ISSN 1563-1532

Biosalinity News

Newsletter of the International Center for Biosaline Agriculture

VOLUME 11, NUMBERS 2 & 3 DECEMBER 2010

FROM THE EDITOR

This current issue of *Biosalinity News* for 2010 is a bumper one combining new developments over the last few months.

The most exciting news is featured on our front page - the signing of a revised and extended funding agreement for ICBA.

As well CBA scientists outline their roles in the conservation of the useful ghaf tree and the quest for salt- and heat- tolerance in vegetables.

We have also included an update on some ICBA projects and our latest successes in capacity building and knowledge-sharing.

Furthermore, one of our readers has explained the latest management techniques of soil salinity using subsurface drip irrigation.

Contributions on research or projects of interest to our readers are always welcome, as are letters to the Editor. Please send your submissions, including relevant photographs and figures, to:

The Editor
Biosalinity News, ICBA
PO Box 14660
Dubai, UAE
editor@biosaline.org.ae

2010: A NEW DECADE AND A NEW BEGINNING...

THE UAE GOVERNMENT AND IDB SUPPORT ICBA

The Government of the United Arab Emirates and the Islamic Development Bank signed on 12 April 2010 a revised and extended agreement regarding the financial support of the International Center for Biosaline Agriculture (ICBA). His Excellency Dr Rashid Ahmad Bin Fahad, the Minister of Environment and Water, and His Excellency Dr Ahmad Mohamed Ali, the President of the Islamic Development Bank, signed the partnership agreement in the presence of senior representatives of the Ministry of Finance, the Ministry of Foreign Affairs and the Chair of ICBA Board of Directors Mr Fawzi Al Sultan.

His Excellency Dr Rashid Ahmad Bin Fahad, the Minister of Environment and Water (right), and His Excellency Dr Ahmad Mohamed Ali, the President of the Islamic Development Bank (left), signing the partnership agreement

Commencing in 2010, the new financial model will involve considerable support from the UAE Ministry of Environment and Water (MOEW), the Environment Agency - Abu Dhabi (EAD) and from the Islamic Development Bank IDB). ICBA also receives support from the Arab Fund for Economic and Social Development (AFESD), the OPEC Fund for International Development (OFID) and the International Fund for Agricultural Development (IFAD) and other international donors.

This extended support will enable the Center to expand its research on water and on agricultural development in marginal areas where biosaline agriculture is viable. Over the last ten years ICBA has established a strong reputation among international centers of excellence in the use of saline water for agricultural production. The adoption of the broader mandate outlined in the *Strategic Plan 2008-2012* has allowed ICBA to expand its mandate to address issues confronting the water sector including research on integrated water resource management, water technology, water policy and institutional development.

Available renewable water resources per capita in the Arab world are among the lowest in the world; a situation being worsened with the advent of economic growth, population increase, and climate change. Water issues are becoming more complicated and can only be solved through a systemic process of scientific discovery and application.

ICBA, with its proven strength in research on better utilization of marginal quality water and its strong partnership with organizations within the region, plays a critical role in this scientific process. The new agreement with the UAE Ministry of Environment and Water, the Environment Agency - Abu Dhabi and the Islamic Development Bank Group will enhance ICBA's ability to expand this role and contribute to advancement of research and development in water-scarce region.

Managing Soil Salinity with Subsurface Drip Irrigation

Thomas L Thompson, Texas Tech University, Lubbock, Texas, USA[1]

Introduction

Drip irrigation is the application of water under low pressure through low-flow emitters embedded within the walls of plastic tubing. In the USA, surface drip irrigation is reserved mostly for permanent (e.g. tree) crops, while subsurface drip irrigation (SDI) is used widely for annual crops. Modern SDI installations can last for 20 years or more with proper maintenance. When compared to surface irrigation (flood and furrow irrigation), SDI will reduce water loss to evaporation, deep percolation, and completely eliminate surface runoff. The use of SDI may also increase crop marketable yield and quality, and can result in high nutrient use efficiency. In fact, the use of SDI offers the ultimate in efficiency of crop water and nutrient management for open-field agriculture. Saline irrigation water can be used with SDI, while maintaining yields and improving water use efficiency compared to surface irrigation, because SDI can result in suitable root-zone salinity.

Accumulation of salts in concentrations detrimental to plant growth is a constant threat in irrigated crop production. With surface irrigation, leaching adequate amounts of water through the soil profile (e.g. the 'leaching requirement') is the desired method for maintaining suitable soil salinity. However, the classical 'leaching requirement' approach does not work well with SDI, because irrigation with SDI results in no salt leaching above the depth of the drip tape, and salts will accumulate throughout the growing season. Irrigation with SDI can maintain suitable root-zone salinity, but surface salt accumulation will occur unless there is adequate leaching from rainfall or supplemental surface irrigation. Facilitating crop establishment with SDI will help to improve the long-term economic sustainability of SDI. The amount of salts that will accumulate above the drip tape is a function of several factors, including, but not limited to, water quality and evapotranspiration. Salt accumulation with SDI is of particular concern in arid and semi-arid regions, where high rates of evapotranspiration and low rainfall can result in large amounts of salt accumulation near the soil surface. This salt can hinder production of salt-sensitive crops.

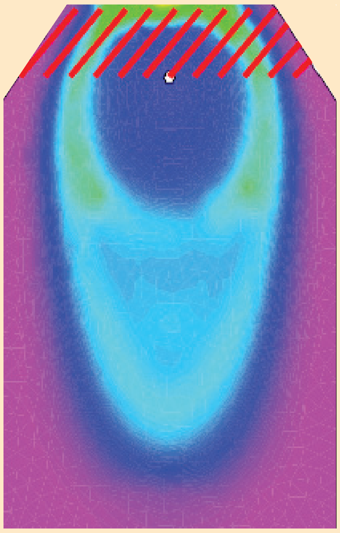


Figure 1. The 'critical zone' of soil above the subsurface drip tubing, where salts will accumulate

The 'critical zone' for salinity management with SDI can be defined as the soil above the depth of the drip tubing, where leaching from irrigation is not effective (see Figure 1). Salts will continue to accumulate in the critical zone unless there is adequate rainfall or leaching from supplemental surface irrigation. Salts that accumulate in the critical zone will become particularly important when SDI-irrigated fields are replanted. The most obvious way to avoid crop failure or yield reduction due to poor stand establishment is by leaching salts from the surface to a depth where they no longer pose a threat to seedlings. In the following paragraphs we will outline three methods for managing salts with SDI so that crop germination and establishment is not compromised—supplemental sprinkler irrigation, shaping of soil beds, and transplanting. The most common method used is supplemental sprinkler irrigation.

Installing subsurface drip irrigation using a tractor

Photo by T.L. Thompson

Newly-installed subsurface drip irrigation tubing

1. *For more information, contact* **thomas.thompson@ttu.edu**

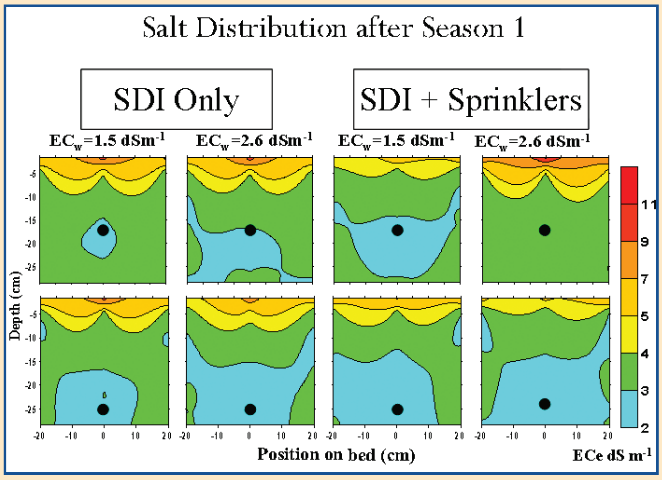


Figure 2. Salt distribution after one season of irrigation with subsurface drip irrigation. The initial soil EC was 2.0 dS m-1

Supplemental sprinkler irrigation

Sprinkler irrigation is the most commonly used method of leaching salts below the critical zone. Using sprinkler irrigation for germination in fields with SDI is a time and energy-consuming task that requires high capital inputs above that required for installation and management of the permanent SDI system. However, combining sprinkler irrigation for crop establishment followed by in-season irrigation with SDI is the most water-efficient combination of irrigation technologies.

