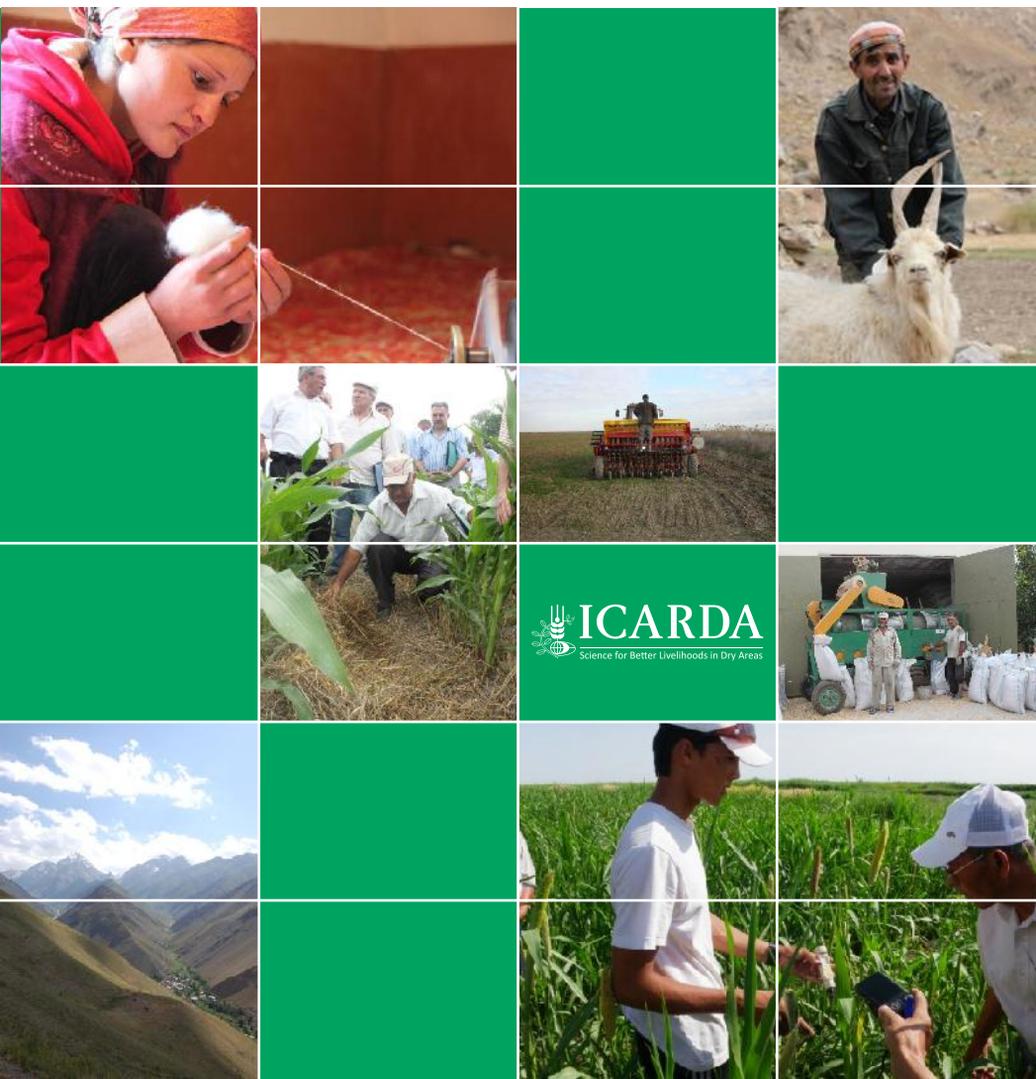


Central Asia & the Caucasus and ICARDA

Ties that Bind



ICARDA in Central Asia and the Caucasus

Ties that Bind
No. 12

*A Partnership Dedicated to Sustainable Agriculture
Development and Food Security in the Region*

International Center for Agricultural Research
in the Dry Areas



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Citation: ICARDA. 2013. ICARDA in Central Asia and the Caucasus: A Partnership Dedicated to Sustainable Agriculture Development and Food Security. ICARDA.

ISBN: 92-9127-167-3

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About ICARDA

Established in 1977, ICARDA (www.icarda.org) is one of 15 centers supported by the CGIAR. ICARDA's mission is to contribute to the improvement of livelihoods of the resource-poor in dry areas through research and partnerships dedicated to achieving sustainable increases in agricultural productivity and income, while ensuring efficient and more equitable use and conservation of natural resources.

ICARDA has a global mandate for the improvement of barley, lentil and faba bean, and serves the non-tropical dry areas for the improvement of on-farm water use efficiency, rangeland and small ruminant production. In Central Asia, West Asia, South Asia, and North Africa regions, ICARDA contributes to the improvement of bread and durum wheats, kabuli chickpea, pasture and forage legumes, and associated farming systems. It also works on improved land management, diversification of production systems, and value-added crop and livestock products. Social, economic and policy research is an integral component of ICARDA's research to better target poverty and to enhance the uptake and maximize impact of research outputs.



CGIAR is a global agriculture research partnership dedicated to reducing rural poverty, increasing food security, improving human health and nutrition, and ensuring more sustainable management of natural resources. It is carried out by the 15 centers who are members of the CGIAR Consortium in close collaboration with hundreds of partner organizations and the private sector. www.cgiar.org

Program Partners

NARS

Central Asia

Kazakhstan — Ministry of Agriculture, KazAgroInnovation

Kyrgyzstan — Ministry of Agriculture, Agrarian University

Tajikistan — Tajik Academy of Agricultural Sciences (TAAS)

Turkmenistan — Academy of Sciences of Turkmenistan, Ministry of Agriculture

Uzbekistan — Ministry of Agriculture and Water Resources, Uzbek Scientific Production Center for Agriculture (UzSPCA)

The Caucasus

Armenia — Ministry of Agriculture

Azerbaijan — Ministry of Agriculture, Agrarian Scientific Center of Azerbaijan

Georgia — Agrarian University of Georgia, Georgian Academy of Agricultural Sciences (GAAS)

Donor Organizations

Asian Development Bank (ADB)

International Fund for Agricultural Development (IFAD)

World Bank

Deutsche Gesellschaft für Internationale Zusammenarbeit

German Federal Ministry for the Environment, Nature Protection and Nuclear Safety

United States Agency for International Development (USAID)

Islamic Development Bank

International Organizations

United Nations Development Programme (UNDP)

Regional Organizations

The Scientific Information Center of Inter-State Commission for Water Coordination

NGOs

Khorezm Rural Advisory Support Service (KRASS)

Other Institutions/Universities

Centre for Legumes in Mediterranean Agriculture (CLIMA)

Ohio State University (OSU)

N. I. Vavilov Institute of Plant Industry (VIR)

United States Department of Agriculture/Agricultural Research Service (USDA/ARS)

Washington State University

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The 13th Steering Committee Meeting of the CGIAR's and ICARDA-CAC's Regional Planning Meeting brought together more than ten ministers from the host country, Turkmenistan, heads of national research programs from the eight CAC countries and ICARDA's team headed by its Director General, Dr. Mahmoud Solh (2010).

