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Biosalinity News

Newsletter of the International Center for Biosaline Agriculture

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FROM THE EDITOR

This first issue of *Biosalinity News* for 2010 highlights several topics.

In Oman, ICBA is collaborating with the Ministry of Agriculture in planning the National Strategy to combat Salinity.

We are also pleased to announce the appointment of the Director of the Arab Water Academy.

Dr Kristina Toderich outlines the diverse challenges affecting marginal lands in the CAC region.

Dr NK Rao shares with us his research into how an exotic herbaceous ornamental could be a useful species for saline landscapes and gardens.

Mr Ghulam Shabbir introduces us to two salt-tolerant grass species, which are promising for forage production, landscape and turf purposes.

News of other projects, conferences and workshops are highlighted at the end of the newsletter.

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

NATIONAL STRATEGY TO COMBAT SALINITY IN OMAN

The *National Strategy to combat salinity and protect water resources from pollution and salinity in the Sultanate of Oman* was launched in Muscat at a workshop co-hosted by the Omani Ministry of Agriculture and ICBA from 4 to 7 October 2009.

The workshop started with a warm welcome from His Excellency Khalfan Bin Saleh Al Naabi, the Deputy Minister of Agriculture in Oman, and reciprocal greetings from Dr Shawki Barghouti, the Director General of ICBA. A team of international experts from the United Kingdom and Australia and representatives from the Ministry of Agriculture, the Ministry of Regional Municipalities and Water, the Ministry of Environment and Climate, the Sultan Qaboos University, the Oman Scientific Research Council and ICBA scientists participated in the workshop.

Over the four days of discussions, the participants agreed on the details and timelines of the work plan, stakeholder consultation targets and mechanisms, and the roles and responsibilities of the working groups.

Following the workshop, the Steering and Scientific Committees were established with the work to start in February 2010.

Official launching of the project

AWA DIRECTOR JOINS OFFICE

Prof Asma El Kasmi took up the position of Director of the Arab Water Academy in November 2009. A Moroccan national, Prof El Kasmi obtained her first PhD in Electrochemistry in 1991 from the University Denis Diderot in France, and as a Fulbright Program grant recipient undertook in 2002 a second PhD in Bio-Electrochemistry and Analytical Chemistry at North Carolina State University, USA.

Prior to joining AWA, Prof El Kasmi was based in Morocco as the UNESCO Chair Holder (Water, Women and Decision Power) at Al Akhawayn University in Ifrane and as Head of Cooperation at the National Water Supply and Sanitation Office (ONEP).

Prof El Kasmi's extensive career includes capacity building in water sectors through research, training and functional networks (in the Arab and African regions); water technology innovations and governance; leadership and change management in water organizations; education for sustainable development; and collaborative mechanisms in water sectors (south-south, north-south-south).

Prof El Kasmi will build AWA's program as a regional Center of Excellence for executive education in water which focuses on strengthening the knowledge and skills of the Middle East and North Africa's decision-makers to address and manage effectively the region's water challenges.

The Arab Water Academy is based in the Environment Agency-Abu Dhabi's (EAD) headquarters in Abu Dhabi, and is linked to the Arab Water Council (AWC) and the International Center for Biosaline Agriculture (ICBA).

NEW GERMPLASM FOR SALT-AFFECTED AREAS IN CAC REGION: ICBA'S ACHIEVEMENTS

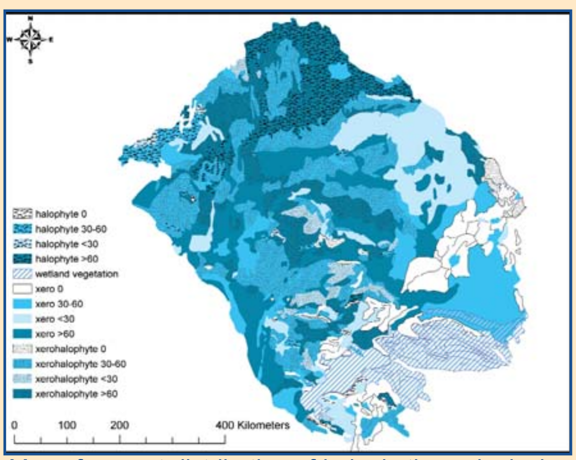
Kristina Toderich and Shoaib Ismail, ICBA[1]

The region of Central Asia and the Caucasus (CAC) covers 418 m.ha; 30% larger than India or about half the size of the USA or China. The CAC is very diverse in ecosystems and dependent on agro-ecological production systems relying heavily on irrigated agriculture. As a consequence of the mono-cropping of wheat and cotton, overgrazing, extensive expansion of the cropped area, increasing soil salinization and waterlogging, the arable land resources in this region (particularly in the desert and semi-desert plains) have been threatened seriously by soil erosion, and loss of soil fertility and organic matter. These problems have been exacerbated by prolonged drought. Consequently the former highly productive livestock system has deteriorated causing a dramatic decline in people's livelihoods.

