ICBA Annual Report 2013

Innovation — Impact — Partnership

نزرع للغد

ICBA

AGRICULTURE FOR TOMORROW

Our Vision

To be the global Center of Excellence for innovative agriculture in saline and marginal environments

Our Mission

To work in partnership to deliver agricultural and water scarcity solutions in marginal environments

Our Core Values

1. Professionalism and integrity
2. Partnership and teamwork
3. Excellence and innovation
4. Our people

Our Strategic Objectives

1. Improve generation and dissemination of knowledge (knowledge hub)
2. Expand food and bioenergy solutions
3. Facilitate competitive agri-business enterprises
4. Increase and enrich partnerships

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Foreword

This was an important year for ICBA. Following a year-long development process that included a ground-breaking foresight workshop and consultation ICBA released its 2013-2023 Strategy. The core of the new strategy is **innovation, impact and partnership**. We feel that the most important contributions that ICBA will make in the next 10 years will be in research innovations supported by enabling innovations. There are five new "Research Innovation" programs that encompass the solid foundational work of ICBA and combine this with the new and innovative research for development that the Center will take up over the coming 10 years. Research innovations will include developing new and improved scientific tools, testing and adapting technologies, exploring new areas of research, and generating, synthesizing and disseminating knowledge. New areas of research will span the food-water-energy nexus. We will harness new technologies to assess water resources and model water use in agriculture. The Research Innovations are underpinned by four "Enabling Innovations": strategic alliances and partnerships, capacity development, agri-business Incubation and knowledge transfer.

In 2013, the Center developed the first of its three-year Business Plans to implement the Strategy. The Business Plan 2013-2016 seeks to strengthen ICBA's role as a global center of excellence by further defining our priorities and recognizing the anticipated funding and competitive environment. There will be increased emphasis on strong monitoring and evaluation and communication and the Plan will align ICBA's activities across the center.

Our activities in helping farmers cope with climate change showed significant results in 2013. Over the course of 2013, the projects focused on adaptation to climate change have identified crops and management systems that can increase farmer's resilience to climate variability, support more income options, and enhance food security across the MENA and in Central Asia. The climate change modeling and remote sensing work has focused on crop modeling in 2013. When combined with other data from climate, crop maps and water availability, the crop modeling will inform decision-makers on local production yields under wide-ranging conditions.

Engaging in research on neglected and underutilized species has continued with results being realized on salt-tolerant forages, bioenergy production and a relatively new crop to the MENA holding great promise—quinoa where the prospect for a wider scale-adoption and production will be further explored.

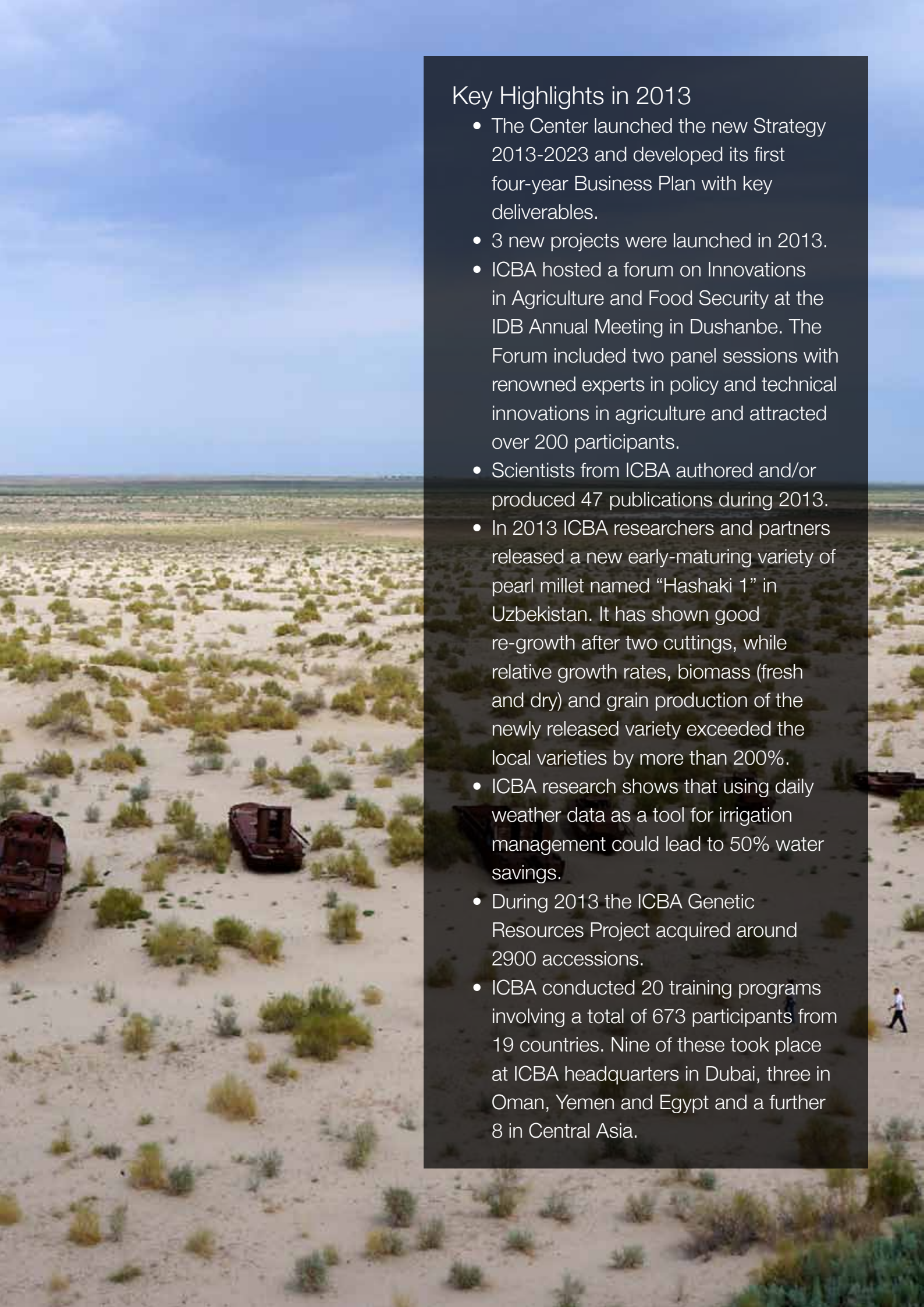
Water productivity remains part of the heartland for ICBA. This year saw the wrap up of a multi-year project on the use of treated waste water in Jordan, Oman and Tunisia, which will be brought together in an international forum in 2014 to guide steps forward in using non-conventional sources of water as a strategy to conserve fresh water resources.