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 rain fall 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. The collapse of the Soviet Union resulted in the need for each country to develop a market-driven economy that promoted food security in the long term while responding to trends in global markets. After the initial phase of struggle for a decade, the countries are now growing economies, and on path to transition into 'standalone' market economies.

However, CAC faces critical development challenges in the form of low agricultural productivity, land degradation, and diminishing already scarce water resources from melting glaciers. Climate change is worsening the scenario for particularly the agriculture sector with increasing variability, higher temperatures, changing hydrology, and extreme events predicted for CAC. An integrated natural resource management and food security strategy is critical for adapting to climate change, sustainable environment and equitable development in CAC.

The CAC region is rich in plant genetic resources encompassing two centers of origin of crops. With a high bio-physical potential for agricultural development, CAC has an immense opportunity to sustainably increase its agro-pastoral productivity. Good institutional infrastructure, continued investment in collaborative research programs and scaling out the technologies and practices across the region can help in developing this potential and improve the livelihoods of the region's vast rural population, as well protect its fragile agro-ecosystem.

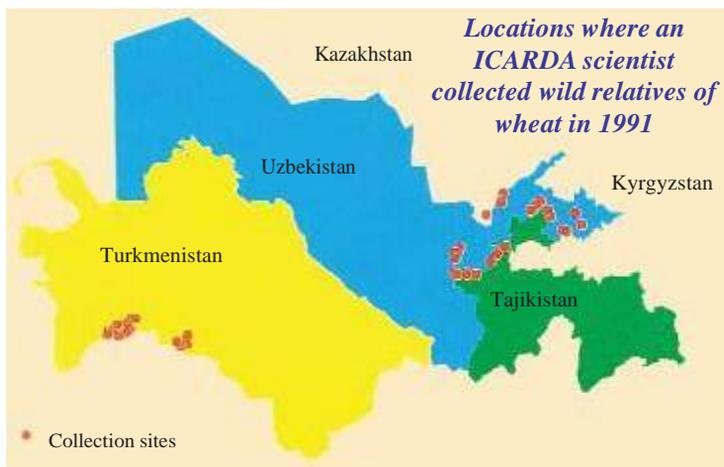
ICARDA's Partnership with CAC

Historical Background

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 Kazakhstan 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 from ICARDA, 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 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 ongoing 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.

CGIAR approved recommendations from 1995 and 1996 meetings at the International Centers Week (ICW) in Washington, DC (1996) 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 geo- graphically 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 and the partnership has grown tremendously since then with several memoranda of agreement signed between ICARDA and CAC research organizations and ministries.



ICARDA-CAC Steering Committee Meeting in 2008 at Astana, Kazakhstan.

ICARDA and CAC Today

ICARDA's partnership with the NARS in the CAC region has come a long way since it was formally consolidated in 1996. Today ICARDA partners with Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan in Central Asia; and Armenia, Azerbaijan and Georgia in the Caucasus to develop and support the following regional research priorities:

- Productivity of agricultural systems
- Natural resources conservation and management
- Genetic resources
- Socioeconomic and public policy research

A major component of ICARDA's activities in the region has been building capacity of CAC countries through NARS, regional forums and networks, academic institutions and on-farm training for farmers. So far, more than 12,000 scientists and farmers have benefited from these activities.

As the convening center for the CGIAR Program for Central Asia and the Caucasus, The Regional Program for Sustainable Agricultural Development in Central Asia and Caucasus or CAC Program (www.cac-program.org), ICARDA has played a leading role in the development and contribution to agricultural research and impacts in the region. Along with other CGIAR institutions, ICARDA works with a range of national partners, farmers and farmers' associations, development agencies, and universities. ICARDA is also currently facilitating the Central Asia and the Caucasus Association of Agricultural Research Institutions, the regional forum for all NARS to drive knowledge sharing and greater uptake of innovations in the region.



*Farmers Day,
Shortanbay,
Kazakhstan, 19 July
2013*

In 2012, ICARDA's research for development activities in CAC took on a more consolidated and intensified with the launch of CGIAR's global research program, *Dryland Systems* (drylandsystems.cgiar.org/). The Dryland Systems program is led by ICARDA and implemented in partnership with more than 60 research and development organizations and 9 CGIAR Centers for increasing agricultural productivity and strengthening food security in the driest areas of the developing world. The CAC region is one of five regions targeted by the program with action sites in the Fergana Valley, the Rasht Valley, and the Aral Sea Basin. Integrated interventions ranging from seed varieties to value chain enhancements will be pilot-tested at these action sites for scaling out to larger similar agroecosystems for widespread benefits.



A Target Region Implementation and Partnership workshop was held in Fergana, Uzbekistan, 12-14 August 2013, to develop a plan for CGIAR's Dryland Systems implementation at the action sites in CAC.

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 building robust national economies, along with long term food security.



A farmer family in Azerbaijan practicing conservation agriculture with the help of ICARDA's team of scientists. Agriculture plays a significant role in rural livelihoods in Central Asia and the Caucasus. Innovative practices like conservation agriculture are important in the region challenged by land degradation and low yields.

Country	Total area	Arable land	Population (million)	Rural Population		GNI per capita	GDP (US\$ billion)	Agriculture (% of GDP)
	(million ha)	(million ha)		%	(million)	(US\$)		
Armenia	2.974	0.4302	2.969	36.3	1.122422	3,720	9.910	19.6
Azerbaijan	8,660	1.8857	9.298	47.8	4.3249115	6,030	68.73	5.8
Georgia	6.97	0.414	4.512	47.1	2.0972688	3,280	15.83	8.4
Kazakhstan	272.49	24.035	16.80	39.7	6.671	9,750	200.5	-
Kyrgyzstan	19.9949	1.2759	5.582	63.4	3.401516	990	6.473	20.7
Tajikistan	13.996	0.85	8.009	73.5	5.0557982	860	6.987	21.3
Turkmenistan	48.81	1.9	5.173	49.3	2.554	5,550	33.68	-
Uzbekistan	44.74	4.3	29.78	59.4	17.697	1,720	51.11	-

Sources: World Bank (2010; 2012); FAO (2011)



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 steeply 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. Sustainable management of salt-affected and marginal lands in Uzbekistan for agricultural purposes must be a priority and can help to find new avenues of agricultural production through innovations such as salt-tolerant crops.

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 "standalone" 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.

Land and Water Degradation: Soviet development plan increased the irrigated area causing irreversible damage in ecosystem causing degradation to land and water quality. Intensive production is no longer sustainable and crop yields are far below those achieved in similar agroecologies 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. Further, 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. The degradation of the vast steppe and desert rangeland are directly impacting livestock producers as the 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.



ICARDA team visits villages to advise on grazing as part of livestock activities in the region. While distantly located rangelands are under-utilized, those near the villages are overgrazed.

Weak Institutional and Policy Infrastructure: 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.

Lagging National Capacity: 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.

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. The region must take big steps to invest in its agriculture sector and preservation of its natural resources.

