ISSN 1563-1532

Biosalinity News

Newsletter of the International Center for Biosaline Agriculture

VOLUME 8, NUMBER 2 AUGUST 2007

FROM THE EDITOR

The second issue of this newsletter in 2007 reports a particularly wide array of stories.

Our lead article concerns new overtures in partnership in sub-Saharan Africa and Central Asia.

On the science front, we report on germplasm collection in the UAE. This issue's *Focus on Salinity* features an article about successful research in floriculture utilizing marginal water resources.

Other news about our ongoing collaboration with our host country and its farmers and capacity building activities rounds out the publication.

Contributions on research of interest to our readers are always welcome, as are letters to the Editor. Please send your submissions to:

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New partnerships with Senegal and Turkmenistan

Dr Barghouti shakes hands with Dr Macoumba Diouf, Director General of ISRA, after signing the MoU.

Since 2000, ICBA has participated in the annual Governors Meetings of the Islamic Development Bank (IDB), our largest and most important donor. Each year, IDB holds its meetings in a different member country. The 32nd Governors Meeting was held for the first time in Dakar, Senegal.

ICBA took advantage of the opportunity to lay the groundwork for ongoing collaboration with Senegal's national agricultural research organization, Institut Sénégalais de Recherches Agricoles (ISRA). The collaboration between ISRA and ICBA was formalized with the signing of a memorandum of understanding (MoU) on 25 May. ICBA management, represented by Board Chair Mr Fawzi AlSultan, Director General Dr Shawki Barghouti and Director of Technical Programs Prof Dr Faisal Taha, discussed potential areas of cooperation with ISRA Director General Dr Macoumba Diouf.

On 26 May, ICBA organized a seminar on *Activities of the International Center for Biosaline Agriculture with special reference to Senegal* at the Meridien President Hotel where all IDB events took place.

The seminar was attended by two senior Senegalese ministers: Mr Farba Senghor,

(Continued on p.2)

His Excellency Mr Makhtumkuli K Akmuradov (third from right), Minister of Nature Protection of Turkmenistan, listens to an explanation of how ICBA obtains water for its trials.

A high-level delegation from the Republic of Turkmenistan, including no less than five government ministers, visited ICBA on 25 August. The delegation was headed by His Excellency Mr Makhtumkuli K Akmuradov, Minister of Nature Protection, who was accompanied by the Ministers of Agriculture, Water, Food and Regional Government.

The representatives met with ICBA scientists and management to discuss common interests and potential areas for collaboration. They toured the campus facilities, taking careful note of the way in which ICBA has set itself up for research on biosalinity, drought and utilization of marginal water resources.

His Excellency Dr Saeed Al-Kindi, the UAE's Minister of Environment and Water, welcomed the delegation from Turkmenistan at ICBA's headquarters.

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Left: ICBA's seminar attracted considerable interest amongst representatives of the local community, who participated enthusiastically in the question-and-answer session.

Right: Mr Faisal Al-Zamil, IDB Executive Director and member of ICBA's Board of Trustees.

Minister of Agriculture and Food Security, and Mr Maitre El Hadji Diouf, Minister of Hydrographical Network. Mr Diouf, the Guest of Honor, emphasized the increasing need to combat water and food scarcity in Senegal through research and development projects, notably through collaboration with ICBA.

Mr Faisal Al-Zamil, IDB Executive Director and member of ICBA Board of Trustees, welcomed participants to the seminar and stressed the continuing mission of IDB to alleviate poverty in member countries through research for development. Dr Taha then presented an overview of ICBA's work with emphasis on sub-Saharan Africa.

ICBA's seminar was attended by about 120 IDB officials, members of civil society, government and non-government organizations and the media.

A direct outcome of these deliberations was a generous offer by the Technical Cooperation Office of the IDB to sponsor a 5-day workshop in Dubai to design a regional project on problems facing small-scale irrigation systems in West Africa. The countries involved in the proposed project include Burkina Faso, Gambia, Mali, Mauritania, Niger and Senegal. A total of 21 participants are expected to attend the workshop, scheduled for 20-24 October.

