil fertility management, and crop diversification; strengthening capacities of farmers and national researchers for technology transfer; and impact assessment, constraints analysis, and policy research.

Conservation tillage

Conservation tillage techniques are valuable in dryland agriculture as they play an important role in conserving soil moisture. Northern Kazakhstan is the only area in the region where conservation tillage is generally adopted. Moving ahead to no tillage is associated with adequate weed and pest management. In the rainfed conditions of southern and southeastern Kazakhstan, researchers found that conservation tillage gave almost the same grain yield as that with conventional plowing, but direct seeding with a cultivator-drill was found to be more economical. In the rainfed areas of Kyrgyzstan, deep conservation tillage (at 25-28 cm depth) provided a slight advantage in grain yield, but market prices for inputs made it uneconomical in some years. In

Gallaaral, Uzbekistan, under very dry conditions, where moldboard plowing after the harvest of winter wheat is a traditional practice, direct seeding with the cultivator-drill proved to be the best treatment over two years of experimentation.

Reduced tillage has been found promising for rainfed conditions in Kazakhstan and Kyrgyzstan.

Under irrigated conditions, planting wheat in standing cotton using field cultivators was more economical, providing a yield similar to that obtained under moldboard plowing. This practice has been widely adopted in both Uzbekistan and Tajikistan and is becoming popular in Tajikistan. Raised-bed planting gave good results in Kazakhstan and Azerbaijan, providing considerable saving of seeds and water and higher grain yields than with the traditional seedbed preparation with moldboard plows and sowing with double-disk drills. In Tajikistan and Turkmenistan, studies indicated that, in a cotton-wheat system, a combination of deep tillage for cotton with minimum tillage for wheat provided stable crop yield.

Water management

To address issues concerning on-farm water management, 19 experimental sites were established in the region including two Integrated Research Sites (IRS) at Boykozon in Uzbekistan, and Sorbulak in Kazakhstan. A demonstration site was also established in Chu Valley, Kyrgyzstan. Research activities have been focused on improving water-use efficiency and utilizing marginal water for agricultural production.

In Kazakhstan, alternate furrow irrigation saved irrigation water by 30% and reduced pressure on the drainage system by 40% as compared to traditional irrigation. On sloping lands in Uzbekistan, portable

chutes have been used to increase water productivity by almost 50-100%, whereas advanced technologies, such as low pressure drip and drip jet irrigation proved to be efficient in vineyards and for vegetable production. In Kyrgyzstan, discrete alternate furrow irrigation saved about 20-40% of irrigation water and provided rather high yields of soybean, maize, and tomato. In Tajikistan, adoption of micro-furrow irrigation technology increased uniformity of soil moistening from 0.70 to 0.85 field capacity and reduced surface runoff from 5-50% to 2-20%.

Alternate furrows covered with polyethylene saved additional 26% of irrigation water with 15-20% gains in yield.

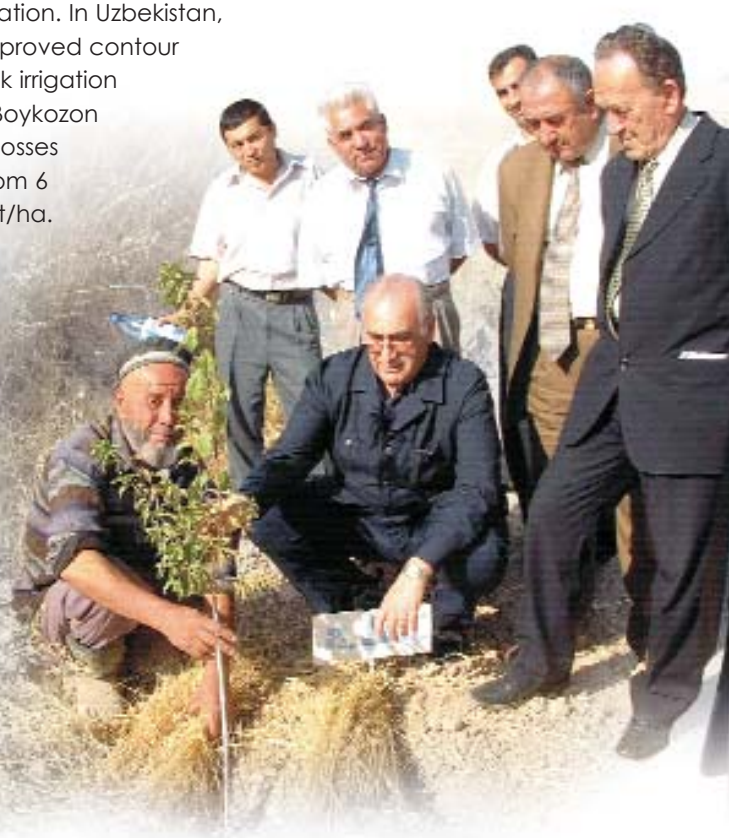
Alternate furrow irrigation of cotton saves 30% water.

