



Biosalinity News

Newsletter of the International Center for Biosaline Agriculture

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FROM THE EDITOR

This first edition of *Biosalinity News* in 2008 features articles about two of our longstanding partner countries in the Middle East, Jordan and Syria.

Also featured are reports of ICBA participation in major scientific meetings on salinity and marginal water resources in Australia and Pakistan, as well as capacity building activities at home and abroad. Two important training courses were held at our Dubai headquarters: one for Iraqi technicians and another for Omani farmers. In January, several ICBA staff traveled to Libya, where 20 delegates from nine Arab countries participated in a course on *Biosaline agriculture technologies for the Arab Region*.

Two short science articles appear in the newsletter. ICBA plant genetic resources scientists describe the benefits of using agar substrate for *in vitro* screening, and Mr Jaap Wensvoort, a long-time friend of ICBA, reports on the use of browse silage as animal feed.

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:

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Royal focus on ICBA

When the expertise of ICBA was brought to the attention of Her Highness Sharifa Zein Alsharaf Bint Nasser, the Jordanian princess who spearheads the Hashemite Fund for Development of Jordan Badia, she was quick to respond. During an ICBA mission to Amman in January, the princess welcomed representatives of ICBA and its partner organization in Jordan, the National Center for Agricultural Research and Technology Transfer (NCARTT), to discuss the possibilities for cooperation.

The Hashemite Fund was set up to utilize the natural resources and human capital in the Badia (Jordan's semi-arid rangeland) to empower communities to initiate, develop and execute projects to improve their socio-



From left: Eng Hussein H Mustafa, Coordinator, Forage Production, NCARTT; Princess Sharifa; Dr Abdullah Dakheel, ICBA; Dr Faisal Awawdeh, Director General, NCARTT

economic status as well as their environment. Much of the Fund's emphasis is on the developmental role of women in maintaining the traditional, social and cultural identity of the Badia.

Forage project completes 3rd year

Both the Steering and Technical Committees of the seven-country Forage Project, ICBA's largest endeavor, met 9-12 March in Damascus, Syria, to review progress and agree on a workplan for 2008. Supported by the International Fund for International Development, the OPEC fund for International Development and the Arab Fund for Economic and Social Development,

the project has made significant gains in improving the livelihoods of the hard-working farmers of the participating countries.



Participants were taken on a field trip to a station maintained by the Animal Wealth Research Administration of Syria's General Commission for Scientific Agricultural Research, where they were treated to an excellent demonstration of modern techniques for preparing forage.

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Novel *in vitro* screening method

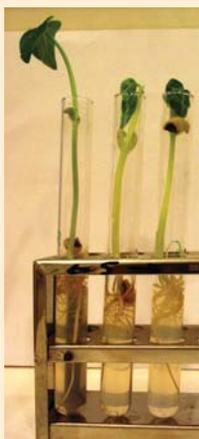
NK Rao and Mohammed Shahid, Plant Genetic Resources Program, ICBA

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Improving the salt tolerance of food and forage crops requires access to new genetic diversity and efficient techniques for identifying salt tolerance. A number of methods are available to screen germplasm for salt tolerance. Although field screening is the most logical method, its use when large numbers of accessions are to be tested is limited. Field experiments demand considerable labor and resources. Moreover, salinity varies substantially with time, location, soil type and depth. Therefore, screening techniques under controlled conditions are often used to reduce the large numbers of genotypes for easier handling in the field.

When screening under controlled conditions, laboratory methods for identification of salt tolerance at germination are widely practiced. These are relatively simple procedures and have been used with success. The most common method is to germinate seeds in a petri dish on top of paper substrate moistened with NaCl solution. One limitation of this method is that seedling roots become entangled, making it difficult to separate individual plants for evaluation. Also, due to evaporation, salt accumulates on the substrate, leading to a gradual increase in salt concentration.

At ICBA, we have overcome these limitations by establishing a simple and effective *in vitro* laboratory screening method based on water agar substrate (0.8-1.0%). The method facilitates the evaluation of the effect of salinity on germination and seedling vigor. Agar substrate can be prepared by dissolving agar powder in water heated on a hot plate or in a microwave oven.



Agar's translucency makes root growth analysis easy

When dissolved, allow the solution to cool, then pour into petri dishes (for small seeds) or other suitable germination containers like test tubes (for medium

and large seeds). Agar solution becomes a stiff gel when cooled, onto which seeds can be placed for germination testing.



