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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

From climate change to water scarcity, from food and nutritional insecurity to poverty… in today's increasingly interdependent world, there is an urgent need for integrated approaches in study, assessment and mitigation of global risks such as land degradation and climate change, as well as for adaptation to them.

The consortium of international agricultural research centers is joining hands with local researchers, practitioners, universities, farmer communities, the private sector and other partner groups in Central Asia and the Caucasus (CAC) region to address the risks in agriculture and strengthen livelihoods of people in the face of urgent threats in the dry areas. Under the framework of several research programs, functioning like a single well-oiled machine, international scientists have teamed up with national agricultural research organizations, advanced research institutions, development agencies and policy makers at all levels, to make headway towards food security, improved nutrition and a better environment in the CAC countries. Transfer of new technologies and development of appropriate options and policies is at the heart of the mission aimed at providing help to the vulnerable farmers in the dry areas to sustain and enhance agricultural production on which they depend.

The CGIAR research portfolio in CAC region integrates technologies and institutional innovations on efficient water management, development of improved varieties for sustainable production of cereal, legume, forage and vegetable crops, their uptake by farmers through more efficient seed systems as well as resource-saving agriculture and conservation of genetic resources. Efforts are being undertaken to facilitate interaction between farmers and researchers, and disseminate knowledge on improved land and water management practices at field level.

In this regard, from January through June 2015, a number of on-farm field days and practical training courses have been conducted for farmers and local scientists in different CAC countries. Moreover, a series of videos were generated and relevant materials were published for public awareness and dissemination of scientific results (pp. 13-16).

The CGIAR collaborative research initiative on Dryland Systems is led by the International Center for Agricultural Research in the Dry Areas (ICARDA) and implemented in two Action Sites by the multidisciplinary research team consisting of the scientists from the international research centers and their national partners. They jointly endeavor to overcome obstacles by strengthening innovation, building capacity and linking knowledge to policy action for improving food security and livelihoods. Drought, salt and frost resistant crops, and sustainable and equitable management of land and water resources are at the core of this research. And there are results to show. Improved options including more resistant and productive crop varieties were evaluated in farmers' fields and adopted for mixed production system integrating cereals, potato, vegetable, horticultural and fodder crops, agroforestry and livestock. For instance, new wheat varieties released in Tajikistan, Turkmenistan and Uzbekistan fared very well during the yellow rust epidemics in 2013, 2014 and 2015. Improved varieties produce higher grain yield than the local varieties at all locations. Seed multiplication of these varieties goes at full drive in Tajikistan and Uzbekistan (pp. 6-8).

The program has also facilitated the exchange of knowledge and experiences with other parts of the world and created an innovation platform, bringing together all relevant partner groups from research, policy, education, private sector and practice. It is the first large-scale research program to use an integrated agro-ecosystems approach to improve productivity and livelihoods in the dry areas. It targets two representative dryland systems: (i) one with the most vulnerable populations, and often associated with severe natural resource degradation (Aral Sea Region); and (ii) the other with the greatest potential to impact food security in short to medium term, in Central Asia (Fergana Valley). This integrated research has been financially supported by the Russian Federation as part of a four-year collaborative initiative with the CGIAR.

The Dryland Systems program also covers several critical issues such as rehabilitation of degraded pastures, and soils, ensuring more productive, profitable and diversified agriculture with well-established market linkages through development and introduction of improved vegetables and cash crops to help rural households to have year round access to greater quantity and diversity of food sources.

New initiatives build upon and complement this approach. The World Vegetable Center (AVRDC) recently started a new three-year project titled "Beans with Benefits" funded by Germany's Federal Ministry for Economic Cooperation and Development, which aims to integrate improved varieties of mungbean as a catch crop to improve soil fertility and increase farmers' incomes in South and Central Asia (pp. 3).

Of course, the overall mission is not an easy one. But, all things are difficult before they are easy. Thus, for the last sixteen years, with the valuable support of donors and national partners, the international research team has been putting all efforts into trying to achieve stated objectives.

Follow the progress on http://www.cac-program.org/enewsletters

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FEATURE

New book on rangeland rehabilitation is published

As overgrazing and other human-induced factors continue to put considerable pressure on rangelands, the predominant landscape in Central Asia, scientists work towards solutions to slow down and reverse the negative impact of human activity. Due to increased demand for food, feed and wood fuel, 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. This figure exceeds 90 per cent of the total, or 3.7m ha, in Tajikistan. In Uzbekistan over 40 per cent of dryland rangelands have different levels of degradation. These areas are characterized by lower yields, inefficient livestock management and outdated infrastructure. As a result, livestock production, a key source of income for rural communities, is also at risk.

A new book presents detailed research results on fodder characteristics of Kochiaprostrata (L.) Schrad. Photo by Kristina Toderich.

One way to solve the problem is cultivating plants that are tolerant of salinity, drought and heat. And a new book that has recently come out looks at one such plant: *Kochiaprostrata* (L.) Schrad, also known as prostrate summer cypress. *Kochiaprostrata* is a long-lived, perennial, semi-evergreen, semi-shrub well adapted to the temperate, semiarid and arid regions. The book[1] is a product of more than ten years of research and field trial by scientists from the International Center for Bioslaine Agriculture (ICBA) and the researchers of the Uzbek Institute of Karakul Sheep Husbandry and Desert Ecology. It includes new information obtained by the authors during experimental and laboratory research, including information on yield capacity, reproduction, germplasm evaluation, breeding program, seed morphology and ecology, dormancy and methods of breaking dormancy with stimulating substances and physical treatments. The authors also compiled and generalized all materials on the fodder properties of *Kochia* forage species, including new and unpublished data.

Studies have shown that forage of *Kochia* species is very palatable and nutritious, especially from late summer through winter. The book discusses the potential of using perennial chenopods in pure stands or mixed with other forage shrubs for rehabilitation of degraded rangelands in arid and semiarid zones of Uzbekistan.It also presents detailed research results on fodder characteristics (yield capacity, time and rate of consumption by ruminants and what type of ruminants, period of use under the grazing, value of hay as fodder; chemical composition and nutrition value, response to grazing, aftergrass/aftermath ability, specification for experiments in cultivation) and its previously tested, as well as the genetic structure of different populations and adaptability of *Kochia* species.

Innovative selection programs and various agro-technologies for seed multiplication, establishment of Kochia within natural plant communities and planting *Kochia* in other arid and semiarid ecosystems are also discussed in the book. The book reviews rangeland re-seeding techniques leading to improved productivity of overgrazed and degraded rangelands. It also includes recommendations on appropriate rangeland rehabilitation techniques through use of *Kochia* for local agropastoral communities in different arid and semiarid zones of Uzbekistan, Kazakhstan and Kyrgyzstan.

It is hoped that the book will become a valuable reference for botanists, ecologists, veterinarians and rehabilitation specialists in rethinking the practice of conservation and management of dryland pastures in Uzbekistan. As the book has illustrations, it will also be accessible to practitioners like breeders, pastoralists, planters and farmers. At the same time the book can serve as a manual for teachers and students at high schools in Uzbekistan who might wish to read a course on ecology, botany, forage production and economic estimation of drought-tolerant plants.