Limited research has been reported that evaluates the effects of salinity on the establishment of crops with SDI in successive seasons. Thus, we initiated a field experiment in Arizona, USA to determine the effects of tape depth (18 and 25 cm), irrigation water salinity (ECw), (1.5 and 2.6 dS m^{-1}) and germination method (SDI vs. sprinkler) on end-of-season salt distribution with SDI during two growing seasons. We sampled soils in the planted area at the end of two growing seasons. Following season 1, in which we planted cantaloupe, salt accumulation was high enough to significantly reduce the germination and establishment of the next crop (see Figure 2). Sprinkler irrigation was needed to achieve 100% establishment of direct-seeded broccoli during season 2. In such situations with SDI, unless significant amounts of rainfall occur, salt will continue to accumulate and the situation will become worse with time.

Other methods for critical zone salt management

Methods for managing salt without using sprinklers include transplanting and shaping of soil beds. Using transplants will eliminate the need for sprinklers during establishment, because the root ball is usually placed a few cm below the zone of highest salt accumulation. However, sprinklers are often used with transplants to prevent desiccation, because several hours may be required for water to move from the drip tape to the root zone. Transplanting may eliminate the need for sprinklers to manage salts, but require high capital inputs and may not improve the economic sustainability of SDI. Transplanting is used only with high-value vegetable crops.

Shaping of soil beds has been used as a means to manage salt accumulation above the drip tape. This method involves forming the beds to a peak and pre-irrigating to move salts toward the peak. The tops of the bed are then removed into the furrow leaving behind soil of low salinity. Direct seeding of some large-seeded crops can then occur without concern of inhibited emergence. Small seeded crops that require precision planters cannot usually be direct-seeded into moist beds. Bed shaping procedures may prove effective in some crop rotations by eliminating the need for sprinklers, but the excess water needed to pre-irrigate beds may not be economically feasible, depending on water cost.

Conclusions

Crop rotations with SDI in arid regions often feature high-value crops to justify the high capital inputs required for purchase and installation of SDI. These crops are often small-seeded vegetables. Depth of placement is a function of seed size; smaller seeded crops must be planted at shallower depths. Direct seeding of small seeded crops requires use of precision planters in dry soil. Shallow seed placement requires higher volumes of water for germination and establishment and, as a result, more salts accumulate in the critical zone.

In climates with >450 mm of annual rainfall, leaching from rainfall will probably be sufficient to maintain soil salinity below harmful concentrations, except when very saline irrigation water is used. Areas with exceptionally good water quality (<0.5 dS m^{-1}) may not require sprinkler pre-irrigation for several years. Where water cost is low and water quality is sufficiently high, the use of SDI for germination and establishment may be preferred. However, if water cost or salinity is high, use of sprinklers for pre-irrigation may be preferred, because less water is needed for germination. The cost and quality of water available to growers will influence which irrigation procedures are used during germination and establishment of small seeded, salt sensitive crops.

Leaching salts with sprinkler irrigation in an SDI-irrigated field

Prosopis cineraria: A Benevolent Tree of the Deserts

Mohammad Shahid[1], NK Rao[1] and Abdullah Jaradat[2]

[1] International Center for Biosaline Agriculture (ICBA), [2] United States Department of Agriculture (USDA)

Prosopis cineraria is an evergreen tree that inhabits the dry and hot regions of the Middle East and South Asia. In the United Arab Emirates (UAE) and other Arab countries *P. cineraria* is commonly called ghaf. A very useful tree that generously supplies food to human, livestock and wild animals, the green canopy of the Prosopis also provides cool shade from the blistering desert heat to a wide range of wildlife. Given its importance to the people, domestic animals and wildlife of the country, it is considered to be the national tree of the UAE.

Belonging to the family Fabaceae (Leguminosae) and subfamily Mimosoideae, the genus *Prosopis* includes about 45 species of shrubs and trees that are found in tropical and subtropical areas of Africa, the Americas and Asia. The natural growth ranges of *P. cineraria* are the arid regions of Oman, Saudi Arabia, UAE, Iran, Afghanistan, Pakistan and India. By growing in areas with 75 mm annual rainfall, eight months dry period and temperature of 50^0C, *P. cineraria* demonstrates its high drought and heat tolerance. It grows quite successfully in sandy soil. Under relatively mild conditions *P. cineraria* usually form open dry woodlands that play an important role in desert ecosystems.

P. cineraria leaves are alternate, bipinnately compound with 1-3 pairs of pinnae. Its spines are straight having a conical base and are spread along the stem length. Yellow to green 0.6 cm flowers are borne on 5-23 cm racemes during March to May and October to January. Its light-yellow to reddish-brown pods that appear after about two months of flowering are 5-20 cm long that enclose up to 25 light to dark brown seeds.

The tree has a long and well developed root system with a tap root that may grow up to 60 m in length vertically, thus anchoring it in the ground and enabling it to absorb water from the deep aquifers. Its root nodules, as with other legumes, have symbiotic bacteria that help in fixing atmospheric nitrogen in the soil.

P. cineraria is a very salt-tolerant tree that thrives quite well in 50% seawater. A number of its ecotypes have been observed growing in the highly saline coastline areas. In the UAE, some of the ghaf trees have been found flourishing close to hyper-saline drainage water. The tree also grows in high alkaline soil of pH 9.8.

Ghaf in the UAE

Prosopis cineraria is one of the three species of the genus that are found in the UAE. It is the tallest tree of this region and may reach to the height of 15 m. Single trees are common in the northern UAE, although forests are found in the Digdaga area of Ras Al Khaimah Emirate, smaller groves exist in the Hajar Mountains.

Before the oil boom in this region, people would eat the young tender ghaf leaves and pods as salad or add them to their rice as a supplement. For its medicinal values, the ghaf has been used to cure different ailments including cataracts, dysentery, dyspepsia and toothache. The ghaf tree plays a vital role for the existence of nearly all of the desert animals by providing food and shelter, for example, wild animals including gazelles, oryx, and hares. Many rare bird species of the UAE like the eagle owl and brown-necked raven nest in it.

For centuries the ghaf has been an essential source of feed for domestic animals. Its leaves which remain green even during the hottest months of the year provide fodder to domestic animals and the pods which are rich in protein are collected in summer and fed to livestock during winter.

Local people love and revere the generous ghaf so much that they name their children after the tree, for

P. cineraria *is a multi-use tree of the deserts*

P. cineraria *bark can be used in tannery processes*

Camels love to nibble at tender nutritious pods of P. cineraria

1. *For more information, contact* **m.shahid@biosaline.org.ae**

example, Ghafa, Ghafan and Ghaufa. The founding father of the modern UAE, Sheikh Zayed bin Sultan Al Nahyan, emphasized the importance of preserving the ghaf tree and encouraged its plantation along the highways as well as in the open desert.

