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CGIAR Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus

CGIAR Collaborative Research Program for Sustainable Agricultural Development in Central Asia and the Caucasus is being implemented in the region since 1998. The goal of the Program is to contribute to achieving the overall goal of food security, economic growth, environmental sustainability and poverty alleviation in the countries of Central Asia and the Caucasus. Its immediate objective is to assist the CAC countries in achieving sustainable increases in the productivity of crop and livestock systems through development, adoption and transfer of production technologies, natural resource management and conservation strategies, by strengthening agricultural research and fostering cooperation among the CAC countries and international agricultural research centers.

EDITORIAL

Together with national partners in eight countries of Central Asia and the Caucasus (CAC), the CGIAR Regional Program continues to promote sustainable agricultural technologies and innovations in the region. And this work is bringing about good results.

Many years of collaboration has seen considerable effort put in saving biodiversity of the CAC countries, including Georgia, a country known for very rich plant diversity. And agricultural biodiversity is the basis for breeding new, more resistant and more productive varieties for food security. To date a number of new varieties of different crops have been released in Georgia, including potato varieties like 'Meskhuri', 'Meskhuri Tsiteli' and 'Javakheturi', as well as wheat, vegetable soybean, chickpea and lentil varieties (pp. 2-4). In Uzbekistan, a multi-year collaborative study resulted in the official release of a new high-yielding, early-maturing and stress-tolerant variety of pearl millet (pp. 4-5). The new variety is called 'Hashaki 1' and yields up to 30 per cent more compared with local proso millet. It also matures within 64-78 days and can be used as forage for all kinds of animals.

International scientists together with their national counterparts also continued to research into different aspects of water management, from increasing water use efficiency in Uzbekistan to women's changing role in agricultural production in Tajikistan. Under a three-year project on lift irrigation, researchers from the International Water Management Institute (IWMI) are looking at ways of improving water transportation from the River Amu Darya to the Karshi Steppe, a region in southern Uzbekistan, and are working to identify new technologies for sustainable water and energy use (pp. 5-6). A different study by two IWMI researchers found that more women are working in farming in northern Tajikistan than ever before, spurred by male labour migration and privatization of the agricultural sector (pp. 6-7). This study sheds new light on the rising phenomenon of feminization in agriculture by looking at land reforms and the feminization of agricultural labour in Sughd Region, northern Tajikistan.

A number of regional events have taken place to foster regional research collaboration, promote solutions to land degradation, and encourage sustainable agricultural production. For example, during several days of talks in Baku, Azerbaijan, scientists from the International Center for Agricultural Research in the Dry Areas (ICARDA) and experts from the region pondered on ways to improve land and water management, ensure sustainable growth of productivity, tap the potential of mountains and other less-used areas for better livelihoods, and step up capacity-building drives in the region (pp. 7-9). In particular Central Asian, the Caucasus scientists asked for more technical support from international research centers. Combating land degradation in Central Asia was the main focus of attention at the Annual Project and Steering Committee meetings of the CACILM Knowledge Management initiative in Tashkent, Uzbekistan (pp. 9-11).

The Program continued its capacity-building efforts. As part of activities to tackle land degradation in Tajikistan, a team of researchers from ICARDA conducted a training workshop on principles and practices of conservation agriculture (CA) at the Tajik Academy of Agricultural Sciences (p. 14). The training course was focused on introducing CA technologies and experiences to local researchers and farmers with a special emphasis on weed management, forage production and no-till drill. Furthermore, over 20 young researchers joined a wheat travelling seminar in Uzbekistan to evaluate joint winter wheat research activities (pp. 14-15). This training helped young scientists to improve their knowledge and skills in breeding more resistant wheat varieties. Efforts are also under way to enhance the competence of national researchers in conducting climate change-related studies. Thus, a training course on downscaling climate change scenarios in Central Asia was organized in Tashkent, Uzbekistan (pp. 15-16). The training course was attended by participants from national institutions of four Central Asian countries.

All this work shows the importance of collaboration and support from the national and international research and donor communities. And the Program is committed to continuing its mission in the region.

Dr Jozef Turok,
Head of Program Facilitation Unit,
ICARDA Regional Coordinator

FEATURE

Saving Georgia's biodiversity for food security of future generations

In the Caucasus and even beyond, Georgia's biodiversity takes some beating. It is so exceptional that German biologist and ecologist Michael Succow once said: "Not a single country in Europe possesses such a rich flora and fauna as Georgia. No European country offers such diverse landscape in such a small area." Georgia also boasts great agricultural biodiversity, an integral part of its natural riches and a product of human activity over centuries. Local farmers have developed many unique varieties that can be used in improvement of cultivated crops.

This legacy, however, has been at recurrent risk of loss as agricultural production, a mainstay in the national economy, is growing. Many of the traditional varieties have been lost because of abandonment or replacement by new varieties and alternative crops. But as pests and diseases remain the main concern of farmers in Georgia, plant genetic resources, that is the genetic materials holding valuable traits in both indigenous domesticated and wild plants, are all the more important. Preserving genetic diversity is necessary not only for research, but also for increased productivity and sustainable agriculture. Plant breeding programs, which used to be quite effective in the past, face problems from insufficient funding to aging human and material resources to uncertainties about future research priorities. Conservation activities are often underfunded and understaffed too, and their scope is limited. And in some cases, facilities are lacking or in need of modernization.

The Agricultural University of Georgia prepares students for a career in agricultural research. Photo credit: Agricultural University of Georgia.

Georgia is a signatory to the Convention on Biological Diversity, and has commitment to conservation of biodiversity and sustainable management of genetic resources. As one of the first steps, Georgia completed a National Biodiversity Strategy and Action Plan in 2005. It is a comprehensive document on biodiversity in the country and provides an excellent framework for designing conservation measures, including those for agricultural biodiversity. Lack of financing for conservation and research, however, puts a drag on the progress. In 2007 FAO commissioned an EU-funded study in partnership with the International Center for Agricultural Research in the Dry Areas (ICARDA) to facilitate efforts on effective management and use of plant genetic resources in Georgia. The study reviewed the state of plant genetic resources conservation, management, improvement and use in Georgia. It identified a range of issues from the need for an integrated and coordinated national plant genetic resources program to capacity building.

The situation has picked up since then. More efforts are now under way to preserve plant genetic resources in situ (as wild resources or on-farm) and ex situ (usually in gene-banks or field collections). Both public and private organizations are joining forces in support of conservation and crop improvement. Where government institutions left off, NGOs and private companies have taken up the slack. Two of them are Elkana, a Georgian NGO, and Agro Cartu, a research-focused company. Both have programs for conservation and sustainable use of local landraces. Founded in 1994, the biological farming association Elkana promotes conservation and sustainable use of landraces of traditional agricultural crops. It works with local communities on in situ or on-farm and community-based preservation of important landraces of Georgian crops. The association also helps to improve the livelihoods of rural populations and step up environmental protection through, among other things, agro-tourism. Elkana members, currently 450 farmers, offer agro-tourism services, promoting them online (http://www.ruraltourism.ge). This gives them extra income and stimulus to conserve traditional landraces.

Georgian farmers are also getting support from international research and development agencies. In 2009 the USAID and its national partners completed a 23-million USD program called AgVANTAGE. Launched in 2002, the program contributed to increased production, sale and export of value-added agricultural products. Georgian suppliers and producers learnt how to better compete on the domestic and international markets. As a result, the US is now a leading export market for Georgian wines. Potential for wine tourism increased too. The program helped to create 1,880 permanent jobs and generated over 37 million USD in foreign and domestic sales.

Georgia is known for its unique grapevine genetic diversity. According to a widely-held view, grapevine was domesticated here about 4,000 years ago. Since that time, wine - and with it grapevine - has spread throughout the world and has evolved from being a major part of the diet before the advent of safe drinking water to a social drink. A project implemented by Bioversity International in 2003-2009 supported the conservation of the local varieties of

grapevine in Georgia and other five countries of the Caucasus and Northern Black Sea. In fact, a field inventory was carried out, which resulted in a comprehensive database of varieties and ampelography, and the unique genetic material was multiplied under safe and standard conditions and re-planted in new collections. The Research Institute of Horticulture, Viticulture and Winemaking, which now operates under the Georgian Agricultural University, continues these efforts and now conducts research on indigenous grapevine genetic resources at molecular markers.