Evaluation, domestication and large-scale adaptation of native and introduced halophytic and salt-tolerant plant resources could make a significant impact on salinity control and remediation of arid/saline lands. Recognizing this, researchers at the International Center for Biosaline Agriculture (ICBA-CAC) introduced and adapted new and improved germplasms for the salt-affected areas within the agricultural production systems, thus improving the economic livelihoods and food security of the rural communities.

Conserving Halophyte Diversity

The halophytic flora of Central Asia has highly valuable genetic diversity, but little is known about them apart from the facts that they grow well naturally in saline wetlands and marginal desert areas. Given the critical importance of conservation of plant genetic resources in the region, the ICBA-CAC program researchers were able to make a significant contribution to the collection, documentation and domestication of salt-tolerant crops and halophytes. Field expeditions conducted showed more than 380 halophytic species of different groups representing 19 taxonomical families, which were described and documented. The study areas showed a high endemism in plants (about 3.4% of total species). Most noticeable is the relative richness of the Chenopodiaceae (nearly 33%) followed by Asteraceae (20%); Poaceae (11%); Fabaceae; and Brassicaceae (about 11%). Species belonging to Polygonaceae, Plumbaginaceae, Zygophyllaceae, Cyperaceae, and Tamaricaceae account for a smaller share (3-5%), whereas, Eleagnaceae, Plantaginaceae and Frankeniaceae make up an even smaller percentage of <1% of rangeland halophytic pastures.



Map of current distribution of halophytic ecological groups in the Aral Sea Basin

The mapping of halophytic vegetation and domestication of economically valuable halophytes showed that soil salinity types, moisture and sodium ion content were the major factors responsible in the vegetation cover changes. Leaf carbon isotope (^{13}C) analysis and water use efficiency (WUE) of different ecological groups of halophytes and salt-tolerant crops, including perennial legumes, were studied to determine the relationship of soil salinity with biomass production. Field investigations and collaborative research between ICBA, the University of Yamanashi (Japan), and the Plant Physiology Institute of the Academy of Sciences of Russian Federation, had been initiated in 2008 to undertake the study. A scientific-based concept for the domestication of natural trees/shrubs and perennial halophytes into a biosaline agriculture system for Central Asia is being developed.

Domestication of Under-utilized Plant Resources

Until recently, no tangible research efforts had been focused on the commercial cultivation of halophytes and therefore the market value has not been fully recognized. In 2005 ICBA-CAC initiated an innovative program on the domestication and utilization of *Glychyrryza glabra, Hippophae ramnoides, Berberis intermedia, Elaeagnus angustifolia, Artemisia diffusa* and *Alhagi pseudoalhagi* with appropriate modern agro-technologies. Incorporation of these medicinal and fodder species into a biosaline farming system represents the only source of income for many poor rural families, who are dependent on a crop-livestock production system on marginal, low-fertile lands.

The advantages of these plants are multiple as they: can be propagated both vegetatively and by seeds; are the target fodder species for rehabilitation of degraded pastures; are useful in sand-fixation; assist in controlling the water-table and soil erosion; are useful for hay-making and silage; and provide better stock feeds (feed blocks) for animals in the late-autumn winter. The fruits of *Hippophae* and *Elaeagnus* are rich in sugar, flavonoids and various vitamins, and serve both as food for local people and as raw material in processed food. Glychyrric acid extracted from *Glychyrryza glabra* roots is used in the cosmetics industry and as a flavoring agent in food, tobacco, and candies. Licorice

1. For more information, contact **k.toderich@cgiar.org**

(*Glychyrryza glabra*) along with *Alhagi pseudoalhagi*, both forage species from Fabaceaea, are potential species for salt-affected and degraded rangelands as soil bioremediants and highly palatable pastures. The mature root material (after 4-5 years of planting) is well-known to have a very high market value in many industries.