A faded background image showing a man and a child, possibly a father and son, looking towards the camera. The man is on the left, and the child is on the right, both appearing to be in a rural or agricultural setting.

Regional Research Priorities

Stakeholders representing national and international agricultural research organizations, donors, NGOs, the private sector, and farmers have been involved in identifying the research priorities for the region. In consensus with the NARS leaders and representatives of the concerned CG Centers and donors, 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) given the inherent 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.

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. These research activities have been supported by various international 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.

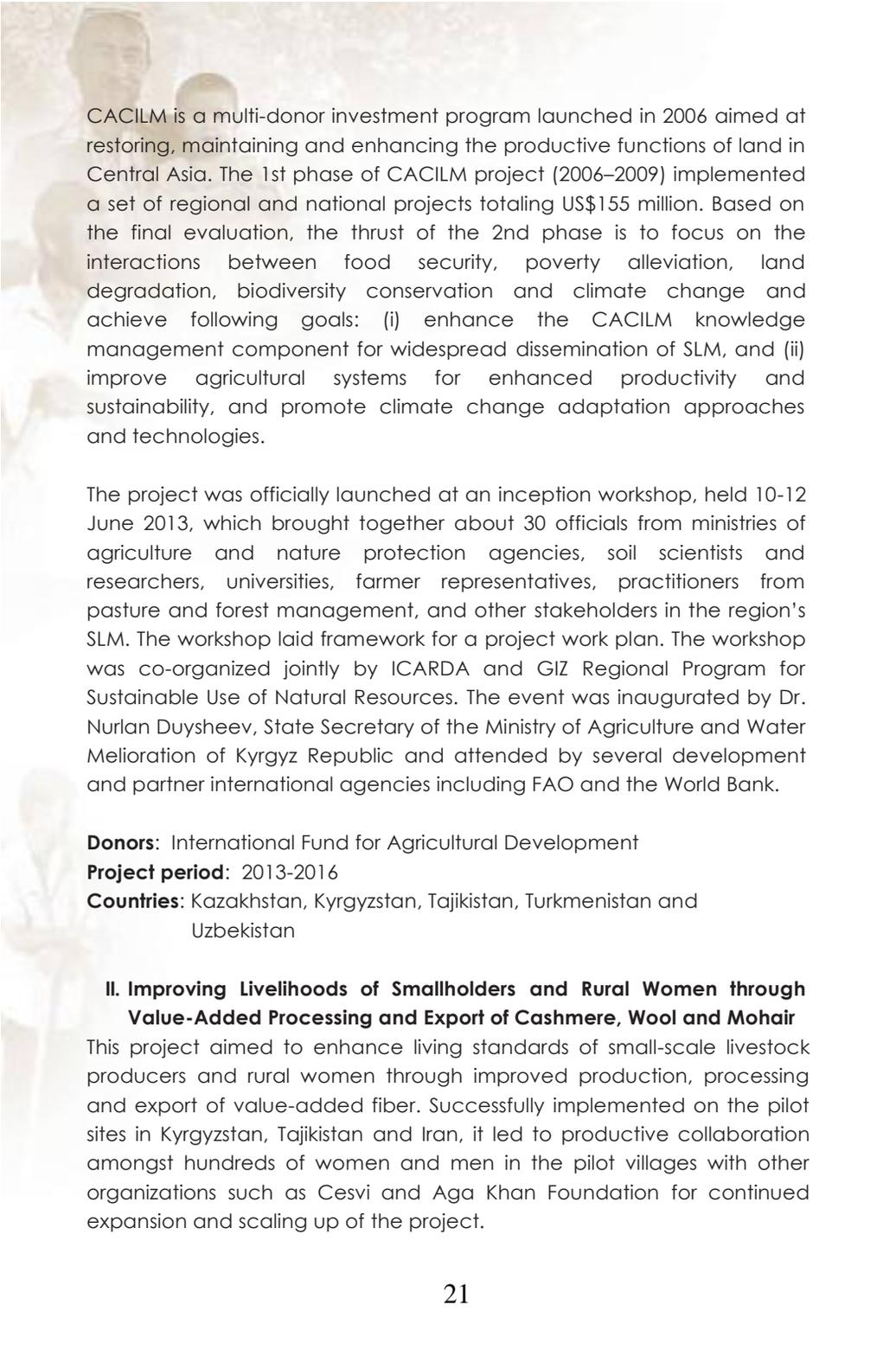
Accomplishments & Activities in the past five years

I. Knowledge Management for Central Asian Countries Initiative for Land Management (CACILM)

The International Fund for Agricultural Development endorsed a three-year regional grant to ICARDA, which seeks to support the second phase of the Central Asian Countries Initiative for Land Management (CACILM) project by building a knowledge platform to consolidate knowledge and for scaling-up sustainable land management (SLM) interventions.



The project was officially launched in June 2013 with inception workshop in Bishkek, Kyrgyzstan.



CACILM is a multi-donor investment program launched in 2006 aimed at restoring, maintaining and enhancing the productive functions of land in Central Asia. The 1st phase of CACILM project (2006–2009) implemented a set of regional and national projects totaling US\$155 million. Based on the final evaluation, the thrust of the 2nd phase is to focus on the interactions between food security, poverty alleviation, land degradation, biodiversity conservation and climate change and achieve following goals: (i) enhance the CACILM knowledge management component for widespread dissemination of SLM, and (ii) improve agricultural systems for enhanced productivity and sustainability, and promote climate change adaptation approaches and technologies.

The project was officially launched at an inception workshop, held 10-12 June 2013, which brought together about 30 officials from ministries of agriculture and nature protection agencies, soil scientists and researchers, universities, farmer representatives, practitioners from pasture and forest management, and other stakeholders in the region's SLM. The workshop laid framework for a project work plan. The workshop was co-organized jointly by ICARDA and GIZ Regional Program for Sustainable Use of Natural Resources. The event was inaugurated by Dr. Nurlan Duysheev, State Secretary of the Ministry of Agriculture and Water Melioration of Kyrgyz Republic and attended by several development and partner international agencies including FAO and the World Bank.

Donors: International Fund for Agricultural Development

Project period: 2013-2016

Countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan

II. Improving Livelihoods of Smallholders and Rural Women through Value-Added Processing and Export of Cashmere, Wool and Mohair

This project aimed to enhance living standards of small-scale livestock producers and rural women through improved production, processing and export of value-added fiber. Successfully implemented on the pilot sites in Kyrgyzstan, Tajikistan and Iran, it led to productive collaboration amongst hundreds of women and men in the pilot villages with other organizations such as Cesvi and Aga Khan Foundation for continued expansion and scaling up of the project.

The project team worked on developing all components of mohair and cashmere value chains in northern and southern Tajikistan: (1) Angora and cashmere goat breeding; (2) fiber collection and processing and (3) production and export of luxury yarn and products. In Kyrgyzstan, the project continued training women groups in producing exportable felt handicrafts and strengthening connections between wool producers and felting groups.