The ghaf tree in the UAE is under threat for many reasons including global warming which is making the deserts too hot for its survival. The increase in camel number is to blame for the overgrazing of the tree while the population boom is responsible for the overuse of groundwater that has led to declining levels making it beyond the reach of the ghaf roots. Pollution of both air and water is also contributing to a fall in the number of ghaf trees in the UAE. The UAE conservationists are running a campaign to secure the future of the tree in the country.

Utilization and benefits

Prosopis cineraria produces new foliage during the hot and dry months of July and August when most other trees are leafless. Its leaves have 14% crude protein, 20% crude fiber and 18% calcium that make the tree highly nutritious fodder which is liked by different animals such as goats, sheep, camels and donkeys. As both its leaves and pods are rich in protein (and low in fat) they can be exploited as food for health-conscious people. Its flowers can be used as a source of nectar in honey production.

The tree is an excellent source of firewood and charcoal (5,000kcal/kg). It is also used in house-building, boat frames, tool handles and posts. Its bark produces edible gum and the bark itself has the potential to be used in industries such as tannery.

P. cineraria plays a role in containing desertification by stabilizing the sand dunes with its deep root system. This system also means that the tree does not compete with nearby crops for water and nutrients and soil fertility of soil is improved by the addition of nitrogen.

Research need

Within its natural range, *Proposis* is considered to be one of the most important trees with key economic and environmental roles to play in some of the most hostile arid environment. In the vast desert areas found in the Arabian Peninsula large *P. cineraria* woodlands are found, which are vital to local inhabitants, who have used the tree historically in a sustainable way.

Increased pressure on the woodland has halted regeneration and threatened the trees' survival in large parts of the Arabian Peninsula. Its high degree of tolerance to adverse soil and climatic condition and wide and unexploited genetic diversity within the species shows its potential role in agro-forestry and silviculture programs.

In some of its natural range areas it is an important agro-forestry species. Exploitation of its genetic variation in other regions may bear fruit. With this in mind a study was undertaken by the Plant Genetic Resources Program of the International Center for Biosaline Agriculture to find the diversity of *P. cineraria* trees in the UAE. For this purpose different morphological characteristics of the tree including angle/shape of tree crown, leaf color, number of leaves per 30 cm of branch, leaf area and dry weight, date of flowering, maturity date of pod, inflorescence color, length and weight, pod length and weight, number of seeds per pod, number of seeds infected with insects and other seed details (width, thickness, color and weight) have been studied in detail.

Initial results indicate the presence of considerable genetic variability within the local ghaf trees. The sizeable genetic diversity of *P. cineraria* can be exploited for different breeding purposes including introduction to other non-natural range areas.

Many bird species including the Collard dove shelter in P. cineraria *tree*

P. cineraria *flowers provide nectar for honey production*

At Al Hayer in the UAE, a road has been bifurcated for a short distance to save a P. cineraria *tree*

The quest for Salinity and Heat Tolerance in Vegetables

NK Rao[1] Plant Genetic Resources Scientist, International Center for Biosaline Agriculture

Vegetables provide much higher income per hectare than staple crops. Worldwide, the production of vegetables has doubled over the past quarter century and the value of global trade in vegetables now exceeds that of cereals (de la Peña and Hughes, 2007). In recent years, however, the increase in salinity of soil and water in many agricultural areas is threatening vegetable production. Increasing demand for water from expanding populations is also constraining fresh water supplies, forcing farmers to use brackish and other low quality waters to grow crops, including vegetables.

The salt tolerance of vegetables is important because of their high cash value. Germplasm tolerant of high temperatures, flooding and drought has been identified and advanced breeding lines are being developed in major vegetable crops (de la Peña and Hughes, 2007; Keating *et al.*, 2010). However, salinity has not received much attention, in comparison with other abiotic stresses.

In addition to salinity, vegetables are known to be sensitive to temperature extremes. The Arabian Peninsula is one of the hottest regions in the world with day temperatures in summer often exceeding 50°C. It is also one of the driest regions in the world with very low and unreliable rainfall. Climate change predictions for the Arabian Peninsula project 1-2°C increase in temperatures by 2030-2050. Higher rates of evaporation due to increased temperatures are expected to aggravate land and water resources degradation with adverse affects on vegetable production. Thus, the identification of germplasm which could produce economic yields under the harsh climatic conditions will be crucial to sustain vegetable production in the region.

ICBA's research

The selection and use of genetic variation already present in existing crops and developing halophytes as alternative crops have been the two main approaches adopted by the International Center for Biosaline Agriculture (ICBA) to improve the productivity of salt-affected lands. With an initial focus on salt-tolerant forage production in marginal areas, several thousand genotypes of more than fifteen species were acquired and screened for tolerance to varying levels of irrigation water salinity - from moderate to highly saline and under controlled as well as field conditions. This has resulted in the identification of many salt-tolerant genotypes of crops such as sorghum, pearl millet, triticale, canola, and fodder beet.

Since 2008, ICBA has extended its initial focus on applied research and technology development in saline irrigated agriculture to the broader mandate to improve agricultural production with an integrated water resource system approach, using other marginal quality waters such as treated wastewater. High value vegetables and ornamental crops find a 'special niche' in production systems based on treated wastewater, since the returns from these exceed input costs by acceptable margins. There is also growing interest in the UAE and other countries of the region in protected agriculture based on vegetable production to reduce dependency on imports and achieve self-sufficiency. In line with this, ICBA has recently started to acquire the germplasm of major vegetables to study and identify genotypes capable of producing economic yields with marginal soil and water resources.

Screening procedure

The identification of salt tolerant germplasm with adaptation to local growing environment requires systematic screening using more than one screening method, bearing in mind that crop response to biotic stresses (salinity, heat, etc.) depends on the developmental stage and field screening is difficult when the number of accessions is large.

The screening procedure followed at ICBA is shown in Figure 1. It integrates more than one method to be able to identify germplasm with high yield potential and

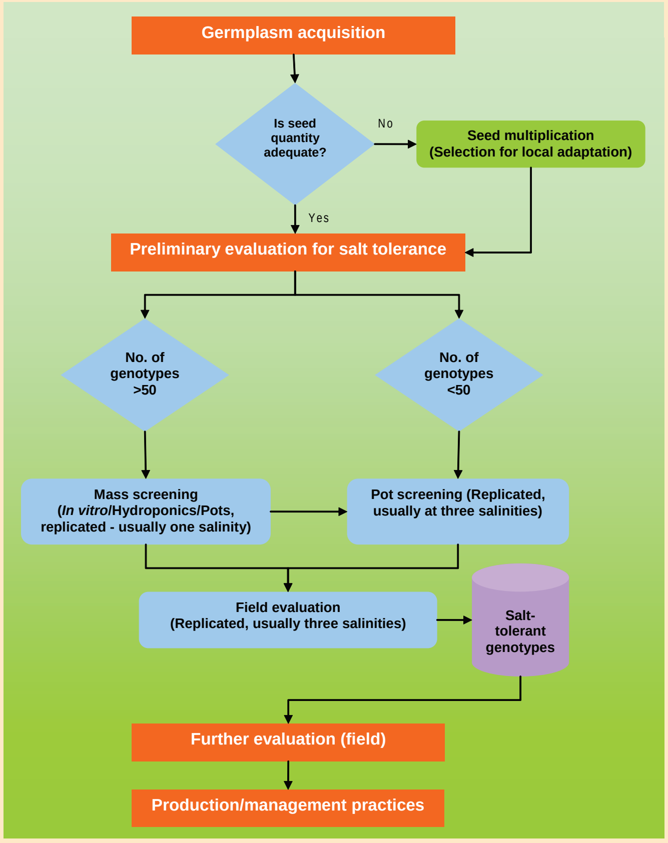


Figure 1: Salinity evaluation procedure at ICBA

1. *For more information, contact* **n.rao@biosaline.org.ae**

good adaptation to local growing conditions, in addition to salt-tolerance. Most often, the quantity of seeds received from donors is small, which necessitates seed multiplication prior to evaluating them for tolerance to saline irrigation.