No year goes by at ICBA without building the capacity of our staff and partners. During 2013, ICBA conducted 12 training programs involving a total of 229 participants from 15 countries. Nine of these took place at ICBA headquarters in Dubai, and three held in Oman, Yemen and Egypt. The feedback from these sessions is overwhelmingly positive and inspires us to continue and improve our training and capacity development efforts.

Finally, we'd like to thank the donors and partners who have supported us. Their continued confidence in ICBA inspires us to work harder to find innovative solutions to food and water security in marginal environments.

Mr. Fawzi Al Sultan,
Chair, Board of Directors

Dr. Ismahane Elouafi,
Director General



Key Highlights in 2013

- The Center launched the new Strategy 2013-2023 and developed its first four-year Business Plan with key deliverables.
- 3 new projects were launched in 2013.
- ICBA hosted a forum on Innovations in Agriculture and Food Security at the IDB Annual Meeting in Dushanbe. The Forum included two panel sessions with renowned experts in policy and technical innovations in agriculture and attracted over 200 participants.
- Scientists from ICBA authored and/or produced 47 publications during 2013.
- In 2013 ICBA researchers and partners released a new early-maturing variety of pearl millet named “Hashaki 1” in Uzbekistan. It has shown good re-growth after two cuttings, while relative growth rates, biomass (fresh and dry) and grain production of the newly released variety exceeded the local varieties by more than 200%.
- ICBA research shows that using daily weather data as a tool for irrigation management could lead to 50% water savings.
- During 2013 the ICBA Genetic Resources Project acquired around 2900 accessions.
- ICBA conducted 20 training programs involving a total of 673 participants from 19 countries. Nine of these took place at ICBA headquarters in Dubai, three in Oman, Yemen and Egypt and a further 8 in Central Asia.

Moving forward—ICBA Strategy 2013-2023

ICBA has had a history of innovation since its founding in 1999. Its scientists have led the way tackling the problems farmers face with saline environments and finding innovative solutions. In 2012, with a mind to continuing this success into the future and in the light of increasing rate of technological and social/political change, the ICBA Board of Directors initiated the development of a new strategy for the Center for 2013 to 2023.

Director General Dr Ismahane Elouafi outlined the steps taken to develop the strategy noting that ICBA did not want to engage in a traditional strategic planning process and only focus on today's problems but rather in consultation explore tomorrow's opportunities and to continue ICBA's tradition of innovation.

A broad representation of stakeholders subsequently participated in a two-day strategy foresight symposium in November 2012, giving them opportunities to suggest alternative technological and organizational visions for ICBA's future. The creative results of the symposium helped ICBA identify strategic pathways and major initiatives for the next 5-10 years, and gave guidance in framing a new research agenda and vision through to 2023.

The new ICBA Strategy 2013-2023 received approval and endorsement when the ICBA Board of Directors met in March 2013. They viewed the Strategy as a new mission and vision, with an expanded mandate and more emphasis on impact, innovation and partnership. Based on innovation as a core principle, the Strategy affirms applied research directions towards innovative solutions to food and water security in marginal environments, towards new technologies including biotechnology, and towards developing potential uses for wastewater and seawater. It also flags the evolution of a pioneering knowledge hub, extending and deepening the Center's partnerships.


Strategy Foresight Symposium

The launch of the ICBA Strategy 2013–2023 has given ICBA the foundation for developing a Business Plan for the period 2013–2016. This Plan further refines ICBA priorities, develops research activities aligned with its five Research Innovations, and defines a process for leveraging ICBA's core knowledge strengths. It highlights an increased emphasis on strong monitoring and evaluation and communication, and ensures that ICBA's activities align across the center. Download the ICBA Business Plan 2013-2016 at: http://www.biosaline.org/pdf/ICBA-Business-Plan-2013-2016.pdf.

Helping farmers prosper in the face of climate change

Climate change exacerbates the problems of lack of freshwater; dry areas may become drier, and changing weather patterns affect temperatures, humidity, and winds—all of which directly affect crop water use. ICBA has applied many different policy and technology approaches, including crop and livestock production diversification and better natural rangelands management, to help farmers in marginal areas prepare for such long-term climate changes.

One project initiated by ICBA and having significant outcomes in 2013 has involved testing varieties of sorghum and pearl millet to improve farmers' livelihoods in the central Asian countries of Uzbekistan, Tajikistan and Kazakhstan through crop diversification and improved crop-livestock productivity. ICBA, in collaboration with ICRISAT, ICARDA and NARS of the three countries, undertook research to evaluate superior genotypes and improved salt and drought lines of sorghum and pearl millet sourced from ICRISAT. On-station and farmer-participatory on-farm trials on marginal lands involved monitoring of irrigation water, ground water and soil salinity levels. The researchers identified high-performing lines for further testing. They tested promising sorghum and millet lines in different cropping combinations to help lift productivity. In one instance alley-cropping sorghum and pearl millet with triticale and alfalfa yielded 20% higher green biomass than barley alone in a traditional barley-fallow system.

Over the course of 2013, ICBA has also led and coordinated the selection of species, varieties and cultivars suitable for marginal conditions and saline water irrigation in Egypt, Yemen, Tunisia, Jordan, Syria, Oman and Palestine. The salt-tolerant crops evaluated are barley, pearl millet, sorghum, buffel grass, fodder

(for cattle), canola, triticale, mustard, sesbania, quinoa and guar. The project works with progressive farmers to enhance their capacity in efficient on-farm seed production and delivery systems of selected stress-tolerant forages, also to help them benefit from more efficient packages of forage production and use. In Uzbekistan, ICBA and partners have successfully tested a number of halophytes (salt loving plants) and salt-tolerant crops in marginal environments on moderately saline lands, looking for suitable species to use as animal fodder or in biogas production. The crops were irrigated with mineralized artesian water. Preliminary results showed that although halophytes contain high amounts of minerals they also can have high nutritional values, and species of *Kochia, Salsola, Climacoptera, Suaeda* and *Atriplex* were successfully added to green fodder for cows, sheep and goats on the farm.

Innovations in climate change modeling and remote sensing for the Middle East and North Africa—increasing resilience for food security

A regional effort based out of ICBA is developing a remote sensing/modeling node for the MENA–LDAS system (Middle East North Africa–Land Data Assimilation System). With support through the USAID/Office of Middle East Programs (OMEP) this project makes use of satellite observations, in situ data and integrated hydrologic models to generate water data sets, providing vital information to MENA decision-makers.