1 *Kochiaprostrata* (L.) Schrad - a valuable forage plant for improving the productivity of arid and semi-arid degraded rangelands in Central Asia (in Russian with an English summary). It can be downloaded at: http://www.biosaline.org/pdf/Kochia-Prostrata-Book.pdf

NEW PROJECTS

Beans with benefits

In parts of Uzbekistan and Central Asia, mung bean is a common ingredient in food. There are a number of mung bean dishes as nutritional qualities make it a healthy dietary choice. For agricultural scientists, however, its virtues do not stop there. Mung bean is hailed as a crop which improves soil, needs little water and can increase farmers' profits.

As there is a growing focus on productivity, researchers look for ways to help farmers make the most of their lands and other resources. For example, fertilizers make up a large share of production costs. So the less farmers use fertilizers, the more they save and earn. Mung bean's capacity for nitrogen fixation can help to reduce the amount of fertilizers needed and thus the cost of production. And if used as a catch crop sown after winter wheat harvest, it helps to increase land and water productivity.

In recent years considerable work has been done to introduce and promote new varieties of mung bean in the Fergana Valley under the CGIAR Research Program (CRP) on Dryland Systems. Seeing potential financial gains, a number of seed producers in Andijan and Fergana regions, Uzbekistan, are already producing seed of improved varieties of mung bean (http://cac-program.org/news/detail/446). More and more farmers are also engaged in experiments. On-farm trials help researchers to test technologies in the field and farmers see them work in real conditions. In an experiment in 2014, a group of scientists from the International Water Management Institute (IMWI), ICARDA and AVRDC - The World Vegetable Center, members of the Dryland Systems program and the CGIAR regional consortium, demonstrated how double cropping could improve water use efficiency in the Fergana Valley. Double cropping is an effective way of converting evaporation losses from fallow land into useful crop transpiration. This may result in improved water use efficiency, enhanced food security and increased income for farmers. A farmer, who took part in the experiment, planted mung bean after winter wheat in mid-June and made a net profit of 1,000 USD per ha (http://cac-program.org/news/detail/444).

A new German-funded project in Uzbekistan aims to develop new varieties of mung bean resistant to salinity and heat. Photo by Ravza Mavlyanova.

In collaboration with national partners, AVRDC - The World Vegetable Center has released a number of improved varieties like 'Zilola', 'Marjon', 'Durdona' and 'Turon' to date. However, as salinity and heat are commonplace in the country, more new varieties are needed.

This is the goal of a new project funded by Germany's Federal Ministry for Economic Cooperation and Development and implemented by AVRDC - The World Vegetable Center. Aptly titled "Beans with Benefits", the project will run until March 2018, and aims to integrate improved mungbean as a catch crop into the dryland systems of South and Central Asia to increase smallholder farmers' income and establish more sustainable production systems.

To plan future actions and joint collaboration with national partners, the project team organized a project launch workshop on 6-7 May 2015 in Tashkent, Uzbekistan. The meeting brought together 20 scientists and experts from AVRDC - The World Vegetable Center, research institutes of Uzbekistan, Germany, Pakistan and India, as well as representatives of the German Society for International Cooperation (GIZ).

During the meeting, participants agreed that the main focus of efforts will be on introducing new varieties of mungbean as a catch crop with such traits as short growth period, high yield, resistance to bruchid and mung bean yellow mosaic virus (MYMV), salinity and heat. Overall, the project will help to achieve five major objectives: ensure

better access to mungbean trait diversity from gene banks for breeders; make available improved farmer-preferred mungbean lines with increased resistance to viruses and bruchid pests, and resilience to environmental stresses; develop mungbean production technologies increasing soil fertility and crop productivity in marginal areas and under salinity stress; strengthen the uptake pathway for improved mungbean varieties and technologies; and enhance research and development capacity of project staff and extension personnel and farmers.

As the project targets resource-poor smallholding farms and households, it is hoped that new varieties will be an extra source of income for them. Researchers also plan to involve farmers extensively in variety evaluation and selection and testing new cultivation methods that mitigate land degradation. And forming learning alliances of major stakeholders is expected to contribute to high uptake and sustainability of the project results.

RESEARCH HIGHLIGHTS

How licorice can make salt-affected lands healthier and farmers richer

Salt-induced land degradation is a big problem in Central Asia, a region of mostly arid and semi-arid lands. According to the Asian Development Bank (ADB) and the World Bank, it causes losses of well over 2bn USD a year in the region. ADB estimates that agricultural yields have fallen by 20-30 per cent due to land degradation across the region since independence in the early 1990s. Declining fertility of arable lands makes this problem more pronounced. It is little wonder, then, that reclaiming salt-ridden areas is again top of the research and political agenda. Once undervalued and abandoned, these lands can no longer be a forgotten, neglected asset.

Licorice helps to decrease the groundwater level, reduce soil salinity and improve fertility. For example, trials in CentralKyzylkum, Uzbekistan, have shown that licorice does well in saline conditions and can be highly valuable as livestock feed. Photo by Kristina Toderich.

Restoring salt-affected lands is, however, expensive. And there has not been much certainty about costs and benefits of such effort. But a growing body of research, including a recent study by Qadir et al (https://macsphere.mcmaster.ca/handle/11375/15697), is making out a strong case for action. Their findings show that it can be cost-effective to invest in sustainable land management. Preventing land degradation and restoring degraded lands would lead to less cost than letting land degradation continue. Qadir et al argue that depending on a number of factors, doing nothing may result in losses of up to 69 per cent. And this estimate does not include implications like employment losses, an increase in human and animal health problems, and associated environmental costs as these lands emit more carbon and thus contribute to climate change.

Scientists point out that there are a number of ways to fight soil degradation and salinization, that is, accumulation of water-soluble salts in the soil (http://www.cac-program.org/news/news/detail/410). One is to cultivate plants that help to rehabilitate abandoned salt-affected lands and rangelands in the region. It is an economical solution which would benefit the environment and, above all, rural households and farmers. Studies show that crops like sorghum, pearl millet and licorice do quite well in saline conditions (http://www.cac-program.org/news/news/detail/392). And certain trees and shrubs can be used as biological pumps to lower elevated groundwater levels in waterlogged areas.

Licorice, however, merits special attention for a few reasons. First, there is scientific evidence that it helps to decrease the groundwater level, reduce soil salinity and improve fertility. In a recent study on biological effects of the crop, a team of scientists from the National University of Uzbekistan and the International Water Management Institute (IWMI) found that licorice enriches soil with organic matter, improves its physical and chemical composition, and increases biological activity.