Using approaches like community breeding, the new stocks are expected to produce more meat and cashmere and cashgora fiber than the existing ones increasing incomes and improving livelihoods of the village households. A major accomplishment in fiber processing was organizing first



large-scale fiber processing in the Asht region, North Tajikistan. The training groups started to produce sophisticated luxury items that can successfully compete on international markets. In terms of marketing, the project developed new contacts with buyers of fair-trade yarn and products such as ClothRoads that want to purchase yarn and other handicrafts made by the groups. In Kyrgyzstan, artisans were trained in making felt slippers and fine silk scarves.

The project website “adventureyarns.com” continues to help generate interest in the project and its products among potential customers and the public.

Donors: International Fund for Agricultural Development

Project period: 2009-2013

Countries: Kyrgyzstan, Tajikistan

III. Simulating Impacts and Adapting to Climate Change in Central Asia and China

ICARDA executed this project in partnership with IFPRI and the scientists from the NARS of China, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. The overall objective of the project was to increase knowledge on climate change and its potential impact in Central Asia.



The project was implemented through three major research components, including GIS mapping, crop modeling and socio-economic assessment.

The project simulated impacts of climate change under various scenarios on crop growth, water and nutrients uptake and total aboveground biomass and yield of 14 wheat varieties grown on 18 sites in key agro-ecological zones of Kazakhstan, Kyrgyzstan, Uzbekistan and Tajikistan. Often a short(er)-season variety is lower yielding than a long-season variety, because the crop has less time for photosynthesis and biomass build-up. In Central Asia however, simulations revealed that a potentially negative effect of a shorter lifecycles in a climate change-affected future was counter balanced by more favorable growth conditions in spring. Overall, only minor impacts were predicted, however, in the long term, climate change is a key concern for all countries.

Further 10 different farming systems were examined in Central Asia using the data collected from surveys of representative households on a number of factors, such as main crops, farm size, machinery availability and yields. The investigation of factors playing an important role in achieving high agricultural productivity as a strategy for enhancing resilience of farms to climate shocks confirmed the importance of establishing government policies. The analysis of resource use efficiency in these countries – an important criterion for sustainable agriculture, especially under climate change conditions – showed that machinery availability, farm size and access to extension services are the main factors influencing technical efficiencies of wheat and cotton production in CAC countries. The results show that large-scale farms have higher technical efficiency for wheat production as in Northern Kazakhstan. Tajikistan and Kyrgyzstan, however, have small-scale farms, with limited machinery availability and thus lower efficiency when compared with Uzbekistan and Kazakhstan. Thus, the analysis demonstrates the vulnerability of small-scale farmers to climate change due to high resource losses during the production process and pointed to a critical need to help improve the resource use efficiency of small scale farmers as a means to adapt to climate change. This calls for action to improve delivery of farm advisory services including extension and weather information, and access to credit to acquire needed inputs and machinery for smallholder farmers. Special policy reforms are also needed to improve availability of farm inputs.

The project concluded with a workshop in February 2012 in Tashkent, Uzbekistan, where 40 experts and specialists from Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and China, as well as from development and donor agencies, ICARDA and IFPR came together to summarize the project findings, review the recommendations and jointly identify the policies that support farmers' resilience to climate change. The project outcomes are available in a final project report.

Donors: Asian Development Bank

Project period: 2009-2011

Countries: Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan

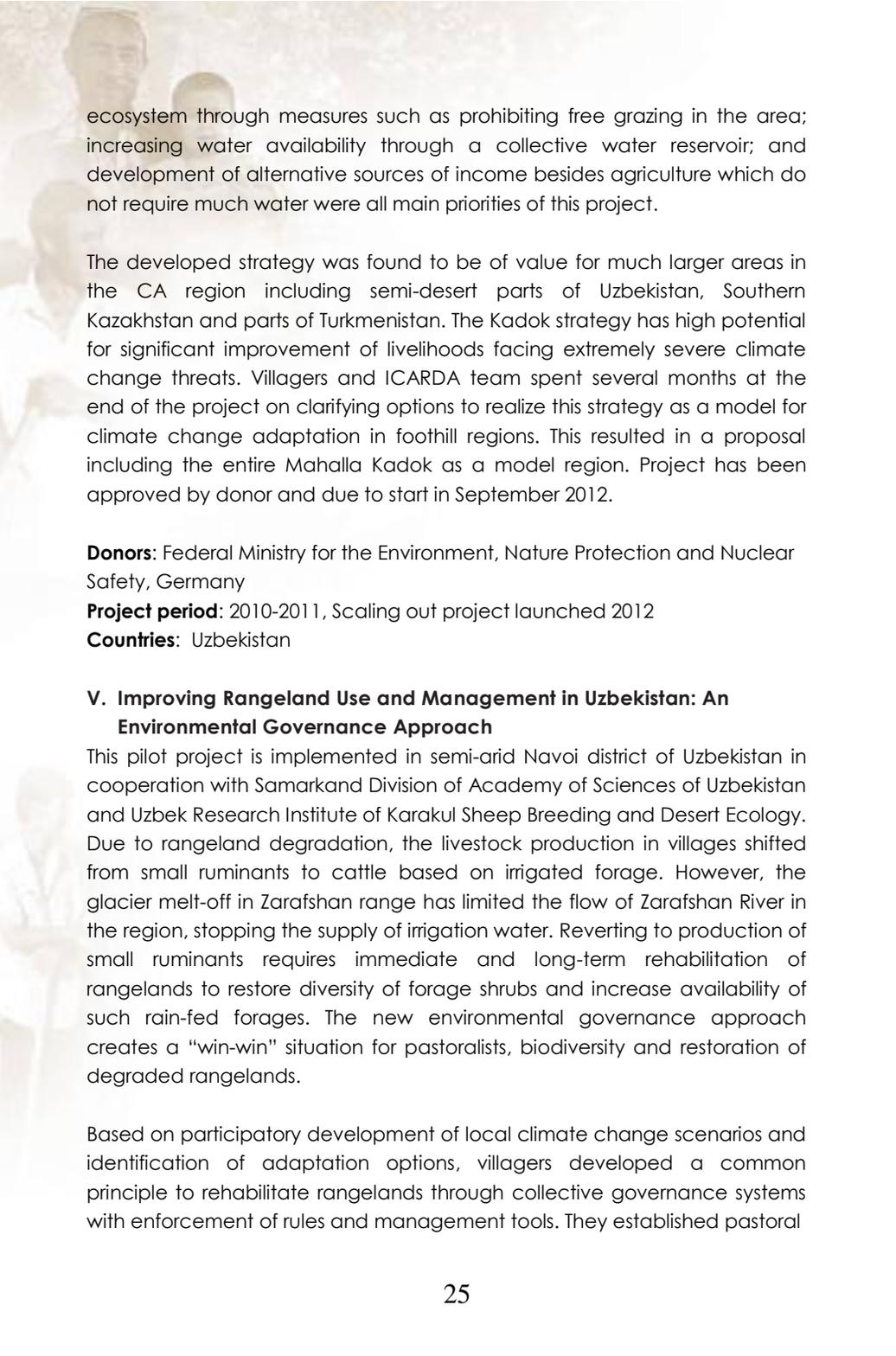


Social science pilot project assessing vulnerability of mountain villages to glacier loss and climate change in Tajikistan

IV. Promoting Sustainable Economic Diversification for Resilient Ecosystems as Climate Change Adaptation Strategy

The project implemented by ICARDA in collaboration with International Center for Biosaline Agriculture assessed vulnerability to climate change through case studies in Kadog foothills and Papanaya (settlement) in Uzbekistan and introduced the dual purpose crops alternate by fruit trees and forage shrubs in strip-alley-system as climate change adaptation measures. The strategy developed by the villagers of Kadok as a result of the project has now become an excellent blue-print for climate change adaptation for foothill areas in semi-arid zones of Central Asia.