Biosaline agroforestry for the remediation of saline wastelands

An agro-silvicultural model of salt-tolerant trees intercropped with complementary crops was evaluated by ICBA-CAC on marginal lands at sites in Akdepe (Turkmenistan) and Kyzylkesek (Uzbekistan). Fodder crops planted alternatively with salt-tolerant trees/shrubs improved the productivity of salt-affected soils; provided a valuable solution for the animal feed gaps on lands degraded both by overgrazing and salinity; and improved the profits for farmers.

ICBA-CAC research findings from the screening of 16 multi-purpose tree species (MPTS) showed high survival rates and relative growth rate, better adaptive features and firewood and/or foliage values. The most promising were *Haloxylon aphyllum, Populus euphratica, P. pruinosus, P. nigra L.* var. *pyramidalis, Elaeagnus angustifolia, Robinia pseudoacacia, Tamarix hispida, T. androsowii, Salix babylonica, Cynadon oblonga, Armeniaca vulgare, Malus silvestris* and *Acacia ampliceps*. Among shrubs, *Atriplex canescens, A. nitens,* and *A. undulata, Hippophae ramnoides* and *Ribes niger* appeared to be potential species, in addition to the rangelands halophytes, either alone or mixed with conventional salt-tolerant fodder crops. The establishment of trees/shrubs requires limited irrigation during the initial stage of growth before being irrigated with saline water (EC: 4.0-6.3 dS m^{-1}). *Elaeagnus angustifolia, Morus alba, M. nigra, Acacia ampliceps* and *Atriplex* spp. offer important possibilities as supplementary feed to the low-quality roughages during the off-season. The expansion and commercialization of non-timber forest products has significant potential to increase the cash income of rural households.

The preliminarily experimental data showed the high WUE of some tree species on marginal lands (in the degraded landscapes of the Aral Sea region). This can be important for afforestation on marginal land currently used under inefficient, high-input cropping systems. The conversion of degraded and salt-affected drylands to tree/shrubs plantations can locally generate wood for fuel, fruit, fodder and timber, while also contributing to land restoration by lowering the water table and soil salinity; replenishing nutrient stocks of unfertile soils; and reducing wind erosion. Additionally, agroforestry systems with salt-tolerant legumes and cereals plantations enrich the soil organic carbon, thus significantly improving the soil fertility. However, more detailed studies on the performance of these species, particularly on biomass partitioning under drought, salinity and low fertility conditions, is needed before final recommendations about their suitability for afforestation of degraded land can be made.

Crop diversification and Use of Marginal Quality Water

The CAC region is known for its mono-cropping of a few major crops in irrigated areas; mainly wheat, cotton, maize and rice. Therefore, crop diversification is a strategic direction for increased cropping intensity and sustainability as well as increased income for farmers in these less productive lands. The ICBA-CAC program took the initiative to test and demonstrate the potential of crop diversification in the CAC region.

A range of trials for large-scale evaluation of promising dual-purpose salt-tolerant sorghum and pearl millet crops were established in different eco-agroclimatic zones (significantly differing in salinity types and levels) in Uzbekistan, Kazakhstan and Tajikistan. Salt-tolerant varieties: Raj 171, ISMS 7704, HHVBC Tall, Gurenian-4 and IP 13150 among the evaluated pearl millet lines; thin-stemmed tall Sugar Graze, Pioneer 858 and Speed Feed; and dwarf ICSV 172 and ICSV 745 sorghum lines, were found to be most promising for both forage and grain production on marginal lands irrigated with drainage water (2.5-8.3 dS m^{-1}).

After three years of evaluation, ICBA scientists have been able to introduce two salt-tolerant varieties of alfalfa (*Medicago sativa*), Eureka and Skeptre, which outperformed the local varieties: Khivinskii (used in Karakalpakstan and Turkmenistan) and Vakhsh (Tajikistan). Only the local variety Kyzylkesekskaya (Uzbekistan) showed similar salt tolerance, green biomass and grain yield compared with the newly introduced alfalfa cultivars in all the CAC countries. The introduced salt-tolerant alfalfa germplasm showed better germination, higher seed production and excellent regenerative capacity. Additionally, these two varieties were better than the local varieties for all the growth parameters studied and also showed higher seed productivity. Fresh biomass production at the third year varied from 23 t ha^{-1} for var. Eureka and 20 t ha^{-1} for Skeptre, respectively. These levels of biomass production under saline soils (EC_e: 1.6-9.1 dS m^{-1}) and groundwater salinity (5.6-21.1 dS m^{-1}) were 1.5-2.5 times higher when compared to local varieties, such as Khivinsky (in Turkmenistan) and Vakhsh (in Tajikistan).