Second, this crop has a long history of use and production in Central Asia. It is reported that the American firm MacAndrews and Forbes set up a plant in Turkmenistan in 1906 and the plant has been in continuous production ever since (https://www.richters.com/show.cgi?page=MagazineRack/Articles/wikileaks_and_licorice.html). Furthermore, there is also considerable research in favour of using licorice in salt-affected lands. In particular in Uzbekistan some of this research dates back to the 1960s. However, recent efforts started in the country in the late

1990s and early 2000s and are more comprehensive. For example, scientists at Gulistan State University, Uzbekistan, carried out a study between 1999 and 2003 in medium- and heavily-saline lands in Bayavut district of Syrdarya Region, where around 90 per cent of the lands are salt-affected to varying degrees. They demonstrated that cotton could be grown again in these areas after five years of licorice cultivation. The success of this study led to an ADB-funded project called 'Bright spots', which ran from 2005 to 2008. The later study was more extensive and also involved researchers from IWMI, a member of the Dryland Systems Research Program and the CGIAR consortium operating in Central Asia and the Caucasus. For the past ten years, IWMI researchers have taken the lead and worked closely with Gulistan State University and the National University of Uzbekistan on an inter-disciplinary initiative on licorice. Of late other members of the CGIAR consortium like the International Food Policy Research Institute (IFPRI), the International Center for Agricultural Research in the Dry Areas (ICARDA), and the Central Asia and the Caucasus Association of Agricultural Research Institutions (CACAARI) have also joined in. As part of the most recent initiative, IWMI scientists have also conducted two separate studies using satellite images to map salt-affected and native licorice-growing areas, analyze the dynamics of salinization in Syrdarya Region and northwestern Karakalpakstan. This data helps to better understand where licorice is and could be grown in Uzbekistan. More than 30 scientists, farmers, policymakers and donors met in Tashkent, Uzbekistan, in December 2014 to present and discuss the results of this multi-year work.

Third, growing global demand may outstrip supply as most of the licorice on the market is currently wild in origin. Licorice extract is used worldwide in medicines, candy, food, alcohol and cosmetics. It is an ingredient in more than 100 drugs. In a recent study IFPRI researchers argue that Uzbekistan, a major exporter in the region, can increase licorice shipments to China, where demand has steadily grown since 2001 and is forecast to continue in next decade due to tightened regulations on domestic supply and incentives on imports (http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/128017). In 2011 China imported 10,659 tons of licorice roots, a 123-per-cent increase on 2010. Of this, about 80 per cent came from Central Asia. Uzbekistan exported 2281.05 tons of licorice roots to China in 2010, accounting for 47.74 per cent of China's total import. In 2012 China imported dried roots worth 9.9m USD from Uzbekistan. Overall, the import of licorice extract from Uzbekistan to China increased 65 times in terms of value, and 30 times in volume between 2007 and 2011. By some estimates, over 70 per cent of licorice grown and processed in Uzbekistan is exported abroad, including Germany, France and South Korea.

Fourth, there is a thriving domestic market for licorice. The number of licorice processing enterprises is growing. According to the Chamber of Commerce and Industry of Uzbekistan, more than 30 companies are involved in licorice production across the country. Two of the largest businesses are Kegeyli-Boyan LLC, based in Kegeyli district, Karakalpakstan, and AgroBioKimyo LLC in Qibray district. More foreign investment is coming in too. In recent years a number of joint ventures have sprung up. For example, the Uzbek-Chinese joint venture Lanextract and the Uzbek-German joint venture Licoroots are working at full capacity in Chimbay district of Karakalpakstan (http://sovminrk.gov.uz/ru/pages/show/1411). Chinese companies like the Chinese Holley Company, Beijing Shizhen Chinese Medicine Technology Ltd, and Xinjiang Zhonglin Bio-tech Ltd have also initiated investment in Uzbekistan for licorice cultivation or processing. In July 2013 an entrepreneur, who cultivates licorice roots in Syrdarya Region, secured investment from the UAE and India to set up a joint venture Syrdarya licorice extract LLC. The plant has the capacity of 3,600 tons per year, which is expected to reach 6,000 tons per year in the near future. Around 70 people work at the plant and 500 ha of abandoned lands are used for licorice production.

There is, however, a downside to this boom. In a study in 2014, supported by CACAARI, IFPRI researchers found that licorice is cultivated in relatively small areas in Uzbekistan. This means that collectors and farmers harvest mostly wild licorice. There are some regulations on harvesting, which are aimed at preventing the depletion of natural licorice reserves and harm to the environment. However, strong demand for the plant brings into question how sustainable and manageable current practices are. There has been a growing interest in cultivation of licorice in Uzbekistan. And the government of Uzbekistan has been keen to support licorice production while protecting the environment. A number of government decrees have been adopted to that effect. For example, the Cabinet of Ministers of Uzbekistan passed a decree in March 2013 on measures to improve and support organizations involved in processing licorice. The decree simplifies the process of obtaining licenses for licorice collection. Now companies and individuals can harvest licorice without obtaining a special license as long as they have contracts with enterprises in Uzbekistan that process and produce the root extract.

But cultivation is not widespread yet as some challenges remain. Scientists believe that lack of knowledge, technologies and, above all, financing put a drag on progress. First, it is necessary to improve seed supply. Seeds are currently collected in the wild. So their quality and quantity often do not meet market needs. Second, licorice farmers need technical support. Collectors lament that they don't know all agro-technologies and lack special harvesting equipment. Everything from choosing suitable land to sowing to harvesting requires good knowledge and skills. Third, financing should be more easily available for licorice cultivation. As it takes at least 2-3 years before

licorice can be harvested, small-scale farmers find it hard to keep putting effort and money into cultivation. Without access to financing, cultivation can hardly expand. Dr Inna Rudenko, a consultant with IWMI, says that farmers have long known about the economic feasibility of cultivating licorice. But they are put off by the fact that profits come only after three years. She thinks that government support in helping farmers to get unsecured and low-interest loans could boost interest in cultivation. Studies show that investments are usually recouped after three years and farmers make profit afterwards.

Growing licorice in salt-affected lands is promising. But it is not a cure-all. And it cannot be a substitute for sustainable land and water management practices. Yet it can serve as an additional interim measure towards effective salinity management in the region. The economic and social benefits of cultivating licorice are substantial. This would create extra employment and income opportunities for rural households, a goal shared by government and international organizations. Licorice is known for its sweet roots. Perhaps these roots one day could make the lives of people in salt-affected lands a little sweeter.

Seeds of hope: improving agricultural seed production in Uzbekistan

Climate change-related problems cause growing concerns about the future of agricultural production in Central Asia. Droughts (http://www.cac-program.org/news/news/detail/444) and outbreaks of diseases like yellow rust (http://www.cac-program.org/news/news/detail/350) undermine prospects of enhancing food security. Livelihoods of rural dwellers are also at stake as they usually make a living from farming. Population growth also adds to this problem.

Considering financial gains, seed producers in Andijan Region, Uzbekistan, are motivated to produce seed of an improved variety of mungbean. Photo by Ravza Mavlyanova.

In recent years national governments, international donor and research-for-development organizations have put considerable efforts into developing solutions for sustainable agricultural production in the region (http://www.cac-program.org/news/news/detail/444). However, scientists argue, a paradigm shift is needed. First, the focus should now be on raising production by increasing productivity. Farmers should learn to grow more with less land, water and other input. Second, crops should be resistant to extreme weather conditions, different diseases and pests. So there is a need for more new varieties adapted to local conditions. Both approaches help to ensure sustainable agricultural production and increased incomes for farmers and rural populations.