Marginal water of different quality and origin has been tested for irrigation at the research sites in Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan. In Kazakhstan, utilization of treated wastewater (TWW) for irrigation of fodder crops (Sudan grass, maize, sunflower, Jerusalem arti-

choke and sorghum) and tree plantations contributed to higher yields and good rooting rates of saplings. Using TWW for irrigation also decreased the need for fertilizer application, thus significantly reducing production costs. Conjunctive use of canal and low-saline drainage water for irrigation of tree saplings in Turkmenistan saved about 45% of fresh water.

Soil erosion control

In Azerbaijan, Tajikistan and Uzbekistan, scientists have been investigating ways to combat soil erosion on sloping lands. At Faizabad and Fakhrabad in Tajikistan, terracing and mulching have been successful, with good yields of grapes and high rooting rates of walnut and pine trees. Micro-furrow irrigation technology reduced soil erosion from 12-25 t/ha to 2-6 t/ha at Yulduz-95 site, Tajikistan. Mulching by using plant residues has been found economically viable and efficient for moisture conservation. In Uzbekistan, application of improved contour furrow and djoyak irrigation technologies at Boykozon site reduced soil losses due to erosion from 6 t/ha to 0.12 - 1.1 t/ha.



Terracing and mulching reduce soil erosion and enable production in sloping lands. A farmer in Uzbekistan demonstrates the technology to Prof. Dr Adel El-Beltagy (sitting, right), Director General of ICARDA.

Salinity management

Different techniques of salinity management have been tested in areas affected by poor drainage in Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan. In Bishkent Valley, Tajikistan, basin and furrow leaching technologies significantly reduced salt concentration in the crop root zone. In Uzbekistan, lysimeters (used to measure percolation of water through soil) helped to develop appropriate irrigation rates and scheduling, thereby preventing soil salinization, and increasing cotton yield from 3.9 to 4.5 t/ha. In Kazakhstan, application of phospho-gypsum on soil with low sodic content considerably improved soil physical and chemical properties, leading to an increase in cotton yield from 1.4 t/ha to almost 2.5 t/ha.

Socioeconomic studies

Research activities under the socioeconomic component are focused on implementing impact assessments of technologies being tested by the project on the livelihoods of farmers. Preliminary results of socioeconomic research provided information on the general economic situation at the research sites and addressed critical issues on access to natural resources, financial resources, internal and external market for farm inputs and outputs, and production constraints. It was found that farmers are constrained by lack of good quality inputs such as seeds and fertilizers, poor or almost no access to financial resources to perform field operations on time, poor maintenance of irrigation systems, and a lack of farm machinery services. Findings on the marketing issues and institutional limitations indicated poor and disorganized access to output markets, monopolized input and output markets for strategic and commercial crops like cotton and wheat and low prices for agricultural produce.

3. Feed and Livestock Management

As a result of reorganization of agricultural production systems, new forms of farming have emerged. At present, large-scale farms no longer concentrate on animal production. Up to 90% of meat and dairy products are produced by small-scale households. Medium-scale farms in Central Asia are developing gradually. However, their role in livestock

production is still insignificant and it varies from 1% (Uzbekistan, Turkmenistan) to 5-10% (Kazakhstan, Kyrgyzstan).