In the MENA region, irrigation is a very important variable in the water cycle because of low annual rainfall. Simulating the irrigation process is therefore a key component that should be included in the MENA modeling work, but does not currently exist in NASA's Land Information Systems (LIS) software.

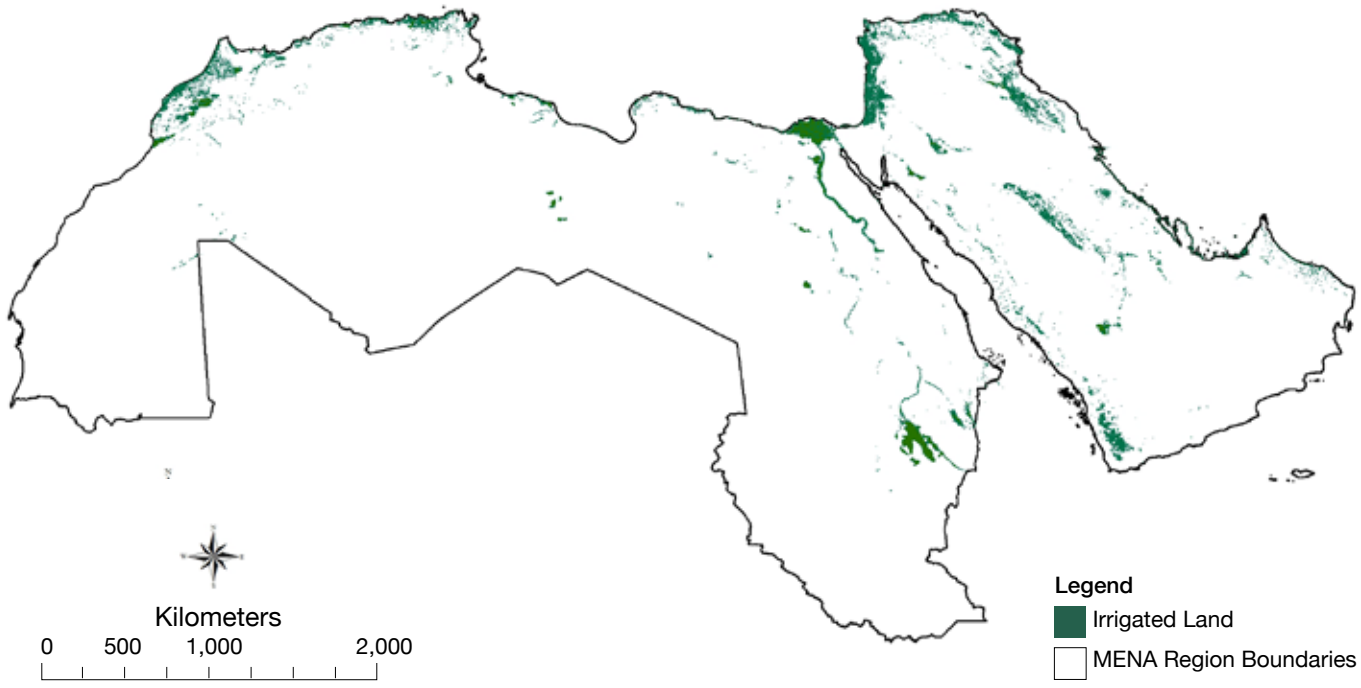
Work has begun to adapt an existing irrigation model for use in LIS; it includes simulating the practices used in the region (when, how and how much we irrigate). There is also a need to locate the areas of irrigation, so the team has developed a combined irrigation intensity map for the entire MENA region.

The arrival of updated scripts from the University of Wisconsin enabled production of a new MENA irrigation map using MODIS satellite data. This brought an important new data source at 250-metre resolution as opposed to the 10-km resolution of the existing FAO maps, enabling the team to capture in much finer detail the nature of irrigation throughout the area under study.

Crop modeling has received a new focus this year. ICBA has led the development of estimates of crop yield under certain climatic, management and plant physiologic conditions. When combined with other data from climate, crop maps and water availability, the crop modeling will inform decision-makers on local production yields under wide-ranging conditions. This work directly supports food security planning as well as strategic climate change adaptation ideas.

A modified crop type map of the Tunisian footprint was produced using images from the new Landsat mission, Landsat LDCM. Data collected from the field in addition to local knowledge were used at training sites to distinguish between the different main crop types. Seven main classes were studied: forests, olive trees, oat, cereals, orchards, citrus trees, and vineyards. Work also progressed to further develop crop modeling for cereals in Tunisia.

Irrigated Areas of the MENA Region-2012



Similar efforts to develop models of irrigation and crops are underway in Iraq, and in mid-2013 ICBA hosted a mission from Iraq's Ministry of Water Resources. The meeting discussed the future of the program and highlighted the areas in mapping and modeling of water/agriculture and climate change that Iraq most needs.

New ideas for livestock forages

In many parts of Uzbekistan arable lands are in serious decline due to monocropping of cotton and wheat. Use of intensive surface irrigation is causing soil erosion, loss of organic matter, salinization and waterlogging, all of which greatly reduce the sustainability of agriculture and undermine the long-term security and income of poor rural communities.

Promising research is underway to increase the agro-biodiversity on low productive lands with uncertain levels of water and increasing soil salinity. The strategy is to identify salt-loving (halophytic) plant varieties and salt-tolerant dual-purpose crops such as sorghum and pearl millet; these could replace traditional crops (e.g. cotton, wheat, corn, rice) or augment them on difficult marginal lands. To this end ICBA, together with ICRISAT and national partners, are assessing the best way to integrate these non-conventional varieties as food crops or livestock feed in local farming production systems in Central Asian countries.

The teams have screened more than 52 improved lines of pearl millet through on-station and farmer-participatory trials under different field management practices. They have identified a number of salt/drought tolerant varieties productive for food, grain and forage production. If these cultivars were grown near watering points in the vicinity of livestock herds of around 2000 animals on a 10-hectare area, their daily ration could easily be doubled from 2.0 to 4.0 kg per animal during the severe

winter months. The trials also identified promising dual-purpose varieties that produce grain for human food and feed for poultry or livestock.

In 2013 the national researchers released a new early-maturing variety of pearl millet named “Hashaki 1” in Uzbekistan. It has shown good re-growth after two cuttings, while relative growth rates, biomass (fresh and dry) and grain production of the newly released variety exceeded the local varieties by more than 200%. Hashaki 1 silage has proved itself the equal of maize silage when cut at 8-12 weeks. This new variety has performed well in dryland saline environments and has promise for planting widely to boost grain and forage production—either as the main crop in early spring, or as the second crop following the wheat harvest or as part of a rice rotation system.