Much work has been done to develop and promote improved technologies and varieties of traditional and non-traditional crops by members of the CGIAR Regional Program for Central Asia and the Caucasus. For example, together with national partners, the International Center for Agricultural Research in the Dry Areas (ICARDA) and the International Maize and Wheat Improvement Center (CIMMYT) have developed and released a number of yellow-rust-resistant wheat varieties such as 'Gozgon', 'Yaksart', 'Bunyodkor' and 'Hazrati Bashir' in Uzbekistan, and 'Ormon', 'Alex' and 'Chumon' in Tajikistan. In 2014 a new high-yielding and stress-tolerant winter wheat variety was submitted to the State Variety Testing Commission in Turkmenistan (http://www.cac-program.org/news/detail/438). In partnership with national research institutions, AVRDC - The World Vegetable Center released a total of 42 new varieties of eight vegetable crops, including tomato, sweet and hot pepper, eggplant, vegetable soybean, mungbean, yard-long bean and cabbage between 2007-2014. As a result of a multi-year collaborative study, the International Center for Biosaline Agriculture (ICBA) and local researchers in Uzbekistan released a new high-yielding, early-maturing and stress-tolerant variety of pearl millet called 'Hashaki 1' in 2014 (http://www.cac-program.org/news/news/detail/392).

While research has made progress, adoption in farmers' fields has been slow. Both scientists and farmers point to a shortage of well-organized seed supply systems and rural advisory services as the main reason. Seed multiplication is a big problem. Many farmers say they do not know where to get qualified information on seeds and technologies. For example, most national vegetable seed supply systems in Central Asia are fragmented and limited (http://www.cac-program.org/news/news/detail/432). It is true that strategic crops like wheat and cotton receive considerable government support. In Uzbekistan there is a state-run system of wheat supply. To improve

farmers' access to quality grain seed, the National Center for Seed Production of Grain Crops was established by presidential decree in Uzbekistan in 2014. But seed production of other crops also needs more attention.

The shortage of seed adapted to local conditions and lack of knowledge make farmers turn to imported alternatives. Imported seed is, however, often more expensive. Farmers using such seed face higher financial risks since seed usually accounts for more than half of the production costs. For example, in Uzbekistan many farmers rely on seed potato imports as 95 per cent of the cultivated varieties are of western origin. The imported seed potatoes cost around 2,400 UZS (around 1 USD at the exchange rate) and more per kg in 2012.

To deal with the problem, scientists help to set up seed multiplication plots, show farmers how to produce quality seed for themselves and occasionally hand out seed. For example, during a one-day training course in Tajikistan in October 2014, 12 tons of seed of two improved wheat varieties and one ton of seed of an improved barley variety were given to farmers for multiplication (http://www.cac-program.org/news/news/detail/444). Researchers from the International Potato Center (CIP) started a project in 2012 in Tashkent Region, Uzbekistan, to teach smallholder potato producers a cost-effective method of seed production (http://www.cac-program.org/news/detail/348).

But reaching more farmers requires a new approach. Now the focus is on improving the whole seed production system. Under the CGIAR Research Program (CRP) on Dryland Systems, scientists are working out an integrated systems approach to seed production in two Action Sites, the Aral Sea Region and the Fergana Valley in Uzbekistan. As seed is the most important input and quality seed is vital for improving crop productivity, it is necessary to understand the strengths and limitations of the prevalent seed systems of various crops. Such information will help to develop plans to improve seed systems and eventually farm productivity.

On 31 March 2015 a group of scientists from ICARDA, AVRDC - The World Vegetable Center, ICBA and Bioversity International organized a workshop with farmers to analyze seed systems in Karauzak district, Karakalpakstan, which is part of the Aral Sea Action Site. The purpose was to indentify present seed systems for cereals, legumes, vegetables, fodders and fruits in the district, understand the strengths and limitations in terms of infrastructure and availability of quality seed to farmers and discuss ways to improve seed systems for various crops. Two major problems arose during the discussion with farmers.

First, except for wheat, there are no seed production systems for other crops. For example, many farmers grow rice in the district. But they complained they do not know where to buy rice seed and there is no rice seed production system. Farmers usually produce seed for themselves or buy on the local market. But there is no guarantee of quality and the cost is high. So farmers also urged help from research institutions to set up seed production farms.

Second, except for wheat, farmers do not know where to get information about seed they need. They requested developing training materials and books, and more extensive and practical training. Lack of knowledge considerably reduces farmers' profits. Dr. Zokhid Ziyadullayev, director of the National Center for Seed Production of Grain Crops, said that many wheat seed producers do not know enough about necessary agro-technologies and as a result, their seed output is of low quality and they earn less. Echoing Dr. Ziyadullayev's opinion, one of the farmers said they often fail to recoup costs and repay loans. So they lose interest in seed production. This is why there is an urgent need for institutional support for farmers. And rural advisory services are also needed.

Seed is the single most expensive input in agricultural production. So making high quality seeds easily available can result in substantial gains for farmers and rural populations. This would definitely help to sow the seeds of successful and sustainable agricultural production in Uzbekistan and other Central Asian countries.

Promoting salt- and frost-tolerant wheat varieties in Central Asia

Soil salinity, frost and heat remain the main abiotic stresses to winter wheat production in many parts of Central Asia. They affect yields and farmers' incomes. So much of international research effort in the region is focused on identifying and developing improved winter wheat varieties resistant to these factors. This is also a focus of the CGIAR Research Program Dryland Systems led by the International Center for Agricultural Research in the Dry Areas (ICARDA) in the Aral Sea Action Site. In recent years considerable work has been carried out to this effect.

As a result of collaboration with scientists in Uzbekistan, for example, formal research into winter wheat is well under way at various demonstration sites. Winter wheat accessions are being tested for high yields and resistance to salinity, frost and heat. To date ICARDA scientists and their research partners in Khorezm Region and Karakalpakstan, both in Uzbekistan, have evaluated a large number of improved germplasm of winter wheat for tolerance to salinity, frost and heat. Several new varieties have been identified as a result. And a few are on the way. Most recently, researchers have found two winter wheat lines tolerant of medium-level soil salinity and frost. Researchers now also have solutions for farmers who sometimes fail to grow winter wheat for one reason or another. There are, for

example, new varieties of spring wheat which are fast-maturing and heat-resistant. There are also heat-tolerant chickpea varieties.

To date ICARDA scientists and their research partners in Khorezm Region and Karakalpakstan, both in Uzbekistan, have evaluated a large number of improved germplasm of winter wheat for tolerance to salinity, frost and heat. Photo by Ram Sharma.

While research is making progress, practice in the field still lags behind. Farmers usually lack either knowledge about improved varieties and technologies or do not have access to seeds of the improved varieties. But sometimes they have neither. This means that scientists need to engage more with farmers and train young agronomists who can really help farmers. So scientists are now doing more to promote their research findings among farmers and keep them up to date with best practices. More and more farms are also becoming testing grounds for new technologies and varieties. These farms often serve as examples of the advantages of improved varieties at events like farmers' field days. Researchers also listen more carefully to what farmers want as a growing number of farmers are being involved in evaluation of new varieties.