CONSERVING THE PRESENT FOR THE FUTURE

The United Arab Emirates (UAE) is located at the southwestern tip of the Arabian Peninsula. It lies between 20 50' and 26 N and 51 and 56 E, bordered by Oman to the east and Saudi Arabia to the west and south. The UAE has a tropical desert climate with very little rain. While many people identify the issue of biodiversity with tropical rain forests, the desert ecosystems also contain unique biodiversity, including plants and animals not found elsewhere. Recent botanical surveys of the flora and habitats of the UAE have documented nearly 750 plant species. These uniquely adapted species provide a vital resource for food and feed security for local communities. They also have other important economic uses as medicines and ornaments.

In an environment typified by drought, salinity and heat, unsustainable agricultural practices are increasingly aggravating desertification and ecosystem imbalances. Habitats are coming under increasing threat due to rapid urbanization and expansion of human settlement. Overgrazing also contributes to the depletion and exhaustion of plant cover.

The UAE has ratified the Convention on Biological Diversity which establishes three main goals: conservation of biological diversity, sustainable use of genetic resources and fair and equitable sharing of the benefits of genetic resources.

The rapid development of the UAE poses enormous challenges to the environment in general and to plant biodiversity conservation in particular. It is therefore imperative

Desmostachya bipinnata*, a salt-tolerant grass found in coastal areas.*

that urgent measures be taken to conserve existing plant diversity and to fully integrate the diversity considerations into development, mitigation and rehabilitation plans to preserve environmental quality.

In the past, systematic attempts to collect and conserve the genetic resources of economically important plant species have been few and far between. For instance, the International Center for Agricultural Research in the Dry Areas (ICARDA) collected 114 samples representing 22 taxa in 1998. Wishing to duplicate this collection for *ex situ* conservation, ICARDA sent a complete set to ICBA. However, only 41 samples, mainly of three species (P*anicum turgidum*, *Pennisetum divisum* and *Stipagrostis plumosa*) were successfully processed and registered for conservation in ICBA's genebank. The point is that careful follow-through is necessary to safeguard the survival of economically important species. In view of the imminent threat of genetic erosion from rapid increase in population and associated developmental activity in the UAE, ICBA's genetic resources program has recently prepared a 2-year plan to collect and conserve species of economic importance.

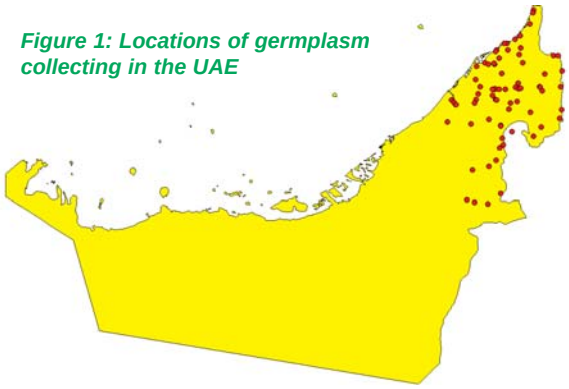
This dying mangrove forest underscores the need for protecting habitats and diversity.

Table 1: List of species collected

	Species	No. samples
1	*Acacia tortilis*	31
2	*Avicennia marina*	1
3	*Cenchrus ciliaris*	11
4	*Citrullus colocynthis*	2
5	*Desmostachya bipinnata*	1
6	*Indigofera intricata*	1
7	*Lasiurus scindicus*	1
8	*Leucaena leucocephala*	1
9	*Moringa oelifera*	1
10	*Panicum antidotale*	3
11	*Panicum turgidum*	1
12	*Parkinsonia aculeata*	1
13	*Pennisetum divisum*	5
14	*Phragmites australis*	2
15	*Pithecellobium dulce*	2
16	*Prosopis cineraria*	23
17	*Prosopis juliflora*	1
18	*Rhynchosia schimperi*	1
19	*Salvodora persica*	1
20	*Senna italica*	3
21	*Sporobolus spicatus*	1
22	*Stipagrostis plumosa*	1
23	*Synapis arvensis*	1
24	*Vitex nigundo*	1
Total		**97**

The first phase, consisting of six collecting expeditions, was launched in the northern part of the country during June and July 2007. The areas covered are shown in Figure 1. For seed-propagated species, seeds were collected, processed and conserved under controlled conditions in the genebank at ICBA. For clonally propagated species, and where seeds were unavailable at the time of collecting, stem

Figure 1: Locations of germplasm collecting in the UAE



cuttings, rhizomes and other vegetative parts were collected as appropriate. These were then transferred into pots under a shade-house at ICBA to establish the plants. Herbarium specimens were collected for species not readily identified in the field. Information concerning the habitat and morphological characteristics was recorded using the standard collecting data form.

