

Biosalinity News

Newsletter of the International Center for Biosaline Agriculture

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FROM THE EDITOR

Biosalinity News is produced three times a year by the International Center for Biosaline Agriculture (ICBA). The electronic version appears on ICBA's website www.biosaline.org

This newsletter is expected to serve as a forum for exchange of news and information among people interested in research and development activities in saline agriculture. To achieve this vision we need your help and input.

This issue carries not only the highlights of the international symposium held by ICBA but also an article from USA on the use of halophytes in treating effluent of saline aquaculture. Future issues will endeavor to carry such articles by scientists working on biosaline agriculture that would be of interest to all persons interested in saline agriculture.

The Editor will be pleased to receive short articles on research and development in saline agriculture; announcements of seminars, workshops, meetings and training courses; reviews of new publications. Please send your submissions to:

The Editor
Biosalinity News, ICBA

The Center takes a new name: International Center for Biosaline Agriculture (ICBA)

The name Biosaline Agriculture Center (BAC) was conceived as a research institute that would initially address the problems relating to saline water irrigation of the member countries of the Gulf Cooperation Council (GCC) and later scale up to deal with similar problems in other Islamic countries and elsewhere in the arid, semi-arid and Mediterranean regions. While the Center was indeed grappling with the global problem of declining fresh water resources by trying to grow economically useful crops using saline water of which there is no global scarcity, the Center was increasingly identified as a regional, if not local, organization by the media and public in its initial year of operations. In keeping with its interest in solving a global issue and getting international acceptance, the Board of Directors and its stakeholders, accepted the suggestion of the Center to rename it to the International Center for Biosaline Agriculture (ICBA) which reflects the international scope of the Center's activities.

On 10 December 2000, Director General Dr Mohammad H Al-Attar officially announced that BAC had become ICBA following consultations with the host country's Ministry of Agriculture and Fisheries. The change was also ratified by the host country's Ministry of Finance and Ministry of Foreign Affairs and ICBA's Board of Trustees, in the Islamic Development Bank.

With this change, ICBA will proceed to deal with the global challenge of managing water: 97% of which is saline and therefore not utilized for agriculture, while ensuring a judicious use of 3% of global fresh water reserves, increasingly utilized for agriculture, conservatively estimated at 80 percent increment following the Green Revolution. While requirement of water for agriculture is not likely to increase, the needs of water in our ecosystem is bound to increase due to demands of increasing population, industrial demand and pollution. Thus the challenge of using saline water may be acute in the member countries of the GCC and other Islamic countries but the issue is increasingly becoming

global in character. From Australia to Uzbekistan, the problem is now worrying Governments and ICBA could be a nodal point of technology exchange that provides solutions not just to the GCC members but to the world at large.



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ICBA'S FIRST INTERNATIONAL SYMPOSIUM

Charting the Roadmap of Saline Agriculture in the GCC Countries

An international symposium on "Prospects of Saline Agriculture in the GCC Countries" was held from 18 to 20 March, 2001, at Dubai, United Arab Emirates (UAE), under the patronage of His Excellency Saeed Bin Mohammad Al-Raqabani, the Minister of Agriculture and Fisheries, UAE. The symposium was organized by the International Center for Biosaline Agriculture (ICBA), the Islamic Development Bank (IDB), and the International Center for Agricultural Research in Dry Areas (ICARDA), in collaboration with the UAE Ministry of Agriculture and Fisheries.

Attending the event were more than 150 participants from 22 countries as well as participants from 10 regional and international organizations. His Excellency Saeed Bin Mohammad Al-Raqabani inaugurat-

ed the symposium with a keynote address. Other distinguished speakers in the inaugural session included His Excellency Dr Ahmad Mohamed Ali, the President of the Islamic Development Bank; Dr Mohammad H. Al-Attar, Chairman of the Board of Directors and Director General of ICBA; the Director General of ICARDA, Prof Adel El-Beltagy; and Mr Ahmed Hariri, Deputy Director General of ICBA.