Engaging farmers in wheat evaluation was also the purpose of two field days in Chimbay District, Karakalpakstan, and Urgench, Khorezm Region of Uzbekistan, on 4 and 7 June 2015 respectively. More than 100 farmers, including women, took part in these events. The field days were particularly productive for two reasons. First, local authorities and senior officials were present. They had a chance to learn first-hand about work being done under the Dryland Systems program. Speaking at the field day in Chimbay District, chairman of the Supreme Assembly of Karakalpakstan Musa Erniyazov noted that new varieties could boost grain production in Karakalpakstan. Furthermore, he said, it was important to increase wheat seed production as a large share of seed comes from other regions, including Andijan. He added that the authorities are keen and ready to support local seed production. He also pointed out that it was necessary to strengthen seed production and capacity-building efforts should be a priority. Second, farmers had a chance to evaluate the performance of new winter wheat varieties for themselves. New varieties they selected during these events would be tested further. Thus, most of the farmers in Urgench, for example, selected the new variety 'Yaksart'.

All this work once again demonstrates how important international collaboration and support are in dealing with wheat production constraints affecting food security in Central Asia. As Dr Ram Sharma, of ICARDA, said: "Cultivation of new varieties will help to increase wheat production in Central Asia as a whole. We hope that all countries can benefit from using new varieties in wheat research and breeding programs."

New wheat varieties help farmers save and earn more in Fergana Valley Action Site

Farmers in Tajikistan and Uzbekistan are making more profits from growing yellow-rust-resistant winter wheat varieties developed through international collaboration and evaluated in farmers' field trials under the CGIAR Research Program 'Dryland Systems' led by the International Center for Agricultural Research in the Dry Areas (ICARDA) and financially supported by a contribution from the Russian Federation.

Stripe rust, also known as yellow rust, a serious wheat disease, is a scourge on wheat production in Central and West Asia. The pathogen has been the most severe disease constraint to winter wheat production for the past 15 years. In a study on global incidence of wheat rusts, Morgounov et al. (2012) reported increased incidence of yellow rust between 2001 and 2010 in Central and West Asia, leading to substantial losses throughout the two regions. Central Asia has seen several outbreaks since 1999. The most recent regional epidemics struck in 2009 and 2010. And Tajikistan and Uzbekistan saw further outbreaks in the spring of 2013, 2014 and 2015. Adding to the problem is the cost of fungicides widely used to control the disease. And changing weather patterns and ineffective monitoring make things worse.

Finding wheat that is both resistant to the pathogen and can bring in good harvests is a daunting task. This has been a focus of winter wheat research programs in Central and West Asia in recent years. For example, under the Dryland Systems program, researchers from ICARDA and its partners continue to work on introducing

more resistant varieties through adaptive farmers' field demonstration trials in the Fergana Valley Action Site in Uzbekistan and Tajikistan. And there are already some positive results. Varieties like 'Bunyodkor', 'Gozgon' and 'Yaksart' in Uzbekistan and 'Chumon', 'Alex' and 'Ormon' in Tajikistan, which fared very well during the outbreaks in 2013, 2014 and 2015, have shown promising results in farmers' fields. They yielded up to 8 tons per ha, which was 15 to 25% more than the local wheat varieties. Seed multiplication of these varieties is well under way in Tajikistan and Uzbekistan.

Farmers in Tajikistan and Uzbekistan are making more profits from growing yellow-rust-resistant winter wheat varieties developed through international collaboration. Photo by Ram Sharma.

Scientists from ICARDA and their national research partners now focus more on promoting these varieties among farmers and improving farmers' knowledge and skills through training events and field days. During two field days in Sughd Region, Tajikistan, and Quva District of Fergana Province, Uzbekistan, on 6 and 9 June 2015 respectively, more than 60 farmers, including women, visited fields cultivated with new varieties and learnt how they can benefit from growing them. First, some farmers in Sughd Region reported that by growing yellow-rust-resistant varieties they managed to save around 100-120 USD per ha on fungicides (a saving of some 25% on production costs). By not using fungicides farmers can also reduce environmental impact and health hazards as not all farmers are well versed in how to apply chemicals. Second, despite an outbreak of yellow rust in some areas, new varieties were unscathed. What is more, farmers were expecting to get high yields. In Quva District, forecasted yields were as much as 7-8 tons per ha.

These results show great promise as the cultivation of the new, better adapted varieties can significantly increase wheat growers' incomes. More importantly, these varieties will help to remove the need for costly fungicides and protect the environment. The more farmers grow these new varieties, the higher their contributions would be to food security, environmental safety and improved living standards in rural areas in the region.

MEETINGS, SEMINARS AND CONFERENCES

Bracing for climate change in Central Asia

Impact of climate change is not a distant prospect in Central Asia, a region of mostly arid and semi-arid lands. Some countries already report that weather variability causes damage to agriculture. Agricultural production is at risk particularly from sporadic droughts and water shortages. According to FAO, extended dry weather conditions in the northern parts of Kyrgyzstan in 2014 affected wheat production and raised serious concerns over the country's food supply (http://www.fao.org/WAICENT/faoinfo/economic/giews/english/shortnews/KYR08082014.pdf). However, Kyrgyzstan suffered from similar droughts in 2008 and 2012 when wheat yields fell to 1.94 and 1.68 tons per hectare respectively.

As the Central Asian countries share not only borders and climatic conditions, but also concerns and constraints, they appreciate the need for closer cooperation in tackling challenges linked to climate change. Successful approaches and strategies in one country could also work in another. So the countries are expanding collaboration between themselves and with international research and development organizations on issues ranging from water use efficiency to knowledge sharing on sustainable land management practices. They are working to align national strategies with regional priorities. Reinforcing regional synergies in addressing climate change would create extra value and benefit all countries.

Water management, for example, is one important area where greater collaboration is needed. A reduction in water availability is predicted to occur along with an increasing demand for irrigation water of about 30 per cent in a 4 C warmer world. The region is likely to experience more intense warming than the global average: in a 4 C warmer world, the mean annual temperature over Central Asia could be by 3 C higher than the global mean. Combined with increased heat extremes that negatively affect crop productivity, substantial risks for irrigated and rainfed agricultural systems can be expected (http://documents.worldbank.org/curated/en/2014/11/20404287/turn-down-heat-confronting-new-climate-normal-vol-2-2-main-report). In May 2014, the World Bank convened the

2nd Central Asia Climate Knowledge Forum in Almaty, Kazakhstan. It concluded with a call from all five Central Asian countries for a regional program on climate resilience to strengthen climate-smart information, institutions and capacity for multi-sector and cross-country planning, investment preparation and implementation, so as to increase regional collaboration in the long term.

In July 2014, around 185 policymakers and researchers from the Central Asian countries, as well as representatives from international organizations and Mongolia, gathered in Dushanbe, Tajikistan, for the Central Asian Sub-regional Conference in the run-up to the 7th World Water Forum scheduled for 2015 in South Korea. During the two-day event, they worked to formulate and agree on a sub-regional agenda on water (http://www.cawater-info.net/7wwf/subregional-conference_e.htm).

Adoption of technologies like raised-bed planting is one way to tackle challenges associated with climate change. Raised-bed planting helps to save water and increase yields. Some farmers in Uzbekistan, for example, already use this technology to grow soya bean. Photo by Aziz Nurbekov.