Collection and identification of plant species at the Ecocenter "Dzeiran"

African daisy: An herbaceous ornamental for saline landscapes

NK Rao and Mohammed Shahid, ICBA[1]

In recent years, rapid expansion of urban and suburban areas is increasing the demand for landscaping in many countries of the Arabian Peninsula. At the same time, the availability of good quality water for the gardens and landscapes is becoming increasingly restricted due to the rising demand for domestic use of the scarce fresh water resources. Consequently, landscape architects are in search of ornamental plants that perform well with saline groundwater and treated wastewater. To date, only limited systematic work has been carried out to study the tolerance of landscaping plants to higher levels of salinity.

The International Center for Biosaline Agriculture (ICBA), based in Dubai, has been evaluating several exotic herbaceous ornamentals for their adaptation to the local environment and salinity tolerance with the objective to introduce them into local landscapes. Recently, the effect of saline irrigation on the performance of a salt-tolerant wildflower mix containing ten herbaceous ornamental species obtained from Applewood Seed Co, USA, has been studied. Three species, *Loubularia maritima, Dimorphotheca aurantiaca* and *Gaillardia aristata,* were identified as promising. In this article, the response of *D. aurantiaca* to saline water irrigation is further detailed.

D. aurantiaca, also known as African daisy, belongs to the family Asteraceae and is a native of South Africa. It is an annual herb with light green and spoon-shaped leaves that combine well with other colors in the garden. The flowers, which have a variety of shades such as yellow, orange and white, are borne singularly at the tip of each branch.

The study was carried out at ICBA research station during the year 2009. The soils at the experimental site were sandy in texture with very low organic matter. Four salinity treatments with electrical conductivity (EC_{w}) of 2 (control), 5, 10 and 15 dS m^{-1} were used to assess the performance. Seeds were sown during mid-January in rows directly into the field plots of size 3 m x 3 m per treatment. The distance between rows was 50 cm and between plants within each row was 25 cm. The plots were irrigated with a drip system using water at the chosen level of salinity. Prior to sowing, the soil fertility was improved by incorporating organic fertilizer (compost) at the rate of 40 t ha^{-1}. Where necessary, especially at the lower salinities, thinning and transplanting were undertaken to maintain adequate spacing and good plant stand. The response of *D. aurantiaca* to salinity was evaluated by determining plant height; plant width (spread); number of branches; days to 50% flowering; number of flower heads; and fresh and dry weights. Three plants, randomly selected from each treatment, were used to record the data. The mean flower diameter and seeds per head were also assessed from five randomly selected flower heads from each treatment (Table 1). Dry weights were determined by drying the samples in a forced-drought oven at 80°C for 48 hrs.

Germination, plant establishment and growth were severely affected at 15 dS m^{-1}. Furthermore, flowering was delayed by more than three weeks, whereas the differences among control, 5 and 10 dS m^{-1} treatments were only marginal. Increase in salinity from 2 to 15 dS m^{-1} resulted in gradual decrease in plant height, plant width, number of flowers per plant, fresh weight and dry weights (Table 1). The number of flower heads produced per plant decreased by about 12% at 5 dS m^{-1}, 30% at 10 dS m^{-1} and 90% at 15 dS m^{-1}, compared to the control. Analysis of variance of the data on plant height, plant width and number of flower per plant showed that differences among the control, 5 and 10 dS m^{-1} were not significant ($p>0.05$). Similarly, differences in fresh and dry weights of plants from the 5 and 10 d Sm^{-1} treatments also were not statistically significant, although they were significantly reduced compared to the control. All traits, except the number of branches and flower diameter, showed a marked decrease at 15 dS m^{-1}, in comparison with other treatments ($p<0.05$) (Table 1).