Bioenergy potential from saline land

For a number of years, ICBA research has targeted cultivation of halophytes for crop and forage production with the belief that a possible avenue for reclamation of saline lands is to grow halophytic species (salt-loving plants) that remove salts from saline soils and water. However a promising new area of development is the cultivation of these salt-loving plants for renewable bioenergy. One project currently underway targets the unproductive, marginal salinized lands surrounding hundreds of small lakes in the Aral Sea Basin in Uzbekistan. Research has indicated these small lakes have potential utility as a resource for aquaculture or irrigation, but this utility could induce salinization that renders the water unusable. Hence, reclaiming saline lands near these lakes may benefit the economic utility of both land and water by reducing salt loads.

The research team of ICBA and partners has surveyed 50 farms affected by the conditions in the high vulnerable zone of the Aral Sea Basin. The project has also conducted field surveys to collect seed of some native salt-tolerant halophytes. Four halophytes (*Atriplex nitens, Climacoptera lanata, Salsola sclerantha, Kochia scoparia*) were planted in pure stands and intercropped with salt-tolerant crops (sorghum, pearl millet, artichoke and licorice) using artesian water for irrigation. The team examined the feasibility of using biomass from these demonstration plots as livestock feed or as a renewable energy resource.

The research team also assessed potential biogas production out of biomass from seven wild halophytes species. *Karelinia caspia* was flagged as the most promising of the seven for biogas production in desert areas of Central Asia, with possible sources of biomass coming from harvesting plants from the wild or plantings on abandoned saline arid lands.

Another species showing great promise as a biofuel is the genus *Salicornia* (saltwort). Researchers at the Masdar Institute in Abu Dhabi along with Boeing, Etihad Airways, and UOP Honeywell are looking at the potential of growing *S. bigelovii* (dwarf saltwort) in sea water and harvesting oil from its seeds as a biofuel source. ICBA collaborated with the Masdar Institute in 2012 on the first set of trials, and the encouraging results have led to further collaboration in 2013 to evaluate various *S. bigelovii* genotypes at different seawater salinities for green biomass and seed production. Similar work to look at short duration genotypes that can grow with seawater was undertaken in collaboration with King Abdullah University of Science and Technology.

A third project in the study of haloyphytes as biofuels is studying the potential for castor (*Ricinus communis*) and colocynth (*Citrullus colocynthis*) for biodiesel and feedstock production in marginal areas. Castor is native to Africa while colocynth, also known as desert gourd and Handhal (in Arabic), is a desert plant found in the Emirates region. Early studies have shown that castor has good adaptation to the UAE conditions and is moderately sensitive to salinity. In the study of colocynth 26 accessions were collected from the northern Emirates, UAE in expeditions during June-July 2013, and now studies are underway to compare the seed oil content of different accessions.

Quinoa holds promise of new crop in the Middle East and North Africa

Quinoa, an annual herb native to the Andes Mountains of Bolivia, Chile, and Peru, has great potential in the food and feed industry. It is gluten-free, highly nutritious and can thrive in marginal environments, making it a significant option to help sustain farm productivity when growing traditional crops becomes uneconomical due to increased soil and water salinity. In view of its exceptional nutritional quality and ability to grow in marginal environments, the FAO has identified quinoa as one of the crops that will play an important role in ensuring food security in the 21st century.

Quinoa is a facultative halophyte and can grow successfully in poor soils (including pure sand) and in environments with annual rainfall as little as 200-mm. Preliminary studies at ICBA research station and in on-farm trials in the western region of Abu Dhabi have indeed demonstrated quinoa's potential as an alternative crop for marginal environments characterized by poor soils and low quality irrigation water.

The prospect for a wider scale-adoption and production however requires further testing under a range of constrained biophysical environments (e.g. salinity,

water scarcity and nutrient-poor soils) and development and evaluation of production technologies for optimal yields under local growing conditions. Thus ICBA, in partnership with the UAE's Ministry of Environment and Water (MOEW), Abu Dhabi Farmer's Service Center (ADFSC) and the Peruvian organizations Institute of Scientific and Technological Research Cooperation Arab – Latin America of the Caribbean (ICCTALA), Instituto Nacional de Innovacion Agraria (INIA) and Universidad National Agraria La Molina (UNALM), is currently evaluating the performance of several quinoa varieties. It is testing their productivity on a range of soils using different qualities of irrigation water, in order to identify high-yielding salt- and heat-tolerant quinoa lines/varieties.

The prospects for quinoa are promising. With further testing there is a prospect for a wide-scale adoption and production in the region. ICBA has initiated work with partners to improve food security and nutrition security through a substantial increase of quinoa production. ICBA and its partners are together evaluating the potential of quinoa as an alternative food and feed crop for salt-affected areas, focusing on selected countries of the Middle East most affected by salinity and water scarcity and where agriculture and the agri-food sector contribute significantly to the national GDP.

A promising water resource for agriculture in the Arab world

Estimates show that 70% of the water in the MENA region is used for agriculture. With a diminishing supply of freshwater to sustain agriculture production, there is a critical need to look for other sources of water. Treated wastewater (TWW) is recognized as a potential substitute.

Field irrigated with treated waste water (Jordan)

ICBA, with partners in Jordan (National Center for Agricultural Research and Extension), Oman (Directorate General of Agriculture and Livestock Research) and Tunisia (National Research Institute for Rural Engineering, Water & Forest), has been engaged in a project that is evaluating how to increase the sustainable use of TWW in the irrigation of diverse crops in order to save fresh water resources. During 2013 the project focused on the effects of TWW on plant productivity, the limitations of TWW utilization for irrigating agricultural fields and an assessment of the environmental impact.

The researchers undertook screening/evaluation of a range of crops over the three partner countries and sought to establish the optimum application of TWW. In Jordan, evaluation of TWW use in tree production led to the study of two farms of olive trees and the biofuel plant, *Jatropha*. In Tunisia, they undertook extensive work on fruit trees, especially olive, citrus and pomegranate orchards, and applied irrigation using TWW in three representative locations on experiment stations and in on-farm trials. Forage trials in Jordan and Oman returned good results for yield and quality. In addition, non-conventional crops such as *Medicago. Jatropha* and *Jojopa* were tested with either saline or TWW irrigation, producing fodders that did not differ from conventional fodder for animal digestibility, fertility and health.