A participatory approach was used to study conflicts and complementarities among different production systems. In countries with more intense reforms such as Kazakhstan and Kyrgyzstan, the balance still

Central Asian farmers and scientists visiting the Sheep Unit at ICARDA's headquarters in Aleppo, Syria.

leans to the negative side and is detrimental to the stability of rural society due to gaps in the social structure. Complementarities and labor contribution to larger enterprises have not been fully identified, and household flocks often degrade ranges around villages. However, the awareness of the need for community action is on the rise. In countries where reforms have been applied gradually (i.e. Uzbekistan), the balance is less negative because of the incentives created by the large farms (cooperatives) for household cooperative members (e.g. the Nurata case in Uzbekistan), although range degradation around villages has taken place.

The breakdown of the Soviet Union led to the dissolution of large markets for traditional products such as wool (Kazakhstan and Kyrgyzstan) and pelts (Uzbekistan and Turkmenistan). In the changed scenario, lower purchasing power, changes in the demand for manufacturing goods, market channels operating without control and low product quality cause stagnation of traditional production. Prospects for the Karakul pelts market are not promising and will require careful assessment. A considerable local demand exists for milk and dairy products, which also calls for further assessment, especially with regard to market potential for sheep milk derivatives.

Range management and forage production

Scientists have had some success in using drainage water to grow salt-tolerant plants (halophytes) for animal feed. In Turkmenistan, *Suaeda* spp., *Atriplex* spp., and *Klimocoptera* spp. provided up to 3 t/ha of dry matter. This technology might help establish a reliable winter feeding system for livestock. In Kazakhstan, marginal water was used to irrigate forage crops for sheep fattening without risk of any contamination.

Rehabilitation of the rangelands is difficult in harsh weather conditions. However, *Haloxylon* spp. and *Salsola* spp., planted in strips, could be established in Turkmenistan despite three years of drought. *Haloxylon-Kochia-Salsola* direct planting in projective strips was successful in Kazakhstan and Uzbekistan. By assessing production and degradation in Kazakhstan, scien-

Remote rangelands are not managed efficiently.

tists discovered critical levels of degradation around villages, while remote areas were undergrazed. Successful systems for range seed production as nurseries for future rehabilitation were established in Kazakhstan, Turkemenistan, and Uzbekistan.

Researchers successfully cultivated sainfoin with barley as a cover crop in Kyrgyzstan. This strategy yielded an additional 1.5 t of straw, 2 t of grain and 700 kg of stubble per hectare. In Uzbekistan, growing intermediate crops (mixtures of small grains and feed legumes) followed by corn proved to be a successful intensive cropping system. Triticale + oats + pea sown in fall and harvested in spring, followed by corn for the silo and for grain, produced 67 t/ha of green matter and 4.5 t/ha of grain. Mulberry leaves, as an alternative feed source, could be promoted in Uzbekistan.

Winter feeding and flock management

Crushed grain is commonly used as a winter feed in Kyrgyzstan. Scientists demonstrated that farmers could feed whole grain to their lambs instead. Safflower could be used as a winter feed in Kazakhstan. The feed-block technology was tested successfully in Nurata project site and could be promoted for large-scale adoption.

Sarajin and Karakul breeds could also be used for milk production.

Artificial insemination to improve milk yield of local sheep in Uzbekistan.

Diversification of animal products

The need for diversified products from the livestock sector appeared to be critical for the sustainability of resource-poor farmers. Production of sheep milk derivatives was a promising option for livestock product diversification, which was not considered a commercial option during Soviet times. In order to determine market potential for milk derivatives, targeted interviews with farmers, sellers and consumers of livestock products were conducted in four Central Asian countries. The main finding was that there is a good potential for sheep milk derivatives in Uzbekistan and Turkmenistan markets. Farmers from Central Asia took part in the specially organized traveling workshop to West Asia, where they had a chance to get directly exposed to the techniques of sheep milk processing. A farmer in Turkmenistan for the first time milked 40 Sarajin ewes and obtained 1148 kg of milk with an average of 28.7 kg/ewe. He transformed the milk, with technologies learnt in West Asia, into 230 kg of fresh cheese that fetched him about USD 380. This experience introduces an interesting and beneficial option to the farmers and provides additional source of income.