The villagers of Kadok created a holistic approach including strategic measures against desertification and developing alternative livelihoods, as the region is extremely prone to water scarcity. Rehabilitation of eroded foothills to prevent mudflows, increasing forage and benefiting from this



ecosystem through measures such as prohibiting free grazing in the area; increasing water availability through a collective water reservoir; and development of alternative sources of income besides agriculture which do not require much water were all main priorities of this project.

The developed strategy was found to be of value for much larger areas in the CA region including semi-desert parts of Uzbekistan, Southern Kazakhstan and parts of Turkmenistan. The Kadok strategy has high potential for significant improvement of livelihoods facing extremely severe climate change threats. Villagers and ICARDA team spent several months at the end of the project on clarifying options to realize this strategy as a model for climate change adaptation in foothill regions. This resulted in a proposal including the entire Mahalla Kadok as a model region. Project has been approved by donor and due to start in September 2012.

Donors: Federal Ministry for the Environment, Nature Protection and Nuclear Safety, Germany

Project period: 2010-2011, Scaling out project launched 2012

Countries: Uzbekistan

V. Improving Rangeland Use and Management in Uzbekistan: An Environmental Governance Approach

This pilot project is implemented in semi-arid Navoi district of Uzbekistan in cooperation with Samarkand Division of Academy of Sciences of Uzbekistan and Uzbek Research Institute of Karakul Sheep Breeding and Desert Ecology. Due to rangeland degradation, the livestock production in villages shifted from small ruminants to cattle based on irrigated forage. However, the glacier melt-off in Zarafshan range has limited the flow of Zarafshan River in the region, stopping the supply of irrigation water. Reverting to production of small ruminants requires immediate and long-term rehabilitation of rangelands to restore diversity of forage shrubs and increase availability of such rain-fed forages. The new environmental governance approach creates a "win-win" situation for pastoralists, biodiversity and restoration of degraded rangelands.

Based on participatory development of local climate change scenarios and identification of adaptation options, villagers developed a common principle to rehabilitate rangelands through collective governance systems with enforcement of rules and management tools. They established pastoral

user groups (PUGs) and different kinds of fenced seed isles to ensure seeding of forage shrubs and facilitate seasonal grazing. The project started to develop different models for rangeland rehabilitation by local land users within this environmental governance approach.

Donor: Federal Ministry for the Environment, Nature Protection and Nuclear Safety, Germany, within the International Climate Change Initiative

Project period: 2011-2012

Countries: Uzbekistan

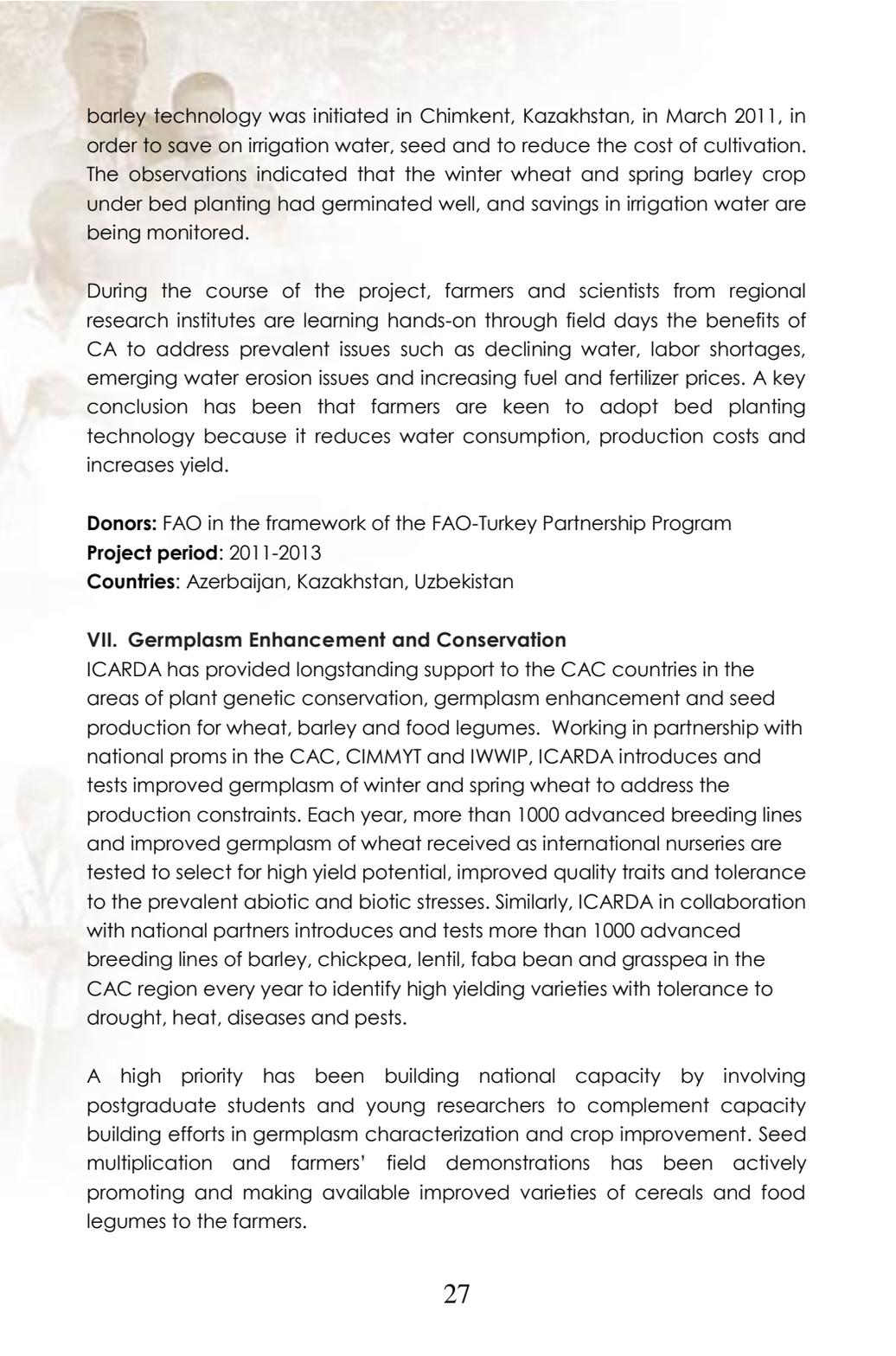
VI. Conservation Agriculture in Irrigated Areas of CAC Region

The project launched in 2011 aims to improve rural livelihoods and food security through increased productivity of irrigated farming systems in the CAC region using the principles and practices of conservation agriculture (CA). It is expected that at the end of the project, improved water and soil conservation techniques will be sufficiently validated by a core group of farmers and an expanded program will be prepared for farmers in a broader geographic area.