As Georgia's food industry picks up steam, improving quality of agricultural products like wine, fruits, vegetables, and bread depends on finding the right variety for the right location. This again requires plant genetic resources. Crop varieties have to be resistant to pests and diseases. Without access to plant genetic resources, it is impossible to breed crops with desirable traits. Thus, conservation of plant genetic resources as seeds in gene-banks must also be a priority. More advanced short, medium and long-term storage facilities are needed. In 2004 ICARDA helped to open a gene-bank, which became fully operational in 2006. The gene-bank is based at the Georgian Agricultural University and is the only facility in Georgia with medium and long-term seed storage capacity, where temperatures are maintained at 0-+40C and under -200C respectively. It has recently been moved to new, renovated rooms on the university campus. Out of the available accessions, 1,990 have already been regenerated and studied for various agronomic and morphological traits. Much of the research is focused on field crops, especially grain and food legumes. The gene-bank currently holds more than 2,500 accessions of various crops. Safety duplicates are stored at the Svalbard Global Seed Vault and the National Center for Genetic Resources Preservation in Fort Collins, USA. The Georgian Agricultural University is installing a cryogenic storage facility at the gene-bank. As this technology is new in Georgia, a group of scientists has undergone training at Kew's Millennium Seed Bank recently. Researchers at the gene-bank collect samples from local breeders, through exchange with foreign gene-banks and field collecting missions. In 2013 local scientists took part in two international expeditions to collect and evaluate plant genetic resources in the country together with Dutch, South Korean and Russian experts.

Collecting and preserving plant genetic resources are one thing. But it is also necessary to ensure there are enough quality seeds of existing and new crop varieties for farming purposes. In recent years private companies have taken the lead in meeting domestic demand for seeds and planting material. For example, Agro Cartu has been developing production of high-quality virus-free vegetable and potato seed since 2007. The company hopes to not only meet local demand but also increase exports and advance Georgia's reputation as a reliable supplier of high-quality agricultural products. Agro Cartu operates a research center near Tbilisi, the Georgian capital. The center has 54 ha of land in the highlands and is well-equipped for production of high-quality virus-free seed and planting material. There are greenhouses, screen houses and laboratories for tissue culture and enzyme-linked immunosorbent assay (ELISA) analysis at the center. One of the laboratories studies viruses according to European and Mediterranean Plant Protection Organization (EPPO) standards. The center has a collection of 430 local and 280 introduced grape varieties. It also cooperates with research organizations from Germany, Italy, France, USA, Ukraine and other countries. In 2008 Agro Cartu and the International Potato Center (CIP) signed an agreement of collaboration on seed potato research and production. CIP regularly provides germplasm material to Agro Cartu. To date around 18 new potato cultivars have been tested at the Akhalkalaki experimental station. And three new varieties 'Meskhuri', 'Meskhuri Tsiteli' and 'Javakheturi' were registered in Georgia in 2012-2013. They are high-yielding and resistant to viruses, late blight and drought. They also demonstrate good marketable traits, which is one of the reasons their seeds are being multiplied on farms. Seed multiplication is particularly important as potato is one of Georgia's major staple and cash crops. It is cultivated in an area of 30,000-35,000 ha, but productivity still remains very low. And poor seed quality is often blamed.

There are strong research partnerships with CGIAR members. Besides Bioversity, CIP and ICARDA, the International Maize and Wheat Improvement Center (CIMMYT) and AVRDC - The World Vegetable Center also provide technologies to support farmers. Maize germplasm from CIMMYT is used to develop hybrids suited to Georgia's climatic and soil conditions. In 2011-2012 local scientists patented high-yielding hybrids such as 'Tserovani 4', 'Tserovani 5', 'Lomtagora 4' and 'Lomtagora 5'. AVRDC - The World Vegetable Center collaborates closely with the Institute of Farming and shares improved lines and germplasm from its gene-bank. As a result, tomato variety 'Saadreo (CLN 2026D)' was released in 2011. What is more, non-traditional crops such as vegetable soybean are being introduced. For example, two new varieties like 'Mtsvane Parkiani (AGS 292)' and 'Sabostne 1 (Jasuto-75)' were also released in 2011. A new variety of common bean 'Mravalmartsvala (TOT 5976)' is now expected to be registered in 2014.

Thus, collaboration with the international centers has already borne fruit. Initial seed multiplication of released chickpea and lentil varieties originating from ICARDA, 'Aragvi', 'Eleksir', 'Tsilkani', 'Sarkineti' and 'Pablo', is under way. In 2013 local scientists received new chickpea and lentil germplasm, which is resistant to diseases and pests most widespread in Georgia. Since 2000, the Institute of Farming has been successfully working with CIMMYT and ICARDA under the International Winter Wheat Improvement Program (IWWIP). The six nurseries obtained in 2012-2013 alone were planted at the Sartychala experimental station in Gardabani district, eastern Georgia. Seven promising varieties will be multiplied at seed production nurseries. So far wheat varieties 'Lomtagora 109', 'Lomtagora 123' and 'Sauli 9' have been released. They are grown in eastern Georgia and produce yields of 3 to 5 t/ha in normal conditions, reaching 7-8 t/ha in optimal conditions. These varieties are used extensively by local farmers. Wheat developed through such collaboration is cultivated on considerable acreages in Georgia. It currently stands at 20,000 ha, or 10% of the total area.

Despite these successes, some problems persist. One of them is the slow pace of seed multiplication. Seed distribution is also disjointed. Farmers and researchers also often lack knowledge and skills. So capacity building remains a priority. As Dr Guram Aleksidze, President of the Georgian Academy of Agricultural Sciences, an advisory body, said at a recent regional meeting, knowledge sharing was very important for the country as local farmers often seek knowledge from their parents and other people rather than scientists. Farmers need to learn and introduce new technologies. Capacity-building efforts, he added, should also focus on training young specialists and researchers on climate change. Georgia's biodiversity is extraordinary. But making sure it stays so in future depends on how effective measures are today.

RESEARCH HIGHLIGHTS

New 'super' pearl millet approved for countrywide cultivation in Uzbekistan

A multi-year collaborative study has resulted in the official release of a new high-yielding, early-maturing and stress-tolerant variety of pearl millet in Uzbekistan.

Like in other Central Asian countries, intensive irrigation is leading to soil erosion, loss of organic matter, salinization and waterlogging in large parts of Uzbekistan. And this puts at risk not only sustainability of agriculture but also the long-term welfare and income of rural communities. Poor quality of soil and lack of water also cause shortages of forage in arid and semiarid regions. Researchers point to the need for diversification of the production system to tackle these problems. In marginal lands with different levels of water and soil salinity, it is more practical to use alternative salt- and drought-tolerant crops to replace or alternate with traditional crops, which are difficult or impossible to grow in such conditions. Salt-tolerant species like sorghum (*Sorghum bicolor*) and pearl millet (*Pennisetum glaucum*) are a case in point. Both crops need little water and are highly tolerant of drought, heat and soil salinity. They can also help to deal with two problems at once. First, a stable system of grain production and fodder supply can be set up. Second, their cultivation will help to prevent erosion and improve soil productivity. These features make sorghum and pearl millet especially suitable for saline and drought-prone areas.

Together with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and national partners in Uzbekistan, the International Center for Biosaline Agriculture (ICBA) and the International Center for Agricultural Research in the Dry Areas (ICARDA) have been assessing ways and benefits of integrating pearl millet and sorghum into local crop-livestock feeding and farming production systems in different agro-ecological zones. ICBA and ICRISAT have supplied a set of improved lines and high-yielding accessions of pearl millet and sorghum in recent years. And following screening of more than 50 improved lines of pearl millet through on-station and participatory on-farm trials using different field management practices, researchers have identified 'Sudan Pop III', 'Guerinian-4', 'IP 6104', 'IP 6112', 'IP 131150', 'IP 19586', 'HHVBC Tall', 'Raj171', 'ICMV 7704' and 'MC 94 C2' as the most salt- and drought-tolerant and highly productive varieties for food, grain and forage production. They yield 30% more dry fodder and 25% more seed compared with local varieties. Pearl millet lines from ICRISAT produced from 38 to 96 t/ha of green biomass under different agro-ecological conditions in Uzbekistan. Most importantly, on-station and multi-location evaluation helped to identify promising dual-purpose varieties that produce grain for food and feed for poultry and livestock.

The new pearl millet variety called 'Hashaki 1' yields up to 30% more compared with local proso millet. Photo by Kristina Toderich.

Several years (2008-2013) of experiments at the Corn Station of the Uzbek Scientific Production Center for Agriculture in Tashkent Region resulted in the release of a new variety of pearl millet 'Hashaki 1'. This variety has been approved recently by the State Variety Testing Commission of Uzbekistan and released after successful evaluation in different agro-ecological zones of the country with different levels of soil salinity. 'Hashaki 1' yields up to 30% more compared with local proso millet. The average yield of green biomass after two cuts is around 45 t/ha. Grain yield varies between 2.28 and 2.96 t/ha. It also matures earlier than other tested varieties, within 64-78 days, and can be used as forage for all kinds of animals. It can be grown as the main crop in early spring or a second crop in pure stands or mixed with different salt-tolerant legumes after winter wheat harvest or in rice rotation systems. Plant density observations indicated that 'Hashaki 1' grows and produces viable seeds on medium saline soils. But it can also thrive on highly saline soils (sulfate-chloride type soils), as found in experiments in the Syr Darya river basin areas and on Shortanbay farm in Karakalpakstan. Furthermore, as

experiments with small ruminant animals showed, it has fairly good digestibility and palatability. Thus, for example, the variety can be grown on degraded pastureland in the Kyzylkum desert. Research results in central Kyzylkum showed that 'Hashaki 1' produced good quality grain, which was successfully used in the region for small ruminants during lactation and lambing, as well as for poultry.