Experiments using TWW to artificially recharge the overexploited ground water table were successful and also led to a slight decrease in salinity. Another nine trials were implemented in experiment stations to analyze soils, water (irrigation, drainage and ground waters) and harvested plants (forages and fruits) for mineral composition (heavy metals and nitrates), parasites and bacteria composition. Results show that in sandy and silty-clay soils there can be significant soil contamination from both fecal indicators and heavy metals at 0–60 cm depth. However, until now there has been no reported fruit contamination with fecal bacteria, despite the fact that *Escherichia coli* concentration in TWW at times was above the World Health Organization limit. Further work will include more analyses on a wider sample size to ensure that TWW doesn't affect human health. Other analyses are projected to gain more knowledge about the effect on fodders and to produce a guideline about forage processing techniques to decrease potential threats.

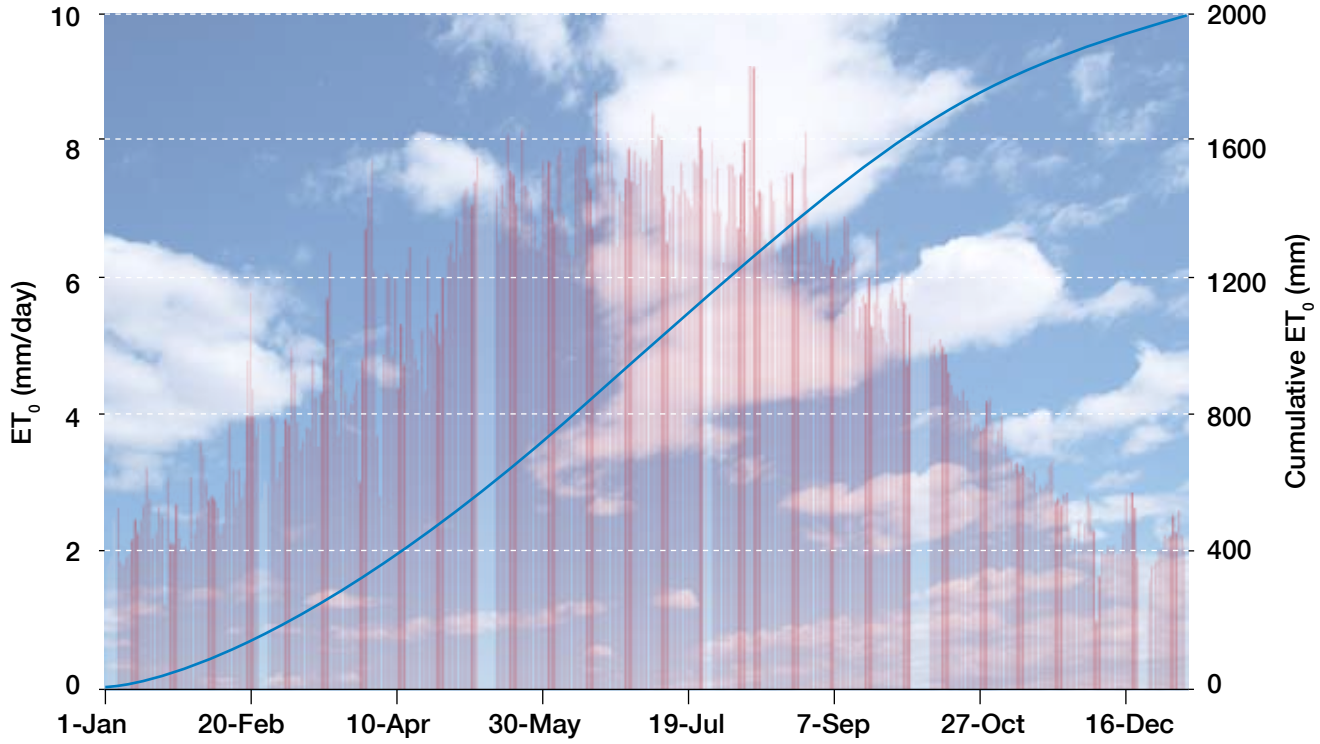
Outputs from this project include microbiological in-country guidelines for TWW use in agriculture. These guidelines will be shared between the partner countries in an effort to establish unified Arab guidelines.

As an additional knowledge exchange activity ICBA is looking to share the knowledge gained from this project at an international conference in 2014 and to extend capacity building activities.

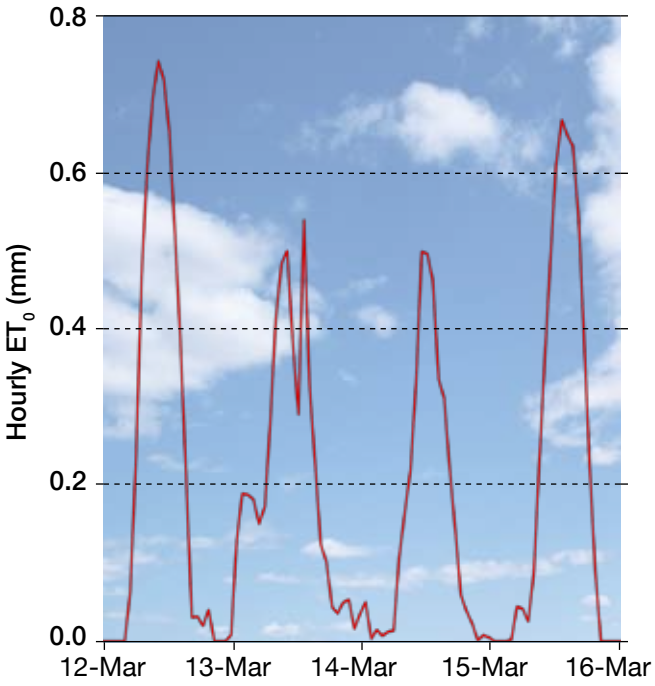
Weather data as a tool for irrigation management

Irrigation is a major consumer of water in many countries in the Middle East, but growing populations and urbanization have lifted competition for the limited water resources of the region. Reducing irrigation water requirements by improving irrigation management can help address the issues of both water security and food security.

Daily (mm/day) and cumulative (mm)potential evapotraspiration (ET_0) in 2012 estimated at International Center for Biosaline Agriculture, Dubai



Hourly ET_0 estimated from ICBA weather data



ICBA promotes the fundamental tenet that good irrigation management is knowledge of crop water requirements, which are driven largely by weather considerations. The Center thus supports a weather station to collect continuous data on critical factors such as temperature, humidity, wind speed and solar radiation. These data are processed into an equivalent depth of water required from irrigation in order to meet crop water requirements at various time scales—hourly, daily, weekly etc. as appropriate.

The usefulness of weather data for improved irrigation management relies on it being readily available when required. ICBA regularly collects daily weather data for use by ICBA research projects. In 2013 ICBA installed another weather station on a farm in Gayathi, in the Western Region of Abu Dhabi, as part of a project with the Abu Dhabi Farmer Services Center to further elaborate this technology on farmers' fields.