Seed multiplication is conducted under open field conditions using low-salinity irrigation water (2-3 dS m^{-1}). This facilitates simultaneous assessment of the material for general adaptation to the local environment and yield potential, which enables selection of promising accessions for further studies. Germplasm accessions which survive and produce adequate quantities of seed are subjected to mass screening at a single discriminating level of salinity under controlled conditions in the hydroponic system (with 10 cm diameter plastic pots filled with gravel and salt water applied in 1/4th Hoagland solution) or in soil beds under a cooled plastic tunnel/greenhouse or alternatively, plastic pots (20 lit) filled with 1:1:1 mixture of sand, organic fertilizer and vermiculite and buried in the ground under outdoor conditions. The system adopted for screening depends on the crop and number of accessions available for evaluation. Accessions that perform well go though a second cycle of screening in pots, using three levels of water salinity (low, medium and high). Since a realistic assessment of yield is not possible with pot-screening system and the ultimate test for any crop or genotype is its ability to produce economic yields in farmer's field, the selected accessions are further assessed for their performance under field conditions in replicated trials. The field trials are repeated over 2-3 seasons to validate the results and select accessions (genotypes) that are better adapted to local growing conditions, combined with salt tolerance.

In all of the methods, seeds are germinated with fresh water and salinity treatment is generally initiated after 2 weeks of growth, starting with low salinity and gradually increasing to the maximum over a period of 2-4 weeks, depending on the level of the treatment. In general, the parameters used to evaluate the response of genotypes include: plant stand, height, days to flowering, number of branches, leaf area, number of fruits, fruit size, fruit weight and yield.

ICBA has established a simple and effective laboratory screening method based on water agar substrate to evaluate the effect of salinity on initial germination. This method overcomes the problems such as drying of the substrate, associated with the traditional Petri-dish method using a paper substrate (Rao and Shahid, 2008).

Status of work

To date, over 500 germplasm accessions of eight major vegetables have been acquired from various sources (Table 1). Genotypes with good adaptation and high yield potential were identified in each of these crops during field grow out for seed increase. In asparagus, for instance, accessions with spear yields close to 3 t ha^{-1} were identified (e.g. PI 277824) in the second year of growth, comparable to the yields reported from favorable growing conditions (Rao and Shahid, 2010a). Similarly, in cowpea, guar and mustard, accessions with high seed yields potential [4.9 t ha^{-1} (TVu 9604), 2.5 t ha^{-1} (PI 263891) and 3.0 t ha^{-1} (ATC 93142), respectively], similar to those obtained from highly productive environments were identified (Rao *et al.*, 2009; Rao and Shahid, 2010b).

Screening for identification of salt tolerant vegetable germplasm is at different stages in all these crops. In mustard, laboratory screening of germplasm at 10 dS m^{-1} has led to the identification of accessions such as ATC 93180, ATC 93245 and ATC 93400, tolerant to moderate

Table 1. Vegetable crop germplasm acquired by ICBA for salinity research

Crop	Botanical name	Number of accessions	Source
Pepper	*Capsicum annuum*	117	Plant Genetic Resources Conservation Unit, Griffin, Georgia, USA.
Tomato	*Lycopersicon esculentum*	100	Plant Genetic Resources Unit, Geneva, New York, USA.
Guar	*Cyamopsis tetragonoloba*	100	Plant Genetic Resources Conservation Unit, Griffin, Georgia, USA.
Mustard	*Brassica juncea*	100	The Australian Temperate Field Crops Collection, Horsham, Australia.
Okra	*Abelmoschus esculantus*	40	AVRDC-The World Vegetable Center, Taiwan; Plant Genetic Resources Conservation Unit, Griffin, Georgia, USA.
Cowpea	*Vigna unguiculata*	23	International Institute for Tropical Agriculture (IITA), Ibadan, Nigeria.
Eggplant	*Solanum melongena*	23	AVRDC-The World Vegetable Center, Taiwan; Plant Genetic Resources Conservation Unit, Griffin, Georgia, USA.
Lablab	*Lablab purpureus*	16	Plant Genetic Resources Conservation Unit, Griffin, Georgia, USA.
Cucumber	*Cucumis sativus*	40	North Central Regional Plant Introduction Station, Ames, Iowa, USA.
Courgette	*Cucurbita pepo*	50	North Central Regional Plant Introduction Station, Ames, Iowa, USA.
Asparagus	*Asparagus officinalis*	14	Plant Genetic Resources Conservation Unit, Geneva, New York, USA. Abu Dhabi Municpality, UAE.

levels of salinity during germination (Figure C). In cowpea and guar, pot and preliminary field screenings were completed and accessions which performed well or seeds harvested from individual plants that survived at higher salinities (as in guar) are being further evaluated in replicated field trials irrigated with saline water at 5, 10 and 15 dS m^{-1} (Figure A). Okra was screened at three levels of salinity (EC_w 4, 8 and 12 dS m^{-1}) in pots (Figure B). While none of the accessions survived at high salinity (12 dS m^{-1}), growth and fruit bearing were found to be low at 8 dS m^{-1}, but with no obvious differences among accessions. Tomato, pepper and lablab (hyacinth bean) were more tolerant than okra as no mortality was observed when evaluated at 12 dS m^{-1}. Similar to okra, differences among accessions for growth and fruit yield were not very obvious, probably because the plants were older by the time water salinity was increased to 12 dS m^{-1}. In all these crops, screening will be repeated with the application of highly saline water from very early stages of growth to be able to discriminate tolerant accessions for further studies.

ICBA's research on vegetables is expected to lead to the identification of genotypes tolerant to salinity and heat and that can consistently give high yields with marginal water and soil resources. However, enhancing crop productivity in marginal environments is an enormous and difficult task, which requires a multidisciplinary approach – including biotechnology and genetic engineering, and the combined efforts of many national and international institutions. ICBA strongly believes that collaboration, complementarities and coordinated objectives are crucial to improve vegetable productivity at the regional and global levels and invites others pursuing similar objectives to join hands to consolidate, share and utilize the scientific information and technologies in a strategic way.

References

de la Peña, R. and J. Hughes. 2007. Improving vegetable productivity in a variable and changing Climate. SAT eJournal 4: 1-22.

Keating J.D.H., F. Waliyar, R.H. Jamna da, A. Moustafa, M. Andrade, P. Drechsel, J.d'A. Hughes, P. Kadirvel, and K. Luther. 2010. Relearning old lessons for the future of food – By bread alone no longer: Diversifying diets with fruit and vegetables. Crop Science 50: 51-62.

Rao N. K. and M. Shahid. 2008. Novel *in vitro* screening method. Biosalinity News 9 (1): 2.

