CGIAR PROGRAM
FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT
IN CENTRAL ASIA AND THE CAUCASUS

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Program Facilitation Unit
Tashkent, Uzbekistan

CONTENTS

ABBREVIATIONS

ACIAR	Australian Center for International Agricultural Research
APAARI	Asia-Pacific Association of Agricultural Research Institutions
ARD	Agricultural Research for Development
ARI	Advanced Research Institute
AVRDC	The World Vegetable Center
CA	Conservation Agriculture
CAC	Central Asia and the Caucasus
CACAARI	Central Asia and the Caucasus Association of Agricultural Research Institutions
CATCN-PGR	Central Asian and Trans-Caucasian Network for Plant Genetic Resources
CCER	Consortium Commissioned External Review
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo
CIP	International Potato Center
GFAR	Global Forum for Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
MTP	Medium Term Plan
NARS	National Agricultural Research System
PFU	Program Facilitation Unit
PGR	Plant Genetic Resources
PGRFA	Plant Genetic Resources for Food and Agriculture
PSC	Program Steering Committee
RCT	Resource Conserving Technology
SVTC	State Variety Testing Commission
SWEP	System-Wide Eco-regional Program
TAC	Technical Advisory Committee
TRRC	Temperate Rice Research Consortium
USDA	United States Department of Agriculture
UNEP-GEF	United Nations Environment Program-Global Environment Facility
WUA	Water Users Association
ZEF	Center for Development Research, University of Bonn, Germany

INTRODUCTION

The CGIAR Consortium for Sustainable Agricultural Development in Central Asia and the Caucasus marks a historic milestone in 2008. Initiated in September 1998, the Program has been steadfastly serving the region ever since, to achieve the goal of increased productivity through generation and transfer of sustainable agricultural production technologies, while ensuring protection of natural resources.

Initially comprised of nine CG Centers - CIMMYT, CIP, ICARDA, ICRISAT, IFPRI, ILRI, Bioversity International (former IPGRI), former ISNAR, and IWMI - and the eight National Agricultural Research Systems (NARS) of Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan, the Program has expanded over these ten years to also include International Rice Research Institute (IRRI)[1], and three other Advanced Research Institutions (ARIs) – AVRDC - The World Vegetable Center, the International Center for Biosaline Agriculture (ICBA) and Michigan State University (MSU). ICARDA is the Convening Center of the Program.

The Program Facilitation Unit (CAC-PFU), also established in Tashkent, Uzbekistan, in 1998, provides support to the research and capacity building activities of the Consortium partners. A sub-regional office of PFU was established in 2007 in Tbilisi, Georgia, to further enhance the collaborative activities of the Program partners in the Caucasus.

The region of Central Asia and the Caucasus is huge – covering - and very diverse in agro-ecologies and production systems. Even though the countries are now moving into different directions of overall and policy development, the fundamental issues of sustainable agricultural development remain common for all countries of the region, thus necessitating a double-pronged approach - regional perspective for common strategic issues, and country-distinctive action plans for implementation at national levels.

Moreover, since the research problems are inter-related, developing solutions needs a research program that integrates genetic and natural resource management for crops and livestock with economic assessments and the necessary 'supportive' policies. During the last ten years, the CAC Program has achieved considerable progress in three areas of research and development activities, namely conservation of genetic resources, germplasm enhancement and crop diversification, and efficient soil and water management, and in one more supportive area of activities, the strengthening of the NARS.

During the reporting period, between June 2007 and June 2008, work in these areas has continued and was vigorously re-enforced by all the partners of the Program. In addition, promising results were achieved in two other research areas, socioeconomic and policy research (SEPR), and livestock and fodder production.

[1] In April, 2007, IRRI has, however, officially informed of its withdrawal from the CAC Consortium and of its intention to re-direct its future collaboration with the CAC Program through the Temperate Rice Research Consortium (TRRC).

To assess the results and impact of the Program in the region since its inception, an External Review of the Program was conducted in 2008 by a Panel consisting of three eminent international scientists: Dr. Elias Fereres (Chairman), Dr. Gurdev Khush, and Dr. Mohammad Roozitalab. The conclusions and recommendations of the Review Panel will be presented during the 11th Steering Committee Meeting in Astana, Kazakhstan.

Dr. Raj Paroda, former Head of PFU and Regional Coordinator (RC) of ICARDA in CAC, completed his mission in Tashkent office in March, 2007. During the interim period between April, 2007 and December, 2007, first Dr. Surendra Beniwal and then Dr. Raj Gupta were acting Heads in both positions. Starting from late December, 2007, Dr. Christopher Martius joined as the new Head of PFU, and Regional Coordinator of the ICARDA-CAC Program.

This report highlights, in brief, major activities undertaken by the Consortium partners during the period of June 2007-June 2008.

CONSERVATION OF PLANT GENETIC RESOURCES

The CAC region is extremely rich in plant genetic resources (PGR), representing a very rich genetic diversity of crops with many landraces and their wild relatives. In all, more than 8,100 plant species are recorded in the region, of which 890 are endemic. The region is the center of origin of many economically important crop species. The region is also blessed with one of the world's best collections of fruits, nuts, and melons. Due to financial constraints and breaking of links with the Vavilov Research Institute, the leading Russian institution on PGR, the activities on collection, conservation and documentation in the region had been considerably slowed down. Fully conscious of the critical importance of conservation of plant genetic resources in the region, the CAC program partners were able to make a significant contribution to this effort since 1998. In total, 18 collection missions were organized and several thousand valuable accessions were collected. All countries of the region have now functional gene banks. The CAC-PGR Network was established, and eight PGR groups are functioning. The Regional PGR strategy was developed and approved by NARS partners. The documentation of *ex situ and in situ* collections of plant genetic resources is being continued.

In 2007, two ICARDA-led projects on "Genetic Resource Conservation, Documentation and Utilization in Central Asia and the Caucasus" (funded by ACIAR), and "PGR Information Network in CAC" (funded by GTCD) were successfully completed. These two projects allowed strengthening the capacities of national programs in conservation, documentation and utilization of plant genetic resources. They also helped to develop gene bank storage facilities in the CAC countries. Out of the total of almost 230,000 *ex situ* accessions stored in the collections of 86 institutes in all the eight countries of the CAC region, by now more than 50% have been inventoried in the databases. After the end of the project, the work on the documentation is being continued by the national partners themselves.

In 2007-2008, ICARDA provided several highly needed gene bank equipments to NARS partners in Krasniy Vodopad research station and Research Center of Farming and Plant Industry (Kazakhstan), Research Institute of Plant Industry (Uzbekistan). They included eleven deep freezers for conservation of seed, two air-conditioners, and thermostat controls for seed germination.

ICARDA has also continued its efforts on assisting the NARS partners in developing national PGR strategies. In the last quarter of 2007, the project on "Implementation of National Studies for Georgia and Armenia on Elements of a National Integrated Strategy for Plant Genetic Resources Management and Use: organization of Multi-stakeholder workshops and Policy Dialogue meetings" was started with funds and participation of FAO. This project has been successful on conducting two national studies on national integrated PGR strategy in Armenia and Georgia. The results of the studies were discussed and endorsed during the multi-stakeholder and policy dialogue workshops organized in both countries. In addition, based on the preliminary study results, outlines for proposals on "Capacity Building for a National Integrated System of Use and Management of PGR" in Armenia and Georgia were designed.

Bioversity International is currently conducting seven projects on various aspects of PGR in the region, with the total funding amount of projects worth 7.1 mln USD.

Under the project on "In situ Conservation of Crop Wild Relatives (CWR) through enhanced information management and field application in Uzbekistan" (funded by UNEP-GEF), a national information system on crop wild relatives was developed in Uzbekistan. The database now contains 855 records on seven crops. Flora of Uzbekistan were analyzed and species pertaining to 94 types of 25 plant families of crop wild relatives were identified. Many of them are at risk of loss. Six expeditions were mounted to survey priority taxa and identify their coordinates. It was found that areas of some species are shrinking, abiotic and anthropogenic factors are having a strong negative impact on them leading to the loss, area decrease and genetic erosion. Recommendations from the project were suggested into the "Forest Code" of Uzbekistan.

Under the project on "In situ/on farm Conservation and Use of Agro-biodiversity (horticultural crops and wild fruit species) in Central Asia" (UNEP-GEF), field assessments of distribution and *in situ*/on farm diversity level of target fruit crops and their wild relatives was conducted. Genetic Resources Information System developed by Bioversity International is being used to document and manage the collected information on diversity and distribution of target crops as well as on traditional knowledge on their maintenance. A web portal (http://forum2.bioversity.cgiar.org/cwana/c.asia) was developed for effective information exchange among partners and project implementation units.

The other Bioversity projects in the region have also been successfully implemented in 2007. They have provided much needed training programs on participatory tools for diversity assessment of horticultural crops and their wild relatives, socio-economic assessment methods, data management, and others.