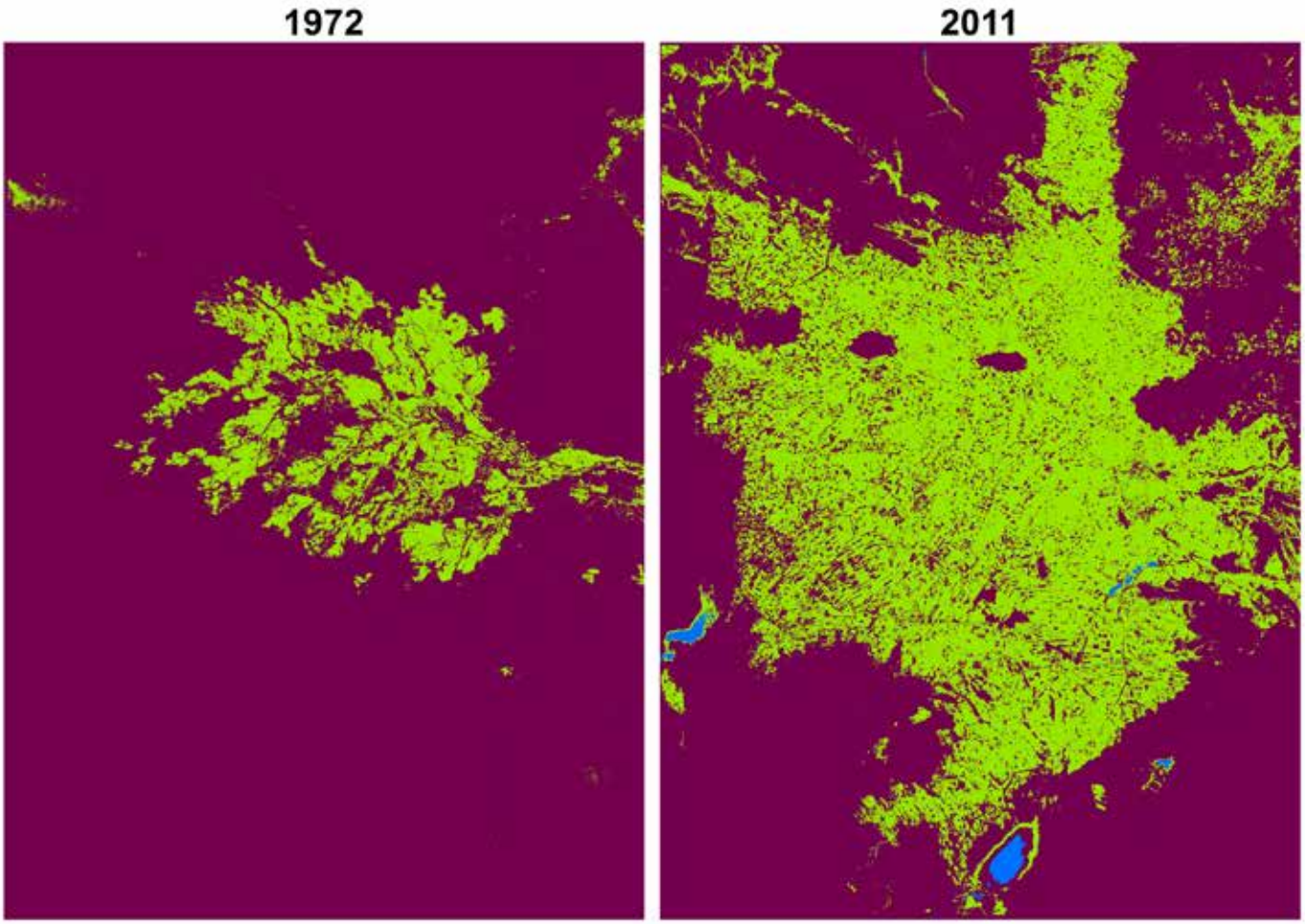
Next steps to ensure wide adoption of the new variety include seed multiplication and supply. At the moment seed production is in early stages. The Uzbek Scientific Production Center for Agriculture is involving interested farmers in this process at one of its experimental stations in Tashkent Region. In future, seeds can be produced by individual or cluster farms of nearby villages. It is hoped that 'Hashaki 1' will play a significant role in filling gaps in the crop-livestock feeding systems in the dryland areas of Central Asian countries. However, since it is a relatively new grain crop in the region, there are no readily available markets. Therefore, although the grain is well-suited to both human and animal consumption, producers should secure a market prior to large-scale cultivation.

Scientists use satellite images to set up sustainable water, energy management system in south Uzbekistan

Water efficiency and productivity is a top priority in Central Asia since water for irrigation is getting scarcer. For that, researchers argue, irrigation practices, among other things, need to be improved and infrastructure upgraded first. This is because inefficient water management also leads to waterlogging and salinization, a major problem in the region. In some areas, however, water is also lifted to the fields with pumps, a method known as lift irrigation. And this raises another issue: energy efficiency.

The International Water Management Institute (IWMI) has been working on these issues in Central Asia together with national partners and international research-for-development organizations for a number of years now. For example, IWMI launched a three-year project on lift irrigation in Uzbekistan in 2012 to increase water and energy efficiency in lift irrigation areas. It builds on another similar project carried out in the Fergana Valley, mainly in northern Tajikistan, where enormous amounts of water are pumped to the foothills. That significantly increases electricity use for irrigation and makes operation of pumps extremely costly.

The new project focuses on water transportation from the River Amu Darya to the Karshi Steppe, a region in southern Uzbekistan where water scarcity is being experienced and local communities are dependent on agriculture. It aims to



These satellite images show that the area of irrigated land has significantly increased in the Karshi steppe since 1972. Image credit: Landsat program.

identify new technologies for sustainable water and energy use in these areas and make necessary recommendations. Water transportation has helped to increase the irrigated area from about 50,000 to 325,893 ha. But today water shortages and degradation of agricultural lands have become a major concern. And the project pursues a multi-pronged solution, including efficient use of groundwater and optimization of energy and water consumption. The rationale is that groundwater is pumped for irrigation when needed, and the water table is replenished naturally when no irrigation takes place.

The project also involves studying water balance and water demand using remote sensing to collect data on land use and land cover (LULC) types in the Karshi Steppe. Data on changes in LULC is very important for water resource management, water supply planning, flood control and waste water treatment. Quantifying the LULC change rate is necessary for improving land and water management systems, agricultural resources and the wider environment.

The study, which was completed recently, determined LULC change dynamics in the Karshi Steppe, where the irrigated area grew drastically in the Soviet past. The researchers used images from the Landsat program, an enterprise for acquisition of satellite imagery of Earth, and ground truth data obtained through field visits. They examined the LULC change dynamics for five years: 1972, 1978, 1987, 1998 and 2011. To analyze land cover in the Karshi Steppe, the researchers employed two methods: supervised classification to classify crops, only for 2011 for which ground truth data was collected, and the Normalized Difference Vegetation Index (NDVI), for all other years. All available data was then fed into ArcGIS, a program for working with maps and geographical information.

Initial results show that a substantial change in land use has occurred since 1972. An area of 325,893 ha was under cultivation as of 2011 and different crops were grown. The researchers are now calculating levels of evapotranspiration, the sum of evaporation and plant transpiration, to determine how much water is evapotranspired and how much water local farmers actually need. Once results are in, they will identify the actual water requirements and suggest options to reduce any water and energy losses. These results will also be used to draw up recommendations for utilizing groundwater for irrigation. It is hoped that this will help to regulate the water table, increase water efficiency and reduce any losses. It will also help to tackle the problem of salinity as water will be used more efficiently.

Changing face of agriculture in northern Tajikistan

More women are working in farming in northern Tajikistan than ever before, spurred by male labour migration and privatization of the agricultural sector. As men leave for other countries in search of higher pay, women are taking the lead in the household and contributing to supporting their families. They are juggling the demands of their households with casual work to cover the basic needs.