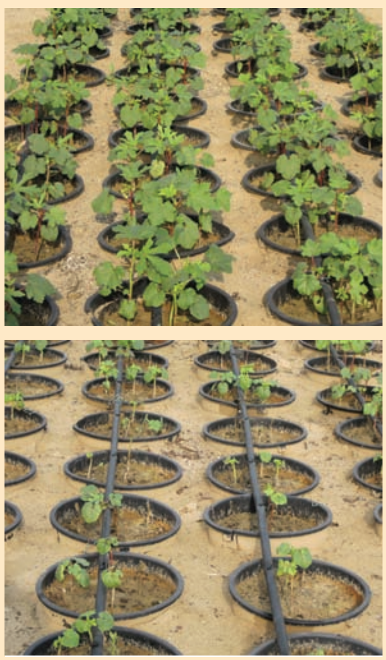
Rao, N.K. and M. Shahid, 2010a. Performance of asparagus under the desert conditions of Arabian Peninsula: A pilot study. *Journal of Applied Horticulture* (in press).

Rao, N.K. and M. Shahid, 2010b. Potential of cowpea and guar as alternative forage legumes for the United Arab Emirates. *Emirates Journal of Food and Agriculture* (in press).

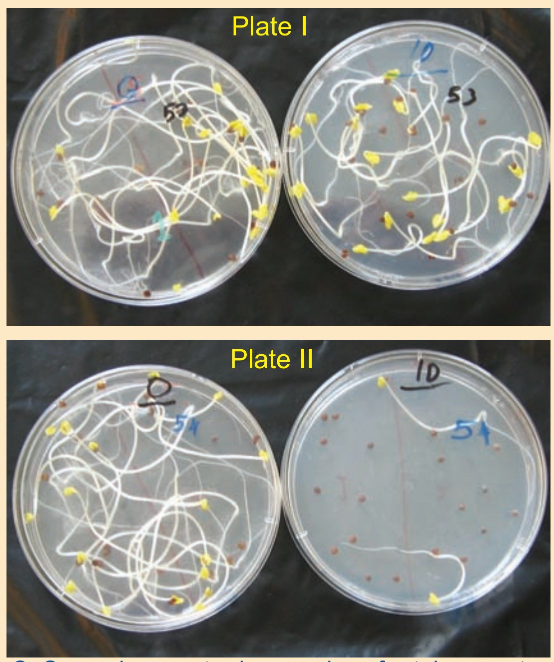
Rao, N.K. and M. Shahid and Shabbir Shahid 2009. Alternative crops for diversifying production systems in the Arabian Peninsula. *The Arab Gulf Journal of Scientific Research* 27:195-203.

Screening vegetable germplasm for salinity tolerance

A. Preliminary evaluation of guar (top) and cowpea (bottom) accessions at 15 dS m^{-1} salinity (EC_w). P. cineraria *is a multi-use tree of the desert.*



B. Evaluation of okra accessions at 4 dS m^{-1} (up) and 12 dS m^{-1} (bottom) salinity (ECw).



C. Screening mustard accessions for tolerance to salinity at germination. Plate I: Tolerant (ATC 93400), Plate II: Sensitive (ATC 93402). In both plates, substrate salinity in the left is 0 dS m^{-1} (control) and 10 dS m^{-1}i n the right.

2010: International Year of Biodiversity

Biodiversity is life, biodiversity is our life

The year 2010 has been declared by the United Nations as the ***International Year of Biodiversity*** to increase worldwide awareness of biodiversity and its importance, and to engage more people in its conservation. The International Day for Biological Diversity was observed on May 22, with the theme "Biodiversity for Development and Poverty Alleviation". In September, the UN General Assembly held a special high-level meeting on biodiversity at its 65th annual general debate.

As part of the public discourse on the importance of biodiversity, the director general of Bioversity International, Dr Emile Frison, stated:

> *"Any serious discussion of biodiversity conservation must include the diversity of crops and livestock that are absolutely fundamental to human survival and well-being. Agricultural biodiversity is not only vital for human and animal nutrition; it is also indispensable for meeting the challenge of climate change and for lifting people out of poverty".*

Since its establishment in 1999, the International Center for Biosaline Agriculture (ICBA) has contributed to the conservation and sustainable use of diversity of crops through its genetic resources program. For the last 10 years, ICBA has been collecting and maintaining the germplasm of species with proven or potential salinity tolerance to provide a source of genetic diversity; a critical way to help sustain productivity in degraded environments. Continued access to germplasm adapted to marginal environments for research and other uses requires that adequate seed stocks are maintained. Most often, the seed samples obtained from the donors or those collected from natural habitats will be in small quantities, therefore necessitating regeneration. Regeneration also becomes necessary when seed viability of individual accessions declines below acceptable limits or the seed quantities fall to low levels due to distribution to users. Furthermore, several of the economically important native plants are poor and unreliable seed producers; this limits the availability of propagation material of these species in quantities sufficient for large-scale use.

Initially the emphasis was on assembling germplasm of salt-tolerant forages to support ICBA's mandate, but the focus has changed since 2008 when ICBA broadened its mandate *to help water-scarce countries improve the producity, social equity and environmental sustainability for water use through an integrated water resource systems approach, with special emphasis on saline and marginal quality water.* As explained in more detail elsewhere in this Newsletter, the program has consequently started to acquire and conserve the germplasm of high value crops such as vegetables and ornamentals to study their adaption to marginal environments and disseminate the germplasm to national programs for research and other uses.

Agricultural biodiversity is a critical focus for the ICBA genetic resources research program

To date, the ICBA Genebank holds nearly 10,000 accessions, representing 224 species from 136 countries. As well the Genebank holds 18 samples of 8 ornamental species acquired to evaluate the potential for landscaping in the Arabian Peninsula. In the United Arab Emirates, ICBA has undertaken 14 explorations for germplasm collection resulting in the collection of 220 samples of 70 economically important species for conservation and sustainable use.

More recently, ICBA has developed a proposal for the Environment Agency - Abu Dhabi (EAD) to establish a genebank for the conservation and sustainable use of native plant diversity. The UAE has several unique plant species, including wild relatives of important crops grown in other parts of the world. Many of these species, due to their natural adaption to the highly saline conditions, extreme heat and low rainfall, have global importance; especially in the context of climate change and future crop improvement needs. However, these botanical resources are threatened in recent years by habitat loss from expansion of human settlements and associated developmental activities, overgrazing and desertification. The genebank is expected to serve as a focal point for integrated conservation of both terrestrial and coastal plant resources, in addition to functioning as a research and development center for the restoration of degraded arid ecosystems.

In this international year-long focus on biodiversity, ICBA will continue its valuable genetic research program to acquire, conserve, regenerate and disseminate plant genetic resources. it also has plans to develop a web-based information portal on the use of biological diversity to mitigate environmental problems, thus further contributing to global research to improve the productivity of marginal areas.

Related links

United Nations International Year of Biodiversity http://www.cbd.int/2010/welcome/

Convention on Biological Diversity http://www.cbd.int/

CGIAR Systemwide Genetic Resources Programme (SGRP) http://sgrp.cgiar.org/

Bioversity International http://www.bioversityinternational.org/

Update on Projects

Oman Salinity Strategy

The members of the Working Groups tasked with the research and formulation of the National Strategy to Combat Salinity and Protection of Water Resources from Pollution and Salinity in the Sultanate of Oman met in Oman.

The main objectives of the meeting were to review progress on major data collection by each workgroup, identify any data gaps and the means to resolve such gaps. As well the working groups developed the Project Progress Report which was due 21 October. The working groups also contributed to the development of a roadmap identifying major milestones for the project's implementation from the end of October until early 2011.

Aquifer Recharge using Excess Treated Wastewater in Oman

Another project in Oman revolves around supplementing the water supply which is seasonal. During periods of water surpluses, water is stored in an aquifer which is an excellent storage means as there is no evaporation loss and negligible pollution. The water can be withdrawn from the aquifer when a deficit occurs. Aquifers are an appropriate means of storing water as storage of the water below ground means that there are no evaporation losses; the water is usually protected from pollution; minimal land area is used; and there is no environmental damage. On the other hand, MAR has some disadvantages: namely, in most cases, only a part of the recharged water is recovered in the short run.