GERMPLASM ENHANCEMENT

The CAC region faced equally daunting challenges in breeding of new crop varieties after the collapse of the former Soviet Union. Key issues in germplasm enhancement in the region were lack of new breeding material since 1991, lack of seed of new varieties and lack of salinity resistant varieties. In addition, the widely used varieties of winter wheat were mostly Russian varieties susceptible to Yellow Rust. Germplasm enhancement on diversified crops was quite limited due to cotton and wheat mono-cropping practices.

Therefore, research activities on germplasm enhancement have focused on testing and identifying most promising breeding materials with resistance to both biotic and abiotic stresses. Under this collaborative program, 37 new promising varieties of winter wheat, triticale, barley, chickpea, lentil, lathyrus, soybean, mungbean and groundnut have been released in the region. These varieties have recorded consistently higher yield with superior quality and disease resistance over the local checks. Some of them are now covering large areas and getting popular with the farmers.

The reporting period has been extremely rewarding for the Program's efforts on germplasm enhancement. In total, 16 new varieties developed by the Program were released in the region during the period of 2007-2008. Crop-wise distribution of these varieties released in 2007-2008 is given in Table 1.

Table 1. Crop-wise distribution of recently released varieties

Crops	Variety name	Country
Winter wheat	Egemen	Kazakhstan
	Norman	Tajikistan
	Alex	Tajikistan
Barley	Zhybek Zholy	Kazakhstan
	Sona	Turkmenistan
Triticale	Norman	Uzbekistan
	Farhad	Uzbekistan
Chickpea	Zumrad	Uzbekistan
	Djahangir	Uzbekistan
	Janalyk	Kazakhstan
Lentil	Darmon	Uzbekistan
	Oltin don	Uzbekistan
Soybean	Ilhom	Uzbekistan
	Universal	Uzbekistan
Mungbean	Marjon	Uzbekistan
	Zilola	Uzbekistan

In addition, 2 varieties of winter wheat: Akbosh and Karakulshik Turkmensky (Turkmenistan), 2 varieties of barley: Kuralai (Kazakhstan) and Ehson (Tajikistan), 3 varieties of chickpea: Miroz and Asilbek (Uzbekistan) and Lusik (Armenia) were submitted to State Varietal Testing Commissions in the respective countries for final evaluation and release.

Wheat

The expansion of area planted under the earlier released varieties of winter wheat in the Caucasus is quite encouraging. In Armenia, the total area planted to winter wheat variety Armcim - released in Armenia in 2006 - reached 200 ha in 2007 as compared to only 15 ha in 2005. In Azerbaijan, further expansion of two other varieties was recorded: The area planted to Azametli-95 and Nurlu-99 in Azerbaijan in 2007 is estimated at 185,000 and 60,000 ha, respectively, as compared to 40,000 and 20,000 ha in 2005, respectively. The area of the winter wheat variety Gobustan, which was released for rainfed areas in Azerbaijan in 2006, expanded to 7,000 ha.

Winter wheat breeding activities in South Kazakhstan are conducted within the framework of CIMMYT-ICARDA International Winter Wheat Improvement Program (IWWIP). As a result of successful cooperation of CIMMYT, ICARDA and the national breeding programs, dozens of the new winter wheat varieties have been and are being bred.

The cold and severe climate of Northern Kazakhstan is not favorable for growing winter wheat. However, breeding wheat varieties adapted for these conditions, in combination with zero tillage technologies (including leaving the straw and crop residue on the field, direct sowing) can be a good alternative for wheat production and diversification in the northern parts of the country. In the recent years, the global climate change is leading to softer winters, and the option to grow winter wheat in the Northern Kazakhstan is becoming more realistic and feasible.

Kazakhstan-Siberian Network on Wheat Improvement (KASIB) was established in 2000 as a result of cooperation between wheat breeding institutions in Northern Kazakhstan and Western Siberia. The objective of the KASIB is to improve efficiency of spring wheat breeding in Northern Kazakhstan and in Siberia through exchanging new varieties, breeding materials, coordinated assessment of materials, exchanging information, meetings and discussions. The results of the 7th KASIB-Spring Bread Wheat and 7th KASIB-Spring Durum Wheat studies were analyzed and summarized in 2007. The nurseries contained 35 varieties of bread and 17 varieties of durum wheat. Data were statistically analysed and the best advanced cultivars were selected. Among the bread wheat varieties, the following were promising: Altayskaya 105, Altaiskaya 530 (Altay, Russia), Lutescens 210/99-10, Omskaya 36 (Omsk, Russia), OK 1 (Kurgan, Russia). Best resistance to leaf rust was shown by Stepnaya 15 (Aktobe), Lutescense 20 (Karabalyk), Line 210/99-10 (Omsk, Russia), Pamyati Ryuba (Chelyabinsk, Russia). Amongst the durum wheat varieties, best yields were shown by Kargala 303, Kargala 447 (Aktyubinsk, Kazakhstan), Subastrale 489, Altayskaya Niva (Altai, Russia), Gordeiforme 94-94-13, (Omsk, Russia). At present, all members of the KASIB network provided the

grains of 8th KASIB nurseries for further technological analysis, along with yields and other data obtained this year.

Under the CIMMYT-led wheat bio-fortification activities in Kazakhstan, about 300 wheat varieties originating from Kazakhstan, Russia and other parts of the world were tested for Fe and Zn content in the different ecological zones. As a result, cultivars with high content of micronutrients were identified. The high importance of genotype for Fe content variation in wheat has been demonstrated. A hybridization nursery was established in Shortandy, Kazakhstan, to make crosses and start breeding activities for wheat bio-fortification.

Barley

After wheat, barley is the second most important grain crop in the CAC region. During the former Soviet Union, around 7.0 million ha of land were sown to barley in Kazakhstan alone. Usually, barley yields are, on an average, about 10-15% higher than those of wheat under rainfed conditions. One of the main constraints to increasing cropping area under winter barley in Northern Kazakhstan is insufficient cold tolerance of the available barley varieties. Therefore, development of cold tolerant varieties is the highest priority for barley breeders.

In 2003, a new winter barley variety "Zhibek Zholy" ("Silk road") was officially submitted to State Variety Testing Commission of Kazakhstan for evaluation and release. The submission was based on outstanding performance of this variety, which had been earlier selected from IBCB-WT-99 ICARDA nursery. During the last four years, "Zhybek Zholy" variety out-yielded the standard check (variety Bereke-54) by almost 34%, providing stable yield even under unfavorable weather conditions. Based on four-year data, the new barley variety Zhibek Zholy was officially released in south Kazakhstan in late 2007.

Kazakh scientists and ICARDA partners are continuing their efforts on breeding of new barley varieties. One of the important directions of this research which promises to yield considerable impact is development of new salt-resistant barley varieties adapted to the saline environments of Central Asia. The barley germplasm enhancement activities on saline soils of Kyzylorda province of Kazakhstan, near the Aral Sea, have been initiated by taking into account genetic aspects of salt-resistance and drought-tolerance of barley lines. This research is conducted through putting high emphasis on barley productivity through the combination of hybridization and generation of cross-breeds. A collection of spring barley lines from different countries such as Syria, Iran, Turkey, Russia, Ukraine, the Czech Republic, and Kazakhstan has been studied and a new spring barley variety Syr Aruy was selected. This new variety, highly adapted to the extremely saline environments of the rice systems of Kyzylorda province, Kazakhstan, has been submitted to the State Variety Testing Commission.

A new barley variety was released n 2007 in Turkmenistan under the local name "Sona". Originating from ICARDA germplasm, 'Sona' out-yielded the local check by some 20-

25% and showed good resistance to diseases and lodging as well as drought and heat tolerance. There are four more promising lines of barley in the pipeline, all of them originating from ICARDA nurseries.

Legumes

After the end of the Soviet era, the eight CAC countries looked for sustainable agriculture, and some adopted crop diversification strategy in their farming systems. Legumes, including chickpea and lentil became important components for profitable crop rotation as they fix atmospheric nitrogen, and improve carbon and organic matter in soil. Since the beginning of joint legume improvement activities, ICARDA has provided more than 2,000 lines of chickpea and about 600 lines of lentil through its international testing program to various research institutes in Uzbekistan for evaluation and development of new varieties adapted to local agro-ecologies which meet the farmer needs. As a result, eight chickpea and three lentil lines had earlier been submitted to the State Varietal Testing Committee (SVTC) in Uzbekistan for official release and subsequent wider adoption among farmers. After three years of evaluation, the SVTC released two chickpea 'Zumrad' (FLIP-98-210C) and Djahangir (FLIP-88-85C) and two lentil varieties 'Oltin don' (ILL-7513) and 'Dormon' (FLIP-97-4L). These varieties have continuously out-yielded the local checks (18-25%), besides having disease-resistance. In addition, these new varieties have larger seed size and attractive cream color, the characteristics highly demanded in the local market. Thus, the new varieties are expected to provide both better income for farmers and more healthy diets for consumers.