The present study indicates that *D. aurantiaca* has good adaptation to the local growing environment and it could be successfully cultivated with low quality water of up to 10 dS m^{-1} salinity. Interestingly, the number of branches and flower diameter are not affected by an increase in salinity, which could make this species an excellent choice for highly saline landscapes and gardens. In this study, seeds were directly sown in the

African daisy is excellent for naturalized areas and as a ground cover for large areas, parking strips, borders and even for large pots and tubs. Flowers appear in shades of white, orange and yellow.

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

field and irrigated with highly saline water from the first day. Increasing the seedling rate to compensate for poor germination or transplanting the seedlings raised with fresh water and hardened with saline water are expected to improve its performance even at higher salinities.

Table 1. Growth and floral characteristics of African Daisy irrigated with saline water

Salinity (EC_w)	Plant height (cm)	Plant spread (cm)	No of branches	No of flowers per plant	Flower diameter (cm)	Fresh weight (g)	Dry weight (g)
Control	54.0	41.6	7.0	78.4	5.2	669	136.2
5 dS m^{-1}	46.7	38.4	8.8	68.6	5.1	304	66.8
10 dS m^{-1}	40.5	34.0	9.2	54.2	5.4	196	35.4
15 dS m^{-1}	17.5	20.8	8.8	7.8	4.6	60	9.0
LSD (0.05)	*11.1*	*9.8*	*n.s.*	*39.5*	*n.s.*	*205*	*41.4*

Distichlis spicata and *Sporobolus virginicus*

Promising grass species under saline environments

Ghulam Shabbir and Abdullah Dakheel, ICBA[1]

The challenges: water and salinity

Continuous depletion of fresh water resources is one of the major environmental disasters that humanity will confront in the 21st century. According to the United Nations predictions, 2.7 billion people will face severe water shortages by 2025 if consumption continues at current rates. Rapidly expanding population growth is placing increased pressure on limited fresh water resources in arid and semi-arid regions where soil and water salinity are serious problems. Due to this critical water shortage, the use of potable water for agricultural purposes and landscape irrigation is seen as a low priority and there is an increasing emphasis on the use of multi-purpose crops that can successfully be grown in marginal areas.

Salinity is an escalating global problem with nearly 10% of the earth's total land surface (954 m.ha) being covered with salt-affected soils and up to 100 m.ha land is saline due to irrigation with saline water. Every year, almost 20 m.ha of irrigated land is lost to production due to salinity. Salinity problems are also becoming acute in coastal areas where increasing demand on fresh water aquifers is resulting in saltwater intrusions. Therefore, irrigation in these areas is often accomplished by using brackish water from affected wells or other secondary water sources.

Salinity management

The diagnosis and management of salinity problems under field conditions is often difficult and expensive. The most common salts in saline water and soil are in the form of ions of sodium, potassium, calcium, and magnesium (cations) and chloride, sulfate, and carbonate/bicarbonate (anions). Salinity problems are often compounded when high exchangeable sodium in the soil causes dispersion of soil colloids resulting in anaerobiosis due to the loss of soil structure and reduced root growth which ultimately increases the salt transport to shoots, thus hindering plant growth and survival. Moreover, the loss in leaching potential of the soil results in the accumulation of salts within the rootzone.

Salinity tolerance is a complex phenomenon, influenced by various factors such as the stage of plant development, temperature, relative humidity and plant response. Plants are more sensitive to salinity under hot, dry conditions. Salt tolerance has been associated with osmotic adjustment and avoidance of "physiological drought". Exclusion of Na^+ and Cl^- from shoots coupled with minimal yet adequate osmotic adjustment is correlated with salt tolerance among divergent plant genera and considered pivotal to salt tolerance in most plant species. Salt-sensitive plants accumulate saline ions in their tissue to toxic levels resulting in shoot sap osmolarities (osmotic adjustment) higher than saline growing soil/media. Species such as *Distichlis spicata, Sporobolus airoides, Sporobolus virginicus, Cynodon dactylon, Zoysia japonica, Sporobolus cryptandrus, Buchloe dactyloides*, and *Bouteloua curtipendula*, maintain complete osmotic adjustment even under high salinity by maintaining leaf sap osmolalities greater than that of the saline growing media (Figure 1c). However, the salt-sensitive species had greater leaf osmotic adjustment than the salt-tolerant species. In parallel, salt-sensitive species had higher leaf Cl^- concentrations under salt stress than salt-tolerant species (Figure 1b). These facts conclusively demonstrate that salinity tolerance is associated with salt ion (i.e. Cl^-) exclusion and minimal shoot osmotic adjustment. In fact, salinity tolerance (salinity resulting in 50% shoot yield) is highly correlated with shoot Cl^- ion exclusion and with leaf sap osmolarity.