These are some of the findings of a recent research paper by Ms Nozilakhon Mukhamedova and Dr Kai Wegerich, two researchers at the International Water Management Institute (IWMI). The report sheds new light on the rising phenomenon of feminization in agriculture by looking at land reforms and the feminization of agricultural labour in Sughd Region, northern Tajikistan. In particular the report examines changing patterns of labour relations and women's roles in meeting the basic needs through sustaining livelihoods in rural areas of Tajikistan.

According to World Bank Indicators (2009), women make up 44.1 per cent of the labour force in Tajikistan. Today agriculture accounts for 75 per cent of total employment in the country. As men see few opportunities for higher income at home, they prefer to work abroad. The International Organization for Migration (2012) estimates that annual labour migration reaches some 62 per cent of the labour force in Sughd Region. This regular outflow of male workforce leaves considerable gaps in the local job market. And it is women who are taking up the slack. Women can be found doing lots of different agricultural activities.

However, the increased involvement of women in agriculture is also a result of land reforms. Ms Mukhamedova points out that these reforms also played a part. For example, the Tajik government passed a law on *dehkan* farms, midsized peasant farms, in 2002. This has led to an upsurge of new types of private farms, including family farms and farming partnerships. But new farms are often small and cannot offer well-paid regular jobs. So they hire casual workers to meet changing demands and peak workloads. These low-paid day jobs attract mainly women who have family commitments and cannot work full-time.

Today more and more women can be found doing lots of different farming jobs in northern Tajikistan. Photo by Neil Palmer/IWMI.

Low wages and poor conditions, however, do not seem to be putting women off farming. The authors put this down to lack of other employment opportunities. Women have at least some way of earning money for

their basic needs. Not only are they acquiring new roles but are also occupying multiple parallel activities. They are learning new skills too. What is more, they usually organize themselves into groups to have more bargaining power with potential employers and meet their labour requirements.

The authors note that this change in roles is also bringing about a shift in cultural perceptions. Women are no longer shy of doing jobs previously dominated by men. They have filled almost every niche of agriculture: from preparing land to planting and irrigating. Women are finding it easier now to work as day labourers and do different casual jobs. This kind of employment has its own benefits: flexibility and daily income. They are sometimes paid in cash and produce.

But there is also the flip side to this situation. There are no official contracts. Women and their employers make only a verbal agreement. Also, these jobs do not contribute to future pensions and there is no long-term financial security. Finally, women depend on more types of agricultural work to ensure day-to-day as well as long-term livelihood security.

This study has broad implications. It shows that efforts aimed at agricultural development need to widen their focus to target this layer of population. Furthermore, reforms of employment protection legislation are also necessary. As the authors note, it is essential for all farms and agricultural institutions to learn more about the needs of women employed in agriculture and create better incentives for women so that they can earn more and look after their families at the same time. The authors hope that this study will lead to wider acknowledgment of these women's contributions to agricultural production and their roles in helping to improve rural livelihoods.

MEETINGS, SEMINARS AND CONFERENCES

Central Asian, Caucasus scientists ask for more technical support from international research centers

During several days of talks in Baku, Azerbaijan, in early December 2013, scientists and experts pondered on ways to improve land and water management, ensure sustainable growth of productivity, tap the potential of mountains and other less-used areas for better livelihoods, and step up capacity-building drives in Central Asia and the Caucasus (CAC). And four major issues emerged from these discussions.

First, there are growing concerns over water availability in the not-so-distant future as scientists forecast falls in precipitation. And this is a troubling prospect for the region where agriculture contributes largely to the national economies and rural populations depend on farming. Speaking at the biennial ICARDA Regional Coordination Meeting, held on 4-5 December, Acad Dzhamin Akimaliev, Director General of the Research Institute of Crop Husbandry in Kyrgyzstan, called for giving priority to water-related issues. He also warned that there are forecasts of serious water shortages by 2050, which could even lead to disputes in the CAC region. Researchers agree that new approaches are needed to deal with these problems. Increasing water productivity is one way to go. As Dr Theib Oweis, Director of Integrated Water and Land Program at ICARDA, pointed out at the meeting, the focus of research-for-development in dry areas is shifting from water efficiency to water productivity. Water-saving technologies can also help. Dr Ashir Saparmuradov, chief expert of the agriculture department at the Academy of Sciences of Turkmenistan, said it is important to introduce water-efficient irrigation, and raise new, more stress-tolerant crop varieties and breeds of animals.

Second, a number of successful initiatives and projects have been carried out in the region to date to increase agricultural productivity. But ensuring their sustainability and taking successful results beyond project sites remains an issue. A recent IFAD-funded project in Kyrgyzstan and Tajikistan on production, processing and export of value-added fiber can be a case in point. It is widely seen as successful. But there are questions about how sustainable its results are. For example, commenting on the project at the meeting, Dr Zakir Khalikulov, Deputy Regional Coordinator at ICARDA-CAC, wondered if women artisans and livestock breeders, the main beneficiaries, will continue to enjoy increased incomes after the project ends. In a similar vein, Dr Aden Aw-Hassan, Director of Social, Economic and Policy Research Program at ICARDA, said sustainability is an important issue to be addressed. So approaches should be in place to ensure sustainability and disseminate knowledge in other countries.

Third, participants also raised the issue of mountain agriculture and tourism. Mountains cover vast areas of territory in the region. Acad Akimaliev believes that concentrating on and using only irrigated areas is not effective as mountains remain unused. He argues that mountain tourism could help Kyrgyzstan and Tajikistan in particular as mountains make up over 90 percent of their territories. This idea has many advocates. A project in Uzbekistan on community-based landscape restoration as a way of adaptation to climate change is an example of what can be achieved in mountainous areas with community support. According to Dr Stefanie Christmann, researcher on environmental governance at ICARDA, one of the benefits of this project is that locals started earning money from tourism.

Finally, capacity development should be the cornerstone of every research-for-development effort. National scientists and farmers need to be taught new innovative practices and approaches. Knowledge sharing is still sluggish. Dr Guram

Aleksidze, President of the Georgian Academy of Agricultural Sciences, lamented that Georgian farmers still get knowledge from their parents and other people rather than scientists. He argued that young specialists and researchers should learn more about climate change and approaches to tackle its effects. Echoing this view, Dr Khalikulov pointed to a serious lack of young scientists. Their poor language skills are also a barrier to learning, he added. But as international funding is often limited for these purposes, national research organizations are encouraged to step in and be more generous.

The issue of sharing research and innovations was also raised at ICARDA's 53rd Board Meeting, held in Baku at the end of November 2013. Speaking at the opening session, Dr Ilham Guliyev, Deputy Agriculture Minister of Azerbaijan, said: "...access to technology, new approaches and practices are critical to ensure that we are competitive and can meet the growing demand for agricultural products." And international research-for-development centers are a treasure trove of such knowledge. For example, ICARDA has a variety of relevant technologies. As Dr Mahmoud Solh, Director General of ICARDA, commented at the meeting: "Today, technically, we are at a stage where a number of practical solutions to these challenges exist and we can actually double or triple the production and incomes for smallholder farmers in irrigated areas and in dryland farming." He also highlighted the significant potential and range of available technical innovations suited to various agro-ecosystems.

ICARDA Board members held a meeting with Mr Heydar Khanish oglu Asadov, the Minister of Agriculture of Azerbaijan, in Baku in December 2013. Mr Heydar Khanish oglu Asadov was presented with ICARDA's silver plate of appreciation. From right to left: Mr Heydar Khanish oglu Asadov, Dr Mahmoud Solh, Director General, Dr Camilla Toulmin, Chair of the Board of Trustees, Dr Mona Bishay, Vice Chair of the Board, and Dr Masum Burak, Chair of the Program Committee. Photo by Dr Jozef Turok.

ICARDA assists Central Asian and the Caucasus countries in drawing up national programs and strategies for agricultural development. At a meeting of ICARDA's representatives with Azerbaijan's Agriculture Minister on 4 December, the parties agreed to boost technical cooperation. Mr Heydar Asadov, Minister of Agriculture of Azerbaijan, stressed the need for research and technological innovations as a driving force for sustainable agricultural growth in the country. Stating the full political support for ICARDA's work in Azerbaijan, Mr Asadov requested a technical consultancy from ICARDA, which would aim to develop and agree on a collaborative research strategy. He also mentioned the need for ICARDA's advice on building institutional research capacities in the country. The parties agreed to hold a technical workshop to identify elements of the strategy and develop project proposals based on mutual interest in March 2014.

All these meetings identified a number of key areas of collaboration between ICARDA and national partners in the region. But, as scientists agree, regional cooperation needs to be enhanced. Agricultural researchers and policymakers urge closer cooperation and support from agricultural research-for-development centers in increasing productivity and tackling problems stemming from climate change. A member of the CGIAR Consortium, ICARDA has been leading the Regional Program on Sustainable Agricultural Development in CAC since 1998. It is widely held that regional exchange of improved germplasm and genetic resources of cereals and legumes through observation nurseries and yield trials belongs to the priority areas. There is also a need to work out a complex approach to research by involving rural communities in rangeland improvement and carry out more extensive research into livestock production. To promote sustainable land management through conservation agriculture, it is also necessary to arrange more travelling workshops on minimum tillage and other practices in the region and outside.