Testing of a promising chickpea line FLIP-98-131 submitted to the State Varietal Testing Commission of Turkmenistan in 2005, yielded the preliminary results. Identified by the scientists of Turkmen Research Institute of Grain and given a local name "Ahal", the new line showed good results both in terms of disease resistance and crop standing. Based on these results, Turkmen Research Institute of Grain initiated seed production of this line in 2007. Hopefully, "Ahal" will become soon the first chickpea variety released in Turkmenistan.

Forage crops

Crop-livestock integration is one of the important areas to achieve strong growth in the agricultural production in the region. The lack of fodder, especially during harsh winter periods, is significantly hindering the growth in livestock production. In this regard, introduction of high-yielding forage crops has a very promising potential in the region. CIMMYT has continued its efforts to introduce improved hybrid maize varieties in Georgia. The work on maintenance of inbred parent lines and hybrid seed production of two hybrid varieties (CIMMYT materials by local lines: S91SIWQ x Ajametskaya zheltaya and CML-176 x Ajametskaya) was initiated at Georgian Research Institute of Farming and Lomtagora Farm in May, 2008.

Triticale is used in Uzbekistan only for feed purposes. In the recent past, Uzbek Research Institute of Plant Industry (UzRIPI), which has more than 750 accessions of triticale in its

Genebank, has also initiated activities on development of drought, heat and salt resistant varieties of this crop. The results achieved so far are highly promising. As a result of research since 1996, a total of twelve varieties were selected, five of which were analyzed for bakery qualities in Kazakh Research Institute of Crop Husbandry named after Williams. The analyses have also demonstrated that triticale has superior bakery qualities. As we know, triticale has higher yield then wheat, more resistant to diseases and pests and also a salt resistant crop. This gives a basis for scaling up the areas under this crop in CAC region not only as a feed crop but also as a food crop. Two promising and early maturing varieties of triticale has been selected from CIMMYT materials and was submitted under the names "Norman" and "Farkhad" to the State Variety Testing Commission (SVTC) for testing in different agro-climatic conditions and further release. Based on the results of evaluation, both of these varieties were released in Uzbekistan recently in 2007.

Potato

Fifteen late blight (*Phytophthora infestans*) resistant clones issued from in-vitro plants multiplied by the laboratory of the Crop Husbandry Institute (Georgia) in 2006, were tested in 2007 under farmer field's conditions in Dmanisi district, about 100 km from Tbilisi, in a preliminary trial at the altitude of 1 200 m asl. The B3C1 & B3C2 clones showed a maturity cycle too long to be considered suitable for local conditions. The only positive feature was represented by plant resistance to LB with only 5 to 10% of leaf area covered by blight spots. New clonal materials will be supplied in 2008.

In order to assess the distribution of potato viruses in the main potato growing areas of Uzbekistan, a survey was undertaken in the lowlands of two regions, Tashkent and Samarqand, during the month of October 2007. Six potato viruses (PLRV, PVY, PVX, PVS, PVA, PVM) were identified using DAS-ELISA kits supplied by CIP-HQ, Lima, Peru. The results indicated that fields in Samarqand region are more infected with potato viruses than those in Tashkent region. The prevailing viruses in Samarqand region were PVY (96.3%), PLRV (68.3%), and PVA (39.0%), while in Tashkent region, PVS (64.7%) was the most important potato virus, followed by PVM (28%) and PVX (19%). This means that the practices of cutting seed tubers before planting is more frequent in Tashkent than in Samarqand region, being PVS a mechanically transmitted virus.

Potato tubers obtained from in-vitro elite breeding lines supplied by CIP-Lima, in April 2005, and multiplied locally, were planted under farmers' field conditions in Faizabad and Jirgatal districts, Tajikistan, in Almaty region and three Uzbek localities: Pskem, Tashkent and Urgench. Clones 391180.6 and 390478.9 were the most performing clones in Faizabad district (Tajikistan) and Pskem (Uzbekistan), with respectively 4.3 and 3.7 kg/m^2 in Faizabad, and 4.2 and 4.4 kg/m^2 in Pskem. On the other hand, 392797.22, rich in iron, performed well in Lakshe, Jirgatal district, and Tashkent with 6.4 and 3.3 kg/m^2, respectively. Clone 397077.16 showed very good multilocation adaptation, yielding well at the high altitude site of Lakshe, Tajikistan (6.8 kg/m^2), at the mid elevation site of Pskem, Uzbekistan (4.2 kg/m^2), and in the lowlands (Tashkent: 2.9 kg/m^2; Almaty: 3.3 kg/m^2), therefore, from mild to extremely warm temperatures. All the above clones can

be classified as mid-early maturing with a vegetative period ranging from 90 to 100 days. In Kazakhstan, the Research Institute of Potato and Vegetable Farming identified as extremely promising clones 397077-16 (candidate name: Alliance) and 388676-1 (Miras), with a yield of 32.8 and 33.1 t/ha, respectively, and a cycle ranging from medium-early to medium (90-100 days). They were submitted to the State Commission for Variety Testing of the Republic of Kazakhstan for further release.

Under the Regional Clonal Selection in Tajikistan, after three years of selection/evaluation conducted in two sites, Lakshe, Jirgatal district, at 2 700 m asl, and Faizabad district, 2 000 m asl, two clones belonging to TS families TITIA x C93.154 (302478) and C92.140 x 92.187 (303414), both of red skin colour, were identified as the most promising in 2007. In total, 29 clones, 14 in Faizabad and 15 in Jirgatal districts, were retained for further evaluation/selection. Fourteen clones issued from the Regional Clonal Selection implemented in the highlands of Jirgatal district, Tajikistan, have been distributed to NARS of Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan and Uzbekistan. NARS of Turkmenistan will receive them towards October-November, 2008, so that they will be ready for planting at the beginning of February 2009.

In the highlands of Uzbekistan, following the direct seeding technique in nursery, TPS family LT-8 x TPS-13 had the highest yield (5.8 kg/m^2) although not significantly higher than that of SERRANA x TS-15 (5.3 kg/m^2) and ATZIMBA x TPS-13 (5.0 kg/m^2), during the main cropping season from May till September. All TPS families showed a cycle of 128 days (sowing till haulm killing).

F_1C_1 seedling tubers of hybrid TPS family LT-8 x TS-15 were tested for the second consecutive year in the highlands of Tajikistan. They yielded better at the higher altitude of Lakshe (2 700 m asl), Jirgatal district, with 8.8 kg/m^2 compared with 4.5 kg/m^2 of Faizabad district (2 000 m asl). Tubers had a morphological homogeneity almost similar to that produced by a clonally propagated crop. In particular, they had a very nice shape, an attractive yellow skin and a marketability approaching 90% with an average tuber weight of about 130 g.

In Georgia, CIP together with a local NGO (IAAD - International Association for Agriculture Development) has developed a methodology for training potato growers in seed quality management. With the help of the European Union and Mercy Corps, more than 100 seed potato multipliers are now associated in 11 cooperatives established in three districts (Akhalkalaki, Aspindza and Akhaltsikhe). In 2007, they planted about 17 ha with Elite seed categories and 120 ha with class A seed of Dutch cultivars Agria, Marfona, Kondor, Picasso and Amorosa. At harvest, from the initial 50 tons of Elite seed, farmers obtained 528 tons of potatoes with 59% of them in the seed tuber size.

In Uzbekistan, the support given to the Biotechnology Department of the National University of Uzbekistan, Tashkent, has made possible the increase of the operational capacities of the laboratory that can now produce about 100,000 in-vitro plants per year. The accent has been put on the rapid multiplication of var. Nevskyi and CIP clone 397077-16, either in form of in-vitro plants or micro-tubers.

Vegetables and fruits

The AVRDC's Regional Varietal Trial was conducted in different soil and climatic conditions in seven countries of the CAC region in 2007. In total, nine varieties of tomato (5) and eggplant (4) from AVRDC were studied. Promising tomato line CLN2545A and varieties King Kong, Farmers 209 and eggplant varieties Charming and Fullness were selected based on their higher yields as compared to local checks. Presently in 2008, a total number of 87 accessions of 4 vegetable crops are being evaluated in 8 countries. New trials have been initiated in Armenia, Georgia, Kazakhstan, Kyrgyzstan and Uzbekistan on 105 accessions of 8 crops.

Competitive varietal trials of 46 promising varieties of eight vegetable crops were conducted in five countries in 2007:

- Armenia: tomato - 5, sweet pepper – 3 and hot pepper – 3;
- Azerbaijan: tomato - 4 and vegetable soybean – 2;
- Kazakhstan: sweet pepper - 2 and hot pepper – 1;
- Turkmenistan: tomato – 2, sweet pepper - 2 and hot pepper – 2;
- Uzbekistan: leafy cabbage - 5, asparagus - 2, hot pepper - 2, long yard bean - 3, vegetable soybean - 4 and mungbean – 4.