ICBA's role in this partnership with the Sultan Qaboos University (SQU) to conduct a socio-economic and technical feasibility of MAR schemes in Oman especially in the Muscat areas was to provide technical support and jointly with SQU to achieve project outcomes, in particular aspects related to irrigation and groundwater modeling.

In 2009 ICBA managed a comprehensive review of the use of MAR with treated wastewater; a practice common to in several countries, including the USA (where the legal requirements in California are highly relevant to the Omani context), Belgium, Morocco, Singapore and Australia as part of their overall water resources management. Currently groundwater recharge in Oman is practiced using recharge dams only.

Adaptation to climate change in WANA

Building on the success of the Forage Project, ICBA, in partnership with NARS of selected countries in WANA, and again supported by IFAD, AFESD and OFID, has started work on another project to further the development of forage production technologies in marginal and stressed conditions.

Feed shortage is an acute problem in most of the WANA region. Developing farming systems based on salt-tolerant forages and marginal quality water can help to overcome this problem in localities where saline groundwater and treated wastewater are used for agriculture production, and in salt-affected areas in prime agricultural lands where saline drainage water is available. Such systems will help ameliorate feed scarcity in small scale crop-livestock farms and also help sustainable production and consequent income diversification.

The project is targeting the development of local capacity for the seed production. The emphasis on in-country seed production (a need identified in the Forage Project) is critical due to the commercial unavailability of the selected genotypes and the lengthy time for adoption of seed production in each country. The specific quantities of seed needed to sustain the use and expansion of the targeted varieties will be produced in each country. As well, the project will use treated wastewater as one of the most important marginal water resources already being used in forage production in several targeted countries (Jordan, Syria and Tunisia). Local farmers will be involved in the development and application of integrated forage production packages, thus further building the capacity of farmers and NARS in seed production, field management and the handling and efficient on-farm use of the produced forages.

The first Technical Committee Meeting was held 1-2 June 2010 in Damascus Syria to review the IFAD-ICBA assessment and recommendations of phase 1 and present work plans, budgets and capacity building events. The members of the committee represent the countries involved in the project: Syria, Tunisia, Yemen, Oman, Palestine and the United Arab Emirates with ICBA in a management/coordination role. This meeting was followed on 3 June by the inaugural Steering Committee meeting, which reviewed countries' work plans and resource allocations.

ICBA opportunities in the US

ICBA representative Dr Rachael McDonnell, a scientist experienced in water governance and policy, met with visiting US Congressmen Brian Baird (WA - Washington), Chairman of the House of Representatives Subcommittee on Science and Technology, Bill Shuster (PA - Pennsylvania) and Bob Inglis (SC - South Carolina). Dr McDonnell briefed the Congressmen on ICBA's ongoing science and technology initiatives tackling various water issues in the region. During the meeting, the participants discussed the impact of ICBA's work and ways for US businesses and organizations to partner with ICBA in the future.

Abu Dhabi Farmers Service Centers

Dr Shawki Barghouti, Director General of ICBA, and Mr David O'Brien, Chief Executive Officer of the Abu Dhabi Farmers Service Center (FSC), signed an agreement on 23 June 2010 in Abu Dhabi in the presence of H.E. Rashid Mohamed Al Shariqi, Director General of the Abu Dhabi Agriculture and Food Safety Authority (ADAFSA).

The agreement for 54 months formalizes the collaboration between FSC and ICBA to sustain farm-level productivity in the Western Region of Abu Dhabi by introducing improved farming management practices and developing capacity building for extension services and farmers.

H.E. Rashid Mohamed Al Shariqi welcomed the collaboration between FSC and ICBA. He praised ICBA's in-country experience and particularly its specialized technical activities in Abu Dhabi, which will be fully utilized in this partnership with FSC to ensure the delivery of sustainable agricultural practices in the Emirate.

Mr O'Brien elaborated that FSC chose ICBA as its partner given ICBA's long experience in the region providing technical support and capacity building to farmers and extension services across a range of aspects such as improved irrigation systems; on-farm management of saline water and land resources; improved crops and cropping systems; and the establishment of demonstration farms.

The Farmers Service Center was established in 2009 by ADAFSA to streamline links to the farming community. Concerned about the rapid depletion of natural resources, ADAFSA had targeted the agricultural sector for reform given its high levels of water use and unsustainable production practices.

In the short term reform will focus on the implementation of efficient integrated farming systems, including livestock, along with forages, vegetables and date production. Water usage in agriculture can be reduced by more than 40% through changes to the cropping patterns, adoption of improved water application techniques and the updating of old and inefficient on-farm water systems. The resultant improved agricultural productivity will considerably benefit the environment. In the longer term, the FSC will consider sustainable agricultural practices in relationship to markets in Abu Dhabi.

Addressing Soil Salinity in Iraq

Salinity has long been identified as a major threat to agriculture in the central and southern parts of Iraq. The country's extensive irrigation infrastructure has fallen into disrepair and consequently the salinity problem has intensified. According to FAO estimates, more than 2 million hectares are irrigated and it is estimated that approximately 75 per cent of this area is moderately saline and another 25 per cent has levels of salinity that prevent farming.

To address the salinity issues in Iraq, ICBA has joined a consortium of Australian researchers from CSIRO and the University of Western Australia, two Iraqi organisations (the State Board for Agricultural Research in Iraq's Ministry of Agriculture and the Ministry of Water Resources), the International Center for Agricultural Research in Dry Areas (ICARDA), and the International Water Management Institute (IWMI). The consortium has been developed by the Australian Center for International Research (AIAR) in consultation with AusAid.

ICBA's role in the project will be team leader of the component 'on-farm production and management of salt-affected farms', and also contribute technical and capacity-building expertise.

To Mix or Not to Mix: That is the question!

S.A. Prathapar[1] and Seif Al Khamisi[2]

Globally fresh water available for agriculture is diminishing. This is especially true in arid and semi arid regions where there is plenty of saline water. In order to increase the volume of water available for irrigation, there seems to be tendency to mix saline water with fresh water.

Before we venture into mixing saline and fresh waters we need to reflect on what happens to the mixed water after irrigation. Some of the mixed water will be consumed by the crop for evapotranspiration, and the remainder will leach the salt from the root-zone. Otherwise the land will become salinised and unsuitable for production. If we mix a small volume of fresh water with a large volume of saline water, then obviously we will have a large volume of saline water, with salinity marginally less than the original water. If we mix a large volume of fresh water with a small volume of saline water, then we have not sufficiently increased the volume of water needed for irrigation! Therefore, "To Mix or Not to Mix is the Question".

The answer to this question was found by researchers at Sultan Qaboos University Water Research Center. Our research shows that a good rule of thumb in deciding whether to mix or not is the salinity tolerance level of the crop to be irrigated. For example, if a wheat variety could tolerate a salinity of 6 dS/m, then saline water to be mixed could be as saline as 6 dS/m, but no more! If it is more, then most of the mixed water will have to be used for leaching salts, and will not be available for the crop's evapotranspiration needs.

1 Director, Water Research Center, Sultan Qaboos University, Oman
2 Ministry of Agriculture & Livestock, Rummais, Oman

Conferences and workshops

International Conference on Soil Classification and Reclamation of Degraded Lands in Arid Environments - ICS2010

Over 200 scientists, specialists and researchers from over 35 countries shared their knowledge and experience at the International Conference on Soil Classification and Reclamation of Degraded Lands in Arid Environments (ICS2010) held in Abu Dhabi from 17-19 May 2010.