A total of 97 samples, representing 24 economically important taxa, were collected (Table 1). The mission was timed to collect seeds of species like *Acacia tortilis* and *Prosopis cineraria* which flower during spring. However, collections of several annual forage species were late because the seeds had already been shed and the plants dried up. In perennial forage grasses, where seeds were unavailable, rhizomes were collected to establish plants on the ICBA research farm.

ICBA, as always, is pleased to share its material with researchers and national programs. Follow-up missions will be undertaken at appropriate times to collect the annual species and also to cover the remaining areas, especially in the south.

For additional information, contact Dr NK Rao at n.rao@biosaline.org.ae.

Collecting* A. tortilis *in the Hajar Mountains.

Board of Directors

ICBA's new Board of Directors held its first meeting on 15 June. A wide array of issues was discussed, chief amongst them the new vision and strategy of the center, which is now in the last stages of finalization. The Board approved the center's *Annual Report 2006*, as well as the work plan and budget for 2007.

The ICBA Board of Directors (left to right). Seated: Dr Mahmoud Solh, Mr Fawzi AlSultan (Chair), Dr Mohammad Al-Attar. Standing: Mr Mohamed Ennifar, Eng Abdulla Mohammed Rafia, Eng Mohamed Saqer Al-Asam, Mr Majid Al Mansouri, Dr Shawki Barghouti (DG, ICBA). Dr Mona Bishay and Mr Jumaa Saeed Hareb were unable to attend the meeting.

Visitors

***2 May:** His Excellency Eng Mohammed Elamin Kabashi Eisa, Sudan's Minister of Agriculture and Forestry, accompanied by Mr Badr Eldin Ali Mohamed, Sudan's Consul in Dubai.*

***28 June:** Swedish Ambassador to the UAE Mr Bruno S Beijer, accompanied by Ms Caroline Ankarcrona of the Royal Swedish Academy of Engineering Sciences.*

Farmers examine new forage varieties

The farmers of Northern Emirates have been dealing with salinity for generations. But with increasing population pressure in the UAE, water and soil resources are threatened as never before. Finding that their traditional forages can no longer tolerate the increasing salinity, they must seek viable options to sustain their livestock.

On 15 August, a field day was organized by ICBA in collaboration with the Ministry of Environment and Water (MOEW) in the Emirate of R'as al-Khaimah. Farmers from several villages met at the MOEW Research Station there to find out about new options for salt-tolerant forages.

After an inaugural session at the station, the group proceeded to Dibba to inspect the unqualified success of trials that included three forage crops: pearl millet (17 varieties), sorghum (17 varieties) and bufflegrass (2 varieties – 1 African and 1 Australian).

Farmers watch a presentation on new salt-tolerant forages.

Farmers discuss pearl millet trials.

When farmers have the opportunity to choose new varieties for themselves, their sense of empowerment is enhanced.

Seminal seminar

An important seminar was presented at ICBA headquarters on 7 June by Mr Vijay Jagannathan, Manager of the Water Sector in the Sustainable Development Department of the World Bank's Middle East and North Africa (MENA) region. Mr Jagannathan led a team that produced a seminal report, *Making the most of scarcity*: *Accountability for better water management in the Middle East and North Africa*. During his seminar at ICBA, which was attended by policy makers and academics as well as the scientific community, he explained the salient points of the report.

The World Bank's Mr Jagannathan explains the MENA Development Report.

Water in the MENA region, said Mr Jagannathan, is a source of major social and economic challenges stemming from scarcity, variability, unreliable services, and environmental degradation. Unless current practices change, population growth will put further stress on this situation in the near future. In addition, climate change is predicted to increase the temperature and water demand in agriculture, causing more droughts and floods. While water professionals have been advocating comprehensive water reforms for years and many countries have improved their water policies and institutions, some of the most politically sensitive elements of reform remain untouched. The MENA Development Report suggests that a series of factors are now emerging that represent a potential opportunity to break this impasse.