Barley cultivars evaluated for salinity tolerance on agar

The advantage of agar over standard paper substrate is that it provides a constant supply of moisture for the entire duration of the test, thus facilitating uniform germination. Also, because agar is translucent, assessment of root growth is easy. With agar, the roots remain moist for several days, obviating the need to continually wet the substrate. This helps minimize the accumulation of salts on the substrate caused by evaporation of salt solutions. Further, agar substrate can be amended with mineral nutrients and with chemicals like heavy metal salts to evaluate their effects on germination and seedling growth.

Using the agar method, we screened 133 pigeonpea, 100 sunflower and 6 cowpea accessions at three salinity levels (0, 10 and 20 dS m⁻¹). While data are yet to be fully analyzed, sunflower appears relatively more tolerant than cowpea and pigeonpea. In sunflower, 4 accessions germinated and produced normal seedlings at 20 dS m⁻¹ and about 25 accessions performed reasonably well at 10 dS m⁻¹. In cowpea, germination was severely affected at 20 dS m⁻¹, and seedling growth reduced by 40-50% at 10 dS m⁻¹ in all 6 accessions. In pigeonpea, while none of the accessions germinated at 20 dS m⁻¹, root and shoot lengths were drastically reduced at 10 dS m⁻¹.

The tolerant genotypes identified by *in vitro* screening are now being evaluated in the field and preliminary results confirm the tolerance of these accessions.

Agar is generally used as a medium for tissue culture and for *in vitro* screening of organs, tissues and cells for salinity, chemical toxicity, etc. (Vijayan et al. 2003). It is also used to provide aseptic and uniform germination of seeds, especially in species which require long periods of testing (Coyne et al. 2005).

The *in vitro* screening method described here provides an effective germination procedure in combination with a simple and efficient protocol for selecting genotypes with the ability to germinate and survive under saline conditions.

References

- Coyne C, Cashman M, Chen W, Muehlbauer F and Mallikarjuna N. 2005. Simplified germination of perennial *Cicer*. Intl Chickpea and Pigeonpea Newsl 12:16.
- Vijayan K, Chakraborti SP and Ghosh PD. 2003. *In vitro* screening of mulberry (*Morus* spp) for salinity tolerance. Plant Cell Rep 22:350-357.



Screening cowpea accessions for salinity tolerance

LETTERS TO THE EDITOR

Readers will recall that the last two issues of *Biosalinity News* have featured letters about Bahrain's famous Tree of Life. By happenstance, the



foremost authority on the subject, Dr Ghazi Al-Karaki, visited ICBA on 13 February. Dr Al-Karaki, who holds professorships at both the Arabian Gulf University in Bahrain and the Jordan University of Science

and Technology, presented a seminar about Mycorrhiza. These soil-borne fungi, he says, dramatically increase a plant's capability for water and nutrient uptake. This explains why the Tree of Life is able to remain alive in an area where no other flora can survive.



Image by Google Earth
25° 59' 38.86"N
50° 34' 58.42"E

This satellite image of the Tree of Life is proof positive of the lack of life anywhere nearby.



Ministerial visit

ICBA was honored by a visit from Her Excellency Mme Siti Kassim, Minister of Agriculture, Fish and the Environment of the Union of the Comoros. Mme Kassim met with ICBA scientists and toured the farm on 23 April.

Readers interested in additional information about Mycorrhiza and the Tree of Life are referred Dr Al-Karaki's article 'The 400 Year Survival of Bahrain's Tree of Life' in the January 2008 issue of *Landscape*, a Dubai publication, pictured above. Visit www.landscape-me.com for details.



ICBA goes down under

ICBA participated at the Second International Salinity Forum, which took place 30 March to 3 April at the Adelaide Convention Centre in South Australia. Representing ICBA were Prof Dr Faisal Taha, Director of Technical Programs, and Dr Mahmoud Abdelfattah, Soil Scientist. Both scientists were speakers at this seminal meeting of the foremost authorities on salinity



Dr Abdelfattah (above) and Dr Taha (right) joined on a field trip on the Murray River

from all over the world. Dr Taha's gave a keynote presentation on *Managing salinity in the developing world*. Dr Abdelfattah spoke on *A model for salinity mapping using remote sensing and geographic information systems – a case study from Abu Dhabi Emirate, UAE*.