At the closure of the two-day deliberations at ICARDA's Regional Coordination Meeting, participants set out new priorities for collaborative work covering three broad areas such as crop improvement and plant genetic resources; livestock production and rangelands; and natural resources management. First, more joint work is planned on genotyping of yellow-rust-resistant varieties from the region using molecular markers; providing technical assistance to molecular labs in the region; and promoting mountain agriculture. Second, more attention will be paid to integrated livestock and feed/forage production considering climate change; development of veterinary services; organic livestock production and processing of livestock products; forage production and enhancement of degraded rangelands near villages. Third, more focused efforts will be put into salinity management in irrigated areas and increasing water productivity in irrigated areas through improving irrigation systems; and enhancing the resilience of production systems of mountain agriculture.

All this shows how important a role international research-for-development centers play in facilitating sustainable agricultural development in CAC and elsewhere. As Dr Solh said, ICARDA is committed to working more closely with Central Asian and the Caucasus countries, including in capacity-building and training of scientists and young specialists. Helping CAC countries achieve this will form the pivot of ICARDA's activities in the near future. The good thing is there

is unflagging enthusiasm to conduct agricultural research in the region on integrated land and water management, food security enhancement, crop improvement, water management on saline soils, conservation agriculture, and capacity building across all disciplines. What is needed, though, is more political will and support to achieve all this at national and regional levels. To this end, the ministerial meeting planned in Turkmenistan in 2014 will be an excellent opportunity for policymakers.

Combating land degradation in Central Asia

The degradation of land, a blanket term for all natural resources contributing to agricultural production, is a serious socioeconomic and environmental problem in Central Asia. It adversely affects, among other things, food production and biodiversity. During its Soviet days, the region saw this process accelerate. Decades of poorly managed irrigated agriculture has done considerable damage to vast areas of land. The shrinking Aral Sea is now the epitome of man-made environmental disaster. Once independent, the Central Asian countries faced a plethora of socioeconomic and environmental issues. In the early 1990s, all ratified the United Nations Convention to Combat Desertification (UNCCD) and developed national action plans to tackle the challenge. Yet some twenty years on, they still find it hard to break free from agricultural practices of the past. Irrigated lands in the region expanded from 4.5m ha in the 1960s to 7.9m ha in the early 2000s, accounting for more than 75 per cent of the cultivated areas in most countries. Recent estimates by the Food and Agriculture Organization (FAO) show that over 13 per cent of the region's territory was degraded between 1981 and 2003 (measured as a loss of net primary productivity adjusted for changes in climate), affecting 6 per cent of the population. The Asian Development Bank (ADB) reckons that agricultural yields have fallen by 20-30 per cent across the region since independence due to land degradation, causing annual production losses worth as much as 2bn USD.

Scientists point out a few major types of land degradation in the region. Water and wind erosion, often linked to poor agricultural practices, plays a big role. In Uzbekistan, some 800,000 ha of the irrigated croplands are estimated to be subject to serious soil erosion. And more than 50 per cent of the farmlands in Uzbekistan are estimated to suffer from serious wind erosion. In Turkmenistan, water erosion is a serious problem on slopes, covering an area of about 690,000 ha. In Kyrgyzstan, almost 60 per cent of the arable land is considered to be subject to serious soil erosion by water and wind. Soil erosion is also a major concern in Kazakhstan and Tajikistan, especially on slopes. These factors contribute to soil fertility decline. Soil fertility is low and declining in many irrigated areas of Central Asia. Another problem is waterlogging, which is closely linked with salinization. Both are caused by inappropriate irrigation. Recent estimates suggest that between 40 and 60 per cent of the irrigated croplands in Central Asia are salt-affected and/or waterlogged. This consequently leads to decreased plant growth and yields. Cotton losses due to salinization are thought to stand at 100,000 tons per year. Livestock production is also at risk. Overgrazing puts considerable pressure on rangelands, the predominant landscape in Central Asia. Due to increased demand for food and feed, many rangeland areas in the region are poorly managed. For example, 24m ha of rangelands, or 13.2 per cent of the total, are believed to be degraded to varying degrees in Kazakhstan. And this figure exceeds 90 per cent of the total, or 3.7m ha, in Tajikistan.

A nursery of black saxaul (Haloxylon aphyllum) in Kyzylorda Region of Kazakhstan. The plantlets are used for reforestation of the dry Aral seabed and desert rangelands. Photo by Prof Z. Novitskiy.

The countries appreciate the need for regional cooperation in coordinating, above all, water use. Among their first joint moves was the establishment in the early 1990s of the International Fund for Saving the Aral Sea (IFAS), an interstate body. And later the Interstate Coordination Water Commission (ICWC) was formed under the IFAS. But to expand and promote multi-sector cooperation in addressing environmental problems in Central Asia at the local, national and regional levels, all Central Asian countries, as well as the United Nations Development Programme (UNDP) and the European Commission (EC), founded in 1998 the Regional Environmental Centre for Central Asia (CAREC), currently based in Almaty, Kazakhstan. Unfortunately, efforts were unsystematic and most countries lacked either funds or research potential, and often both. Difficulties in implementing action plans and fulfilling international obligations under UNCCD led to the formation of another regional initiative. The Central Asian Countries Initiative for Land Management (CACILM) was launched in 2006 as a multi-year program between the Central Asian countries and international donor organizations to combat land degradation and improve rural livelihoods in the region. One of the main achievements of the first phase, which ended in 2010, is a functional partnership among international, regional and national organizations. Moreover, ADB published the Atlas of Natural Resources of Central Asia in 2010, which is available at http://caatlas.org/. The results of research conducted during the first phase were documented and published by the International Center for Agricultural Research

in the Dry Areas (ICARDA) and comprehensive studies of the forestry sector in Tajikistan and pasture management in Kyrgyzstan and Turkmenistan were published by the German Society for International Cooperation (GIZ).

In recent years, however, international research-for-development organizations in the region have also joined forces. For example, a new CGIAR research program called the Dryland Systems was launched in 2013. The program is now well under way in three transboundary Action Sites, namely the Aral Sea region, the Fergana Valley and the Rasht Valley. Central Asian scientists and their counterparts from international research-for-development organizations fight land degradation on several fronts. They are testing and promoting new technologies and approaches, and are introducing improved varieties.

First, conservation agriculture, a concept for resource-saving crop production, is gaining momentum in several countries. Kazakhstan and Uzbekistan are ahead. For instance, as a result of government support in Kazakhstan, the areas under conservation agriculture practices are reported to have increased from virtually zero ha in 2000 to 1.6m ha in 2011. But other countries are also keen to move from tillage-based systems to conservation agriculture. Unfortunately, conservation agriculture technologies are being introduced slowly in the irrigated croplands. This is blamed on lack of planting machines and of farmers' knowledge of no-till technologies. Yet across the Central Asian region, data indicate that minimum tillage can lead to fuel savings of around 50-75 per cent as compared to conventional tillage, and net benefits of around 24 USD per ha. So efforts were made to promote this resource-saving approach in irrigated areas by ICARDA and its national partners in Azerbaijan, Kazakhstan and Uzbekistan under a FAO-funded project. As a result, irrigated areas under conservation agriculture reached 1,800 ha in Azerbaijan, 1,100 ha in Kazakhstan and 2,050 ha in Uzbekistan in 2013. And a three-year project funded by the International Fund for Agricultural Development (IFAD) aims to promote conservation agriculture technologies in Tajikistan.

Second, researchers suggest that farmers in the region grow new varieties of traditional crops and alternative crops to ensure sustainable agricultural production. New crops could help to tackle soil degradation and salinization. For instance, researchers from AVRDC - The World Vegetable Center, ICARDA and the International Center for Biosaline Agriculture (ICBA) have been working on new varieties of legumes like vegetable soybean and mung bean, which increase soil fertility and are good for crop rotation, as well as the Jerusalem artichoke, in Uzbekistan. What is more, these varieties help to reduce soil salinity and improve soil structure. The results of a number of studies show that non-traditional crops like sorghum and pearl millet can help to rehabilitate abandoned salt-affected lands and rangelands in the region. And certain trees and shrubs can be used as biological pumps to lower elevated groundwater levels in waterlogged areas. In Kazakhstan, Tajikistan and Uzbekistan, ICBA, together with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and local partners, has demonstrated that sorghum and pearl millet can be grown as a second crop after wheat, as well as in rotation with rice. Trials have identified promising dual-purpose varieties that produce grain for food and feed for poultry and livestock. For example, a multi-year collaborative study has recently resulted in the official release of a new high-yielding, early-maturing and stress-tolerant variety of pearl millet called 'Hashaki 1' in Uzbekistan. It yields up to 30 per cent more compared with local proso millet. In 2013 ICBA scientists started studying ways of cultivating quinoa in marginal lands in Azerbaijan, Kyrgyzstan and Uzbekistan. According to initial results, this crop already shows great promise as a grain and fodder crop for salt-affected arid areas.