An excellent example of how weather data are used at ICBA for research purposes can be seen in its incorporation into irrigation management regimes in the SCADA automated irrigation platform. Here the daily estimates of potential evapo-transpiration (evaporation of water from soil and plant) are used to determine the irrigation duration required, and then to automatically turn the irrigation on and off while simultaneously recording factors such as water flow rate, pressure, and salinity.

Another example is a project initiated in 2013 and scheduled for implementation early in 2014 in partnership with Environment Agency Abu Dhabi and scientists in New Zealand to measure the actual flow of water through date palms (transpiration) as a function of hourly evapo-transpiration. This will enable operators to determine the amount of water required by this major UAE crop compared with the amount actually applied, helping them to develop improved irrigation guidelines. So far, the actual daily and hourly measured water use by three date palms at ICBA (using sap flow measurement technology) correlates very well with the daily and hourly evapo-transpiration, showing considerable potential to reduce irrigation water usage. As well, the contribution of daily weather data could lead to 50% water savings.

Plant genetic resources for marginal environments

In the years since its establishment ICBA has accumulated a unique bank of crop and forage species germplasm with proven or potential salinity tolerance; a rich source of genetic diversity for researchers seeking to mitigate problems of salinity in agricultural production systems.

In the Arabian Peninsula, native species are under increasing threat due to overgrazing and rapid urbanization. Many of these species have great potential for economic exploitation and, because of their natural adaptation to the local environment, they are more appropriate in landscaping and habitat restoration programs than exotic species.

ICBA's genetic resources project continues to acquire, conserve and distribute germplasm of species identified as superior on marginal lands for food production, animal feed, bioenergy generation or ornamental use. The project is also collecting germplasm of native plants for conservation and sustainable use.

During 2013 the project acquired around 2900 accessions of eight species. These included the barley core collection of the US Department of Agriculture (USDA), consisting of 2,750 accessions, and a wild cowpea native to the Hawaiian Islands that grows naturally on the sandy beaches and frontal dunes near the seashore with promising value as salt-tolerant forage.


Salicornia

The project evaluated 42 accessions of grain amaranth for suitable traits. The ICBA scientists found significant variation among the accessions, especially for plant height, stem and leaf color, days to flowering, seed and biological yields. They selected 12 promising accessions, based on their growth performance, leafiness and seed yields, and will further evaluate these for yield potential under saline field conditions. In addition the team expanded the program to multiply seed of stress-tolerant germplasm for conservation and further utilization.

The barley core collection from USDA, held at ICBA, was the subject of intensive study in a second project. Barley is the most salt tolerant of the small grain species, but to date no one has undertaken a systematic evaluation of barley's extensive genetic resources to determine variation in salinity tolerance. Already the collection had been thoroughly genotyped by the USDA, so during 2013 the project team carried out an association analysis to identify the major genes that contribute to variation in salinity response. The collection was assessed under two irrigation treatments—fresh or saline water—at the ICBA research farm. Ten flag leaves of each line were harvested once fully expanded, then the treatments were compared for leaf length, maximum width, fresh weight and dry weight. At harvest, each plot was assessed for plant biomass and grain yield/quality.

Early results have enabled scientists to characterize several candidate chromosomal regions for sodium exclusion and either cytoplasmic (within-cell) sodium tolerance or sodium sequestration, along with superior agronomic performance. They are now cataloguing the level of salinity response in barley genotypes known to be well adapted to West Asia, especially the Arabian Peninsula.

Sharing knowledge builds partnerships as well as skills: ICBA's capacity development activities in 2013

ICBA has a sustained effort to ensure that its partners and beneficiaries gain new knowledge and skills. It does this by organizing training courses, workshops, seminars and graduate programs, and also by conducting a capacity building within projects. During 2013, ICBA conducted 20 training programs involving a total of 673 participants from 19 countries. Nine of these took place at ICBA headquarters in Dubai, three in Oman, Yemen and Egypt and 8 workshops and farmer field days were held in Central Asia (Uzbekistan, Karakalpakstan, Kazakhstan and Tajikistan)

Eight of the program's held at ICBA headquarters were part of the Center's program to increase capacity of UAE staff, especially the staff of the Ministry of Environment and Water (MOEW). From September through December 2013, selected participants from MOEW learnt about irrigation scheduling and water consumption, utilization of soil and thematic maps

for agricultural development, plant genetic resources in the UAE, production systems of non-conventional forage crops, date palm production systems in saline environments, GIS for water resources and irrigation management, economics and productivity of water in agriculture sector, and production systems of field and forage crops.

Participants in the courses responded enthusiastically to their experiences. From the course on plant genetic resources in the UAE one participant commented on the usefulness of the lecture on genetic engineering, the lectures on forest trees and the various ways of preserving them, also the practical session on Ghaf vegetative propagation.

Some who attended the course on production systems of non-conventional forage crops were especially pleased with their new understanding. There were favorable comments on how the course covered non-conventional forages from all aspects, starting with planting and best management practices, up to harvesting, conservation, marketing and reaching the consumer.

The participants in the course on date palm production systems in saline environments expressed their great satisfaction from the information learned. One participant was very eager to take back his new knowledge of date palm in saline environments and the quality of the dates to his workplace so that he could begin to apply it to many areas where they have been facing challenges.

After completing the course on economics and productivity of water in the agriculture sector one participant was pleased to have tackled the issues of water scarcity and increasing demand, and to have studied an array of solutions including water rationing, introduction of new technologies, and increasing farmers' awareness.

Another course held at ICBA's headquarters studied reclamation of lands affected by salinity in Africa. It attracted participants from 10 French-speaking countries—Benin, Burundi, Cameroon, Cape Verdi, Congo DR, Guinea Equatorial, Madagascar, Mali, Niger and Chad. The course was the fourth in a series that started in 2007.

In January 2013 ICBA organized a regional workshop on guidelines and methods for socioeconomic assessment and farm surveys in Muscat, Oman, as part of the regional project titled "Adaptation to climate change in WANA marginal environments through sustainable crop and livestock diversification". Participants learnt the relevance of socioeconomic studies to the project, along with basic methods and skills in farm surveys and their practical application.

In September 2013 ICBA organized a travelling training workshop in Yemen, titled "Variety selection, seed production, soil and crop management practices and on-farm efficient forage utilization". The workshop was part of the year's activities in the project "Adaptation to climate change in WANA marginal environments through sustainable crop and livestock diversification".

Thirty technical and extension staff from AREA and pioneer farmers attended the training theoretical sessions, which were followed by two days at a field school for 58 farmers, some of whom were women interested in the project.