The symposium, with its six sessions, enabled participants to present 54 papers and 20 different posters. The presentations highlighted key factors affecting the use of saline water and soils as well as the importance of developing sustainable production systems.

The symposium acknowledged the problem of depleting fresh water resources and current efforts being made to alleviate this problem by adopting the use of non-conventional



Dr Adel El-Beltagy, Director General of ICARDA (*right*), with Dr Mohammad Al-Attar, Director General of ICBA, during the Symposium.

water resources. Further, the symposium highlighted examples from countries in the region that have made advancements in the use of non-conventional water resources, mainly saline water ranging from low-salinity water to seawater for growing economically useful and environmentally friendly plants and crops. This was achieved through the adoption of a complex system that included selection of salt-tolerant plants, and implementation of suitable irrigation and management systems.



Dignitaries gracing the opening ceremony of the Symposium.

SYMPOSIUM RECOMMENDATIONS



A stimulating Symposium discussion in progress

General

1. Establish an effective network of saline agriculture to share information, data, and models. ICBA can spearhead this network.
2. Establish a Bio-City, with Dubai as a starting model. However, the support of policy makers, the private sector, and the government is essential to make this a reality.
3. Convene an international conference on saline agriculture every 2 years with ICBA to act as a coordinator.
4. Form an expert group on saline agriculture.
5. Intensify efforts to enhance capacity building of relevant countries and institutions, emphasizing development of national human resources.
6. Utilize new technologies in developing salt-tolerant plants, managing saline water, saving water, using marginal water, improving conveyance and distribution systems of such water.

Specific

1. Water, Soil, and Plant Relationships

- * Adopt an integrated approach to ensure sustainability
- * Monitor soil salinity and salt accumulation
- * Give priority to native salt-tolerant species for saline agriculture
- * Utilize indigenous knowledge obtained locally
- * Reduce drainage water loss by using more efficient irrigation systems and re-using and recycling drainage water
- * Save water by using shallow water table in conjunction with irrigation water, where shallow water table exists

2. Research and Development (R&D)

- * Endorse and strongly support R&D for biosaline agriculture by R&D institutions



Symposium participants view accessions with saline tolerance in the shadehouse at ICBA.

- * Prioritize research on germplasm, development of salt-tolerant plants, sustainable production of crops, forage and ornamental plants, water use efficiency, irrigation systems and long-term monitoring of salinity
- * Encourage ICBA to (a) establish a living collection of salt-tolerant plants and halophytes; (b) strive to obtain financial support for this activity from relevant donor organizations; and (c) serve as a custodian for germplasm relevant to saline agriculture with provision for distribution of genetic materials to other relevant organizations
- * Propose that ICBA to establish satellite centers (focal points) in relevant countries to undertake joint collaborative work on biosaline agriculture

3. Raising Public Awareness of Biosaline Agriculture

Enhance public awareness through

- * Communication and publications
- * Educational institutions
- * Mass media
- * Open field days
- * Workshops/seminars

4. Funding R&D in Biosaline Agriculture

- * Encourage national governments, regional and international organizations as well as other investors to provide core funds for ICBA
- * Encourage relevant institutions and organizations to submit joint projects with ICBA to seek financial support

ICBA SIGNS NEW AGREEMENTS

Memoranda of Understanding (MoUs) Signed

With the Environmental Research and Wildlife Development Agency (ERWDA)

ICBA signed an MoU with ERWDA in February 2001 to engage in a series of cooperative activities of common interest and mutual benefit. ERWDA was set up in 1996 by the Crown Prince of Abu Dhabi. ERWDA's mission is to assist the Abu Dhabi Government in the conservation and management of the Emirate's natural environment, resources, wildlife, and biological diversity. Mr Mohammed Ahmed Al Bowardi, Managing Director of ERWDA, and ICBA's Director General Dr Mohammad Al-Attar were the signatories of the document.

Mr Al Bowardi said that this MoU is intended to facilitate the collaboration of both organizations in environmental and agricultural activities. "The Memorandum will enable ERWDA and ICBA to jointly explore, design and implement specific projects in environment and agriculture when the resources of both organizations can be utilized more effectively through specific activities that enhance both organizations' capabilities," he added.