Third, better water management is needed. Experts put much of the blame for poor soil and water quality on intensive irrigation. Traditional methods like heavy leaching and intensive drainage are costly and unsustainable. The International Water Management Institute (IWMI) has worked with international and national partners to address the problem. To this end, two multi-year Swiss-funded regional water projects were successfully completed in 2013. IWMI and the Scientific Information Center of the Interstate Commission for Water Coordination (SIC-ICWC) had implemented the Integrated Water Resources Management project in the Fergana Valley (IWRM-Fergana Valley) and the Water Productivity Improvement at Plot Level project (WPI-PL). The projects pioneered a framework for institutionalizing and scaling up bottom-up cooperation mechanisms on small transboundary tributaries shared between Kyrgyzstan and Uzbekistan, and Kyrgyzstan and Tajikistan. IWMI is also promoting agricultural use of groundwater, a largely untapped resource in the region. It can be particularly useful for farming rural populations that do not have access to sufficient water resources for irrigation. There is evidence suggesting availability of groundwater in large parts of Central Asia. In particular Uzbekistan's renewable groundwater resources are estimated to be at 18.5 cu km and extraction is at 5.43 cu km, of which 42 per cent for household use, 25 per cent for agriculture, and the rest for other uses. Under a three-year project on lift irrigation, a method of pumping water to the fields, IWMI scientists have also been working in Uzbekistan since 2012 to increase water and energy efficiency in lift irrigation areas. Building on similar work done in northern Tajikistan, the project focuses on water transportation from the River Amu Darya to the Karshi Steppe, a region in southern Uzbekistan.

Fourth, scientists breed crops better adapted to changing environmental conditions. For example, in Turkmenistan, ICARDA researchers and local scientists identified recently two new lines of winter wheat resistant to salinity and frost, two main abiotic stresses to winter wheat production in many parts of Central Asia. And one of these lines is being prepared for submission to the State Variety Testing Commission of Turkmenistan. Based on tens of thousands samples of genetic material, or accessions introduced into the region, 18 winter wheat varieties alone were released for cultivation in the countries. Under a three-year German-funded project since 2012, IWMI and CIP, an international potato research

organization, have been helping farmers in Uzbekistan and Tajikistan by providing improved potato varieties and training them in best cultivation and irrigation practices.

These achievements are certainly grounds for optimism. Yet improved varieties and technologies are successful only if they are used by farmers. Although scientists have accumulated extensive knowledge, it has little value if it is not used. Experts point out that widespread adoption is slow in the region due to a number of reasons, including lack of access to such knowledge and stimulating policies. So a recent three-year IFAD-funded project aims to build a platform to consolidate existing knowledge and make sure farmers and policymakers can access and use it. The project is coordinated by ICARDA and seeks to contribute to the second phase of the CACILM initiative. There is a considerable body of documented knowledge available through various platforms such as the World Overview of Conservation Approaches and Technologies (WOCAT), which is available at https://www.wocat.net/. But they lack effective means of reaching policymakers, farmers and other land users. So the project addresses this issue. Its first outcomes were reviewed and work plans for the second year discussed at the recent Annual Project and Steering Committee meetings held in Tashkent, Uzbekistan, from 28 April to 1 May 2014 (www.cacilm.org). But a real change in improving land management depends on better policies conducive to large-scale adoption, as well as capacity building. Farmers need more incentives and better access to knowledge and technologies. And international research-for-development and donor organizations try to foster dialogue between policymakers and other stakeholders at national and regional levels to make this happen through various events. To this end, the ministerial meeting planned in Avaza, Turkmenistan, in August 2014 will be a good opportunity for policymakers to prove their commitment. Moreover, the 2nd International Conference on Arid Land Studies (ICAL 2) titled "Innovations for sustainability and food security in arid and semiarid lands" will also serve as a platform for exchange of ideas between scientists and policymakers. It will be held in Samarkand, Uzbekistan, on 9-13 September 2014 (more information is available at http://cac-program.org/events/ical). Scientists will have the opportunity to present their research to policymakers and farmers and participate in discussions on how to overcome constraints and identify viable policy options. These events should give a new boost to joint efforts to combat land degradation. But the main hope is that commitment will translate into better policies and actions, and eventually better livelihoods for rural populations.

Learning to grow more with less in Central Asia

Increasing water scarcity and changing weather patterns in Central Asia worry policymakers and scientists alike. So much research in the region is focused on ways to cope with the emerging environmental challenges. Scientists are breeding more resilient crop varieties and offering water-efficient technologies to farmers and other land users.

Two problems, however, call special attention. First, most staple crops cultivated in the region require lots of water. Locally-grown potato varieties, for example, need between 3,500 and 8,000 m3 of water per ha. This can be as much as 8,000-9,000 m3 per ha for winter wheat, although only about 60 per cent of the total water consumption comes from irrigation and the rest from rainfall. Second, irrigation practices are far from best, and indiscriminate use of water causes problems. As Dr Jumanazar Ruzimov, of Urgench State University in Uzbekistan, notes, a surplus of 2,500 m3 of water per ha can bring 1,250 kg of salt to the field and increase the water table by 1 m.

Improving the situation is high on the national and regional research agendas. Together with research partners in Central Asian countries, the CGIAR Regional Program for Central Asia and the Caucasus, a consortium of national and international research institutions, also contributes to resolving water-related problems in the region. And this work was at the center of a recent meeting in Tashkent, Uzbekistan, to discuss measures to increase water use efficiency within the framework of the CGIAR Research Program on Dryland Systems. Some 20 scientists from national and international research institutions met on 10 June 2014 to look at how water-efficient crop varieties and technologies can help. Participants agreed that improved crop varieties boost water productivity. For example, some early-maturing legumes grown in June-September need watering only once or twice. Dr Ravza Mavlyanova, of AVRDC - The World Vegetable Center, singles out mungbean as one of the water-efficient crops, which also improves soil fertility. And it can be used as a catch crop. In Uzbekistan, a number of improved varieties like 'Zilola', 'Marjon', 'Durdona' and 'Turon' have been released to date. Another crop is potato. Mr Kahramon Jumaboev, of the International Water Management Institute (IWMI), says that potato yields can go up by as much as 40 per cent if stress-tolerant varieties are cultivated and water-saving technologies used. To that end, IWMI and CIP, an international potato research

Mungbean is considered as a water-efficient crop, which also improves soil fertility. For example, this improved mungbean variety called 'Zilola' has been released in Uzbekistan. Photo by Sarvar Rasulov.

center, have carried out a series of field trials since 2012 to study the effect of different irrigation practices on yields of the varieties 'Sarnav' and 'Sante' in the Fergana Valley, Uzbekistan. And the results have been submitted in a paper to Irrigation and Drainage, the official journal of the International Commission on Irrigation and Drainage, and published in booklets and brochures for practical use by farmers.

There are various approaches and technologies that can help to save water. Prof Abduhalil Kayimov, of Tashkent State Agrarian University, and Dr Muhabbat Turdieva, Regional Project Coordinator at Bioversity International, point out that agroforestry practices also have potential for increasing water productivity. It is well established that trees and shrubs enhance ecosystems. By growing trees with crops, it is possible to improve yields, reduce soil loss, conserve soil moisture and reduce the effects of agriculture on the environment. For example, cotton fields protected by tree stands require less water due to soil moisture and water conservation. Trees and shrubs can also serve as windbreaks. In some cases they reduce wind speed by as much as 60-80 per cent compared with open areas, which saves soil moisture and crops from lodging. Furthermore, relative humidity in such areas is higher by 10-20 per cent and air temperature is lower by 10-25 per cent. In agriculture, the amount of water, fertilizers and other resources used also depends on field levelling. So the advent of laser-controlled land levelling equipment was a significant advance in surface irrigation. Laser-levelled fields help to achieve substantial water savings and an increase in crop yield and quality. By contrast, traditional land levelling results in increased irrigation, leading to higher salinity levels. Dr Oybek Egamberdiev, of the Khorezm Rural Advisory Support Service, a not-for-profit organization at Urgench State University, says that if the slope of a field, that is the ratio of the difference in height between two points in a field to the horizontal distance between these two points, is 5 cm, then some 500 m3 of additional water is used per ha, bringing 250 kg per ha of additional salt into the field and increasing the groundwater level by 0.2 m. The slope is, however, 1-3 cm if a field is levelled with laser-controlled equipment. According to Dr Egamberdiev, the results of laser land levelling experiments in several districts in Khorezm Region of Uzbekistan proved encouraging. A comparison of traditional land levelling and laser land levelling effects on winter wheat and cotton in 2010 showed that a water saving of 1,500 m3 per ha can be achieved for winter wheat and 2,000 m3 for cotton. More importantly, yields were higher: 4 tons per ha with traditional land levelling and 4.4 tons per ha with laser land levelling for winter wheat, and 2.5 tons per ha and 2.75 tons per ha respectively for cotton. Dr Egamberdiev adds that because irrigated agriculture accounts for about 90 per cent of the total crop production in Uzbekistan, benefits of this technology could be enormous. Scientists also propose conservation agriculture as another way to cut down on irrigation. Conservation agriculture is a set of soil management practices that minimize the disruption of soil structure, composition and natural biodiversity. One of its main benefits is water conservation as this approach requires much less water due to increased infiltration and enhanced water-holding capacity from crop residues left on the soil surface. Mulches also protect the soil surface from extreme temperatures and greatly reduce surface evaporation. By some estimates, water savings can be as much as 20-25 per cent.