Mung bean grown as a catch crop with retention of surface residues in Karshi, Uzbekistan (2011-2013). The yield with conservation agriculture was 21% more than with conventional method.

Pilot farms were selected in Azerbaijan, Kazakhstan and Uzbekistan according to the selection criteria developed by the project team in the respective countries. The project has been implemented with a detailed crop rotation scheme for each farm prepared with participation of farmers and national project partners. A baseline study was completed in the countries and a sampling methodology was also developed. Experiments on bed-planting technology were set up on research stations in Azerbaijan (winter wheat and sugar beet), Kazakhstan (spring barley and maize) and Uzbekistan (cotton, soy bean and maize). The research on bed planted



barley technology was initiated in Chimkent, Kazakhstan, in March 2011, in order to save on irrigation water, seed and to reduce the cost of cultivation. The observations indicated that the winter wheat and spring barley crop under bed planting had germinated well, and savings in irrigation water are being monitored.

During the course of the project, farmers and scientists from regional research institutes are learning hands-on through field days the benefits of CA to address prevalent issues such as declining water, labor shortages, emerging water erosion issues and increasing fuel and fertilizer prices. A key conclusion has been that farmers are keen to adopt bed planting technology because it reduces water consumption, production costs and increases yield.

Donors: FAO in the framework of the FAO-Turkey Partnership Program

Project period: 2011-2013

Countries: Azerbaijan, Kazakhstan, Uzbekistan

VII. Germplasm Enhancement and Conservation

ICARDA has provided longstanding support to the CAC countries in the areas of plant genetic conservation, germplasm enhancement and seed production for wheat, barley and food legumes. Working in partnership with national partners in the CAC, CIMMYT and IWWIP, ICARDA introduces and tests improved germplasm of winter and spring wheat to address the production constraints. Each year, more than 1000 advanced breeding lines and improved germplasm of wheat received as international nurseries are tested to select for high yield potential, improved quality traits and tolerance to the prevalent abiotic and biotic stresses. Similarly, ICARDA in collaboration with national partners introduces and tests more than 1000 advanced breeding lines of barley, chickpea, lentil, faba bean and grasspea in the CAC region every year to identify high yielding varieties with tolerance to drought, heat, diseases and pests.

A high priority has been building national capacity by involving postgraduate students and young researchers to complement capacity building efforts in germplasm characterization and crop improvement. Seed multiplication and farmers' field demonstrations has been actively promoting and making available improved varieties of cereals and food legumes to the farmers.

Addressing the critical challenge of land degradation and salinity in the region, ICARDA, in collaboration with the NARS partners in Uzbekistan, Kazakhstan and Turkmenistan started "Utilization of wild relatives of wheat in developing salinity tolerant winter wheat with improved quality for Central Asia" in 2010, a project funded by BMZ/GIZ for three years. The superior lines from this study are tested for identifying new cultivars for saline soils as well as for their use in crossing programs.



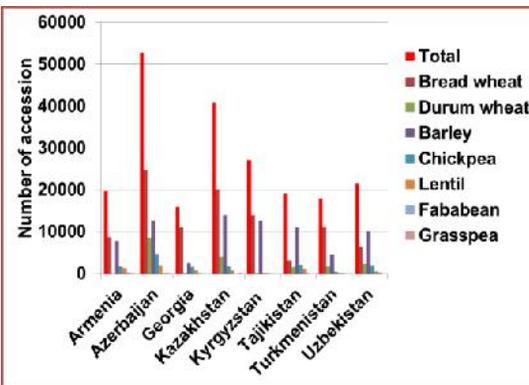
Salt and drought tolerant pearl millet and sorghum varieties

Starting in 2010-2011, ICARDA's seed multiplication and dissemination of improved varieties of cereals and chickpea in the CAC region has led to crop improvements. Some results include chickpea varieties which produce up to 50% higher yield than normally adopted spring planting. Seed multiplication programs in Armenia, Kazakhstan, Azerbaijan, Georgia and Uzbekistan has been helping farmers increase their yields and incomes, while outscaling the improved varieties.

In another important thrust of the partnership, ICARDA-CAC is supporting a large initiative on accelerating adoption of eight yellow rust-resistant winter wheat varieties in Uzbekistan and Tajikistan through a Partners Grant scheme under the CGIAR Research Program on Wheat. Under this new initiative, eight stripe rust-resistant varieties of winter wheat were planted on an area of 126 ha for seed multiplication in Uzbekistan and Tajikistan. This new project intends to plant these wheat varieties on over 50,000 ha of farmers' fields in 2015.



Some new, improved rust resistant winter wheat varieties suitable for the CAC countries made available by ICARDA working in collaboration with the International Winter Wheat Improvement Program and CRP Wheat funding (2010-2013). CAC countries have seen six yellow (stripe) rust epidemics since 1999 causing breakdown of the widely grown cultivars, such as 'Kroschka' and 'Krasnodar-99', which are still widely cultivated in Central Asia.



Improved crop germplasm received as International Nurseries in CAC: 1995 to 2011

Donors: BMZ/GIZ Germany for special projects

Project period: Ongoing

Countries: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan

Additionally, ICARDA has been engaging in the CAC region in conservation of genetic resources, particularly of wild relatives and valuable accessions of cereals, food legumes, and their wild relatives, as well as forage and range species through germplasm collection missions since 1998.

The following table summarizes the accessions activity up to date.

Accessions from CAC in ICARDA's genebank and number distributed to CAC countries – Updated July 2013

Country	No. of Accessions	Distribution
Azerbaijan	1500	1059
Turkmenistan	560	178
Tajikistan	2127	0
Kyrgyzstan	211	21
Uzbekistan	817	438
Armenia	1267	469
Georgia	1062	119



A group of agricultural scientists in Azerbaijan attend ICARDA training on Application of modern conventional tools in Plant Genetic Resources – characterization, pre-breeding and breeding at Genetic Resource Institute, Baku, 16-22 June 2011

Contributions over the Years (1997-2005)

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 countries since 1996.



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

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.



Improved varieties of chickpeas in Azerbaijan

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



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.



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.



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

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.

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.