In 2007, a total of 29 promising varieties of 7 vegetable crops were under the State varietal trials in four countries:

- Armenia: tomato -5, sweet pepper - 3, hot pepper – 1;
- Azerbaijan: tomato - 4, vegetable soybean – 2;
- Kazakhstan: sweet pepper - 2 and hot pepper – 1;
- Uzbekistan: vegetable soybean- 3, mungbean – 2, hot pepper – 2, leafy cabbage - 2, long yard bean – 2.

In addition, new trials of 136 varieties of 8 vegetable crops have been initiated in Armenia, Kazakhstan and Uzbekistan in 2007.

As a result of these efforts, first new early maturing vegetable soybean varieties Ilkhom and Universal were released in Uzbekistan in 2007. Two early maturing and higher yielding new varieties of mungbean Zilola and Marjon were also recently released in Uzbekistan.

Pearl millet and sorghum

In an effort to introduce non-conventional, salt-tolerant crops, ICARDA, ICBA and ICRISAT have started, in close collaboration with their NARS partners, the evaluation of pearl millet and sorghum inserted into the local crop-livestock feeding and farming production systems of diverse landscape and agro-ecological zones in Uzbekistan, Turkmenistan and Kazakhstan. Dual-purpose (grain and fodder) nutritious cereals

(sorghum and pear millet) with limited irrigation were taken up as second crops after early legumes, winter wheat and barley.

The preliminarily results show that by adopting of early-maturing varieties under high plant density, pearl millet could be made into a valuable feed, stover (dry stalk after grain harvest) and forage crop; it could also easily fit into intercropping production systems with low canopy crops, like soybean and others legumes. By providing a dense cover to the salt-affected lands, they can also contribute to the soil improvement and moisture holding that should be considered when crop rotation systems are being designed.

Halophytes

Diversification of cropping system under prevailing saline conditions could sustain agricultural productivity of salt affected areas and allow farmers to make a living on low-productive land. The domestication of native shrubby/tree halophytes (salt loving species) and introduction of new salt tolerant crops, grasses and legumes could potentially reduce salinization and waterlogging commonly observed on saline soils while contributing to restoration of degraded lands and better livelihoods of rural poor communities.

In collaboration with the Institute of Plant Industry, Tashkent, and Akdepe Farm in Turkmenistan a technology for seedling establishment of *Acacia ampliceps*, *Atriplex nummularia*, *Atriplex undulata* and *Atriplex amnicola* has been developed. Evaluation of survival rate, performance and productivity including biomass and seed production of non-conventional halophytes introduced for the first time on non-leached soils showed the highest potential for the reclamation of salt affected marginal lands. All species tolerated average root-zone salinity of 1,8-12 dS m^{-1}.

Among *Atriplex* species, the highest seed germination (approximately 89-95%) under field condition was observed for *Atriplex undulata.* This species has a rapid growth rate and biomass accumulation. Being cultivated at approximately 10-12 plants/m^{-2} (despite of usual density norm of this salt shrub as 4 plants/m^{-2}) in the first year, this species with its large canopy can occupy the inter-row spaces forming a dense mono-component halophytic pasture. The green biomass produced in 4 months was 1.6 kg /m^{-2} of fresh biomass reaching about 5.6 kg m^{-2} value at the 18 months being readily browsed by cattle and small ruminants. In addition plant height and plant diameter ratio of *Atriplex undulata*, with respect to different types of reproduction, showed that plants grown through vegetative propagation result in better establishment. This method is expected to prove to be more convenient for farmers. Lower seed germination (55%), however, was observed in *Atriplex nummularia* and *A. amnicola.*

The leading screened native and introduced tree and shrubs species in terms of survival rate, growth characteristics and adaptability to natural saline environments in Uzbekistan were the following in descending order of performance: *Haloxylon apphyllum, Salsola paletzkiana, S. richteri, Hippophae ramnoides*, Ribes ssp., *P. euphratica* and *P. nigra var. pyramidalis*, followed by *Atriplex undulata, E. angustifolia, Acacia ampliceps*

(except its low frost tolerance), *P. euphratica* and *P. nigra var. pyramidalis, M. alba, Morus nigra,* (on loamy hydromorphic soils), whereas fruit species such as *Cynadon oblonga, Armeniaca vulgare, Prunus armeniaca* and species of genera wild *Malus domestica* at the saline loam sandy deserts of the Dashauz province, Turkmenistan.

CROP DIVERSIFICATION

The CAC region is known for mono-cropping of wheat and cotton. Therefore, crop diversification is key for increased cropping intensity, sustainability as well as increased income for the farmers. ICARDA took major initiatives to test and demonstrate the potential of crop diversification in the region. Some of the results are as follows:

In spring wheat-based cropping systems in northern Kazakhstan, research efforts have revealed good opportunities for crop diversification. Field pea, chickpea, lentil and buckwheat are the best options for inclusion into existing rotations. Also, oat was found to be higher yielding than barley. During field days, farmers showed interest in grain legumes, but desired to have better marketing options before large-scale adoption, as well as exposure to integrated crop production technologies.

In rainfed winter wheat-based cropping systems, there are many opportunities to diversify crop production. Out of spring cereals, oat was found to be most productive and with highest water use efficiency in southeast Kazakhstan. Alfalfa is also very suitable for sustainable farming in semi-arid conditions of south Kazakhstan. Under rainfed conditions, the most successful crop appeared to be safflower, area under which has increased significantly (up to 150,000 ha). This crop is also becoming popular in both Uzbekistan and Kyrgyzstan. In winter wheat-based irrigated cropping systems, a number of alternatives have been identified for more economical and sustainable farming. The most profitable are food legumes. Successful results were obtained in southeast Kazakhstan with soybean, in Kyrgyzstan with field pea, common bean and soybean. Safflower can also be grown under supplemental irrigation. In Kyrgyzstan and south-eastern Kazakhstan, sugar beet and maize are also good alternatives for crop diversification. Nitrogen and phosphorus fertilizers at the rate of 60 kg/ha provided best returns in Kazakhstan. In south-eastern Kazakhstan, most successful crop for diversification is soybean. Its area has increased recently from 3,000 ha in 2002 to more than 50,000 ha in 2007. The major reason being: locally organized market in view of establishment of soybean processing plants.

In Fergana Valley of Uzbekistan, the most widespread crops after wheat are: maize (which provides feed and forage for animals), mungbean, melons and carrots. Rice is also used for double cropping using low salinity drainage water. In Termez area, southern Uzbekistan, maize and mungbean are widely accepted by the farmers for double cropping covering around 7,000 ha and 5,000 ha, respectively. Other alternative crops used by the farmers are sesame, melons, groundnut and vegetables but rather on smaller scale.

In Tajikistan, double-cropping is widely adopted by small farmers. Maize and mungbean are widespread followed by common bean, soybean, vegetables, buckwheat, millet, tobacco, groundnut, and sesame. Rice is also grown where water availability is good.

INTEGRATED PEST MANAGEMENT

Promising results on onion thrips control in Kyrgyzstan have been achieved under ICARDA-MSU program on "Integrated Pest Management" supported by USAID. Earlier research results showed that both onion thrips and spider mites could be effectively controlled by predatory mite species *Amblyseius swirskii* and *Amblyseius cucumeris*. Both these species were provided by the MSU, via ICARDA, to the Uzbek Institute of Plant Protection and the Kyrgyz Centre for Enthomophage Rearing for Plant Protection, for research on their mass rearing and colonization under conditions of Central Asia. The results of this research identified the optimal predator:prey ratios for mass rearing of both the predator mites. For example, the optimal predator:prey ratio on the prey mite, *Acarus siro*, was 1:5 for *A. swirskii* and 1:7 for *A. cucumeris*, and on *Tyrophagus putrescentiae* was 1:7 for *A. swirskii* and 1:10 for *A. cucumeris*. Recently, scientists of the Kyrgyz biolaboratory conducted trials of *Amblyseius cucumeris* species on nectar crops under greenhouse conditions, to measure their performance against *Thrips tabaci*. During the trial, entomophages showed high effectiveness except for where the density of pest infestation was too high, around 10 insects per leaf. The conclusion was made that effective thrips control methodology would require that *Amblyseius cucumeris* is released before the pest appearance on crop.

NATURAL RESOURCE MANAGEMENT

The ADB-funded project on "Improving Rural Livelihoods through Efficient On-Farm Water and Soil Fertility Management in Central Asia" (RETA 6136) has been successfully completed by ICARDA in August, 2007. This project had been implemented in Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. A number of new technologies such as for amelioration of magnesium rich sodic soils, water-wise cost effective technologies, bio-drainage for control of ground water table, conjunctive use of saline and drainage effluents, resource conserving zero till technology, etc have been developed and transferred to the farmers for wide adoption. The implementation of the project in farmer participatory mode helped in raising the farmers' awareness and hands-on technology development and transfer processes.