Knowledge transfer is another priority. And events like the policy stakeholders conference on 'European Union - Central Asia science technology & innovation cooperation in addressing climate change', held in Bishkek, Kyrgyzstan, in September 2014, serve as effective platforms for promoting best practices and latest innovations (http://inco-ca.net/en/261.php). More than 145 policymakers, international donors and researchers from the European Union and Central Asia exchanged views on regional and international science, technology and innovation policies, research programs and projects addressing climate change. The conference was aimed at increasing synergies among these stakeholders and helping to shape future collaborative initiatives addressing climate change between the EU and Central Asian countries.

In 2014 the World Bank designed a regional 'Climate Change Adaptation and Mitigation Program for Central Asia (CAMP4CA)'. To identify synergies with climate-related activities supported by the development community in Central Asia, a round-table consultation was held in Almaty in February 2015. Representatives from the development community, including the CGIAR Regional Program for Central Asia and the Caucasus, provided feedback on 'Regional Climate Knowledge Services' and 'Regional Climate Investment Facility', the two key components of the new initiative. CAMP4CA aims to enhance regional coordination and access to improved climate change knowledge services for key stakeholders, and support the integrated development of climate-smart investments and capacity building for climate vulnerable communities in the Central Asian countries.

Improving knowledge management and capacity building in the region has been the focus of efforts by a knowledge-sharing project under the Central Asian Countries Initiative for Land Management (CACILM) since 2013 (http://cacilm.org/). To streamline the use and creation of knowledge on sustainable land management (SLM) in Central Asia and, most importantly, to link research in the lab with action in the field, scientists from the CGIAR Regional Program closely cooperate with local research counterparts, policymakers and farmers. They work together to enhance knowledge on SLM practices in the region, and tailor this knowledge to the needs of local populations and authorities for practical use and the shaping of better informed policies. For the past two years, the CACILM project has been gathering and synthesizing knowledge in the region and promoting best practices through workshops, training sessions and field days for farmers and scientists. As a result, technologies like raised-bed planting and no-till are attracting more and more attention from farmers. For example, during a field day in June 2014, farmers in Kyrgyzstan learnt about how raised-bed planting could help them save and earn more. It is a proven farming practice that offers the promise of water savings and increased yields. During another field day in July 2014, no-till technology was shown to farmers in Kashkadarya Region, Uzbekistan (https://www.youtube.com/watch?v=rpjTQ5j3i_k). Farmers saw no-till technology at work and learnt how they would benefit from using it in rainfed areas. This project is funded by the International Fund for Agricultural Development (IFAD) and coordinated by the International Center for Agricultural Research in the Dry Areas (ICARDA), a member of the CGIAR Regional Program and the lead center for the Dryland Systems program.

More and more farmers are also engaged in experiments. On-farm trials help researchers to test technologies in the field and farmers see them work in real conditions. In an experiment in 2014, a group of scientists from the International Water Management Institute (IMWI) and AVRDC - The World Vegetable Center, two members of the

Dryland Systems program and the CGIAR Regional Program, demonstrated how double cropping could improve water use efficiency in the Fergana Valley. Double cropping is an effective way of converting evaporation losses from fallow land into useful crop transpiration. This may result in improved water use efficiency, enhanced food security and increased income for farmers. A farmer, who took part in the experiment, planted mung bean after winter wheat in mid-June and made a net profit of 1,000 USD per ha. In another experiment, a team of researchers from ICARDA, the US Department of Agriculture and the Scientific-Information Center of the Interstate Coordination Water Commission of Central Asia (SIC-ICWC) found that using evapotranspiration-based (ET) irrigation scheduling to grow cotton in the Fergana Valley also helps to improve water use efficiency (http://www.cac-program.org/download/file/152). The ET-based irrigation scheduling method has potential for replacing subjective daily water management decisions and thus improving water use efficiency while reducing salinity and waterlogging.

The centers' researchers also help to enhance skills and knowledge of farmers and young scientists in the region. For example, during a one-day training course in Tajikistan in October 2014, 75 local farmers, seed producers, water users and researchers learnt about the principles of quality wheat seed production and how improved, stress-tolerant crop varieties could contribute to food security. What is more, farmers were given 12 tons of seed of two improved wheat varieties and one ton of seed of an improved barley variety for seed multiplication. Under the Dryland Systems program, scientists also exchange knowledge and experience with local counterparts. In September 2014, a team from ICARDA, AVRDC and the International Potato Center CIP organized a training course on scientific management of field experiments in Tashkent, Uzbekistan, for around 22 young scientists from national research institutions in Uzbekistan. The course focused on the principles and practices in designing, managing and data collection of field crop experiments. Another training course on statistical design and data analysis of field experiments, organized by ICARDA in Tashkent in December 2014, brought together 12 young scientists from Uzbekistan, Azerbaijan and Georgia. The young scientists were briefed on statistical concepts and methodologies for designing field experiments and biometrical techniques applied in agricultural research.

All this work is aimed at preparing, above all, researchers, farmers and rural populations for the anticipated consequences of climate change. But taking action in the field in one country is not enough. Regional collaboration is needed. Joint initiatives on knowledge transfer would benefit all countries. Farmers are often enthusiastic learners. With a little government support, they could become early adopters of best practices and improved technologies.

Central Asian countries promote use of knowledge on sustainable land management

In recent years efforts to combat land degradation in Central Asia have received a new impetus. More and more is also being done to address climate change-related problems in the region. For the past two years, the five Central Asian countries have been working together under a project to streamline the use and creation of knowledge on sustainable land management (SLM). This initiative aims to improve knowledge on SLM practices in the region, and tailor this knowledge to the needs of local populations and authorities for practical use and the shaping of better informed policies.

Partners of the Knowledge Management Project of the Central Asian Countries Initiative for Land Management (CACILM, Phase II) convened for an annual planning meeting in Almaty, Kazakhstan, on 17-18 March 2015 to review the achievements and constraints of the project's second year and to plan activities for the third year (http://cacilm.org/). The three-year project, implemented by the International Center for Agricultural Research in the Dry Areas (ICARDA) and supported by the International Fund for Agricultural Development (IFAD) since February 2013, aims to establish a platform to consolidate knowledge and promote sustainable land management approaches and technologies that have often been already devised by researchers in Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. More than 55 participants from government organizations, research institutes, NGOs, regional and international organizations, as well as farmers, met to discuss progress so far and what needs to be done yet.

The Knowledge Management Project of the Central Asian Countries Initiative for Land Management (CACILM) is promoting conservation agriculture technologies like raised-bed planting among wheat growers. Raised-bed planting helps to save water and increase yields. Photo by Aziz Nurbekov.

"Farmers in the region face similar problems related to growing land degradation and climate change. The CACILM Knowledge Management Project aims to raise the awareness of farmers and other land users, as well as officials, about the new technologies and traditional methods that help to increase productivity and reduce costs in agriculture," Dr Akmal Akramkhanov, coordinator of the project, said. To date the project has gathered and systematized tens of SLM practices applicable to the four main agro-ecosystems of the region: rainfed, irrigated, mountains and rangelands. Most of them have been tested at demonstration sites in each of the five countries, he added.