Milk and dairy products are an important source of cash income.

4. Genetic Resources Conservation

The CAC region is the center of origin of a number of important crops, and is rich in plant genetic resources, including crop progenitors, wild relatives, and locally adapted cultivars and landraces. Accordingly, ICARDA has been assisting the region through a coordination mecha-

nism under the Central Asian and Trans-Caucasian Plant Genetic Resources Network (CATPGRN). All the eight countries of CAC have now established plant genetic resources (PGR) units, and ICARDA has trained CAC researchers in germplasm collection, evaluation, and documentation, as well as provided data management equipment.

Celebrating the renovation of the genebank in Uzbekistan in 2002 are Dr Robert Havener (second from right), ICARDA Board Chair, and Prof. Dr Adel El-Beltagy (third from right, ICARDA Director General) with Uzbekistan senior officials and researchers.

The second phase of an ACIAR-funded project, "Development and Conservation of Plant Genetic Resources from the Central Asian and Caucasian Countries," is continuing to support these activities. Between 1998 and 2004, scientists undertook 12 collection missions in different countries, collecting as many as 2400 valuable accessions of cereals, food legumes, and their wild relatives, as well as forage and range species. Through the joint efforts of the Ministry of Agriculture

A collection mission in CAC.

and Water Management of Uzbekistan, USDA, ICARDA, and IPGRI, the Uzbek Genebank was renovated and made fully functional. ICARDA provided technical backstopping to the Uzbek Research Institute of Plant Industry (UzRIPI) for renovation and processing of seed samples for storage. More than 15,000 accessions have been rejuvenated and stored in the genebank so far. Need-based support for upgrading the storage facility of the genebanks at the Kyrgyz PGR Center, Tajik Academy of Agricultural Sciences, and Georgian Research Institute of Crop Husbandry (GRICH) has been provided. Also, a PGR Center was inaugurated in Tajikistan by Prof. Dr Adel El-Beltagy, ICARDA DG, in September 2002. ICARDA continues to provide support for upgrading the facilities at this Center.

Genebank at the Research Institute of Crop Husbandry, Tajikistan.

With support from the Global Crop Diversity Trust (GCDT), a regional meeting on development of CAC PGR Strategy was held on 28-29 August 2004, in Tashkent, Uzbekistan. Twenty-two participants, including those from all eight CAC countries, and representatives from IPGRI, ICARDA, and GCDT attended. As a follow up to this meeting, GCDT has recently funded new PGR projects in plant genetic resources, in collaboration with ICARDA, IPGRI, and VIR, S. Petersburg.

A website focused on PGR activities in Central Asia and the Caucasus has also been launched. The site highlights PGR activities in

the region, gives comprehensive information about institutes involved in PGR work as well as contact details for key individuals. In addition to the PGR-related activities, the site also provides general information about the countries themselves. The URL is: www.cac-biodiversity.org

5. Strengthening National Systems

ICARDA strongly believes in the importance of strengthening national programs and their human resources capabilities for effective research partnership.

Human resources development

More than 62 short- and long-term training courses, 48 study visits, 52 regional/national workshops have been organized, involving around 3600 scientists. In addition, more than 390 scientists have attended English language courses. National scientists have participated in 16 international conferences, and interacted with other stakeholders

An intensive English language course in progress in Tashkent.

through traveling workshops, planning meetings and field visits. Steering committee meetings have provided a platform for scientific interaction and facilitated the formation of a CAC regional forum called the Central Asia and the Caucasus Association of Agricultural Research Institutions (CACAARI).

Research support

ICARDA has also provided research supplies and essential equipment to NARS, including around 62 PCs, 3 automatic weather stations, 12 vehicles, 4 bed planters, 2 zero tillage drills, 6 soil moisture and EC meters and other laboratory and office equipment. National

Participants in a soil and water analysis training workshop in Tajikistan.