The theme of the forum was *Salinity, water and society – global issues, local action*. Participants discussed such issues as new approaches for tackling the salinisation of water resources, irrigation, dryland and urban salinity, and salt water intrusion.

More information: www.internationalsalinityforum.org

Capacity building for the Iraqi water sector



Under the auspices of the Arab Water Academy, the World Bank Institute and the US Government, ICBA organized an interactive course on *Asset management with focus on distribution systems and business planning / risk management: capacity building for the water sector in Iraq*. The workshop, which took place at ICBA from 22 to 25 March, was joined by 25 experts and policymakers from the water sector in Iraq. Lectures were given by international experts from the World Bank, the private sector in the UK and the USA, and ICBA.

The main objectives of the course:

- Bring together government officials and senior professionals to share knowledge and experiences to

achieve a sustainable, more efficient and better quality water service delivery.

- Invite international experts to share case studies.
- Provide participants with concrete methodologies and tools for sustainable water supply operations.
- Enable participants to develop a strategic approach to managing water distribution.

At the end of the course, participants agreed on the need for immediate action on leadership development, finance of water infrastructure, evaluation of the conditions of current assets, the creation of public awareness to reduce water consumption and the need for a sustainable pricing system.

Field test for AFG unit

ICBA's irrigation unit organized a tour at the ICBA farm to examine the results of the winter experiments related to field testing of the AFG saltwater treatment unit. The demonstration, which was led by Dr Nurul Akhand, was conducted with support from Dr NK Rao and Dr Shabbir Shahid. The field test included the first trial of the experiments so far undertaken with this new technology. Additional testing of the treated water will be conducted in summer of 2008 before finalizing the results. The field visit was attended by most of the senior staff of the ICBA's Technical Programs.



Field day for Omani farmers

As part of ICBA's activities in capacity building, ICBA organized on 9 April a field day at its main research farm in Dubai. The field day was attended by Omani farmers and representatives of the Ministry of Agriculture in Oman. This activity is part of the forage project activities in seven countries in the region that include Oman, Jordan, Pakistan, Palestine, Syrian, Tunisia and UAE.



Training workshop in Libya

ICBA organized a regional training workshop on *Biosaline agriculture technologies for the Arab Region* in Misratah, Libya, 6-10 January. The workshop, the first in a series requested by the League of Arab States, was organized in cooperation with Libya's Environment General Authority (EGA) and the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD). The workshop was sponsored by the United Nations Environment Programme, the OPEC Fund for International Development and the League of Arab States. The course was attended by 20 participants from Bahrain, Kuwait, Libya, Mauritania, Morocco, Oman, Sudan, Syria and Tunisia.

Lectures were given by ICBA and ACSAD scientists, and a field day was arranged by EGA in farmers' fields, where salinity had reached 11 dS m⁻¹. Prof Dr Faisal Taha, Director of Technical Programs, who headed the ICBA delegation, met with EGA authorities to discuss future collaboration in the field of oilfield-contaminated groundwater.

STAFF NEWS



Ms Suzara Naga joined ICBA in January as General Accountant. Ms Naga is from the Philippines. Ms Naga replaces her compatriot Ms Irene Galang.

In February, **Ms Patricia Pluvinage**, a Belgian national, joined as Administrative Assistant to the Director of Technical Programs. Ms Pluvinage is fluent in both English and French. She replaces Ms Diane Giessen.



Group photograph of the participants. Mr Mohamed Khalifa, Course Coordinator, is the 5th person from the right.



Participants discussing the quality of forage material with Libyan farmers.



WETEX 2008

For the seventh time, ICBA mounted a display about its work at this annual water technology exhibition.



Even the exhibition mascots were attracted to ICBA's stall!

FOCUS ON SALINE WATER AND WASTE PRODUCTS



Browse silage for animal nutrition in the UAE

Jaap Wensvoort, Animal Nutritionist (jwensvoort@hotmail.com)
Private Office of Sheikh Hamdan Bin Rashid Al Maktoum, Dubai, UAE

Water for plantations and green waste

The combination of costly fresh water, growing population and increasing salinity of natural wells justifies the use of treated municipality waste water and saline water for irrigating plant cultivation. In Dubai, drip irrigation with marginal water is widespread alongside roads, in public parks and in private gardens and farms.