Staff news

Irene Galang, General Accountant, took leave to marry Mr John Bolus in March. Our congratulations to the happy couple. During her absence, her duties were assumed by **Alice Soliman**.

After Ms Galang's return, Ms Soliman accepted an offer of permanent employment with ICBA as Finance and Administration Assistant. Both ladies are from the Philippines.

Tarek Ahmed Abd ElHakim Sakran, an Egyptian national, joined ICBA in July as Administrative Assistant for the Abu Dhabi Office.

Letters to the editor

Dear Sir,

Whilst in Bahrain I saw the 'Tree of Life' (Shajarat al-Hayah), a 400-year-old specimen considered a natural wonder. The unique tree stands alone in the desert about 2 km from Jebel Dukhan. The source of water for this tree remains a mystery because it stands in a place completely free of water.

Wikipedia describes the tree as a mesquite. I am not happy with that identification, however, because mesquite is Prosopsis juliflora *or* P. cineraria*, characterized by large leaves. But the Tree of Life has small leaflets and is therefore an* Acacia *species, most likely* A. tortolis *(Forssk.) Hayne. I wonder if amongst your Dubai-based staff you have a scientist who can positively identify this landmark and perhaps suggest the correct wording for an identification plaque for local and foreign visitors.*

Your 'Focus on Salinity' article in September last year on saline biomass by Dr Hoek stressed the importance of field trial work and perhaps indigenous Acacia *trials with the UAE might be considered as a potential development area.*

The Tree of Life

Yours sincerely,

Richard I Smith, MA, Dip Agric (Cantab), DTA (Trin)
Tropical Agricultural Consultant
West Sussex, England

The Editor invites readers to take up this challenge to identify what has become a major tourist attraction in Bahrain.

Floriculture: Commercial success with marginal water

Catherine M Grieve[1] , Erin K Peabody[2] and Eric M McGaw[3]

1. USDA-ARS US Salinity Laboratory, Riverside CA, USA. 2. USDA-ARS Information Staff, Beltsville MD, USA. 3. International Center for Biosaline Agriculture.

Use of low-quality water is common practice for many floriculturists in the water-deprived western United States. But these waters, often recycled after use on other crops, may contain dissolved salts and ions that can hinder plant growth. Compounding the problem is for growers and nurseries along the California coast is seawater intrusion into groundwater sources.

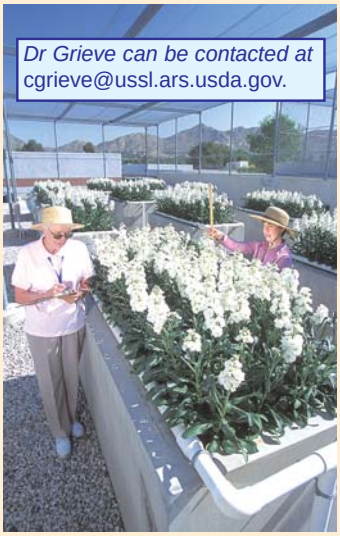
Because of the difficulties facing farmers and growers in accessing high-quality water, researchers with the premier salinity research facility in the country, the USDA-ARS US Salinity Laboratory in Riverside, California, is working to find crops that can endure degraded, often saline, groundwater and wastewater without suffering stunted growth or other salt-induced problems. The laboratory is part of the Agricultural Research Service (ARS) of the United States Department of Agriculture (USDA).

Research has shown that floricultural crops – the bright and dazzling fresh flowers that make their way into decorative vases, wedding chapels, and well-groomed backyards – can be cultivated successfully with saline and marginal water. Many floral crops tolerate water loaded with salts, and some even appear to be fond of it. Second only to maize and soybeans in terms of cash value in the US, floricultural businesses – many small and family-owned – constitute an important commercial sector. In California alone, cut flowers and foliage for bouquets are a $300-million-a-year industry. But with growers experiencing difficulty accessing water because of increasing competition between urban and agricultural users, the need to rely more on low-quality water resources is unavoidable. This water, sometimes recycled two or three times, can accumulate high levels of dissolved salts and ions. Seawater intrusion into aquifers along the California coast aggravates the problem.