Zero till technology tested in Kazakhstan, Tajikistan, Turkmenistan and Uzbekistan gave very promising results and it now occupies close to 100,000 ha in the rainfed winter wheat systems in Southern Kazakhstan. The availability of good prototypes of planters in other countries is the only bottleneck that needs to be removed to result in significant benefits to farmers in other Central Asian countries. Raised bed systems tested

extensively in Azerbaijan and southern Kazakhstan allowed seed saving by almost 50% while improving the productivity of winter wheat.

The research conducted on irrigation methods in flat and sloping lands clearly has brought out than surface mulching combined with alternate furrow irrigation and/or cutback irrigation not only increases water use efficiency by 30-50%, but also improves the cotton productivity by 15-24%. Micro-furrow irrigation technology researched in Tajikistan not only reduced soil erosion by 80% in sloping lands (up to 10% slopes), but also improved the water use efficiency in cotton by nearly 30% and yield by 20%. The average net benefit of growing cotton using micro-furrow irrigation is 43% higher than the traditional furrow irrigation system.

The new resource conserving technologies reduce the tillage and crop establishment costs, save in fuel and labor, and result in timely planting of the crops. The zero till technology induced cost reduction and yield enhancing effects amount to more than USD 40 per ha, suggesting a saving of nearly 4 million USD from 100 thousand hectares of zero till wheat in Southern Kazakhstan alone.

The joint IWMI-ICARDA-ICBA "Bright Spots" project (funded by ADB) on salinity management in Kazakhstan, Turkmenistan and Uzbekistan will be completed this June. During 2005-2007, the project has developed, fine-tuned and out-scaled a number of sustainable, cost-effective salinity management technologies, including phosphogypsum application for amelioration of Mg-rich soils, licorice cultivation for bio-remediation of salinity, mulching and conjunctive use of deferent quality waters, fertilizer use as a management option to mitigate the effects of saline water irrigation, productivity enhancement of fodder based cropping systems through the use of saline drainage water, and others.

A Knowledge Sharing (KS) Pilot project conducted by IWMI under Bright Spots Project was directed at strengthening the capacity of project partners, both farmers and the NARES groups, in the management and remediation of saline affected land and water; and dissemination of the project results through creation of a land management network, which included state agency and international project representatives in all the 3 project countries. The creation of learning alliances was the most important activity of the KS initiative. Two farmer‘s alliances were established for dissemination of two successful technologies, namely licorice and phosphogypsum, on rehabilitation of degraded soils. More than 100 ha of land have been dedicated to these technologies involving local farmers through learning alliances. Within these learning alliances the development of detailed business plans for the adoption and out-scaling of these technologies were prepared in collaboration with farmers, the private and public sectors. Several potential formal alliances were identified in the project locations. For example, farmers' associations in Uzbekistan, agricultural cooperatives in Kazakhstan and dayhan birleshik (farmer unions) in Turkmenistan can be listed as potential learning alliances, with sustained links.

During the Soviet period, it often happened that the lands designated for cereal, and, most frequently, wheat production were climatically and pedologically not suitable for efficient cereal production. After the transition to market economy, many of these lands became abandoned. It was decided to look for the best ways to rehabilitate these lands as well as the traditional local systems of agriculture. To help achieving this goal, the World

Bank and the Government of Kazakhstan initiated a project on “Dryland Management” in the Shetskiy district of Karaganda province in 2003. The project’s purpose was to demonstrate sustainable dryland management systems that would allow moving from non-viable grain production system to rangeland-based livestock production using grasses, which was traditionally practiced in this area. The global environmental objective of the project was to increase the level of carbon sequestration by ecosystems, slow down the global warming, climate change and land degradation, and improve the biodiversity status in the dry areas.

The role of CIMMYT in the project is related to the demonstration of various technologies for rehabilitation of abandoned and marginal lands, including minimal and zero tillage methods, and demonstration of productivity of perennial and annual grass mixtures. In the outcome, the farmers should be offered the most efficient and feasible ways of land rehabilitation, efficient grass cultivation technologies and the best combination of grass species for production.

The initial three years of project implementation have clearly shown that field treatment with non-selective herbicides combined with direct sowing of crops is a very efficient way of land rehabilitation. Also, highly productive grass species and their combinations, highly suitable for the arid conditions of the region, have been identified. A Green Production Line technology is being developed for the region in order to provide the livestock production systems with the maximum amount of forage grown within the optimum vegetation period. As mentioned above, these technologies are also aimed at ensuring maximum carbon sequestration by the green cover, as well as reducing of carbon emission from soil, which may become a significant contribution to slowing down the global warming and addressing the climate change. Based on the successful experience of project implementation in Central Kazakhstan, the World Bank and the Government of Kazakhstan are planning to significantly extend these activities and to implement similar projects in all major dry areas of the country.

The research activities are also being vigorously pursued under the Sustainable Land Management Research (SLMR) project led by ICARDA within the framework of Central Asian Countries Initiative for Land Management (CACILM). This project was started in July, 2007. During the reporting period, the work plans have bean developed and approved. Necessary equipment for conducting the research activities such as laser assisted precision land levelling sets, optical sensors for NDVI/biomass measurement and nitrogen management, portable plastic chutes, and raised bed planters have been procured and provided to the national partners for conducting the research activities. A ten year plan of research called “SLMR Research Prospectus” is being finalized. Under the GIS component of this project, GIS coordinates of benchmark sites under different RETAs and projects were collected and mapped in Central Asian countries. ICARDA GIS Lab is engaged now in benchmark site characterization including different layers such as on climate, soil, water, crop patterns, etc and developing the similarity maps for the region.

The Phase III of IWMI’s project on “Integrated Water Management in the Ferghana Valley (IWRM-Ferghana)” will end in April this year. During its implementation, the project has achieved highly promising results in the pilot sites in the Ferghana valley – Kyrgyzstan, Tajikistan and Uzbekistan. Taking stock of the positive impact of the project, it was decided to extend the project into Phase IV. During the Phase IV,

institutional, organizational, and management approaches of IWRM, developed and tested in the pilot canals, their watershed areas and small trans-boundary rivers, will be finalized and integrated.

IWRM-Ferghana project has so far put in place functional IWRM structures, including hydrographic management, participation, division of governance and management functions, as well as integration of all water users at its target areas in Uzbekistan, Kyrgyzstan and Tajikistan. Additionally, innovative and efficient mechanisms of dissemination of IWRM principles through educational curricula, extension services, knowledge sharing, informal networks, etc were developed.

A clear IWRM structure integrating both vertical (linkages between different hierarchy levels – canal, WUA or other non-agricultural primary water users, water user groups and farmers) and horizontal (incorporation of inter-sectoral linkages such as industrial, water supply, energy, environment etc.) interests and separating governance and management functions were also developed. A pioneering step towards Irrigation Management Transfer has been made in Kyrgyzstan. The state (Water Ministry and the Osh Basin Water Management Organization) and water users (Union of Canal Water Users established by the project initiative) signed an agreement that transferred the governance functions over the Aravan Akbura pilot canal to a joint state-public affiliation body.

LIVESTOCK AND FEED PRODUCTION

Livestock is an important source of income in Central Asia, but often natural resources are not used productively. The research in the IFAD-funded project on “Community Action in Integrated and Market Oriented Feed-Livestock Production in Central and South Asia” is being intensively conducted by ICARDA and the national institutions in all project countries. Under this project, an initial feed survey of 90 households in 12 selected villages in three Central Asian countries (Kazakhstan, Kyrgyzstan and Tajikistan) showed that all of them store forage in the winter months. The most common and popular forage crops, among households and farmers of the selected villages, are maize and alfalfa. Harvested feed is an economic disadvantage in the households when livestock prices are low and labor, machinery, and fuel costs are high and increase from year to year. Also, the yield potential of planted forage crops is very low. Therefore, farmers need the higher yielding varieties of forage crops. In addition, the length of the grazing season and the efficiency of grazing management need to be optimized with the available forage crops. The majority of the respondents were interested in cultivation of forage crops such as sorghum, millet and forage beet. Sorghum and pearl millet can be successfully grown in households and farmers' field in the Khojand site, Tajikistan, as grain for animal feeding and for seed multiplication of improved varieties.

The initial estimation of this feed survey point at the need for practical techniques which clarify and demonstrate the concept of profitable grazing management. Livestock improvement demands the efficient use of available feed resources. Under the prevailing scenario of increasing fuel prices and decreasing area under fodder crops, salinization of irrigated lands, drought and heat problems, and low priority to fodder production and preservation, no significant change is envisaged in the years to come, unless urgent

actions are taken to remedy this situation. Overstocking of rangelands near settlements can decrease available feed resources in the region. It seems that the shortage of feeds and fodders will be a great challenge to the future livestock production in the project demonstration sites. In this regard, it is expected that the research activities of ICARDA's Sustainable Land Management Research Project under CACILM, which involve production of alternative fodder and legume crops using conservation agriculture practices and resource conserving technologies in various agro-ecologies of Central Asia, with special emphasis on productive use of marginal lands, will provide Central Asian farmers and pastoralists with much needed technology packages to address this growing concern.