In December 2013 ICBA conducted a training workshop in Cairo and Sinai, Egypt. It focused on farmers' field schools for rural family empowerment through optimization of forage and animal production, and was part of the year's activities for the project "Adaptation to climate change in WANA marginal environments through sustainable crop and livestock diversification". Participants at the workshop developed a model for presenting a course at farmers' field schools on integrated forage-livestock systems using marginal quality water (MQ) resources that could be replicated in all partner countries.

The workshops and farmer field days in Central Asia attracted a large number of participants (444) who gained experience and understanding on using salt tolerant plants and better farming practices to improve their agricultural production.

ICBA continues its long engagement with capacity building and training and is looking forward to expanding the options and approaches that can be used to build the skills and expertise of the Center's partners and stakeholders.

Voices from the field

Turning the Sinai green—the story of Jamal Al Khouli

Back in 2008 I sold my 0.5 ha of land in the Nile basin, south of Egypt, and bought 2 ha of land in the north of Sinai. I found the land wouldn't give the crops I was used to but in 2011 the extension staff of the Desert Research Center (DRC) introduced to me the benefits of a project they are conducting in collaboration with the International Center for Biosaline Agriculture (ICBA). The project was focusing on planting salt-tolerant crops for feeding animals. I thought that this was a good project that could benefit me so I gave up a piece of my land as a demonstration plot for their crops while I kept my old style of planting. In just few months, I noticed the difference between my land management and their management practices. In 2012, I attended a Farmers' Field School training in Cairo and Sinai organized by ICBA and DRC. In that training and with the follow-ups of the DRC extension staff, I learned how to manage my land. They explained to me land preparation, fertilizer management, planting methods, irrigation scheduling and harvesting methods. After that, and what I consider most important, I learned how to make silage and fodder blocks to feed my animals. This year, 2013, I attended again the second Farmers' Field School training organized by ICBA and DRC in Cairo and Sinai and presented my experience to others including high officials and representative of international organization and NGOs.

I am very proud that the challenge I accepted is worth the experience I went through. I was among few who tried the new crops and management practices but now we are pioneers in the country. Hundreds of farmers in the neighborhood are now interested to get seeds of salt-tolerant crops and plant their fields with the management practices I learned. I am ready to help them all. With all of our efforts, I am sure that north Sinai will turn green in the near future.

Forum explores innovations in agriculture and food security

ICBA's research innovation agenda is based on the premise that coping with an uncertain future in food production requires careful management of resources like soil, water and biodiversity and the most efficient use of environmental goods and services. To further discuss and hear about particular areas of innovation in agriculture and food security, ICBA and the Agriculture Department at the Islamic Development Bank (IDB) co-hosted a forum on 20 May 2013 during IDB's annual meeting, in Dushanbe, Tajikistan.

An audience of over 200, listened to two moderated panel sessions that highlighted recent innovations in policy and technology that would benefit food security.

On the policy panel, Dr Ismahane Elouafi, Director General of ICBA was joined by noted experts in policy perspective, including Dr. Jeffrey Sachs, Director of The Earth Institute at Colombia University, H.E. Dr Kosimov Kosim, Minister of Agriculture of Tajikistan, Dr Sergey Kiselev, Director General of Eurasian Center for Food Security in Moscow, and Dr. Demba Ba, Director of Agricultural and Rural Development in IDB. The panel was united in affirming the need for sustained global recognition and action on food security issues through United Nations efforts and in G8 and G20 deliberations. Members agreed that changes in behavior will be necessary, involving policy development and institutional reform (in both public and private arenas).

The second panel addressed the technical solutions currently being designed and implemented. Hans Hassle, the CEO of Plantagon (a global company with headquarters in Sweden), spoke about the possibilities of growing large amounts of food in urban environments through vertical technology involving a specialty technique devised by his company. Chang Hoo Chun, Senior Advisor at Gyeonggi Agricultural Research and Extension Services (Republic of Korea), spoke about his organization's success in precision agriculture. Stephen Hill, Managing Director of Kimseed International (Western Australia), described innovations in seed production and equipment and how to adapt these to local environments, and Dr. Shoaib Ismail, Senior Scientist at ICBA explained some innovations in optimizing resources. Finally Dr. Hukmatullo Akhmadov, President of Tajik Academy of Agricultural Sciences spoke on other innovations from a regional and local level.

In closing the Forum Mr. Fawzi Al Sultan, Chair, ICBA Board of Directors, noted that pressures on food security are not going away. He stressed that increased investment in agricultural research is fundamental and that investment is needed to scale out research to address the big development challenges we face. Although the issues cannot be solved overnight there is a need to work faster, he concluded.

The importance of partnerships

Strategic alliances and partnerships at different levels are a cornerstone of the ICBA 2013-23 Strategy. With strong alliances and partnerships, ICBA research has greater potential to deliver agricultural and water scarcity solutions in marginal environments. Over the course of 2013 ICBA has engaged with partners in various ways. We have, with partners, developed and implemented projects; we've engaged in targeted events, conferences and meetings as joint efforts with our partners, and conducted training and capacity building for and with partners. As we look forward, ICBA will continue to build on existing partnerships that align with the strategic direction, and develop new alliances that will further the research and innovation outcomes.

During 2013 ICBA consolidated strategic relationships, notably with institutions interested or with a particular focus on research for development of marginal environments. Such strategic partners included the UAE Ministry of Environment and Water, Environment Agency Abu Dhabi as well as financial institutions such as the Islamic Development Bank, the African Development Bank, the Global Dry Lands Alliance and the Arab Authority for Agricultural Investment and Development.

A particularly significant alliance has been with the Association of International Research Centers for Agriculture (AIRCA). AIRCA is a nine-member alliance focused on increasing food security by supporting smallholder agriculture and rural enterprise within healthy, sustainable and climate-smart landscapes. The member organizations all have a proven track record of research, development and implementation, working closely with farmers, extension systems, national research institutes, non-governmental organizations (NGOs) and the private sector across a wide range of crops and ecosystems.

National agriculture research organizations, other international agricultural research organizations such as the CGIAR and academic institutions have also been a focus for partnerships. A full list of these partners is in the section on "**Financial contributors and Partners in 2013**".