"Degradation of lands because of their overuse, irrational use of water resources and overgrazing seriously affect crop productivity and people's well-being," Dr Jozef Turok, ICARDA's regional coordinator for Central Asia and the Caucasus, said. "The Knowledge Management Project will help to solve these challenges by uniting technologies and best practices in sustainable land management, and promoting conservation agriculture among farmers and decision-makers," he continued (http://kaztv.kaztrk.kz/kz/view/society/page_66857_almatyda-zher-resurstaryn-tiimdi-paidalanu-maksatynda).

Among these practices are zero and minimum tillage, raised-bed planting, use of improved crop varieties and intercropping practices, water-saving technologies, non-traditional fertilizers, rotational grazing in desert regions, agro-forestry melioration for rehabilitation of degraded irrigated lands and others.

"At present, 75 per cent of the land in Kazakhstan is prone to degradation and secondary desertification. A total of 44 per cent of our territory is dryland areas with minimum precipitation. Therefore, without the application of new technologies, it is difficult to obtain a high yield," Professor Abdulla Saparov, Director-General of the Kazakh Research Institute of Soil Science and Agrochemistry, said. He also said that promotion and implementation of new technologies contributes to maintaining soil fertility and increasing crop yields, which will improve farmers' incomes and living conditions in rural areas as a result.

As a partnership between the Central Asian countries, international donor and research-for-development organizations, this project underlines how collaboration can make a difference. The initiative also supports the region in implementing the UN Convention to Combat Desertification (http://www.unccd.int/en/Pages/default.aspx). The ultimate goal is, however, to ensure that there is more food without much cost to the environment and rural populations.

Knowledge sharing through traveling seminar in Azerbaijan and Georgia

Every two years, International Winter Wheat Improvement Program (IWWIP) conducts a traveling seminar to evaluate germplasm, assess current practices and relations, and develop an improved plan for the future. IWWIP is a joint program between Government of Turkey, CIMMYT and ICARDA, that serves the winter wheat breeding programs globally though main target is the Central and West Asia and North Africa region.

This year the traveling seminar was held in Azerbaijan and Georgia in the last week of May. There were more than 50 participants from Azerbaijan, Georgia, Iran, Kazakhstan, Kyrgyzstan, Lithuania, Russia, Turkey, Ukraine and Uzbekistan. Speaking at the opening meeting on the first day, the Deputy Minister of Agriculture of Azerbaijan said: "IWWIP provides not only invaluable germplasm to Azerbaijan breeding programs but also serves as an avenue for the young researchers of the world."

Researchers from a number of countries visited experimental sites and research institutions in Azerbaijan during the traveling seminar. At this site, for example, wheat is cultivated using bed planting. Photo by Aziz Nurbekov.

After the meeting, the seminar participants visited the Azeri Research Institute of Farming and Genetic Resources Institute of National Academy of Sciences. Germplasm development by using wild and different species of cereals captured the attention of many participants, who expressed their interest in cooperating with the researchers in the institute for novel germplasm development. Material at the dryland sub-station of Azeri Research Institute of Farming was evaluated. Participants also visited and evaluated the material at Terter Agricultural Research Station, mainly for irrigated wheat. High yield potential of cultivars in the station was a key highlight.

From there, the group traveled to Georgia and visited Georgian National Research Center and Lamtogora Farm, which is the main seed producing company in Georgia.

The company closely cooperates with IWWIP in the release and promotion of the IWWIP originated cultivars that cover big acreage in Georgia. It has established big seed production farms and seed processing units that serve the Georgian farmers.

A key recommendation that emerged from the participants on the last day was that pre-breeding activities should be done in IWWIP that would create germplasm with novel genes to increase the yield, and biotic and abiotic stress tolerance. The participants appreciated the high level and well-handled trials in the institutes and their interactions with young and motivated new generation researchers.

IWWIP commended the contributions and support of the following for the success of this year's traveling seminar: the Ministry of Food, Agriculture and Livestock of Turkey, CGIAR Research Program on Wheat, Azeri Research Institute of Farming (Azerbaijan), Agrarian Center of the Ministry of Agriculture (Azerbaijan), Genetic Resources Institute (Azerbaijan), Lomtagora Farm (Georgia), and Georgian National Research Center (Georgia). Kazakhstan has offered to hold the next traveling seminar in 2017.

CAPACITY BUILDING

International cooperation spurs reforms of rural advisory services in Azerbaijan, Tajikistan

In recent years agricultural science has steadily advanced in Central Asia and the Caucasus (CAC). Supported by international research centers working as the CGIAR Regional Program for Sustainable Agricultural Development in the region, national research institutes have developed and introduced a large number of improved varieties of crops and technologies. Today science, and especially multi-disciplinary research, has a lot to offer to farmers.

Yet innovations take considerable time to reach a large number of farmers and other land users. As a result, the uptake of technologies and practices has been slow. There are, of course, knowledge-sharing and capacity-building efforts within bigger agricultural development initiatives. But their reach and scope is often limited by a sector, crop or geographic area. Strong government support is available for cotton and wheat in some countries.

This means a sustainable system is needed to reach out to farmers. And this is the function of extension and advisory services or EAS for short, which play a significant role in agricultural development for food and nutrition security. EAS contribute to agricultural innovation by developing networks, organizing producers, facilitating access to credit, inputs and output services, promoting gender equality, facilitating knowledge management, supporting adaptation to climate change and disseminating new knowledge through training and demonstrations to farmers.

Rural advisory services will help to promote technologies like bed planting in Azerbaijan. Photo by Aziz Nurbekov.

In CAC, however, linkages between research and farming are limited and fragmented, and EAS are still nascent. What is more, there is usually no legislation governing rural advisory services. The problem gets some episodic attention from donors and international organizations. With this aid, a few non-governmental centers and enterprises on EAS have been set up to date, specifically in Kyrgyzstan and Tajikistan. But EAS lack a systematic approach in most countries of the region. The unsystematic level of interaction undermines the ability of farmers to access and introduce innovative technologies and practices on their farms, and thus deprives them of innovation-based opportunities to improve their productivity, profitability and livelihoods. This is why the Central Asia and the Caucasus Association of Agricultural Research Institutes (CACAARI) and the Central Asia and the Caucasus Forum for Rural Advisory Services (CAC-FRAS), an informal regional platform of the Global Forum for Rural Advisory Services (GFRAS), have joined efforts and taken joint actions towards strengthening rural advisory services in the region. This work pursues the shared goals of learning from each other, developing common approaches, and coordinating efforts to strengthen agricultural innovation systems.

In 2014 an alliance of the International Food Policy Research Institute (IFPRI), Modernizing Extension and Advisory Services (MEAS), CACAARI, GFRAS, and GFAR initiated assessments of the current status, challenges and

opportunities of the EAS systems in all eight countries. The objectives were to better understand the different models of delivery and financing systems across the agricultural production systems, to provide an assessment of what are the factors leading to successes or failures of various approaches, and to draw recommendations for strengthening EAS systems and adopting policies that enable effective EAS implementation. Based on the results of these assessments, national consultations were held in November and December 2014.