HE Majid Al Mansouri, EAD's Secretary General

Held under the patronage of HH Sheikh Hamdan bin Zayed Al Nahyan, the Ruler's Representative in the Western Region and Chairman of the Environment Agency – Abu Dhabi (EAD), the ICS2010 provided a forum for the international scientific community to discuss the latest research and developments in the soil classification and reclamation aspects as well as land use policies and implications in the arid environments for sustainable use of natural resources, environmental services and protection. The ICSC2010 participants also attended a workshop to share their expertise to identify future strategies to ensure effective utilization of the findings of the Abu Dhabi Emirate Soil Survey. The Soil Survey Report was officially launched at ICS2010.

Dr Ahmad Almasoum, ICBA's Deputy Director General

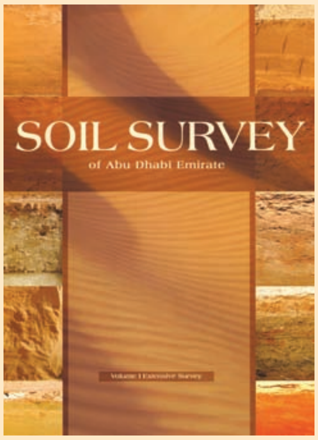
The Conference was structured around five major themes:

- Soil Survey and classification strategies and their use in different agroecological zones
- Advances in soil salinity mapping, monitoring and reclamation
- Land use planning and policy implications
- Use of marginal quality water in agriculture and landscaping
- Research and Development/Innovations in Soil classification and reclamation
- Workshop and potential, constraints and the use of the soil survey database

Inaugurated by HE Majid Al Mansouri, EAD's Secretary General and Chairman of the Conference, the conference featured six keynote speakers from Thailand, the United States, Spain, Austria, Australia and India.

The Abstracts were available during the Conference; the Proceedings will be published soon.

Prof Dr Faisal Taha explaining the Abu Dhabi Soil Survey Report



Abu Dhabi Soil Survey Report

Over 200 scientists, specialists and researchers from over 35 countries participated in the conference

ICBA Seminar in Azerbaijan

Baku in Azerbaijan was the location for ICBA's Seminar on the utilization of marginal water in agriculture, with special emphasis on countries in Central Asia and Caucasia. A collaboration with the Islamic Development Bank (IDB) and the Azerbaijan Ministry of Agriculture, the Seminar was convened on 21 June 2010 on the sidelines of the 35th Annual Meeting of the Board of Governors of the IDB Group.

The Seminar was well-attended by staff from the Azerbaijan Ministry of Agriculture, other local institutions and agencies as well as IDB and Azerbaijan senior officials.

In his welcoming address, the Ministry representative on behalf of the Azerbaijan Deputy Minister of Agriculture HE Mr Bahram Aliyev highlighted the importance of the scientific seminar in achieving the IDB's strategy to focus on capacity building and transfer of scientific knowledge. HE Aliyev expressed his belief that there was scope for stronger cooperation between all parties to ensure more opportunities for scientific interaction in the future.

In the following address, HE Mr Birama Sidibe, IDB Vice-president in charge of Operations, stressed the important role of ICBA through its researches and projects about the use of marginal water resources, such as saline and treated water, aimed at enhancing agricultural production in IDB member countries.

HE Mr Birama Sidibe also praised the outcomes of the joint projects between ICBA and the national agricultural researches in Central Asia and Caucasus and seminars such as the one in Baku.

Also featured on the program were Dr Mostafa Mostafayev from the Research Institute for Soil Science and Agricultural Chemistry of the Azerbaijan National Academy of Sciences, who outlined the current situation in Azerbaijan of soil salinisation and the use of marginal water in fodder production, and Prof. Dr Valida Alizada, Acting Director of the Sciences Institute of the Azerbaijan National Academy of Sciences. Prof. Dr Alizada stressed the importance of sustainable agricultural systems in saline environments. Prof. Dr Faisal Taha, Director of Technical Programs at ICBA, shared with the audience the current scientific research undertaken by ICBA in IDB member countries and prospects for the future. Another ICBA staff member, Dr Christina Toderich, who is based in Uzbekistan, discussed the complementarities of biosaline agriculture researches in the utilization of marginal water resources.

The previous ICBA seminar held in conjunction with the Board of Governors' meeting took place in Ashkabad in Turkmenistan, which like Azerbaijan is part of the Commonwealth of Independent States (CIS). Another member of this important regional organization, Tajikistan, has extended an invitation to the Board of Governors to hold the 39th IDB annual meeting in Dushanbe in 2014.

From right to left: Prof. Dr Faisal Taha, Dr Ahmad Almasoum and H.E. Mr Birama Sidibe

Participants at the seminar

Gulf Water Week 2010

With average rainless less than 100 mm per year, declining groundwater reserves and high reliance on desalinated water, Abu Dhabi was an ideal location for experts in water conservation, wastewater treatment and water distribution to explore water scarcity solutions at the recent Gulf Water Week 2010 conference.

ICBA's Irrigation Management Scientist, Dr Nurul Akhand, joined the conference delegates from countries across the Gulf and South-East to share his expertise in the reuse of reclaimed water in irrigation and its potential to mitigate water scarcity. At the conference held 24-26 May 2010, Dr Akhand explained that the key to the successful reuse of reclaimed water is water quality standards.

The existence of standards for the protection of human health and the environment and then ensuring compliance with these standards by regular water quality monitoring are essential strategies. International and local experience has demonstrated that once water quality standards are in place and implemented fully throughout the water treatment and use cycle, then reclaimed water can be used successfully in irrigated agriculture, forage production, floriculture, landscaping and groundwater recharge. The public perception of risks associated with the use of reclaimed water also needs to be addressed to ensure wide-scale adoption of this much-needed water resource.

At the end of day 2, Dr Akhand formed a panel with his colleagues from South Africa and Abu Dhabi to discuss in an interactive forum with the audience the opportunities and challenges in wastewater reuse in the Gulf region.

Forage Project Symposium

The critical success factors of the Forage Project: improved genotypes, national demonstration sites, specialized working groups, capacity building, farmers' participation, socio-economic research and the importance of forage packages, were shared at a recent regional symposium in Damascus, Syria.

A partnership between ICBA and the NARS of 7 countries in the WANA region (Jordan, Oman, Pakistan, Palestine, Syria, Tunisia and the United Arab Emirates), the four-year Forage Project, Saving fresh water resources with salt-tolerant forage production in marginal areas of WANA: an opportunity to raise the incomes of the rural poor, was funded by the International Fund for Agricultural Development (IFAD), the Arab Fund for Economic and Social Development (AFESD) and the OPEC Fund for International Development (OFID).

Scientists from the NARS of the seven countries in the WANA region discussed from 30 to 31 May 2010 their respective countries' roles in the development of genotypes with better stress tolerance and productivity under marginal conditions achieved through the screening and evaluation of thousands of accessions and genotypes of more than twenty forage species; the importance of national sites to demonstrate and raise the profile of project activities; the establishment of specialized working groups to ensure appropriate knowledge and experience in the various disciplines; and extensive capacity building at both the project and country levels as well as many participatory opportunities for farmers. Given the project's desired outcome, to raise the incomes of the rural poor, socio-economic analysis was also essential to study the extent and scope of project benefits for the target group of farmers, as was the importance of an integrated forage package (identified annual and perennial salt-tolerant forages and management techniques) to secure forage resources all year round for multiplication and distribution to farmers.

Participants agreed that the symposium at the culmination of the project provided an excellent opportunity for all involved in the project to discuss and share the scientific outcomes of the project.