In the livestock productivity component of this project, the following activities have been undertaken. Concentrated food (barley, cotton cake, corn) was used for feeding of experimental groups of animals during the severe winter period. Vaccines and veterinary medicines against widespread diseases were provided to farmers. Additional feeding was organized in the improved farms and an optimal ratio of available forage was proposed. Simplified systems of the individual estimation (grading) of goats and flock circulation were developed and introduced among farmers in Khojand, Tajikistan.

Experiments on early lambing and weaning were successfully continued in Kazakhstan. All ewes involved in this activity were inseminated by artificial insemination. Good progeny was obtained. Physiological conditions of ewes and lambs are being monitored. Product diversification options in sheep production were developed in Shymkent site and include Brynza (a brined white sheep's-milk cheese) preparation technology; Kurut (hard dried balls of fermented milk or milk curds) and dried fruits preparation technology; Chechil (dried 'brynza' (low-fat) cheese) preparation technology; homemade sausage preparation technology. Training of farmers was conducted on milk processing and preparation of homemade sausages.

Similarly, activities on value addition and local processing of goat fibers by women in research sites in Tajikistan are being continued successfully. Market for Angora wool of different colors and production of its processing was studied. Yarns from Takli village, Tajikistan, conquered good reputation in Wisconsin, USA, and are receiving good orders from customers there. The women involved in these activities were provided with spinning machine tools manufactured in New Zealand.

SOCIOECONOMIC AND POLICY RESEARCH

Socioeconomic research was conducted by ICARDA under the joint IWMI-ICARDA-ICBA "Bright Spots" project to characterize the impact of salinity on the livelihoods of rural populations in Central Asia as well as to evaluate the feasibility of the salinity management technologies. The research showed that impact of salinity on rural livelihoods is highly negative. Livestock production and to a lesser extent provision of machinery rental services are one of the key livelihoods strategies that farmers in Uzbekistan are applying to supplement their decreasing incomes.

Under the livestock project led by ICARDA, a study on rapid rural appraisal of livelihoods of livestock breeders at household level and value chain analyses of livestock markets have been completed in Kazakhstan, Kyrgyzstan and Tajikistan. It was identified that low density markets and the frequency of the market days adversely affect rural producers' income. It was observed that low share of farmers in the retail price for lamb was mainly because they do not practice fattening of animals. Thus compared to the smallholders in rural areas, fatteners in urban areas who do fattening in 4-5 weeks have more opportunities for income generation. The research results in Tajikistan demonstrated that there is a big gap in prices (up to 30%) between the regions with good natural resources endowments, where conditions for animal production are satisfactory and supply is the highest, and those with low natural endowments. Lack of standards and quality consideration of mohair goat fiber production, storage, marketing and export does not allow householders in Tajikistan to benefit from mohair production.

A pilot study on "Assessment of information and communication needs of institutions and stakeholders of the national agricultural research and extension system of Kyrgyzstan" was launched in January, 2008. The objectives of the pilot study are to identify policy and legal frameworks, institutional set-up in agricultural research, extension/advisory services, education, farmer organizations, their linkages, their information and communication needs in order to serve farmers' and agribusiness' needs in their orientation to markets. During the reporting period, the surveys were conducted with 24 key agricultural research, extension/advisory services, education, farmer organizations, as will as the Ministry of Agriculture and Water Management and Processing Industry of Kyrgyzstan. The results of the survey indicate that lack of ICT infrastructure and skills is hindering the effective communication between the stakeholders of the agricultural sector in Kyrgyzstan, especially in rural areas.

Under the Sustainable Land Management Research Project, situational analysis and policy reviews on systemic interactions of causes, pathways and impact of land degradation on livelihoods have been conducted. The livelihoods survey instruments have been developed and pre-tested in the research sites in Uzbekistan, Kyrgyzstan and Tajikistan.

CAPACITY BUILDING

All the centers involved in the CGIAR Program in CAC continued their emphasis on capacity building in the report period, with the organization of trainings, study tours, the participation in international, regional and national scientific meetings and workshops, and supply of research equipment, etc. Some examples of these capacity building events are given below.

A three month intensive English training course was organized from 1 November, 2007 – 21 January, 2008 in the Soil Research Institute, Dushanbe, Tajikistan, under the aegis of the CGIAR Collaborative Research Program for Sustainable Agricultural Development in CAC. Young scientists from Tajikistan (24) and from Kazakhstan (1) attended the course.

Similarly, a three month intensive English training course was organized from 5 January, 2008- 5 April, 2008 in Tashkent, Uzbekistan. Twenty-four participants from Azerbaijan (1), Kazakhstan (4), Kyrgyzstan (4), Turkmenistan (1), and Uzbekistan (14) attended the course.

A three-day regional workshop on "Strengthening National Plant Breeding and Related Biotechnology in Central Asia and the Caucasus Countries through Policy Advice" was organized jointly by PFU-CGIAR/ICARDA-CAC, with FAO's support, from 16-18 July 2007 in Tashkent, Uzbekistan.

A regional exhibition on "Integrated Water Resources Management (IWRM) in Central Asia" was organized on 8 September 2007 in Osh by the Ministry of Agriculture, Water Resources and Processing Industry of Kyrgyzstan, IWMI-Tashkent, Scientific-Information Center of the Interstate Coordination Water Commission for Central Asia (SIC ICWC). The event was funded by the Swiss Agency for Development and Cooperation (SDC). Policy makers and scientists from Central Asian countries, representatives of international organizations, as well as a large public of Water Users' Associations' members and farmers were among the participants.

A Review and Planning Meeting on "Vegetable Variety Selection in Central Asia and the Caucasus" was held from 16-18 October, 2007 in Tashkent, Uzbekistan. The workshop participants (30) discussed current constraints and perspectives of regional varietal trials being conducted in different agro - ecologies of the CAC region.

Farmers' Field Days were conducted in research institutions of seven countries of Central Asia and the Caucasus to demonstrate promising varieties of vegetable crops. In total, 200 farmers and researchers participated in these events.

A Regional Training Workshop "Fruit Tree Genetic Resources in Central Asia: Focus Group Discussion Data Analysis and Individual Household Surveys Finalization and Coding" was held on 9-11 December 2007 in Tashkent, Uzbekistan, within the framework of Bioversity International/UNEP-GEF project "In Situ/On Farm Conservation and Use of Agrobiodiversity in Central Asia".

In December, 2007, training workshops were organized in four places of Ferghana Valley to train and enhance planning skills of WUA managers within the framework of "Integrated Water Resources Management in the Ferghana Valley (IWRM-FV)" project.

A methodology training workshop on the socioeconomic research activities of "Community Action in Integrated and Market Oriented Feed-Livestock Production in Central and South Asia" Project was organized by ICARDA from 26-30 November, 2007 in Tashkent, Uzbekistan. A total of 20 participants attended the workshop. The workshop achieved the following outputs: review of the commodity value chains, clarification of the research questions, development of the sampling strategy, identification and understanding of the research methods for market studies and technology evaluation, development of the questionnaire for data collection, sharing and agreement of the data

collection and documentation procedures, and elaboration of the clear timeline for the socioeconomic activities.

ICARDA, with the support of FAO, organized Policy Dialogue workshops in Yerevan, Armenia and Tbilisi, Georgia, on 13 and 20 November, 2007, respectively, to present and discuss the results of the national studies on "Elements of National Integrated Strategy for Plant Genetic Resources Management and Use" in Armenia and Georgia. The results of the studies had been preliminarily discussed at national multi-stakeholder workshops that had been organized by ICARDA on 2-5 and 15-17 October, 2007 in Yerevan and Tbilisi, respectively. The participants approved the results of the studies and policy recommendations. They also provided their inputs for the suggested project proposals on Capacity Building for a National Integrated System of Use and Management of PGR.

A Round Table Meeting on 'Rehabilitation of Degraded and Abandoned Lands' was conducted on 06 November 2007 in Dashauz, Turkmenistan, under the ADB-funded Project on "Bright Spots" by IWMI, ICARDA and ICBA. Representatives from the Ministry of Agriculture, Institute of Deserts, Flora and Fauna of the Ministry of Environment of Turkmenistan, as well as managers of Agricultural and Water Management Departments of Dashauz province actively attended this Meeting. The national partners highly appreciated the results achieved by the project during its implementation in 2005-2007.

A workshop was organized by ICARDA-CAC on 8-9 February, 2008 in Tashkent, Uzbekistan, to discuss the *Research Prospectus* for the sustainable land management research activities under the Central Asian Countries Initiative for Land Management (CACILM) program earlier developed by ICARDA-SLMR team. The workshop was attended by 38 participants, including Heads of CACILM National Secretariats, UNCCD Focal Points, Heads of NARS in Central Asia, National and Site coordinators of the SLMR project, representatives of MSEK (CACILM), scientists from ZEF-UNESCO Project and ICARDA staff from Head Quarters in Aleppo, Syria and Regional office for Central Asia and the Caucasus in Tashkent, Uzbekistan.