Don Suarez, Director, and biologist Christy Carter taking measurements in one of the lab's 24 reservoirs of varying-strength saline solutions used to irrigate test plants. *(Photo: Stephen Ausmus)*

The laboratory's research into floral species that can withstand high salinity while producing viable, commercially acceptable flowers has helped growers learn how to conserve resources, cut costs and become more efficient. The environment and public also win. Re-using greenhouse effluents for cut-flower production reduces discharge of fertilizer, inorganic salts and pesticides into streams, rivers and other sensitive areas.

Dr Grieve can be contacted at cgrieve@ussl.ars.usda.gov.



Plant physiologist Catherine Grieve (left) and halophyte biologist Christy Carter measure the height of stock growing in special sand tanks at the USDA-ARS Salinity Laboratory. *(Photo: Stephen Ausmus)*

The researchers' strategy is smart, but not new. Centuries ago, farmers in the Middle East dealt with salinity by replacing salt-sensitive crops, such as wheat, with more salt-tolerant ones, like barley. But while many studies have focused on vegetables and grains that can tolerate salty waters and soils, little work has been done to investigate salt resistance in flowers and nursery crops.

One of the researchers' first projects was to create different kinds of water. Specifically, they had to decide on the compositions of waters used to irrigate flower species of interest. Well water contaminated by seawater intrusion, for example, contains more sodium and chloride, while concentrated Colorado River water, existing as reclaimed drainage from other crops, contains relatively more magnesium and sulfate. For the experiments, the researchers first used high-quality water to establish the plants. Then, the

seedlings were irrigated regularly with laboratory-created solutions containing gradually increasing concentrations of salts – chlorides and sulfates of calcium, magnesium, sodium, and potassium. The lab's sand tanks, filled with washed river sand, supported the plants and mimicked the systems used by commercial greenhouses.

One of the project's first floral subjects was statice, a plant with small, paperlike, blue or lavender flowers. Statice is a staple flower crop and its flowers are long-lasting, retaining bright, funnel-shaped flowers that often deepen in color when dried. We studied two statice species: *Limonium perezii*, cultivar Blue Seas, and *L. sinuatum*, cultivar American Beauty. In much of the literature, statice is said to be halophytic, and its native environments include sand dunes and beaches. However, although both species were able to complete their life cycles under highly saline conditions, stem length and other qualities important for floriculture production were diminished. Blue Seas was salt-sensitive and American Beauty only moderately salt-tolerant. While statice proved unable to obtain optimal growth under high salinity, the species retain great value as bedding or landscape plants in problem areas.

Another flower found in almost all flower shops, and commonly spotted in perennial gardens, is stock (*Matthiola incana*). This plant, with its stalks of small, bunchy flowers, is known in the industry for its spicy-sweet fragrance. Two different stock cultivars, Cheerful White and Frolic Carmine, were put to the salt test. The stock studies revealed that the species was surprisingly salt-tolerant, contrary to expectations. The ability to produce stock with a less-costly, saline water source is good news for California stock growers.

Reproduced from an article in the August 2004 issue of Agricultural Research (Vol. 52, No. 8) entitled 'Salt-Worthy Flowers Are Stunning – and Sensible' by Erin K Peabody, Agricultural Research Service Information Staff.

Sunflower (*Helianthus annuus*) is native to North America and often sold at farmer's markets across the country. The project studied two ornamental sunflower cultivars, Moonbright and Sunbeam, and found that excess salts did not affect the diameter of the flowers. The test waters used were typical of those used for irrigation in the Coachella Valley, where sunflowers are grown as a field crop. Although the saline conditions affected stem length, the size of the salt-stressed sunflowers – 10-13 cm heads on 70-76 cm stems – makes them completely acceptable for the bouquet market.