Participants at the symposium

First Meeting of the Advisory Panel on OIC Water Vision

The First Meeting of the Advisory Panel on OIC Water Vision, which was held in May in Dubai, was organized in collaboration with the Islamic Development Bank and supported by ICBA.

The Panel was convened following resolutions adopted by the 36th and 37th Council of Foreign Ministers held in Damascus, Arab Syrian Republic in May 2009 and Dushanbe Republic of Tajikistan in May 2010. The resolutions requested that the Organization of the Islamic Conference (OIC) formulate a Water Vision for consideration by the conference of ministers responsible for water.

His Excellency Dr Rashid Ahmed bin Fahad, UAE Minister of Environment & Water, welcomed all participants, who included prominent experts in the water sector and representatives from organizations such as COMSTECH (OIC Standing Committee on Science and Technological Cooperation), IDB, ISESCO (Islamic Educational, Scientific and Cultural Organization) and INWRDAM (Inter-Islamic Network on Water Resources Development and Management).

In the Opening remarks by His Excellency Dr Atta-ur-Rahman, Coordinator General, COMSTECH, he called for all in the Islamic world to join hands together and address the challenges with a clear strategy and action plan.

HE Fawzi AlSultan, Chairman, Board of Directors, ICBA thanked His Excellency for his welcoming remarks and stressed the timeliness of this meeting to begin the process to formulate a vision which was appropriate for the Islamic world.

On behalf of the OIC, Dr Razely Nordin, Director General of S&T, OIC General Secretariat, thanked ICBA for their work to ensure that the meeting took place. The advisory panel of experts shared their wealth of experience in regard to water issues in their respective regions and countries. Elements of the proposed OIC Water Vision were identified and prioritized and a timetable for progressing the drafting of the document to form the basis for a framework on cooperation to resolve water issues was agreed.

BADEA training course

The Arab Bank for Economic Development in Africa/Banque Arabe pour le Développement Economique en Afrique (BADEA) is a financial institution funded by the governments of the Member States of the League of Arab States in 1974 to strengthen economic, financial and technical cooperation between Arab and African countries.

Following up the success of the BADEA-funded training course in 2007 at ICBA, the Bank funded another training course, Biosaline agriculture technologies for arid and semi-arid regions with reference to Africa, to be held from 23 May to 3 June 2010 at the ICBA Headquarters in Dubai.

Designed by ICBA scientists and researchers, the ten-day course comprised a series of technical training modules ranging from 'Strategies for the selection of appropriate production systems for salt-affected environments' to Non-conventional water resources and its importance in bridging the gap between supply and demand'. The program included the opportunity to inspect the agricultural research station in the Northern Emirates and to also see first-hand scientific developments of the United Arab Emirates University Tissue Culture Laboratory in Al Ain.

Participants of the training course at ICBA research station (left) and a group photo after the closing ceremony (right)

Training course in Egypt

Under the patronage of H.E. Amin Abazah, the Minister of Agriculture and Land Reclamation, Egypt, the regional training workshop on Biosaline agriculture technologies and its role in the mitigation of climate change in the Arab region took place from 25 to 28 October in Cairo, Egypt. The course was organized by ICBA, the Desert Research Center (DRC) in Egypt and the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD). Twenty eight participants from Egypt, Iraq, Jordan, Kuwait, Lebanon, Oman, Sudan, Syria, Tunisia, UAE and Yemen attended the course.

Scientists from the three leading institutions brought the audience up to date on the impact of climatic changes on agriculture and the potential for adaptation with special references to Egypt and the wider Arab region. Biosaline agriculture strategies covering the sustainable management of soil, water, agro-biodiversity and salt-tolerant crops and forages to mitigate the effects of climatic change were discussed in detail.

A visit to a local farm and the DRC Research Station rounded off the conference learning experience.

From left to right: Dr Omar Jouzdan (ACSAD), Ms Naema Boshamaa (League of Arab States), Prof. Dr Mohamed Draz (DRC) and Dr Ahmad Almasoum at the launching ceremony

Prof. Dr Faisal Taha discussing with the Deputy Director of Belco Farm the technologies used in the farm

ICBA Board meeting

The ICBA Board of Directors came together for the last meeting of this term on Sunday 23 May 2010 to discuss business relating to the programs of the Center.

The current Board of Directors of the International Center for Biosaline Agriculture is a ten-member committee appointed by the Islamic Development Bank and the Center's host country, the United Arab Emirates. The Chair of the Committee is Mr Fawzi AlSultan and members include representatives from the United Arab Emirates, the Islamic Development Bank and external scientific experts. The Board of Directors is responsible to the Board of Trustees, which is chaired by the Islamic Development Bank President, Dr Ahmad Mohamed Ali.

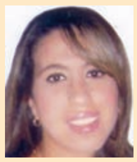
Staffing Update

Dr Ian McCann, a US citizen with a PhD from Texas A&M University, joined ICBA in November as a Visiting Scientist. Dr McCann has extensive experience in irrigation and water management in the region gained from his positions as a Department Head at Sultan Qaboos University in Oman and then a Senior Scientist with the ICARDA Arabian Peninsula Regional Program. Previously Dr McCann had been a faculty member at the universities of Idaho and Delaware in the US, and a consultant in Texas.

Dr Makram Belhaj Fraj, a Tunisian scientist, joined ICBA on a secondment from the National Institute of Agricultural Sciences (INAT, Tunisia). Dr Fraj obtained his PhD in Agronomy in 2003 (ENSA Rennes; UMR INRA–INA Paris-Grignon, France). His discipline is functional biodiversity and his research has focused on the investigation of genotype x environment interaction using agronomic diagnosis for stability assessment.

Mr Karim Bergaoui joined ICBA on a secondment from the National Institute of Meteorology (INM, Tunisia). Mr Bergaoui added his masters degree in Ocean-Atmosphere-Biosphere Scieces (Pau Sabattier University, 1997) to his previous qualification as a civil engineer in Meteorology from METEO-France (ENM, Toulous, 1997). Mr Bergaoui’s research expertise is land surface modeling and surface data expertise.

Ms Sarah Grey holds a masters in modern Middle Eastern studies from the University of Oxford (St Antony’s College). An Arabic speaker, Ms Grey has joined the Middle East and North Africa - Land Data Assimilisation System (MENA-LDAS) Program team at ICBA. Her research will involve the collection of meteorological and hydrological data from a number of countries in the region.



Ms Nancy Alagizy joined ICBA in April 2010 as an administrative assistant to the Director of Technical Programs.

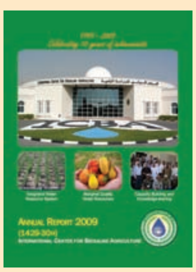
Mr Alhareth Alabdullah joined ICBA in March as a Technical Assistant in the Technical Programs.

Mr Khurshid Mufti, Soil Assistant, left ICBA in October to return to Pakistan after working at ICBA for five years.

New Publications

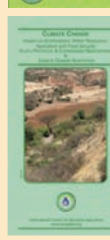
ICBA published recently the following new publications in English:

- *ICBA Annual Report 2009*
- *Book of Abstracts: Scientific Symposium of the Forage Project*
- *Forage Project Highlights*
- *Alternative Agronomic Crops for the Arabian Peninsula*
- *New Herbaceous Ornamentals for Saline Landscapes*
- *The Abu Dhabi Emirate Coast: Natural Heritage to be Conserved*
- *Breakthrough in Soil Taxonomy*
- *Climate Change*
- *Soil Salinity*
- 2011 Calendar








For more information on ICBA and its latest news, please visit www.biosaline.org