The Second Meeting of National Focal Points on Information and Communication Technologies (ICT) under UNEP-GEF project on "In situ/On farm Conservation and Use of Agricultural Biodiversity (Horticultural Crops and Wild Fruit Species) in Central Asia" was held from 15 – 17 January, 2008, in Tashkent, Uzbekistan.

ICARDA-CAC organized a Regional Training Workshop on Optical Sensors (Green seekers) for Monitoring NDVI/ biomass from 3-7 February, 2008, in Tashkent, Uzbekistan. In total, 26 researchers, including 17 SLMR (CACILM) project scientists from the Central Asian countries and six self-sponsored scientists (five scientists from the ZEF-UNESCO Project in Khorezm and one from India), participated in the training. The training workshop was organized in partnership with Oklahoma State University, USA.

Training on laser land leveling was organized for more than 10 farmers and technicians from Kazakhstan, Kyrgyzstan, and Uzbekistan on 24-27 April, 2008, in Tashkent,

Uzbekistan, under the SLMR project. The trainer was Dr. Harminder Sidhu, Research Engineer, Department of Farm Power and Machinery, Punjab Agricultural University, India.

A continuous training of NARS staff and NGOs like IAAD in Georgia, Tukhmiparvar in Tajikistan and the Aga Khan Foundation participating in the MSDSP project in Osh region were conducted by CIP-Tashkent. Furthermore, CIP-Tashkent has provided close supervision to two young and promising researchers who obtained IFAR grants in Georgia and Uzbekistan.

International traveling seminar on spring wheat improvement program was organized by CIMMYT on 30 July – 08 August, 2007, in Northern Kazakhstan, West Siberia and Russia (60 participants).

A series of seminars on extension system improvement for several groups of agricultural specialists were organized by CIMMYT from 16-20 July, 2007, in Astana, Kazakhstan (150 participants).

A Seminar on drylands and abandoned lands management was organized by CIMMYT on 29 November, 2007, in Karaganda province, Kazakhstan (25 participants).

A special workshop on International Day for Biological Diversity was organized jointly by Bioversity International, ICARDA, ICBA, AVRDC, PFU, as well as national partners from the Association of Farmers of Uzbekistan and State Committee for Nature Protection on 22 May, 2008, in Tashkent, Uzbekistan. The event was widely publicized in national TV and radio, articles were published in local newspapers and also posted on the website of the Convention on Biological Diversity.

INITIATIVES FOR RESOURCE MOBILIZATION

A proposal for the funding of the Program Facilitation Unit (PFU) for the year 2007 (USD 300 K) has been approved by the CGIAR/World Bank.

A new Inter-Center project proposal on “Resource conserving technology (RCT) platforms for crop diversification and improved livelihoods of small farm-holders in Uzbekistan” with the requested funding of 1.4 mln USD was submitted to the ADB country office in Tashkent, Uzbekistan (ICARDA, CIMMYT, CIP, ICRISAT, AVRDC, ICBA).

In January 2008, a new project “Enhanced food and income security in Southwest and Central Asia (SWCA) through potato varieties with improved tolerance to abiotic stress”, funded by GTZ-BMZ, of three-year duration, was started by CIP in four countries: Tajikistan, Uzbekistan, India and Bangladesh.

Dr. Christopher Martius participated in the meeting, hosted by UNCCD Secretariat, and jointly organized by ICARDA and ICRISAT in Bonn, Germany, from 12-14 March, 2008, to finalize a global proposal for the "Oasis Challenge Program" which was then submitted to the CGIAR Science Council and Executive Council for consideration. The CAC region has been selected as one of the key intervention areas of this proposed Challenge Program.

Phase IV of the IWMI-led project on “Integrated Water Management in the Ferghana Valley (IWRM-Ferghana)” was approved.

A project on “Sustainable Land Management in High Pamir and Pamir Alai Mountains – An Integrated and Trans-boundary Initiative in Central Asia” (PALM, Phase I), is approved and was launched on 16 June, 2008, in Dushanbe, Tajikistan. This project is implemented by the United Nations University, Bonn, Germany. ICARDA is one of the partners in this project.

A joint IFPRI-ICARDA proposal on “Economic Analysis of Sustainable Land Management Options in Central Asia” has been submitted to ADB and is being considered for funding.

A new project proposal on “Promoting sustainable, renewable and de-centralized energy production in Central Asia” with the requested funding of 2.45 mln Euros for five years, covering Kyrgyzstan, Tajikistan and Uzbekistan, has been submitted to the European Commission (ICARDA, ZEF-Khorezm and other partners).

Another new proposal on “Ecologically combating wheat pests: Enhancement of natural habitats of Sunn Pest” (200 K USD) covering Kyrgyzstan, Tajikistan and Uzbekistan, has been submitted to the “Development Marketplace” program of the World Bank (ICARDA).

The National CACILM Secretariats have endorsed the two multi-country project proposals prepared by ICARDA under CACILM Program, namely, (i) resource conserving technologies and (ii) crop diversification. These proposals can now be submitted to donors.

NARS partners have endorsed and provided their support letters to three new proposals on: i) rice-wheat systems (ICARDA, IWMI, IRRI), ii) Enabling Policy Options for combating land degradation in Central Asia (ICARDA-IFPRI, iii) Concept Note for a Regional workshop on Intellectual Property Rights and Plant Varietal Protection. In their support letters, they strongly called on potential donors to favorably consider funding these projects. The project on “Enabling Policy Options” has been approved by ADB for funding.

A proposal titled “Building national potato (*Solanum tuberosum*, L.) breeding and selection capacities in Azerbaijan”, submitted to CIP, Lima, Peru, for review.

ICARDA has also signed up with the successful long-term, interdisciplinary ZEF-UNESCO project carried out in Uzbekistan, which has been developed by the now Head of PFU, Dr. Martius, while he was working at Bonn University in Germany. This project will provide excellent insight into the technical, economic and policy options for introducing innovations into the Aral Sea Basin, and therefore complement the activities of the CAC Program in an ideal way.

FAO TCP Project "Strengthening the Plant Biotechnology Capacity for Characterization and Utilization of Plant Genetic Resources in Kazakhstan". (CIMMYT-Kazakhstan, 2-years, $380 000).

FAO TCP Project "Capacity Building for Sustainable Agriculture Development in South Kazakhstan". (CIMMYT-Kazakhstan, 2-years, $300 000).

World Bank - Kazakhstan "Agriculture Competitiveness Project". CIMMYT-Kazakhstan's sub-project "Wheat grain quality improvement". (3-years, $100 000).

World Bank - Kazakhstan "Agriculture Competitiveness Project". CIMMYT-Kazakhstan's sub-project "Conservation Agriculture for cereals production in rainfed area of Central Kazakhstan". (3-years, $100 000)

World Bank - Kazakhstan "Agriculture Competitiveness Project". CIMMYT-Kazakhstan's subproject "Conservation Agriculture for irrigated system of South Kazakhstan based on permanent bed planting and furrow irrigation". (3 years, $100 000).

World Bank - Kazakhstan "Agriculture Competitiveness Project". CIMMYT-Kazakhstan's sub-project "Biofortification of micronutrients (Fe, Zn) content in wheat". (3 years, $100 000).

AWARDS AND RECOGNITIONS

Dr. Ravza Mavlyanova, the representative of AVRDC – The World Vegetable Center in CAC, was awarded the Certificate of Honor of the Women Comity of Uzbekistan. The award was presented to Dr. Ravza Mavlyanova by Dr. Svetlana Inamova, Vice Premier Minister of Uzbekistan during the Conference of Women Scientists of Uzbekistan held on 22 of February, 2008 in Tashkent, Uzbekistan.

Dr. Kristina Toderich, Plant Scientist, ICBA-Tashkent, was awarded with "Dustlik" – a prestigious national medal from the President of Uzbekistan for "significant achievements in building intellectual and spiritual capacity of peoples of Uzbekistan and development in the area of science, considerable contribution towards strengthening of independence of the Motherland, peace and stability in our country". Under the CGIAR Program in CAC, Dr. Kristina Toderich is conducting research activities of ICBA for utilization of halophytes for remediation of saline lands in Central Asia.

Dr. David Bedoshvili, Consultant, Head, ICARDA-PFU Caucasus Sub-office, was awarded with a gold medal by FAO for "the support to the mission of the Food and Agriculture Organization and helping to build a world without hunger" on 17th of October, 2007 during the multi-stakeholder meeting for developing the Integrated National Strategy for Management and Use of Plant Genetic Resources in Georgia.

Dr. Raj Gupta, SLMR Project Manager, ICARDA-CAC, has been awarded with a plaque issued jointly by Dr. N.P. Shrestha, Executive Director, Nepal Agriculture Research Council, and Chairman, Regional Steering Committee of Rice Wheat Consortium, and Dr. Masa Iwanaga, former Director General, CIMMYT-Mexico. This recognition is for his services as the Rice Wheat Consortium facilitator for "sparking a farmer-driven revolution in cropping practices based on reduced tillage and other resource conserving technologies, thereby contributing to a greener, food-secure future for millions of farmers" in South Asia.