He said that it would also enable both parties to jointly organize activities of mutual interest, including conferences, workshops and training courses in fulfillment of their mission, and jointly publish the results of research and collaborative work by the staff from both organizations, apart from facilitating exchange of mutually relevant information and documents. The Memorandum will be in effect for 4 years.

Dr Al-Attar noted that this MoU was the first one between ICBA and a local research institution in UAE. Prof Dr Faisal Taha, Director, Technical Programs, ICBA, stated that two projects are being prepared within the framework of the MoU. The first project involves introduction of mangrove species from Pakistan and Japan for planting on the coastline of Abu Dhabi. The second project includes studying the mangrove's characteristics to ascertain why some trees establish well in some areas than in other areas.

With the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

ICBA signed an MoU with ICRISAT in March 2001 at Patancheru, near Hyderabad, India, to initiate collaborative research on problems of biosalinity in agriculture. ICRISAT is one of the oldest international agricultural research centers of the Consultative Group on International Agricultural Research (CGIAR). ICRISAT works on the agricultural problems of the semi-arid tropics spread over Asia, Africa, Australia, and Latin America with specific interest in sorghum, pearl millet, chickpea, pigeonpea, and groundnut (peanut). Though ICRISAT's headquarters are in India, ICRISAT's activities are spread over seven locations in Africa and three in Asia.

Observing that biosalinity is becoming an increasing problem in agriculture, especially in the developing world and particularly to SAT areas, Dr William D Dar, Director General of ICRISAT, declared "With this MoU, we are investing in the future."

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Mr Mohammed Ahmed Al-Bowardi, Managing Director of ERWDA (right) signing the MoU with Dr Mohammad Al-Attar, Director General of ICBA.



Dr William Dar, Director General of ICRISAT (left), exchanging the signed MoU with Dr Mohammad Al-Attar, Director General of ICBA in the presence of senior staff of both organizations.

ICBA SIGNS NEW AGREEMENTS (Cont. from Page 4)

Dr Al-Attar, Director General of ICBA, expressed satisfaction that his young center was entering into partnership with ICRISAT, "a center of excellence, widely known for its impact on the lives of the poor of the world." Dr Al-Attar added, "Together we will have a greater impact."

The MoU identifies the common objective of both institutes to contribute to agricultural research and development for appropriate utilization and management of natural resources in a sustainable manner."

ICBA will be accessing sorghum and pearl millet germplasm with salinity tolerance available with ICRISAT and work closely with ICRISAT on the worldwide desert margins program led by ICRISAT.

Following the signing of the MoU, Dr Dar visited ICBA in April. A former Minister of Agriculture in the Philippines, he described the work being carried out at ICBA as impressive and said that there would always be a good reason to enhance the research collaboration between the two institutes. "The challenges will be many but with ICBA and its partners working together these challenges can be turned into opportunities," he added.

ROLE OF ICBA

ICBA: SERVING R&D IN THE REGION, LINKING PRIVATE, PUBLIC AND ACADEMIC SECTORS

By Ahmed Hariri, Deputy Director General, ICBA

Importance of research and development (R&D) in the advancement of nations and societies in various sectors - be it scientific, economic, social or political - cannot be denied. There are several such research institutions and scientists in these sectors in the Arab and Islamic world. However, these institutions face numerous challenges most of which revolve around a lack of financial resources allocated to them from their own governments or support from the private sector.

Statistics indicate that the number of scientists and engineers in the year 2000 have reached 93,254 in Egypt, 37,000 in Lebanon, and 33,376 in Saudi Arabia. These scientists and engineers are distributed in R&D sectors as follows:

- 42.5% in the agricultural sector,
- 21.2% in natural sciences,
- 13% in economic and anthropological studies, and
- 11.4% in medical sciences.