Financial statements for 2013

Board Approved

STATEMENT OF ACTIVITIES (USD)	2013	2012 (Restated)
GRANTS AND CONTRIBUTIONS		
Grants unrestricted	7,000,000	7,000,000
Grants restricted	2,553,158	1,244,986
Interest income	245,883	151,879
Other income	10,753	6,220
Total grants and contributions	**9,809,794**	**8,403,085**
EXPENSES AND LOSSES		
Salaries and Benefits	(5,554,119)	(4,881,832)
Operating Expenses	(3,985,061)	(2,652,330)
Total expenses and losses	**(9,539,180)**	**(7,534,162)**
SURPLUS FOR THE YEAR	270,614	868,923

STATEMENT OF FINANCIAL POSITION (USD)	2013	2012 (Restated)
ASSETS		
Current Assets		
Cash and cash equivalents	3,865,657	2,885,345
Short-term deposits	9,239,130	9,918,478
Receivable from donor	57,450	292,203
Other receivables	108,164	111,250
Due from employees	38,209	43,067
Prepayments	783,865	125,037
Inventory	25,570	17,825
Non-current assets		
Property and equipment	6,724,794	6,006,155
Total Assets	**20,842,839**	**19,399,360**
LIABILITIES AND NET ASSETS		
Current liabilities	698,907	593,787
Donors payables	1,928,937	1,855,573
Non-current liabilities	812,714	497,530
Total Liabilities	3,440,558	2,946,890
Net assets unrestricted un-appropriated-property and equipment	6,724,794	6,006,155
Net assets unrestricted un-appropriated-others	4,048,824	2,950,872
Net assets unrestricted-appropriated	6,628,663	7,495,443
Total Net Assets	17,402,281	16,452,470
TOTAL LIABILITIES AND NET ASSETS	**20,842,839**	**19,399,360**

Expenditure by category (USD)

Salaries	30%	2,844,770
Employment Benefits	28%	2,709,349
Collaborators and Partnership Costs	10%	932,705
Depreciation	7%	663,349
Supplies and Utilities	6%	586,148
Contract Services	5%	502,204
Consultants and Professional Fees	5%	447,238
Capacity Building	3%	328,103
Travel	2%	231,875
Maintenance	1%	114,669
Other Expenses	1%	69,005
Printing and Publication	1%	67,571
Board Expenses	0%	42,194

Financial contributors and Partners in 2013

Core donors

United Arab Emirates Ministry of Environment and Water (MoEW)

Environmental Agency of Abu Dhabi (EAD)

Islamic Development Bank (IDB)

Grant donors

Ajman Sewerage (Private) Company Ltd.

Arab Bank for Economic Development in Africa (BADEA)

Arab Fund for Economic and Social Development (AFESD)

Australian Centre for International Agricultural Research (ACIAR)

Abu Dhabi Farmers Services Center (ADFSC)
International Fund for Agricultural Development (IFAD)

MASDAR Institute of Technology

National Academy of Sciences

OPEC Fund for International Development
Swedish International Development Cooperation Agency (Sida)

United States Agency for International Development (USAID)

Partners

Abu Dhabi Farmers Services Center (ADFSC)

Abu Dhabi Food Control Authority (ADFCA)

Arab Water Council (AWC)

Arab League

Center of Waste Management, Abu Dhabi

International Center for Agriculture in Dry Areas (ICARDA)

International Crops Research Institute for the Semi Arid tropics (ICRISAT)

International Water Management Institute (IWMI)

Masdar/Boeing, UAE

Ministry of Agriculture and Fisheries, Oman

NARS IN Jordan, Kazakhstan, Iraq, Pakistan, Palestine, Oman, Syria, Tajikistan, Tunisia, UAE, Uzbekistan, Senegal, Burkina Faso, Gambia, Mauritania, Niger, Nigeria

NASA Goddard Space Flight Center National

Institute for Agrobiological Science, Japan

United Nations Development Program (UNDP)

UAE Municipalities: Abu Dhabi, Dubai, Sharjah

Universities: BITS-Dubai Campus, UAE University, Al-Ain University, King Abdullah University of Science and Technology, Department of Applied Ecology National University of Uzbekistan, Academy of Sciences of Uzbekistan, Nevada University, University of Montana

USDA-ARS

2013 Publications

Peer reviewed Journal Articles

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5. Belhaj, F. M., Dakheel, A. J., McCann, I., Abu Rumman, G., Shabbir, G. M., & Gailani, A. A. (2013). Selection of high yielding and stable safflower (Carthamus tinctorius L.) genotypes under salinity stress. *Agricultural Science Research Journal* 3(9), 273-283.

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5. King, P., Grealish, G., Shahid, S. A., & Abdelfattah, M. A. (2013). Land evaluation interpretations and decision support systems: Soil Survey of Abu Dhabi Emirate. Chapter 6, In: Shahid, S. A., Abdelfattah, M. A., & Taha, F. K. (eds.) *Developments in soil classication, land use planning and policy implications: Innovative thinking of soil inventory for land use planning and management of land resources*. (pp.147-164) Springer Dordrecht Heidelberg New York London.

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9. Shahid, S. A. (2013). Developments in salinity assessment, modeling, mapping, and monitoring from regional to submicroscopic scales. Chapter 1, In Shahid, S. A., Abdelfattah, M. A., & Taha, F. K. (eds.). *Developments in Soil Salinity Assessment and Reclamation-Innovative Thinking and Use of Marginal Soil and Water Resources in Irrigated Agriculture* (pp. 3-43) Springer Dordrecht Heidelberg New York London.

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4. Arhanaova, D. D., Akinshina, N. G., Toderich, K. N., Yasui, H., Nishonov, B., Razikova, I., & Rakhimova, T. U. (2013). Ecological peculiarities of halophytes, grown on saline affected desert lands in Uzbekistan. Proceedings of International Conference: Biodiversity and Wild Le Conservation Ecological Issues, Tsaghkadzor, Armenia: pp. 40-45.

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6. McCann, I., Belhaj. F. M., & Dakheel, A. J. (2013). Evaluation of the Decagon® 5TE sensor as a tool for irrigation and salinity management in a sandy soil. Presented at Int. Conf. on Ag. Engineering, Muscat.

7. Khujanazarov T., Tanaka K., Toderich K., Assessment of human activities impact in Zeravshan River Basin, 6th Asia Pacic Association of Hydrology and Water Resources Conference, Seoul, Korea, 2013.

8. Khujanazarov, T., Toderich, K., & Tanaka, K. (2013). Land and Environment remediation in lower Zerafshan river Basin and adaptation measures to address future climate change Abstracts Material of Desert Technology 11 International Conference (San Antonio, TX, USA), November 19-22, 2013 p. 76.

9. Shahid, M., Jaradat, A. A. & Rao, N.K. (6-7 October 2013) Diversity in Omani wheat landraces. 2013. *Biosalinity News* 14(2)

10. Shahid, M. & Jaradat, A.A. (4-5 March 2013). Barley: A salt tolerant cereal crop. *Biosalinity News* 14(1).

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