INFORMATION DISSEMINATION

Website

The web site of the CGIAR Collaborative Program for CAC (http://www.icarda.org/cac/) is available for consortium partners on the Internet since September, 2001. It contains relevant information on CG Centers and NARS partners involved in the Program as well as all major achievements made so far, both in English and Russian. Major efforts on updating and re-designing the website to further increase its user-friendliness and information content have been undertaken since the beginning of 2008.

Publications

Periodical publications produced in the report period include the CAC News that was published quarterly in English and Russian for circulation among all the Consortium partners and other stakeholders, and which covers the activities of the CGIAR Program in the region. The "International Theoretical Research and Applied Agricultural Journal AGROMERIDIAN" that had been founded in 2005 by CIMMYT and other Program members and stakeholders, continued to be published in 2007, with funding by the Government of Kazakhstan, with the issue # 1(5)-2007.

The Program Facilitation Unit (PFU) produced the following two brochures on the CAC Program:

> Program Facilitation Unit (PFU), 2007. **A Decade of Partnership for Sustainable Agricultural Development in Central Asia and the Caucasus.** ICARDA/PFU-CGIAR-CAC, December, 2007. Fourth Edition. 32 pages

Program Facilitation Unit (PFU), 2008. **CGIAR in Kazakhstan: A Decade of Partnership.** CGIAR - PFU - CAC, Tashkent, Uzbekistan. June, 2008. First Edition. 20 pages.

Furthermore, the CAC Program activities resulted in the following print products: A number booklets and posters on AVRDC activities in CAC, "Vegetable soybean", "Mungbean", "Chinese leafy cabbage", "Crop Diversification", "Vegetable Crops Varieties" and "Vegetable Seeds" were printed and distributed to partners in CAC region. AVRDC (2007) also published "Weeds on your field", a field guide for farmers. Factsheets on International Treaty on Plant Genetic Resources for Food and Agriculture have been translated into Russian and circulated among national partners. Proceedings of the Central Asia and Caucasus (CAC) Vegetable Research and Development Network's First Steering Committee Meeting organized on 9 August, 2006, in Tashkent, Uzbekistan. Two new publications "Introduction to Farmers' Field Schools" and "Major Pests and Diseases of Tomato and their control" were prepared by the team of ICARDA-MSU project on "Integrated Pest Management in Central Asia and the Caucasus". Two brochures on "Supplemental Irrigation" (T. Oweis) and on "Water Harvesting" (T.Oweis, D.Prinz, and A.Hachum) were translated and have been published in Russian. A Manual on "Conservation agriculture in Uzbekistan" is being prepared, with FAO/SEC funding support. It is being translated into three languages (Russian, Uzbek and Karakalpak) and is in print.

Scientific Publications

Akramkhanov, R. Sommer, A., C. Martius, J.M.H. Hendrickx, P.L.G. Vlek (2008): Comparison and sensitivity of measurement techniques for spatial distribution of soil salinity. Irrigation and Drainage Systems 22, 115-126. (DOI: 10.1007/s10795-008-9043-9).

Chudinov, V., S. Shpigun. 2007. Cereals gene pool of the Karabalyk Agriculture Experimental Station. Crop plants genetic recourses in XXI century. St.Petersburg, Russia, p.635-637.

Conrad, C., S.W. Dech, M.M. Hafeez, J.P.A. Lamers, C. Martius, G. Strunz (2007): Mapping and assessing of water use in a Central Asian irrigation system by utilizing MODIS remote sensing products. Irrigation and Drainage Systems. DOI 10.1007/s10795-007-9029-z

Karabayev M. 2007. International cooperation of Kazakhstan in agricultural science. CIMMYT Program on wheat improvement in Kazakhstan: together in XXI century. - Strategy of Kazakhstan Development to 2030. Astana, Kazakhstan, , p. 89-98.

Kohlschmitt, S., R. Eshchanov, R., C. Martius (2008): Alternative Crops for Khorezm (Uzbekistan) and their Sales Opportunities as well as Risks on the European Market .42pp. ZEF Work Papers for Sustainable Development in Central Asia. No. 11. 42 pp. http://www.khorezm.uni-bonn.de/downloads/WPs/ZEF-UZ-WP11-Kohlschmitt.pdf

Rudenko, I., U. Grote, J. Lamers, C. Martius (2008): Wert schöpfen, Wasser sparen. Effizienzsteigerung im usbekischen Baumwollsektor. In: M. Sapper, Volker Weichsel (Eds.): Grünbuch. Politische Ökologie im Osten Europas. Berlin. [Osteuropa 04-05/2008], 407-418.

Ruecker G.R., Z. Shi, M. Mueller, C. Conrad, N. Ibragimov, J.P.A. Lamers, C. Martius, G. Strunz, S.W. Dech (2007): Regional scale estimation of cotton yield in Uzbekistan by integrating remote sensing and field data info into an agrometeorological model. In: Uzbekistan Cotton Research Institute (Ed.) Scientific and practical bases of improvement of soil fertility. Proceedings of the International Conference, Tashkent, Uzbekistan (27-28 August 2007). Part 1, 213-220.

Shi, Z., Ruecker, G.R., Müller, M., Conrad, C., Ibragimov, N, Lamers, J. P. A., Martius, C, Strunz, G., Dech, S.W., Vlek, P.L.G. (2007) Modeling of Cotton Yields in the Amu Darya River Floodplains of Uzbekistan Integrating Multitemporal Remote Sensing and Minimum Field Data. Agronomy Journal 99, 1317-1326. DOI: 10.2134/agronj2006.0260

Sommer, R., K. Kienzler, C. Conrad, N. Ibragimov, J.P.A Lamers, C. Martius, P.L.G. Vlek (2008): Evaluation of the CropSyst model for simulating the potential yield of cotton. Agronomy for Sustainable Development. DOI: 10.1051/agro:2008008

Ibrakhimov, M., A. Khamzina, I. Forkutsa, G. Paluasheva, J.P.A. Lamers, B. Tischbein, P.L.G. Vlek, and C. Martius (2007): Groundwater table and salinity: Spatial and temporal distribution and influence on soil salinization in Khorezm region (Uzbekistan, Aral Sea Basin). Irrigation and Drainage Systems. 21, 219B236. DOI 10.1007/s10795-007-9033-3

Tissen, N., V.Chudinov, and S.Shpigun. 2007. Winter bread wheat gene poolof the Karabalyk Agriculture Experimental Station. – Winter bread wheat breeding and seed production: achievements, methods, problems and ways of the solution. Ulyanovsk, Russia, p.78-81.

Toderich K.N., Ismail S, Juylova E.A., Rabbimov A. R., Bekchanov B, B., Shyuskaya E.V., Gismatullina L.G., Osamu Kozan & Radjabov T. 2008. New approaches for Biosaline Agriculture development, management and conservation of sandy desert ecosystems. In: Chedly Abdelly, Munir Ozturk, Muhamad Ashraf & Claude Grignon (Eds.): Biosaline Agriculture and Salinity Tolerance in Plants. Birkhaeuser, Verlag/Switzerland: 247-264

Toderich K.N., Kuliev T., Suleimanov N., S. Ismail, Kushiev H., Alimova G., Aralova D. & Sattarov Sh. 2007. Improving feed resources in the saline desert areas of Uzbekistan by introducing the strip-alley agropastoral cropping system. Proceedings of the International Conference on Conservation of Biodiversity, Gulistan State University

Toderich K.N., Massino I.V., Ismail Shoaib, Khujanazarov A.M., Rabbimov A.R., Kuliev T. A., Boboev H., Aralova D.B., Usmanov S., 2007. “An analysis of Opportunities and Challenges for Utilization of Agriculture Residues and Livestock Wastes in Uzbekistan”. Second Regional Expert Consultation on the “Utilization of Agricultural Residues with Special Emphasis on Utilization of Agricultural Residues as bio fuel” , 29 October-01 November, 2007, Cairo, Egypt

Wehrheim, P., and C. Martius (2008): Farmers, Cotton, Water and Models: Introduction and overview. Pp. 1-16. In: Peter Wehrheim, Anja Schoeller-Schletter, and Christopher Martius (Editors, 2008): *Continuity and change Land and water use reforms in rural Uzbekistan - Socio-economic and legal analyses for the region Khorezm.* Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO). Studies on the Agricultural and Food Sector in Central and Eastern Europe, Vol. 43. Download at: http://www.iamo.de/dok/sr_vol43.pdf

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Zelenskiy, Yu., A. Morgounov, M. Karabayev, S. Shpigun, and A. Baitassov. 2007. Study of winter wheat in North Kazakhstan. - Winter bread wheat breeding and seed production: achievements, methods, problems and ways of the solution. Ulyanovsk, Russia, p.73-78.