Spending on scientific research does not exceed US\$2.4 per person in the Arab world, whereas it reaches US\$50-100 in developed countries. Other statistics show that in 1994 the percentage from Gross Domestic

Product (GDP) allocated to scientific research was 0.4% in Egypt, 0.3% in Jordan and Kuwait, 0.2% in Morocco, 0.1% in Lebanon, Saudi Arabia, Syria and Tunisia, and 0.7% in all other Arab countries except Iraq which had only reached 0.02%. In addition, total spending on scientific research was only US\$548 million in 1992 which is 0.5% of GNP, whereas developed countries spend 3% of their national income on civic research alone*.

The Missing Link

It is well known that R&D plays an important role in solving problems in a scientific way and lead to creative solutions to make life easier. This role is carried on by scientists and engineers in universities and research institutions. However, the Arab and Islamic world suffer from a missing link. This link is the trust among and between the public, the private and the academic sectors. When private companies face difficulties and problems in producing their goods and services, instead of making use of the available resources in the universities and research centers these companies seek the help of



Mr Ahmed Hariri

foreign consultants to find solutions. These foreign consultants accumulate their experiences from our problems. This precarious situation can be averted by having the businessman, the government official, and the scientist or researcher to come together and discuss their problems and concerns, and the missing link will be found.

Aspirations of ICBA

ICBA gives considerable attention to R&D to achieve its mission and transfer of know-how in using saline water. IDB (the sponsoring and funding agency) have so far contributed US\$ 8 million to build the

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* Article on "Scientific Research in the Arab World: Its status quo and problems" by Eng. Hawas Mahmoud, Science and Technology Magazine, KISR, Vol. 75 April 2000.

ROLE OF ICBA (Cont. from Page 5)

Center and support it with a qualified scientific and administrative team that strongly believes in its mission and works hard to achieve it. The host country (UAE) has also generously contributed to its infrastructure development that enables it to fulfill its mandate in a professional manner that meet international standards. Therefore, the Center has developed its strategy and prioritized its areas of concern that include the private sector as its partner to face the problems of rising salinity in water and soil in their respective farms and ambitious projects so as to minimize losses and identify effective

and sustainable alternatives. The Center's management, guided by its Board of Directors, is implementing this strategy by making the necessary contacts with its beneficiaries in the public and private sectors to achieve mutual cooperation.

One such cooperation was initially achieved when the Center contacted the Al Rawabi Dairy Farms (a local private company) to show them alternative varieties for their fodder that are more salt tolerant and nutritionally more productive. Additionally, two farm owners visited ICBA and expressed their admiration and willingness to cooperate and benefit from

its experiences. ICBA also cooperates with UAE Municipalities where working committees had been established with the Abu Dhabi Municipality and the Environmental Research and Wildlife Development Agency (ERWDA) to work on joint projects. Therefore, we like to reiterate our sincere wishes by inviting the companies and farmers to contact us and visit ICBA and talk to the specialists and scientists about their needs and concerns so that we can achieve our objectives together to make ICBA a noble seed in R&D to promote agricultural production in the host country and similar regions.

SALT-TOLERANT PLANTS AS BIO-FILTERS

HALOPHYTES FOR THE TREATMENT OF SALINE AQUACULTURE EFFLUENT

J Jed Brown, NOAA/ Office of Habitat Conservation, USA

Aquaculture has traditionally been considered a "green" industry, but more recently its potential negative environmental impacts have been identified. Perhaps the most damaging environmental impact of aquaculture occurs when untreated effluent, which may contain high concentrations of nutrients, is discharged into surrounding bodies of water. Clearly, low cost and effective treatments of aquaculture effluent are needed to ensure the sustainability of the industry.

I tested the feasibility of using salt-tolerant plants (halophytes) with potential as forage and oilseed crops, as biofilters to remove nutrients from saline aquaculture effluent. By using the saline wastewater to irrigate halophyte crops, I wanted to test whether an environmental liability could be turned into a resource. Such reuse of water is especially beneficial in arid, desert regions.