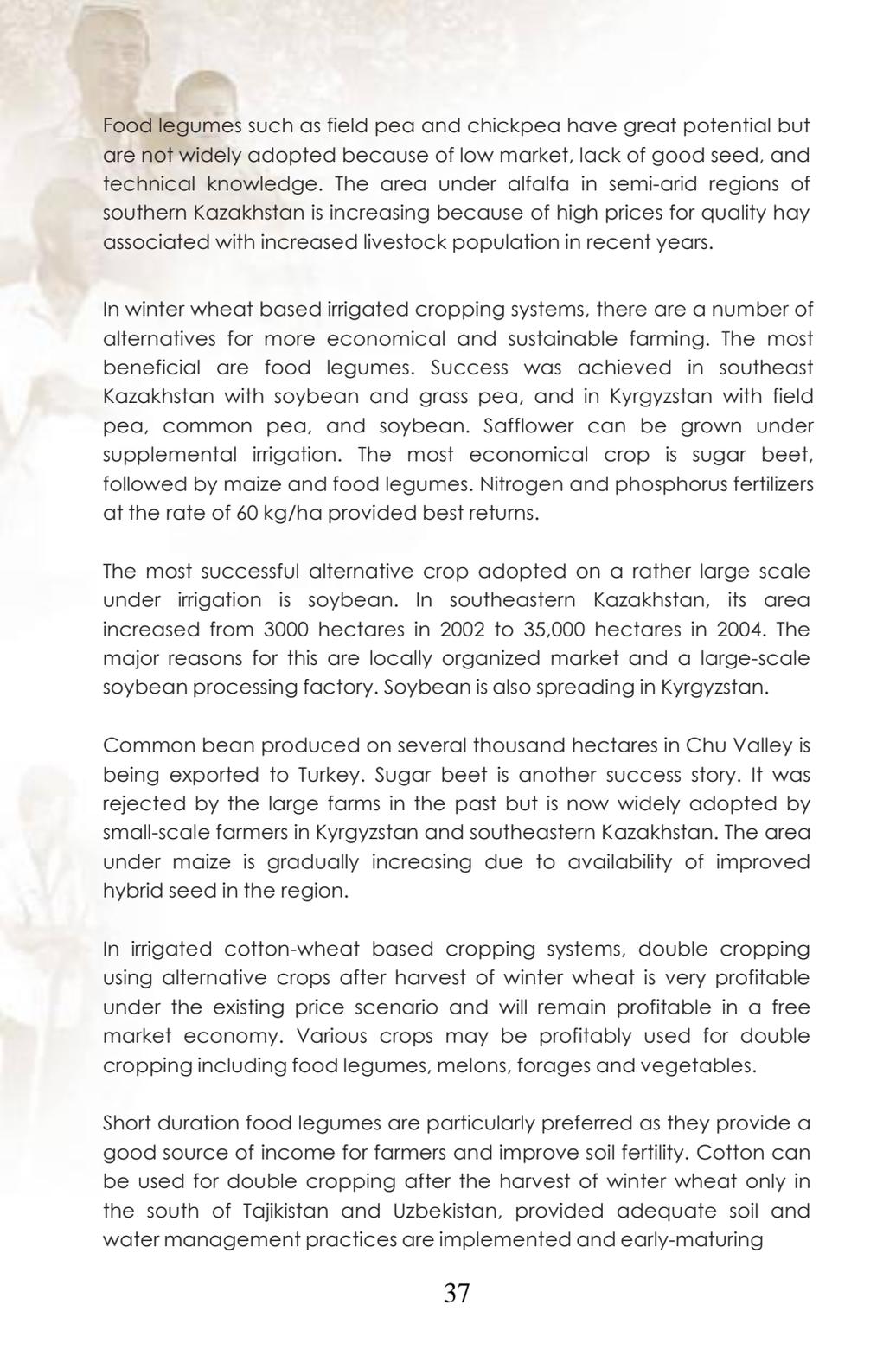
In spring wheat based cropping systems, there are good opportunities for crop diversification. Field pea, chickpea and lentil are the best food legumes to include into crop rotations with cereals. Buckwheat is a good alternative for increased benefit to farmers. Oat, occupying much smaller areas, produced 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



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

increased uniformity of soil

moistening from 0.70 to 0.85 field capacity and reduced surface runoff from 5- 50% to 2-20%.



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

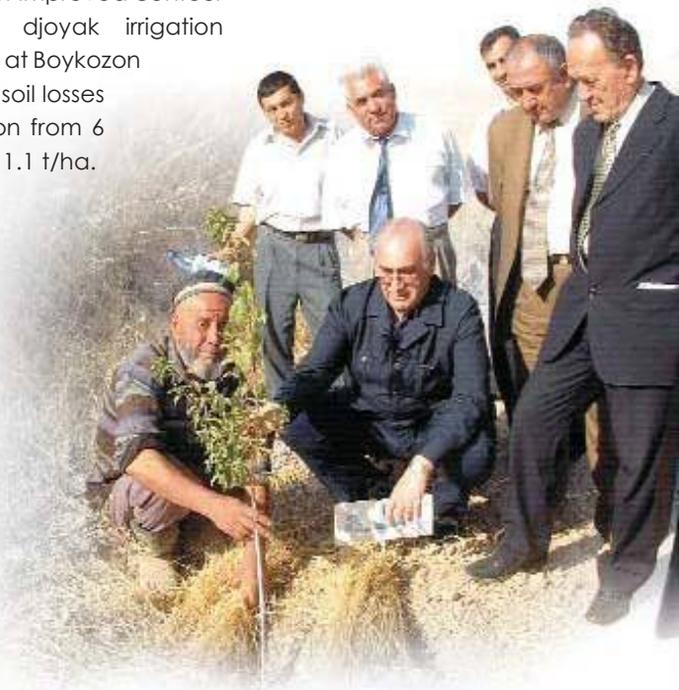
artichoke and sorghum) and tree plantations contributed to higher yields and good rooting rates of saplings. Using TWW for irrigation also decreased the need for fertilizer application, thus significantly reducing production costs. Conjunctive use of canal and low-saline drainage water for irrigation 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 Fakhraabad 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 to reduce soil erosion and enable production in sloping lands. A farmer in Uzbekistan demonstrates the technology to ICARDA team of scientists



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 phosphogypsum 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 salttolerant 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

Remote rangelands are not managed efficiently.

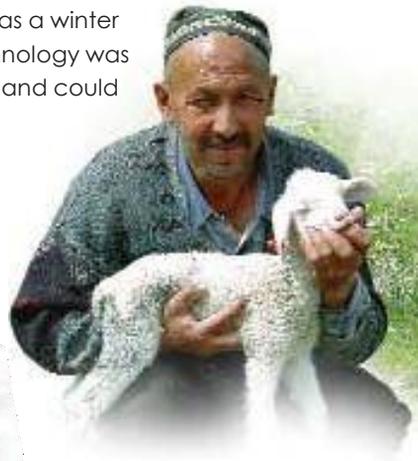


in Kazakhstan and Uzbekistan. By assessing production and degradation in Kazakhstan, scientists discovered critical levels of degradation around villages, while remote areas were undergrazed. Successful systems for range seed production as nurseries for future rehabilitation were established in Kazakhstan,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

mechanism 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.

Catalogued Seeds at ICARDA Genebank



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. Since 1998, more than 20 collection missions were organized and with the partners, several thousand valuable accessions were collected of cereals, food legumes, and their wild relatives, as well as forage and range species.