In managing this cultivation, trees, shrubs and lawns are regularly pruned, mown and replaced. Most of these plant by-products, despite their feed value, are usually mulched or discarded into landfills as 'green waste'. However, when managed knowledgeably and selectively, many of these by-products, provided they are made available in sufficient quantity and quality, can serve as a sustainable feed supply for herbivorous animals, thereby reducing the need for irrigation of feed plantations as well as for feed imports.

Animal and plant - ecological balance

All plants have defense mechanisms to avoid being eaten by animals. Some are morphological, like the placement of leaves and occurrence of thorns. Others are chemical. These chemical defenses are numerous and ubiquitous and are known as Plant Secondary Metabolites (PSMs). Some of the major groups of PSMs are tannins, terpenoids, alkaloids, flavonoids and glucosides. Consumption of these or their metabolites can result in aversive, pathological or lethal effects. But they can also be eaten without problems and even be beneficial for animal health by discouraging parasites, by promoting anti-inflammatory action, by improving mineral metabolism and by



Browse silage material can best be obtained from hedges

increasing dietary efficiency. Important factors to consider in evaluating the feed value of plant material are the plant species, the



Browse silage is eaten readily by goats

physiological state of the plant, the soil and water characteristics, the consumer species, the amount eaten and associative and adoptive dietary factors.

Most herbivorous animals eat browse (the edible parts of trees and shrubs). Different species deal with browse in different ways and according to their original ecology. Animal species (domesticated or wild) that have evolved to consume browse can, due to their behavioral, digestive and metabolic adaptation, cope much better with browse plant defense mechanisms than species that have not so evolved. Wild animals that attain maturity in their native habitats generally avoid plant intoxication through selective feeding. They learn what and how much they can safely eat from specific plants. These browser animals can be characterized into three nutritional categories.

- **Specialist browsers** like the koala (*Phascolarctos cinereus*) and the fat desert rat (*Psammomys obesus*), which browse only on specific trees or bushes.
- **Generalist browsers** like the common brushtail possum (*Trichosorus vulpecula*) and the giraffe (*Giraffa* spp.), which browse several plant species.
- **Intermediate browsers and grazers** like goats (*Capra* spp.) and camels (*Camelus* spp.), which browse trees, bushes and grasses.

Pure grazers like sheep (*Ovis* spp.) or cattle (*Bos* spp.) are usually able to utilize browse, but to a much more limited extent. In the UAE, camels and goats comprise the largest populations.

Feeding in captivity

The feed supply for most herbivorous domesticated or zoo animal species in the UAE is commonly restricted to grasses, alfalfa, vegetables, grains, grain by-products and compounded feeds. When browse is supplied suddenly to captive animals, the risk of intoxication is increased due to unfamiliarity. It is therefore important that keepers who want to feed browse to their animals understand the implications of the types and amounts of browse, as well as the combinations or sequences in feeding. With captive specialist or generalist browser animals, the limited supply or complete lack of browse can result in underperformance, disease and even death.

Fresh browse from green waste

In economic terms, browse is generally best when consumed by free-roaming animals. However, this is a limited option in the UAE because of the restrictions imposed by the authorities on free roaming. Fresh browse supply from green waste presents problems because the prunings are difficult to efficiently transport and store because of their morphology. Prolonged storage decreases nutritional value through leaf loss and through mycotoxin production resulting from fungal growth. Farmers who seek to avoid the transport and storage problems by cultivating fresh browse material near their animal enclosures must carefully consider the availability and quality of water. Good planning and the use of salt-tolerant but nutritious plant species are required to ensure the sustainability of such an endeavor.

Another consideration is that most plant growth in the UAE occurs in the spring and summer. Winter or autumn growth is generally slow, therefore reducing browse availability. The nutritional quality of browse can vary significantly according to growing season and soil and water quality. Another important factor to consider is the effect of pruning or browsing on the plant itself. When damaged – either by the mechanical tools used for pruning or by browsing by



Camel browsing on trees



Browse silage after 3 months in the drum

animals – tannins are released by the plants' defense mechanisms from the bark into the stems and leaves, thereby decreasing palatability.

Green waste will never be completely usable for animal nutrition due to unavoidable toxic or inedible plant parts and contamination. Therefore, selecting animal feed from green waste must be undertaken with specific emphasis on plant toxicity, animal feeding preferences and digestibility. Ideally, the produce fed should be the same browse that would be naturally selected by free-roaming animals.