A number of salinity-adapted species have salt glands or bladders which remove excess saline ions from shoots by excretion. Bicellular leaf epidermal salt glands have been

Mechanical harvesting and bailing of the grasses

1. For more information, contact **g.shabbir@biosaline.org.ae**

reported to occur in over 30 species of the family Poaceae. These salt glands consist of a basal cell attached or embedded into the leaf epidermis and a cap cell. Though the basic bicellular structure of the glands is the same, their size varies; in fact the salt glands of Poaceae are quite small. Grasses with higher salt gland excretion rates maintain lower shoot salt ion concentrations resulting in superior salinity tolerance.

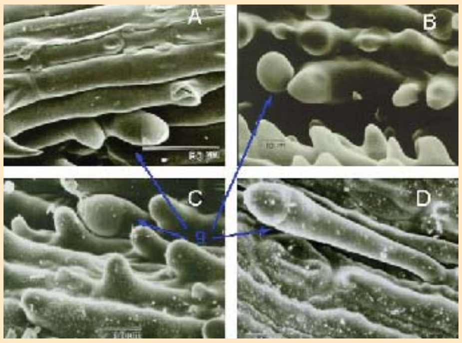


Figure 1: Scanning electron micrographs of salt glands on adaxial leaf surfaces of: (A) Sporobolus airoides, *(B)* Distichlis spicata *spp. stricta, (C)* Cynodon dactylon, *and (D)* Buchloe dactyloides. *Salt glands are labeled as: g. Other protrusions which are not bi-cellular are papillae*[2]

Salinity strategies

The following practices assist in the management of salinity:

- Soil salinity must be maintained below the tolerance level of the crop species to avoid salt injury. EC of drainage water is equivalent to the root zone salinity and consequently the tolerance level of the species.
- Salts, accumulated in the root zone, can be removed by leaching or the average salinity of irrigation water can be reduced either by blending saline water with good quality source or alternate irrigation with poor and good quality water.
- Saturated hydraulic conductivity of the soil must be maintained above water application rate.
- Gypsum should be incorporated into the soil whenever possible to maintain the soil structure. Exchangeable sodium percentage (ESP) should be maintained below 15%.
- Acidifying amendments such as sulfur or sulfuric acid can be used to overcome bicarbonates problems in situations where abundant free calcium carbonate is present like in many arid-land soils.
- The choice and use of salt-tolerant crop species such as *Distichlis* and *Sporobolus* is the least expensive, sustainable and most effective option for salinity management.

Distichlis spicata and *Sporobolus virginicus*

Distichlis and *Sporobolus*, which are two genera of the family Poaceae, are known by several common names: in the case of *Distichlis spicata* as seashore/inland/desert saltgrass; and *Sporobolus virginicus* as marine/sand/salt/saltwater couch, coastal rat-tail grass, or Nioaka. The two genera are widely distributed in the Americas and Australia; and are also found on other continents where they have become naturalized.

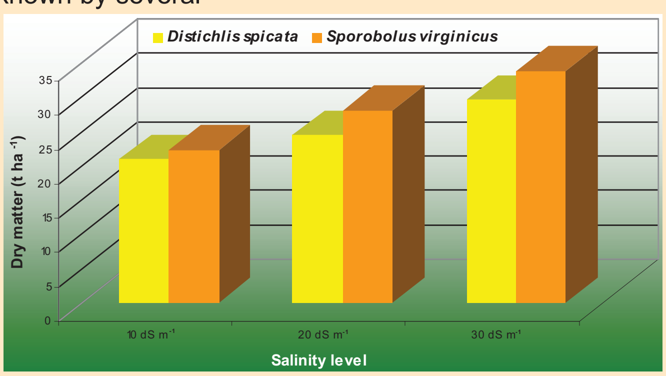


Figure 2: Field dry matter production (t ha^{-1}) of Distichlis spicata *and* Sporobolus virginicus *at three salinity levels*

Both are erect, hardy perennial grasses occasionally approaching half a meter in height but are generally shorter. The solid, stiff stems have narrow leaves which may be crusted with salts in saline environments. *D. spicata* is dioecious (bearing male flowers and female flowers on separate individuals), and reproduce asexually either by stolons and/or rhizomes. With excellent tolerance to salinity, these species can easily be grown in a wide range of soil types from clays to sands and also highly saline marsh soils as they excrete salts from their tissues via salt glands. The species form sods with their hearty root systems that help them to thrive along coastlines, disturbed soils, forest, woodland and scrub habitats. Rhizomes have sharp points which allow them to penetrate hard soils and aerenchymatous tissues that allow to grow underwater and in mud.