A collection mission in CAC.

Through the joint efforts of the Ministry of Agriculture 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.

With support from the Global Crop Diversity Trust (GCDDT), 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 GCDDT attended. As a follow up to this meeting, GCDDT funded new PGR projects in plant genetic resources, in collaboration with ICARDA, IPGRI, and VIR, S. Petersburg.



Strengthening National Systems

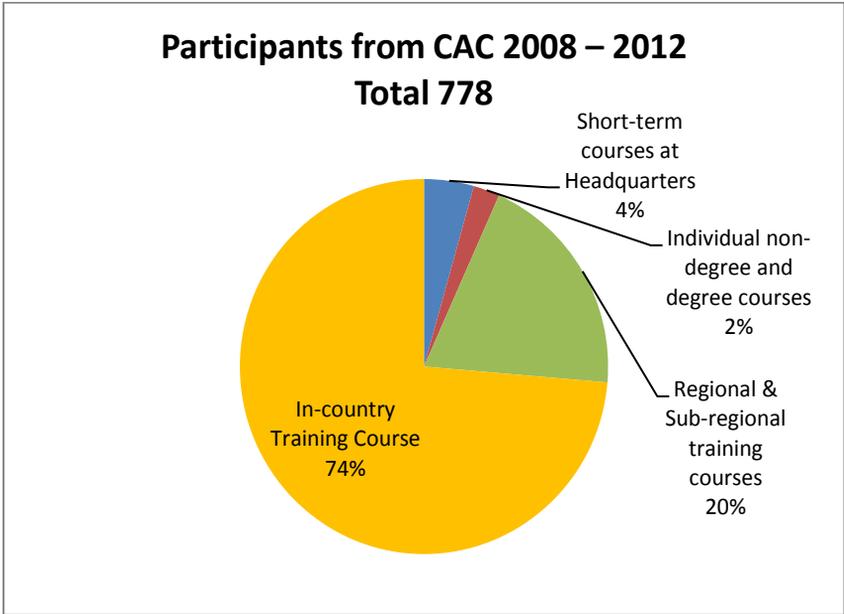
ICARDA strongly believes in the importance of strengthening national programs and their human resources capabilities for effective research partnership and development in countries. Its wide range of training opportunities, in-country, regional and at headquarters has continually trained scientists and enriched national expertise. More recently, ICARDA's support for Masters and PhD program students is fostering a new generation of scientists and stimulating interest among the youth in agriculture sector.

Over the past five years

ICARDA has conducted over 13 courses on different topics and several practical workshops and field days in conservation agriculture over the past five years in various CAC countries, while several trainees from the region have been sponsored to attend courses conducted at the headquarters and in other regions. These courses cover topics such as genebank and molecular techniques, land and water management, integrated crop and livestock production, and socio-economic and policy assessments.

Number of Participants from CAC in training courses conducted by/through ICARDA 2008 – 2012

Year	Headquarters training courses			Non-headquarters courses		Total
	Short-term courses	Individual Non-degree	Individual Degree, M.Sc. & Ph.D.	Regional & Sub-regional training courses	In-country Training Course	
2008	13			16		29
2009	13	4		8		25
2010	5	9				14
2011	2	2	1	97	118	220
2012	1		2	32	455	490
TOTAL	34	15	3	153	573	778



Sampling of ICARDA's training courses since 2008

2008

GPS Regional Training Course for Cereal Rust Monitoring Central Asia and Caucasus Countries

9-12 June 2008, Tashkent (Uzbekistan)

2009

Experimental Design and Data Analysis/CBSU

June 2009, at Tashkent, Uzbekistan

2011

Field Experimental Design and Analysis, ITU

14-26 February 2011 at Tashkent, Uzbekistan

Seed Quality and Seed Health Assessments

24-27 October, 2011 held in Tashkent, Uzbekistan



DNA Marker Application for Crops Improvement

25-29 April 2011 held in Baku, Azerbaijan

Plant Genetic Resources Management and Germplasm Characterization

4-9 Apr, 2011 held in Georgia

Series of trainings for artisan women on design, production and marketing of silk, felt and woolen items

55 women from four villages participated in Kyrgyzstan, April-June, 2011

Application of modern conventional tools in PGR characterization, pre-breeding and breeding

17-21 Jun, 2011, Azerbaijan

Sustainable crop production and Conservation Agriculture

1-3 Nov, 2011 held in Uzbekistan

Management of Plant Genetic Resources and Germplasm Characterization

21-26 Nov, 2011 held in Tajikistan

2012

Actual breeding methods and high effective technologies in vegetable production,

March 2012, Tashkent, Uzbekistan

Biological methods and innovative technologies usage in vegetable production,

April 2012, Tashkent

Integration of Education, Science and Production

May 2012, Tashkent, Uzbekistan

Prior to 2008

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 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.



Participants in a soil and water analysis training work-shop in Tajikistan.



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

National 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 cropor 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 CGIAR Regional Program for Central Asia and the Caucasus has come a long way since it started its work in the region in 1998. Agricultural research collaboration in the region has seen considerable progress in productivity of agricultural systems; natural resources conservation and management; conservation and evaluation of genetic resources; adoption and transfer of technologies; and socioeconomic and public policy research. Through a number of projects, work was carried out to preserve local accessions of grain, legume and forage crops and varieties of apple, apricot, pear, almond, currant and grape. Many of these are stored in genebanks.

The socioeconomic and public policy research is helping the countries identify the gaps in their institutional framework and to overcome the difficulties to a market economy. Researchers offer policy recommendations, help tailor policies to climate change and build necessary capacities. The Program pays special attention to building the research and technical capacities of NARS partners and improving farmers' and breeders' skills in the region. As an integral part of almost every activity and project in the region, capacity building is aimed at creating new and strengthening existing potential of research institutions in facing the research challenges of reforming the agricultural sector. It is also aimed at improving the skills of rural populations involved in farming and livestock breeding to increase agricultural productivity and incomes.

All these efforts have produced significant results and benefits. Going forward. Until recently, efforts were largely focused along specific areas of challenges. Despite their merits, they tended to be limiting in their scope of impacts. Weaving all elements into the fabric of sustainable agricultural research for system-wide benefits offers the most potential.

CGIAR has collated all research efforts into a more integrated research framework to unleash maximum benefits for the farmers and rural communities. Led by ICARDA, is the first large-scale research

program to use an integrated agro-ecosystems approach to improve productivity and livelihoods in the dry areas is enabling ICARDA to position its support to CAC in a more holistic and consolidated manner so it can effectively help meet the strategic goals in the region – increased productivity, food and nutritional security and sustainable natural resource management. The global program will facilitate exchange of knowledge with other parts of the world through an innovation platform, which is bringing together all relevant partner groups from research, government, universities, farmers' associations, the private sector and civil society.



Rural women participating and benefiting from the value-added fiber processing project funded by IFAD and implemented in Kyrgyzstan and Tajikistan (2009-2103). Women are a priority for the Dryland Systems research program for equitable development and benefits.

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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