To conduct my research, I used

lysimeters (draining, soil-filled containers) to quantify the ability of halophytes to remove nutrients from saline aquaculture effluent. Initially, we were interested in determining which of the several species being evaluated for possible domestication would be the best biofilter. In particular, we wished to learn how plant filtering capacity and growth responded to different salinities. Small (0.02 m³) lysimeters were used and three plant species, *Suaeda esteroa*, *Salicornia bigelovii* and *Atriplex barclayana* (Chenopodiaceae), were irrigated once per week with aquaculture effluent salinized to produce three different salinities (0.5, 10, and 35 ppt). The leaching fraction, or the portion of the applied water that leached past the plant root zone, was 0.31, which is considered to be an intermediate level.

The general conclusion derived from this study was that the plants effectively removed inorganic nitrogen from the wastewater. Over all

tested salinities, 94% of the applied inorganic nitrogen was removed by the plant-soil system.

Concentration of the nitrate and ammonia leaching from the planted lysimeters was less than the mean U.S. Environmental Protection Agency recommended limits for effluents. Low levels of ammonia and nitrate were found in the leachate despite the fact that 31% of the irrigation water, which contained high concentrations of nitrate and ammonia, leached past the plant root zone. The plant-soil system removed 97% of the applied soluble reactive phosphorus; however, the soil, rather than the plants, was responsible for sequestering most of the phosphorus. Salt inhibited growth rate, nutrient removal, and volume of water that the plants could process. Plants performed very poorly at the highest (35 ppt) salinity treatment. Poor performance was attributed to unrealistic-

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SALT-TOLERANT PLANTS AS BIO-FILTERS (Cont. from Page 6)

ly high soil salinity levels that arose from the infrequent (once per week) irrigation schedule, as well as the small size of the lysimeters used.

Since most marine aquaculture is conducted with high salinity water, we wanted to determine whether plant filtering capacity and growth could be improved at high salinities if the size of the lysimeters and the frequency of irrigation were increased. Therefore, a second experiment, using much larger lysimeters (0.78 m³ of soil), was conducted to simulate field conditions better. *Suaeda esteroa*, the species that performed best in the first

experiment, was planted in the lysimeters, which were irrigated three times per week with aquaculture effluent salinized to 31 ppt. Lysimeters were irrigated with 5 different volume treatments. Plant biomass increased as the irrigation volume increased, and biomass yields achieved at the higher irrigation volumes were comparable to those of conventional crops grown on freshwater. The concentration of nitrate in the water leaching from the lysimeters decreased during the period of the experiment. Plants had a significant effect on the removal of nitrate, whereas the concentration of

phosphorus increased during the experiment. From these results, we concluded that it is feasible to use high-salinity aquaculture effluent to irrigate halophytes, especially where phosphorus is not a limiting nutrient.

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TRAINING COURSES AT ICBA

Three courses to enhance human resource capabilities of the national agricultural research systems have been planned at ICBA this year. All courses will be conducted over a 5-day period at ICBA headquarters, Al Ruwayyah, 23 km from Dubai.

Irrigation with brackish water, 12-17 May 2001

This course will present the basic principles for agricultural production using brackish water. The overall objective is to introduce the concept of irrigation with saline water and enhance the skills of operators for the management of salt-affected farming systems.

The Arabian Peninsula is arid. Average annual rainfall rarely exceeds 200 mm. With such rainfall, there is little recharge of groundwater supplies and irrigated agriculture is "mining" non-renewable water resources. These fresh water reserves are diminishing and irrigation is tapping into increasingly saline water. Such saline, or brackish water

requires special irrigation and management practices if adverse effects such as deterioration of soil structure and loss of productivity are to be avoided. This course will provide knowledge and skills to manage problems related with salinity and successfully adopt and practice bio-saline agriculture.

The course is primarily aimed at engineers and managers of forage farms and dairy farms.

Course contents:

- * Causes of salinity, initial investigation, and quantification of the extent of salinization.
- * Initial planning: crop selection and estimation of output
- * Basic design principles and material specification
- * Irrigation management, leaching requirements and drainage
- * Long-term monitoring-salinity management practices

Costs: Participating agencies will be required to cover travel and accommodation expenses of their nominees. ICBA will coordinate transportation and housing for participants coming from outside the UAE.