While some dropseed grasses make popular gardening plants, these grasses are generally considered to make inferior pastures as evidenced by names like "poverty grass" or smutgrass. They are high in protein and minerals and can provide important grazing throughout the year especially during the dry seasons; however, these stiff, coarse grasses are poor forages for grazing animals if used solely. The species can be used as lawn, for restoration of salt marshes and landscaping in parks.

Results of a long-term study carried out at ICBA have shown that these grasses can tolerate high level of salinity of irrigation water. They give higher yields at an irrigation level just above the ET level of the area, although the application of NPK (20:20:20) 40:20:20 per ha. Both grasses give production the whole year even under higher salinity levels. The dry matter production in t/ha/year ranged between 22.2 and 33.8 and 20.9 and 29.6 for *Sporobolus virginicus* and *Distichlis spicata* respectively. Both the species showed significant dependence of dry matter production over the season, with the yield being highest in summer harvests. The dry matter yield of both *S. virginicus* and *D. spicata* was increased with rising salinity level as shown in Figure 2. The results also proved that grasses show excellent regeneration potential and maintained sustainable higher production after many years. These grass species are very suitable for irrigating landscape and turf as they can be mechanically harvested, thus reducing dependence on limited freshwater resources.

2. Photo courtesy of: Kenneth B Marcum, Department of Applied Biological Sciences, East College, Arizona State University, 7001 E Williams Field Rd Bldg 130, Mesa, AZ 85212, Kenneth.Marcum@asu.edu

Update on Projects

Abu Dhabi wastewater reuse

A pre-planning workshop to kick-off the *Abu Dhabi Wastewater Reuse Project* was held from 10 to 15 October 2009 at ICBA. Nine external wastewater sector experts, two official representatives from the Environment Agency - Abu Dhabi (EAD), and ICBA scientists contributed to the workshop. Outcomes from the workshop highlighted key messages to be included in the Plan, an outline of annotated reports and the planning schedule of project activities.

Non-conventional water resources are gaining importance as the only dependable water sources for sustainable development. Among non-conventional water resources, recycled municipal wastewater is the most reliable and sustainable water source. Its use has great potential for reducing the use of desalinated water and groundwater.

Managed by the ICBA on behalf of EAD, the main goal of the three-month project is to develop a comprehensive strategy to capture, recycle, and use municipal and industrial wastewaters. The selection of innovative or advanced treatment processes, state-of-the-art modern irrigation technology and international best management practices for high-value crops, landscaping and forestry systems will ensure safe and sustainable use of recycled wastewater in Abu Dhabi Emirate.

Combating salinity in Iraq

The agricultural sector in Iraq is a vital component of Iraq's economy which employs 25 per cent of the labor force and makes the second largest contribution to gross national product (GNP).

Salinity has long been recognized as a major threat to agriculture in the country. However, past policies aimed at improving irrigation and drainage practices have lapsed, the extensive irrigation infrastructure has fallen into disrepair, and soil salinity has spread across many of the irrigated areas of central and southern Iraq. Problems are compounded by the increasing levels of salinity of the irrigation water from both the Euphrates and Tigris Rivers.

The Australian Centre for International Agricultural Research (ACIAR) has proposed funding an intervention that will complement other aid work in Iraq by providing a research-based approach to improve irrigation water management and the production of suitable crops in saline environments. This proposal is essentially about researching salt-affected lands to understand better the irrigation and broader hydrological (surface and groundwater quality and interaction) aspects of the salinization process.

The project will involve collaboration between ICBA, the International Center for Agricultural Research in Dry Areas (ICARDA), the International Water Management Institute (IWMI) and national partners from Iraq.

ICBA's roles in this project are the demonstration of improved crop varieties suitable for salt-affected areas in Iraq; and the development of methodologies to improve irrigation water management for salinity control. ICBA will also support ICARDA and IWMI on the 'irrigation district scale' in the evaluations of current crop/agronomic systems and water management for salinity control.