Why use browse silage?

In Dubai, extensive landscaping plantations exist along roads, in public parks and in private gardens and farms. Many more are planned. Most are irrigated with second-use treated municipal water and with saline water. Turning green waste from pruning into a useful source of feed can be brought about by creating browse silage. This growing resource of plant material, the presence of browser animals like goats and camels, the requirement of browse materials for specific zoo animals, and the difficulties presented by the handling and storing of fresh browse – all point to the creation of browse silage. By ensiling browse in plastic drums, nutritious plant materials that would otherwise be discarded as waste can provide a valuable resource.

The author, a livestock and animal nutrition specialist, has recently initiated a scientific investigation into the creation of browse silage.

The author wishes to acknowledge the contributions of the Sheikh Butti Al Maktoum Wildlife Centre, Dubai, UAE; Breeding Centre of Endangered Arabian Wildlife, Sharjah, UAE; Animal Nutrition Group, Wageningen University, Netherlands; and ICBA.



DDG Dr Ahmed Almasoum (right) at the signing ceremony with Dr Nabil Mohammad Ahmad, Director, CERD, Djibouti.

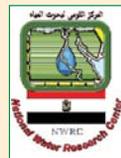


Dr Viloo Patell-Morawala, Chairman and Managing Director, Avesthagen Ltd, gave a seminar about her company at ICBA headquarters in February.

ICBA forges new partnerships

During the first four months of 2008, ICBA has been busy bolstering its partnerships, signing four different memoranda of understanding (MoUs).

- **National Water Research Center (NWRC)** of the Ministry of Water Resources and Irrigation, Egypt. MoU signed 14 March by Dr Shaden Abdel Gawad, Chairperson, MWRC, and Dr Shawki Barghouti, Director General, ICBA.



- **Djibouti Center for Studies and Research (CERD)**. MoU laid the framework for collaboration in conservation of natural resources, the exchange of genetic resources, capacity building and plant system development. MoU signed 19 March.



- **Avesthagen Limited**, a multinational biotechnology company based in Bangalore, India. The partners agreed to cooperate on research in the agri-biotechnology, food, pharma and nutraceuticals fields. The MoU was signed 1 April.



- **BioMyc Environment GmbH**, a research and development company incorporated in Germany established to develop mycorrhizae inocula. Both partners have a common objective of contributing to agricultural R&D for appropriate utilization and management of natural resources in a sustainable manner. MoU signed 23 April.

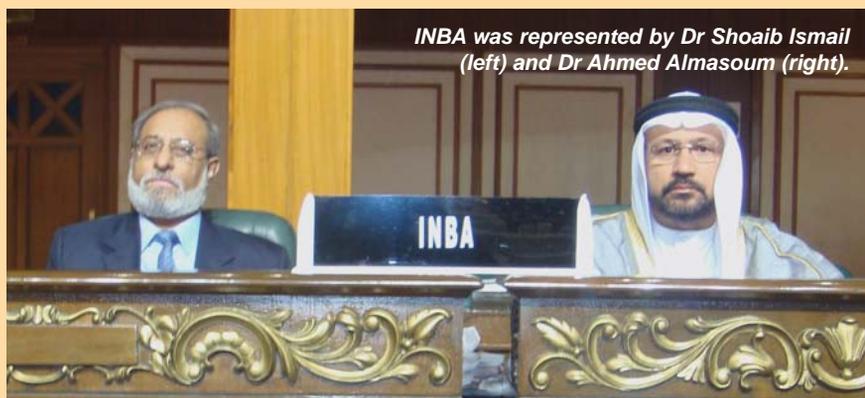


INBA represented at COMSTech General Assembly

The Inter-Islamic Network on Biosaline Agriculture (INBA) was represented at the 13th General Assembly of the Standing Committee on Scientific and Technological Cooperation (COMSTech) of the Organization of the Islamic Conference. The meeting was held at Islamabad, Pakistan, 1-3 April.

INBA was represented at the meeting by two ICBA officials: Dr Ahmad Almasoum, Deputy Director General, and Dr Shoaib Ismail, Coordinator INBA.

Dr Ismail presented INBA achievements during 2006-07. These included a feasibility study in Cape Verde and collaboration with FAO in the organization of a salinity status workshop.



INBA was represented by Dr Shoaib Ismail (left) and Dr Ahmed Almasoum (right).