Researchers agree that there is enough to offer to farmers and other land users in the region. But uptake is lagging for various reasons, including lack of knowledge and skills. So there is continued effort on training and development, and knowledge is shared through various events involving specialists and farmers. Much is also being done by the CGIAR Regional Program. For example, the International Center for Agricultural Research in the Dry Areas and national partners organized a series of training courses in Azerbaijan, Kazakhstan and Uzbekistan in the past few years under an FAO-funded project to promote conservation agriculture practices in irrigated areas. Some 150 people have been trained since 2013. CIP and IWMI have been helping farmers and agronomists to learn best practices in potato cultivation and irrigation under a three-year BMZ/GIZ-funded project. As part of this initiative, 35 people from Fergana and Andijan regions took part in a training course on 14 June 2014 in Markhamat District of Andijan Region, Uzbekistan.

National governments are committed to boosting the adoption rates of water-saving technologies. In Uzbekistan changes were made in 2013 to the Tax Code, exempting farms using drip irrigation from the single land tax for five years. And Kazakhstan has been implementing policies, including an equipment subsidy program, to promote conservation agriculture. But many technologies are still thin on the ground in the region. Conservation agriculture is slowly taking off in some countries, while other approaches and technologies are finding their way into agricultural production. Scientists fret that there is still a way to go to achieve large-scale adoption of water-saving technologies. As Dr Shukhrat Mukhamedjanov, senior researcher at the Scientific Information Center of the Interstate Coordination Water Commission of Central Asia, notes, it is necessary to develop a system for transfer of innovative technologies to Water User Associations (WUAs) and farms. He points out that efficient water use is hindered by such issues as weak water management mechanisms at WUAs, low qualifications of WUA specialists and lack of appropriate water accounting procedures. Breeding new varieties and developing water-efficient technologies is a lengthy process, but making farmers and other land users in the region adopt them often takes even more time. It is hoped that farmers will soon learn the knowledge developed by science, and policymakers will do more to make this happen sooner rather than later. Water is a finite resource, after all.

Production of high-quality fruits, vegetables on rise in Uzbekistan

Uzbekistan is paying more attention to increasing production of high-quality fruits, vegetables and grapes as a result of shift in agricultural policy since its independence in 1991.

Uzbekistan annually produces around 16m tons of fruits and vegetables, President of Uzbekistan Islam Karimov said in his keynote speech to participants of the international conference titled 'The Most Important Reserves of Implementing the Food Program in Uzbekistan' in Tashkent, Uzbekistan. Uzbekistan exports food, particularly fruit and vegetable, products worth about 5bn dollars, and the agricultural exports have increased more than threefold over the last three years, the president added.

The conference, held on 5-6 June 2014, brought together more than 200 representatives of international organizations and financial institutions, including the World Health Organization, the Food and Agriculture Organization of the United Nations, the European Union, the International Fund for Agricultural Development, the World Bank, the Asian Development Bank, the Islamic Development Bank, the International Center for Agricultural Research in the Dry Areas (ICARDA), as well as leading scientists, experts and business people from more than 40 countries.

During his speech, President Islam Karimov also noted Uzbekistan's expertise and potential in the production of vegetables, fruits and grapes and the role the country can play in addressing current global food security challenges. President Islam Karimov's speech underlines growing attention paid in the country to fruit and vegetable production. And the main purpose of the conference was to demonstrate Uzbekistan's experience and potential in cultivation and production of vegetables, fruits and grapes, as well as discuss issues and opportunities related to enhancing Uzbekistan's contribution to addressing global food challenges. In his address to the audience, Jose Graziano da Silva, Director-General of Food and Agriculture Organization of the United Nations, highlighted key challenges and opportunities in addressing food and nutrition security by the global community, and expressed FAO's support in pursuing Uzbekistan's agricultural and food policy goals.

More than 200 representatives of international organizations and financial institutions, as well as leading scientists, experts and business people from over 40 countries, gathered in Tashkent, Uzbekistan, on 5-6 June 2014 for an international conference on Uzbekistan's food program. Photo credit: ifc.uz

The conference comprised one plenary session and five working sessions, which focused on such issues as trends in the global food market, achieving full and balanced nutrition, development of investment cooperation projects in the agricultural sector, the introduction of advanced scientific research and technologies to improve the efficiency and productivity of fruit and vegetable crops, as well as urgent issues of storage, packing, logistics and transportation of fruits and vegetables to consumers. During the discussions, participants stressed the importance of research in ensuring food security in the world.

One of the five working sessions was dedicated to introduction of the advanced scientific and technological know-how to improve efficiency and productivity, breeding, seed production and development of new disease-resistant varieties of vegetables and grapes, improving their useful properties, taste and quality. During this session, CGIAR representatives, in particular Dr Kamel Shideed, Assistant Director General for International Cooperation at ICARDA, provided input on how improved varieties and technologies can help to tackle food security challenges. In this context, the CGIAR centers and other research-for-development organizations can play an important role. As participants noted in their concluding document, the conference and its results can serve as an important part of comprehensive measures, implemented by the international community, on discussion and development of approaches to solving food security problems and creating conditions for healthy and adequate nutrition, as well as give a new impetus to realizing the potential and opportunities to enhance Uzbekistan's contribution to addressing global food challenges.

CAPACITY BUILDING

Promoting conservation agriculture in Tajikistan

Population growth is adding to increased pressure on agricultural resources in Tajikistan. This, among other things, is leading to land degradation. Practices like burning crop residues and plowing are intensifying soil degradation as they reduce the organic matter of soil and destroy its structure. Most of the land resources in Tajikistan are prone to shallow soils and water erosion due to the high proportion of mountain areas in the country (above 80%). But the largest portion is degraded due to human-induced activities. And all this is directly affecting the livelihoods of resource-poor farmers in the country. So increasing agricultural productivity is very important. One way to do that is through improved weed management, forage production and use of no-till equipment according to conservation agriculture practices. Conservation agriculture (CA) has many benefits and considerably saves resources, including water. But it is not yet widely practiced among the farming population in Tajikistan.

Current activities, mainly concentrated in research institutes, are aimed at integrating CA principles and practices into production systems. For example, direct seeding of winter wheat with minimum soil disturbance after cotton harvest is practiced sporadically in an area of about 25,000–50,000 ha.

Training participants were shown how to operate this no-till drill, which was brought to Tajikistan in 2014 under an IFAD-CLCA project. Photo by Aziz Nurbekov.

Research and donor organizations reckon that promoting CA more will contribute to resolving land degradation problems in the country. For example, the International Center for Agricultural Research in the Dry Areas is implementing a project, the first of its kind in Tajikistan, to encourage the wider uptake of CA technologies. Under this project, which is called 'Integrated Crop-Livestock Conservation Agriculture for Sustainable Intensification of Cereal-based Systems in North Africa and Central Asia', project team trains researchers and farmers in using CA technologies. As part of this effort, they organized a training workshop on CA principles and practices from 7 to 10 April 2014 on the premises of the Tajik Academy of Agricultural Sciences (TAAS). The training course was focused on introducing CA technologies and experiences to researchers and farmers with a special emphasis on weed management, forage production and no-till drill. A total of 26 scientists, experts and farmers took part in the four-day training workshop. Besides gaining theoretical knowledge, participants also had a chance to see CA technologies in use. During a field day on the fourth day of the training workshop, they visited an experimental farm of the Research Institute of Crop Husbandry of TAAS in the Sharora settlement, Hisor District. Participants said that more training courses of this kind are necessary as there is a growing interest among local researchers and farmers in CA. More demo plots should also be set up so that farmers can see how this technology benefits others. At the end of the training course several farmers expressed their intention of using no-till drill because it makes it possible to sow a second crop after winter wheat harvest in optimal sowing time, which is crucially important to have two and even three crops per year. Researchers noted that the government can also help to boost adoption rates by creating incentives for farmers. Although it will take some time before conservation agriculture takes a hold in the country, at least first steps have been made.