Abu Dhabi Genebank

Efforts to conserve and sustainably use flora in the United Arab Emirates made considerable progress in October with the Environment Agency - Abu Dhabi (EAD) authorizing the establishment of the Abu Dhabi Genebank. To ensure the success of Genebank, EAD and ICBA are working jointly on logistics and future management of the genebank.

Partnerships

To strengthen its research activities, ICBA signed two Memoranda of Understanding (MoU) with:

- Kuwait Institute for Scientific Research, Kuwait on 25 October 2009.
- BITS, Pilani-Dubai, on 9 November 2009.

Dr Shawki Barghouti (left) ICBA Director General and Dr Naji Al-Mutairi (right) KISR Director General at the signing ceremony of the MoU

Project agreements

ICBA also signed four project agreements to formalize project conditions with:

- Ministry of Environment and Water (MOEW), United Arab Emirates on the *Integrated strategy to protect water resources in the United Arab Emirates* on 15 October 2009.
- Environment Agency - Abu Dhabi on *Establishment of Abu Dhabi Water Council (ADWC)* on 9 December 2009.
- Environment Agency - Abu Dhabi on *Recycled wastewater strategic plan for Abu Dhabi Emirate* on 9 December 2009.
- Environment Agency - Abu Dhabi on *Legal and regulatory framework for the Water Sector in Abu Dhabi Emirate* on 9 December 2009.

Conferences and workshops

Regional training in Kuwait

In collaboration with and funding from the Kuwait Institute for Scientific Research (KISR), the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) and the United Nations Environment Programme (UNEP), ICBA organized in Kuwait from 25 to 29 October 2009 a regional training workshop on *Biosaline Agriculture Technologies in the Arid and Semi-arid Environments*. The Kuwait Foundation for the Advancement of Sciences (KFAS) and the OPEC Fund for International Development (OFID) co-financed the workshop. This workshop is the second in a series of training courses organized under the patronage of the League of the Arab State following the successful training organized in January 2008 in Libya.

Thirty seven individuals from Algeria, Bahrain, Egypt, Jordan, Kuwait, Libya, Morocco, Oman, Palestine, Sudan, Syria, Tunisia and UAE participated in the 5-day workshop. Lectures were given by ICBA, KISR, ACSAD and UNEP scientists and a field day was organized to the KISR Research Station and Al-Sulaibiya Wastewater Treatment Plant.

Participants at the KISR Research Station

International Conference in Oman

The *International Conference on Management of Soil and Groundwater Salinization in Arid Regions* was held in Muscat (Oman) from 11 to 14 January 2010. Organized by the Sultan Qaboos University in collaboration with relevant institutions in Oman, more than 60 international researchers and scientists participated in the conference. Prof Dr Faisal Taha, ICBA Director of Technical Programs, delivered the first keynote address speech and chaired a session. Dr Shabbir Shahid also presented a keynote talk and Drs Nurul Akhand and Mahmoud Abdelfattah rounded up ICBA's contribution with a further two papers.

Keynote speech of Prof Faisal Taha

International Conference in Morocco

Dr Shabbir Shahid joined over 150 delegates from 25 countries to discuss eco-solutions at the International Conference on *The Integration of Sustainable Agriculture, Rural Development, and Eco-systems in the Context of Food Insecurity, Climate Change and the Energy Crisis* held from 12 to 14 November 2009 in Agadir, Morocco. Dr Shahid shared ICBA's experience with the delegates on *Improving soil quality for better agriculture and food security*. He also chaired a panel discussion and presented *Conference Synthesis and Resolution Report* in the closing session.

Dr Shabbir (second from left) at the conference

Launching World Development Report 2010 on Climate Change

The World Bank launched on 11 October 2009 its *World Development Report 2010: Development and Climate Change* in Abu Dhabi, UAE.

Estimates indicate that developing countries would bear some 75-80% of the costs of anticipated damages caused by the changing climate. Developing countries simply neither can afford to ignore climate change; nor can they focus on adaptation alone. So action to reduce vulnerability and lay the groundwork for a transition to low-carbon growth paths is imperative.

The *World Development Report 2010* explores how public policy can change to better help people cope with new or worsened risks, how land and water management must adapt to better protect a threatened natural environment while feeding an expanding and more prosperous population, and how energy systems will need to be transformed.

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