These results were also presented by eight countries at a regional conference in Bishkek, Kyrgyzstan. In collaboration with the GFAR, MEAS, the International Center for Agricultural Research in the Dry Areas (ICARDA), IFPRI and other partners, CACAARI and CAC-FRAS convened a joint Regional Conference on Rural Advisory Services between 17 and 21 November 2014. The conference brought together more than 100 agricultural scientists and practitioners, representatives of ministries, government and non-governmental organizations. It helped to develop a common approach to the planning of joint activities aimed at the development of EAS, current and expected problems caused by the impact of climate change on agro-ecosystems, the establishment and improvement of institutional mechanisms for the exchange of experience and knowledge. More importantly, the conference laid the groundwork for inclusive multi-stakeholder policy dialogue (http://cac-program.org/news/detail/436).

The ongoing dialogue and collaboration has recently contributed to positive new developments in Azerbaijan and Tajikistan. For example, Agriculture Minister of Tajikistan QosimRohbar issued a decree on 15 December 2014 to establish an extension and advisory services center to coordinate all rural advisory services in the country. In Azerbaijan the government launched reforms to support rural advisory services. On 17 April 2015 President of Azerbaijan IlhamAliyev signed a decree on improving facilities and resources of research institutions under the Ministry of Agriculture of Azerbaijan (http://ru.president.az/articles/14865). Under the presidential decree, 10m Azerbaijani manats (around 9.5m USD) will be allocated to the Ministry of Agriculture from the Reserve Fund of the President of Azerbaijan for reconstruction and equipment.

Moreover, the Cabinet of Ministers of Azerbaijan also issued a decree on 17 April 2015 on improving the structure of the Agrarian Scientific Center and affiliated research institutes. Among other changes, the decree stipulates renaming the Agrarian Scientific Center “the Center of Agrarian Science, Information and Advisory Services of the Ministry of Agriculture”.

This progress is a result of several years of collaboration between national research institutions and policymakers, often supported by international research and development organizations and networks. It also shows how important government support is to make things happen. It is hopedthat other countries will follow suit and the EAS systems in the region will receive a renewed impetus. After all, to make agricultural production sustainable, it is necessary to make its key element, that is rural extension and advisory services, sustainable too.

Helping to ensure food and nutrition security in southern Tajikistan

The International Potato Center (CIP), a member of the CGIAR Regional Program for Central Asia and the Caucasus, is implementing a USAID-funded project in southern Tajikistan to help smallholder potato growers increase their profits and ensure rural children have more nutritious food.

Under the US government’s Feed the Future Initiative, the two-year Potato Production Support and Research Project to Improve Food Security in Khatlon aims to enhance the welfare of smallholder potato farmers through increased income and food security, and addresses childhood stunting, food insecurity and undernutrition. The project will help to deal with two major problems at the same time.

First, unfavourable climatic conditions in the region, in particular heat, make it difficult to cultivate potato and get high yields. So making improved heat-tolerant and high-yielding potato varieties available to farmers can boost their income.

Second, according to the USAID, nearly 30 per cent of children under five exhibit stunted growth in Khatlon Region. It is reported that iron deficiency anaemia has harmful effects on early childhood development in the region. So, being an important staple food, improved potato varieties fortified with iron and zinc can serve as a vital source of micronutrients and calories for children and women.

In collaboration with the Institute of Horticulture and Vegetables, the Institute of Botany and Plant Physiology and Genetics under the Tajik Academy of Agricultural Sciences, CIP researchers have been working with smallholder farmers since 2013 to improve yields of potato, including early season varieties that may be sold for high profit. The team has also been studying how to increase the amount of iron and zinc in potato. This work is carried out at 10 demonstration plots in four districts.

Through training courses and field days, the project team has also improved the knowledge and skills of many

farmers in the region. For example, 284 participants, including 140 women, attended 10 training courses and field days on late autumn and early spring potato cultivation under plastic mulching and on positive selection methods between 27 March and 11 May 2015.

These efforts have already produced positive results. To see progress made so far, on 13 May 2015 US Ambassador to UN Agencies for Food and Agriculture in Rome, Mr David Lane, visited one of the USAID-CIP potato demonstration plots in the Chorbogh village and met farmers. Ambassador Lane was in Tajikistan to observe how the United States and the UN Food and Agriculture Agencies collaborate to support rural households, farmers, businesses, and government officials to improve food security and nutrition and promote agricultural development in Tajikistan (https://www.facebook.com/media/set/?set=a.10153292803304555.1073741897.201163534554&type=1).

A USAID-funded project is helping smallholder potato growers in southern Tajikistan to earn an additional income of around 6,800 USD per ha. Photo by Timur Abdurakhmanov.

A combination of early-maturing and stress-tolerant varieties along with appropriate crop management allows farmers to intercrop potatoes with wheat and cotton to intensify land use and earn a higher income. Through mapping and value chain creation, the project is supporting resource-poor farmers to exploit an additional high value crop and gain additional income of approximately 6,800 USD per ha as soon as the second growing season. Smallholder farmers can earn an additional 100 to 120 USD on 181 sq. m. over 90 days. ZaynuraKarimova, a farmer from Qumsangir District, planted CIP potatoes in 2014 and is happy with the results. She said: "New potato varieties provided by CIP are four times more productive and much tastier in comparison with local varieties. My children eat this potato with pleasure. I already can provide my family with seed potato for the summer growing season from the first harvest. It was a big challenge in the past, because seed potatoes for the second growing season are not readily available."

It is hoped that these efforts will help to improve rural livelihoods in Khatlon Region and nutrition for families. And these results will be replicated in other regions of Tajikistan too.

Promoting conservation agriculture in Central Asia

Low soil fertility remains a key problem in parts of Uzbekistan and elsewhere in Central Asia. In such areas, lack of soil nutrients and water often results in low crop production. These problems directly affect the livelihoods of many farmers. Burning crop residues and ploughing also contribute to soil degradation as they reduce the organic matter of soil and destroy soil structure.

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 Uzbekistan.

Research-for-development and donor organizations reckon that promoting CA more will contribute to resolving land degradation problems in the region. For example, the International Center for Agricultural Research in the Dry Areas (ICARDA) is stepping up efforts to encourage a wider uptake of CA technologies.

Conservation agriculture practices like raised-bed planting helps to save water and increase yields. Photo by Aziz Nurbekov

Under this initiative, scientists organize training seminars and field days for local researchers and farmers. The most recent events took place in Karakalpakstan in June 2015.

The first training course focused on crop rotation and no-till technology. During the event in Karauzyak district on 11-12 June 2015, farmers were introduced to the

concept of crop rotation under no-till practices and the technical aspects of double cropping as well as participatory research and extension methodology. Dr Aziz Nurbekov, of ICARDA, and MrBakhitbayAybergenov, of the Karakalpak Research Institute of Crop Husbandry, briefed participants on the status of conservation agriculture in Uzbekistan. Participants also visited demonstration fields in the district where sunflower, sorghum, mungbean, corn, field pea, pearl millet and sesame were planted with no-till drill. Another training event was conducted on 30 June 2015 at a demonstration site in the district. The event brought together around 48 farmers, researchers and local authorities. This time participants learnt how to install and calibrate no-till drill to plant mungbean as a second crop after winter wheat harvest.

All this work is aimed at preparing, above all, researchers, farmers and rural populations for the anticipated consequences of climate change. Experience shows that farmers are enthusiastic learners. With a little support, they could become early adopters of best practices and improved technologies of conservation agriculture.

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