Joining forces against stripe rust, global threat to wheat production

Stripe rust, also known as yellow rust, a serious wheat disease, is a scourge on wheat production in North and East Africa, as well as Central and West Asia. In 2010 a global epidemic destroyed some 400,000 hectares in Ethiopia, and caused losses of up to 80 per cent in some parts of West Asia and North Africa. The pathogen has been the most severe constraint to winter wheat production in Central and West Asia over the past 12 years. Central Asia has seen five outbreaks since 1999. The most recent epidemics struck in 2009 and 2010. And Tajikistan and Uzbekistan saw another outbreak in the spring of 2013. But changing weather patterns and ineffective monitoring add to the problem.

To deal with this challenge, researchers continue to work on developing more resistant varieties. And some have already shown their merits. For example, varieties like 'Buniyodkor', 'Gozgon' and 'Yaksart' in Uzbekistan and 'Chumon' and 'Ormon' in Tajikistan fared very well during the outbreak in 2013. They also yield more than local wheat lines, up to 10 tons/ha. Most of them come from international winter wheat nurseries. And this underscores the importance and effectiveness of collaboration between national wheat programs and international research institutions.

The International Center for Agricultural Research in the Dry Areas (ICARDA) and national partners also work together to improve the knowledge and skills of young scientists through collaborative research and training. There is a continued

capacity-building drive, and training and knowledge-sharing events are held regularly. For example, ICARDA and the Uzbek Scientific Production Center for Agriculture organized recently a wheat travelling seminar in Uzbekistan to evaluate joint winter wheat research activities. More than 20 young researchers joined the seminar between 23 and 25 May 2014 to observe and assess wheat trials in experimental fields in Karshi, Gallaral and Kibray.

But more commitment from national governments is needed to make research results benefit larger numbers of population, and particularly to supply farmers with the proper seeds that they demand. All this calls for improved coordination between countries, as well as dialogue between researchers and national governments. ICARDA and a partnership of research institutions and policymakers continue joint efforts to address the problem and support countries in fighting future stripe rust epidemics. Through a research-policy platform like the International Wheat Stripe Rust Symposium, which is in its second year, they aim to promote research and cooperation on stripe rust monitoring. Organized by the Turkish Ministry of Food, Agriculture, and Livestock, ICARDA, the Borlaug Global Rust Initiative, the International Maize and Wheat Improvement Center (CIMMYT), and the United Nations Food and Agriculture Organization (FAO), the 2nd Symposium was held in Izmir, Turkey, from 28 April to 1 May 2014. The event brought together leading stripe rust researchers to interact with decision-makers from rust-affected countries and assess the current state of research and regional cooperation on monitoring of the disease. As a platform for sustained international collaboration on stripe rust, the meeting updated participants on the latest research innovations: rust monitoring, population dynamics, conventional and molecular approaches to breeding for durable stripe rust resistance, genetics of resistance to stripe rust, and seed delivery systems. The event was hosted by the Regional Cereal Rust Research Center at the Aegean Agricultural Research Institute (AARI) in Izmir, Turkey. The Center was established in 2012 as a collaboration between the Turkish Ministry of Food, Agriculture and Livestock and ICARDA in response to the urgent need for regional cooperation on stripe rust monitoring and capacity building in crop breeding for stripe rust resistance. The center hosts a monitoring and mitigation system for the 'wheat belt' countries - particularly in Central and West Asia and North Africa, which produce more than 25 per cent of the world's wheat.

Many commercial wheat lines were seriously attacked by stripe rust during an outbreak in Tajikistan in the spring of 2013. Photo by Ram Sharma.

The Symposium is, however, one component in a series of efforts targeting improved stripe rust management. And future success is more likely if there is shared commitment translated into action.

For more information on the Symposium please visit: http://www.icarda.org/striperust2014/.

Spreading knowledge on how to adapt to climate change in Central Asia

As agriculture plays an important role in the economies of Central Asian countries, tackling problems related to climate change is a priority on the research agenda in the region. National researchers and their counterparts from international research-for-development organizations work together to breed more resilient crops and develop better technologies, as well as introduce them into cultivation in farmers' fields. To this end, considerable work has been done to date. For example, a study called 'Adaptation to Climate Change in Central Asia and People's Republic of China', funded by the Asian Development Bank and conducted by the International Center for Agricultural Research in the Dry Areas (ICARDA) and the International Food Policy Research Institute (IFPRI), showed that a rise in air temperature in spring, and corresponding heat stress during flowering, is the main factor affecting winter wheat productivity in Central Asia. The results of this extensive study were published in *Agriculture, Ecosystems & Environment*[1]. As a continuation of this research effort, another study began in Uzbekistan in 2012 to test selected facultative wheat varieties for tolerance to heat stress during flowering. It is nearing completion now. Researchers from ICARDA and the Kashkadarya Branch of Andijan Research Institute of Grain and Legume Crops under Irrigation have been conducting field trials at an experimental site in Kojar village of Karshi district, Kashkadarya Region. Scientists have assessed the potential of different sowing dates along with screening of improved heat-tolerant winter and facultative wheat germplasm. They have tried to identify varieties that can resist or cope with heat stress during flowering, and to assess yield losses associated with heat stress. A preliminary analysis of wheat yields between 2012 and 2014 suggests that climate change will negatively affect wheat productivity and may result in more losses in grain production not only because of high air temperatures during flowering but also

[1] Sommer, R., Glazirina, M., Yuldashev, T., Otarov, A., Ibraeva, M., Martynova, L., Bekenov, M., Kholov, B., Ibragimov, N., Kobilov, R., Karaev, S., Sultonov, M., Khasanova, F., Esanbekov, M., Mavlyanov, D., Isaev, S., Abdurahimov, S., Ikramov, R., Shezdyukova, L., De Pauw, E., 2013. Impact of climate change on wheat productivity in Central Asia. Agriculture, Ecosystems & Environment, Volume 178, Pages 78-99. http://www.sciencedirect.com/science/article/pii/S0167880913002168

very low air temperatures during winter. This means that it is necessary to introduce wheat varieties tolerant of both hot and cold weather.

Efforts are also under way to enhance the competence of national researchers in conducting climate change-related studies. As part of the project titled 'Knowledge Management in CACILM Phase II' (the Central Asian Countries Initiative for Land Management), a training course on downscaling climate change scenarios in Central Asia was organized in Tashkent, Uzbekistan, from 16 to 20 June 2014. The training course was attended by 20 participants from national institutions of four Central Asian countries, including the Kazakh Research Institute of Soil Science, the Hydrometeorology Agency (Kyrgyzstan), the Research Institute of Farming (Tajikistan), the State Agency for Hydrometeorology (Tajikistan), the State Research Institute of Soil Science and Agro-chemistry (Uzbekistan), Khorezm Rural Advisory Support Service (Uzbekistan), the Scientific Information Center - the Interstate Commission for Water Coordination (Uzbekistan), Uzhydromet (Uzbekistan), Tashkent State Agrarian University (Uzbekistan), Urgench State University (Uzbekistan), as well as ICARDA and the International Water Management Institute (IWMI). Dr Raghavan Srinivasan, of Texas A&M University, briefed participants on ideas underlying the development of climate change scenarios, principal difference between CMIP3 and CMIP5 methodology and implementation. He also presented information about regional climate models and world weather centers responsible for downscaling General Circulation Models (GCMs) output for each region of the world, including Central Asia, as well as examples of the assessment of climate change impact on water resources and agriculture. Participants learnt how to download prognostic meteorological information provided by a number of world weather centers and how to extract data for the area of interest from downloaded regional datasets for historical or future periods. The course also touched upon impact of climate change on agro-ecosystems in Central Asia. Dr Feras Ziadat, soil conservation and land management specialist at ICARDA, explained the concept of agro-ecosystem to participants and presented information about four target agro-ecosystems in Central Asia: rangelands, rain-fed lands, irrigated lands and mountains. Participants identified effects of climate change per each agro-ecosystem and discussed how sustainable land management practices can help to adapt to climate change.

As part of the study, soil samples were taken to determine nitrogen and soil moisture content at an experimental site in Kashkadarya Region, Uzbekistan. Photo by Tulkun Yuldashev.

It is hoped that the training course will facilitate further joint work in crop and hydrological modelling and climate change impact assessment in the region. But more training and skills development are needed as participants demonstrated a keen interest and willingness to learn about climate change modelling.

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