ARS scientists pollinate sunflowers to develop new inbred lines. *(Photo: Russ Hanson)*

Chief Rose, Celosia argentea *var. cristata. A relatively salt-tolerant plant, Celosia thrives in the brutal heat of southern California summers.* *(Photo: Christy Carter)*

The genus *Celosia*, of the amaranth family, offers blooms that satisfy the florist or gardener seeking an exotic-looking plant, notably the cultivar Chief Rose. Dr Grieve, along with halophyte biologist Christy Carter, studied *Celosia argentea* var. cristata. Its velvety, oversized flowers are crinkled, suggesting the wavy surface of brain coral. The researchers also found the Chief Gold variety of *Celosia* to be highly salt-tolerant. It can be produced with waters contaminated by seawater intrusion.

Looking ahead, the ARS researchers want to see how various container crops and shrubs fare under salty conditions. But first, they need to study whether certain cut-flower crops can endure solutions high in nitrogen and other fertilizer effluents typical of those released from nursery operations. This research could open the door to more on-site water recycling and decreased runoff from field and greenhouse operations.

Soil scientist Jim Poss measures plant and water status to evaluate how plant water-use efficiency changes with salinity. Less water consumption translates into money savings for flower growers. *(Photo: Stephen Ausmus)*

CAPACITY BUILDING UPDATE

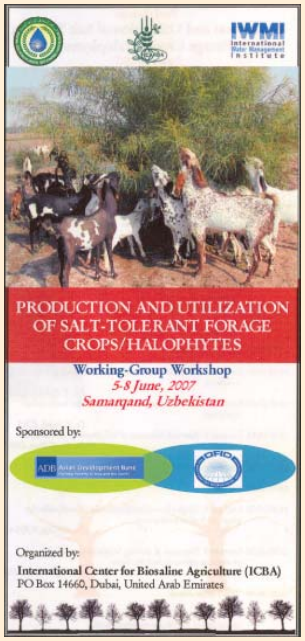
Uzbekistan

A training workshop on *Production and utilization of salt-tolerant forage crops/halophytes* was held 5-8 June in Samarkand, Uzbekistan. Organized by ICBA in collaboration with our regional partners in Central Asia, ICARDA and IWMI, and sponsored by the Asian Development Bank and the OPEC Fund for International Development, the workshop was designed to benefit young researchers and farmers working on salt tolerance and halophyte production for livestock feeding systems in Kazakhstan, Tajikistan and Uzbekistan. The workshop was hosted by the Karakul Institute of Sheep Breeding and Desert Ecology.

Workshop participants in Samarkand, Uzbekistan.

The inaugural session was followed by technical sessions and presentations over two days. ICBA scientists Dr Shoaib Ismail and Dr Abdullah Dakheel were joined by Dr H Al-Shaer of the Desert Research Centre, Egypt, to cover topics on animal feeding techniques. Eminent scientists from throughout the region also contributed to the technical presentations, which focused primarily on the evaluation of genetic resources of salt-tolerant crops and various life forms of halophytes.

The workshop program.



The participants also visited the Kyzylkesek Experimental Pilot Farm at the Madaniyat Sherkat Farm in the Navoi region. Because this desert region faces severe scarcity of forages during the dry season, attempts are being made as part of the project to use wastelands and mineralized underground water for domestication of wild halophytes into biosaline agricultural production systems. The range of species includes such conventional forages as sorghum and fodder beet as well as both indigenous and introduced halophytes (notably *Atriplex* spp. and *Acacia ampliceps*).

A practical session on different processing methods (dehydration, anaerobic fermentation, silage, feed blocks, urea-molasses treatment, etc.) for forage preparation and conservation, based on locally available resources and low-cost technologies, were demonstrated to the participants.

The ICBA-EAD partnership is a shining example of collaborative research.

Dubai

In its effort to build capacity of UAE nationals, ICBA joined forces with its close collaborator Environment Agency Abu Dhabi (EAD) in organizing a 5-day training workshop on *Laboratory techniques in soils* 20-24 May at ICBA headquarters.

The program, which involved 12 trainees, was aimed at improving the knowledge of UAE nationals in laboratory analyses with specific reference to the country's soils. The latest developments and improvements in soil survey methodology and analysis was introduced through lectures, hands-on experience and laboratory sessions. Field visits included a briefing of ICBA's Real Time Dynamic Automated Salinity Logging System and plots irrigated with seawater.

Participants learning to measure soil salinity.