Propagation and management of halophytes for optimum production, October 2001

The course will provide hands-on training to technicians and scientists on management of halophytes from seed handling to production and harvesting.

Costs: Participating agencies will be required to cover travel and accommodation expenses of their nominees. ICBA will coordinate transportation and housing for participants coming from outside the UAE.

Plant genetic resource characterization, evaluation, documentation and data management, December 2001

The course is designed to improve the capabilities of scientists and technicians to conduct regular genebank activities according to internationally recognized standards.

Costs: Participating agencies will be required to cover travel and accommodation expenses of their nominees. ICBA will coordinate transportation and housing for participants coming from outside the UAE.

STAFF NEWS

Prof Dr Faisal Taha **Director of Technical Programs**

Prof Taha joined ICBA in summer 2000. He holds a PhD from the University of Wyoming and has over 24 years of



professional experience in research and development in the USA, Canada, Kuwait and United Arab Emirates. During this period he held key positions at the Kuwait Institute for Scientific Research, the Agriculture Development Fund (Canada), the UAE University and finally the International Center for Biosaline Agriculture.

Prof Taha is an accomplished Researcher and Scientist with over 100 publications in refereed journals, Proceedings, technical reports and scientific books. He has won many regional and international awards in agricultural research and development. Prof Taha also served as consultant to many regional and international organizations working in agriculture and natural resources.

Prof Taha is a frequent speaker at many international conferences and is well known in the international agricultural community.

Dr Abdullah Al Dakheel, **Forage Agronomist**

Dr Dakheel, who joined ICBA in early January 2001, has a strong background in agricultural ecology and physiology of crop and natural plants.

He worked at Aleppo University and as a consultant in ecology and



physiology of cereal crops.

He moved to the UAE as an associate professor of arid land ecology at the UAE University and held the position of Research Farm Director in addition to his other responsibilities.

Dr Dakheel holds a PhD in Ecology from the University of California, Davis-USA.

Dr Shoaib Ismail **Halophyte Agronomist**

Dr Ismail is a research scientist and a university educator with more than 18 years experience in saline agriculture research and development.



Prior to joining ICBA, in summer 2000, Dr Ismail was Associate Professor in the Department of Botany, University of Karachi, Pakistan. His research was focused on forage production from saline and sodic soils and the use of saline irrigation water for sustainable productive agriculture in arid and semi-arid areas. He has worked on a number of national and international projects in Pakistan sponsored by local and international funding agencies.

Dr Ismail holds BSc, MSc and PhD degrees in Botany and Plant Physiology from the University of Karachi, Pakistan.

Mr Ghassan Sarris, **Finance and Administration Officer**

Mr Sarris is a Certified Public Accountant (CPA) from the US state of Delaware and he is an associated



member of the American Institute of CPAs. Mr Sarris is also a Certified Internal Auditor (CIA) from the International Institute of Internal Auditors. Prior to joining ICBA in Spring 2001, he was on the staff of the Department of Civil Aviation - Dubai Government. His previous 8-year stint at the United Nations Relief and Works Agency (UNRWA) headquarters in Lebanon and a 2-year spell with the private sector in Canada will provide valuable expertise in financial skills for ICBA. Mr Sarris also lectures for the Becker Courvisor CPA course.

Mr Jugu Abraham, **Donor Relations Specialist**

Mr Abraham, who also joined ICBA in Spring 2001, brings to ICBA rich knowledge of global funding opportunities for international agricultural R&D gained while working as the Head of the Donor Relations Division at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). At ICRISAT, he developed and implemented innovative resource mobilization strategies. Earlier he was a Senior Advisor on Donor Relations and a Senior Editor. He also worked for 7 years as a journalist in New Delhi for a premier newspaper group.

Mr Abraham holds a Masters degree in Business Administration from IGNOU, New Delhi, a Master of Arts in English Literature and Aesthetics from Bombay University, and a Bachelors degree in Science from Madras University. He is an alumnus of the Indian Institute of Mass Communication, New Delhi.