Uzbek scientists demonstrate an automatic weather station at Boykozon, Uzbekistan, to ICARDA DG Prof. Dr Adel El-Beltagy (fourth from left).

Heads of CAC NARS are working as a team to solve common problems at the regional level.

genebanks in Azerbaijan, Georgia, Kyrgyzstan, Tajikistan, and Uzbekistan have also been modernized for improved efficiency and better storage facilities. Efforts are underway to support the establishment of a genebank in Turkmenistan.

Special attention has also been paid to the development of crop- or discipline-specific networks in the region to facilitate scientific interaction and germplasm exchange. There are now five regional networks operating in the CAC region:

- Central Asian and Trans-Caucasian Plant Genetic Resources Network (CATPGRN)
- Central Asia and the Caucasus Winter Wheat Improvement Network (in collaboration with CIMMYT)
- Central Asia and the Caucasus Barley Improvement Network
- Central Asia and the Caucasus Legume Improvement Network
- Central Asia and the Caucasus Wheat Yellow Rust Network

Two other networks, for soil and water management and for livestock and rangeland management, will soon be formally established.

Looking Ahead

The CAC region is faced with enormous challenges that require immediate scientific solutions and appropriate technologies to overcome problems of natural resource management, promote sustainable pro-

ductivity and profitability, and above all, ensure food security and alleviate poverty. As the countries in the region are highly dependent on agriculture, these issues must be addressed if the region's economies are to stabilize and grow.

The region also offers tremendous potential for agricultural growth and development. Substantial progress has already been made in building partnerships and developing human resources. Through signing agreements for collaborative research, the NARS are showing a keen interest in joining hands with ICARDA in order to promote sustainable agricultural production in the region.

The future strategy of ICARDA in CAC will seek to address the emerging challenges relating to policy and land reforms, management of depleting natural resources, conservation of genetic resources of plants and small ruminants, breeding new crop varieties of cereals and legumes, diversification of agriculture including sustainability of wheat and cotton production systems, seed development and harmonization, livestock development including feed and fodder management, rangeland rehabilitation, on-farm water resources, including use of marginal waters and management of salinity. Most NARS continue to face constraints to research support and human resource development. The socioeconomic and policy-related options also need increased attention, including support for ICT and market intelligence and pricing.

Fortunately, the CAC region has the needed infrastructure and human resources to steer the future growth and development of agriculture. Hence, effective interface and partnership between ICARDA and NARS would help to accelerate agricultural development in the region. Support to the recently formed regional forum - CACAARI - would further strengthen research collaboration and partnership. The Consortium approach, involving other CG Centers, with ICARDA playing the lead role, would add value to scientific support to NARS in their efforts.

Towards a better future.

Towards sustainability.

Since 1995, ICARDA has played an important role in promoting research for development in the region. The CGIAR Systemwide Program for CAC and the Program Facilitation Unit in Tashkent have helped ICARDA promote strong partnerships and create effective linkages with international organizations. In June 2001, policy makers from the eight countries, representatives of donor organizations and CGIAR centers, leaders of NARS, and other stakeholders met at Issyk-Kul, Kyrgyzstan, to reinforce their commitment to agricultural research and development. They were unanimous in their endorsement of the Issyk-Kul Declaration (see Appendix), stating that agricultural research is to be given the highest priority in order to improve livelihoods, alleviate poverty, and strengthen national economies through improved productivity and sustainability of agricultural production systems. The declaration has paved the way for all stakeholders to work together and benefit from a partnership approach to solving the problems of the region.

Appendix

Ministerial Level Meeting on Strengthening Agricultural Research Systems in Central Asia and the Caucasus

ISSYK-KUL DECLARATION

At the invitation of the Prime Minister of the Republic of Kyrgyzstan, the Ministers, Deputy Ministers and senior representatives of the Governments of the eight countries of Central Asia and the Caucasus (CAC)—Armenia, Azerbaijan, Georgia, Kazakstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan—the Heads of the National Agricultural Research Systems (NARS) of these countries, representatives of the Consultative Group on International Agricultural Research (CGIAR) and the funding organizations met in Issyk-Kul, Kyrgyzstan, on 8 June 2001, to review the status of agricultural research and further development in these countries and to reaffirm its importance for the sustainable growth and development of the entire region.

The participants consider that the economic growth of the CAC region depends largely on the agricultural sector and, therefore, agricultural research has a critical role to play in achieving the general goals of sustainable economic development, including improvement of livelihood of people through poverty reduction, food security and the arresting of the degradation of natural resources of the region.

Delegates also realize that the agricultural research organizations in the region are facing major constraints that limit their ability to perform more effectively. In this respect, while the situation varies from country to country, common concerns are: inadequate financial resources, inadequately maintained research facilities, obsolete equipment, lack of incentives for the scientific staff, difficulties in attracting young talented scientists and the insufficient scientific linkages at the regional and global levels. Also, inadequate mechanisms of technology transfer need further strengthening and support.

The delegates highly appreciate the new initiatives undertaken by the scientists of the region in partnership with the International Centers of the CGIAR, however the agricultural research outputs could be more effective and enhance the income of rural sector and contribute sustainable economic development of the region.

Therefore, the delegates solemnly call for all concerned stakeholders to take the necessary steps, in their respective spheres of responsibility, to renew the agricultural research systems in each country through the following measures:

- The respective Governments shall pay high priority attention to agricultural research systems in strengthening both the human and financial resources. They also shall support the process of renewal of agricultural research so as to improve its efficiency and cost-effectiveness to meet the new demands of the agricultural sector;
- The policy makers, the Governments, and leaders of the National Agricultural Research Systems are urged to undertake the required reforms to make them more responsive to the specific needs of the farmers and agricultural enterprises, especially the small and resource poor farmers.
- The International Centers of the CGIAR, Global Forum on Agricultural Research (GFAR) and other Advanced Research Institutions working in the region, shall accept their responsibility towards this renewal process of agricultural research in the CAC region and to build their strong partnerships for agricultural research for development; and
- The international donor community is urged to give very high priority to support this initiative for agricultural development of the region.

We are fully convinced that the above initiatives will foster overall prosperity through growth and development of the agricultural sector in the States of Central Asia and the Caucasus.

Issyk-Kul (Kyrgyzstan)
8 June 2001

Acronyms

ACIAR	Australian Center for International Agricultural Research
ADB	Asian Development Bank
BMZ	Federal Ministry for Economic Cooperation and Development
CAC	Central Asia and the Caucasus
CACAARI	Central Asia and the Caucasus Association of Agricultural Research Institutions
CATPGRN	Central Asian and the Trans-Caucasian Plant Genetic Resources Network
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Center for Maize and Wheat Improvement
CIP	International Potato Center
CLIMA	Centre for Legumes in Mediterranean Agriculture
CWANA	Central and West Asia and North Africa
FAO	Food and Agricultural Organization of the United Nations
FSU	Former Soviet Union
GAAS	Georgian Academy of Agricultural Sciences
GCDT	Global Crop Diversity Trust
GDP	Gross Domestic Product
GM	Global Mechanism
GRICH	Georgian Research Institute of Crop Husbandry
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
ICRISAT	International Crops Research Institute for the Semi-arid Tropics
ICW	International Centers Week
IFAD	International Fund for Agricultural Research
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IPGRI	International Plant Genetic Resources Institute
IRS	Integrated Research Sites
ISNAR	International Service for National Agricultural Research
IWMI	International Water Management Institute
NARS	National Agricultural Research Systems
PGR	Plant Genetic Resources
TACIS	Technical Assistance for the Commonwealth of Independent Republics
TAAS	Tajik Academy of Agricultural Sciences
TWW	Treated Wastewater
UAAS	Uzbekistan Academy of Agricultural Sciences
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UzRIPI	Uzbek Research Institute of Plant Industry
VASKHNIL	The Soviet Union Academy of Agricultural Sciences
VIR	N.I. Vavilov Institute of Plant Industry
WANA	West Asia and North Africa
WCLBN	Wheat-Cereal Leaf Beetle Nursery

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